CYLON ENGINEERING CENTRE
USER GUIDE

Cylon

www.cylon.com
www.cylon-automatrix.com

Style conventions used in this document:

UI Text: Text that represents elements of the UI such as button names, menu options etc. is presented with a grey background and border, in Tahoma font which is traditionally used in Windows UIs. For example:

Ok

Standard Terms (Jargon): Text that is not English Language but instead refers to industry standard concepts such as Strategy, BACnet, or Analog Input is represents in slightly condensed font. For example:

BACnet

Code: Text that represents File paths, Code snippets or text file configuration settings is presented in fixed-width font, with a grey background and border. For example:

```
$config_file = c:\CYLON\settings\config.txt
```

Parameter values: Text that represents values to be entered into UI fields or displayed in dialogs is represented in fixed-width font with a shaded background. For example

`10°C`

Product Names: Text that represents a product name is represented in bold colored text. For example

INTEGRA™

PC Keyboard keys: Text representing an instruction to press a particular key on the keyboard is enclosed in square brackets and in bold font. For example:

[Ctrl]+**[1]**

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SECTION 1 : CYLON BUILDING MANAGEMENT SYSTEM

The **Unitron** and **Cylon BACnet Building Management System**s are made up of two main types of component:

- **Hardware** - the products that monitor and control a building's environment.
- **Software** - the interface which allows users to configure and monitor Cylon Hardware.

HARDWARE COMPONENTS

Unitron and **Cylon BACnet** use the following main hardware components:

- Communications Controllers.
- I/O Field Controllers.
- Keypad
- PC

There may also be other supplementary hardware components such as printers, modems, pagers etc., but these are not essential to the basic system.

Communications Controllers

The **UC32.netK**, **UCC4** and **UCC4.net** are programmable communications controllers, which network I/O controllers together. They also handle **global time schedules** (*see page 384*) for the I/O Controllers connected to them.

Communications controllers ("**Comms Controller**s") can be connected together and, communicate with each other in a peer-to-peer arrangement. For **UC32.netK**s this connection is over fast Ethernet (100Mbps Full Duplex by default), and for **UCC4**s and **UCC4.net**s it is by **ARCnet**.

Comms Controllers also deal with Alarm handling and other network functions.

A **Comms Controller** can be linked directly to a PC, a modem or a printer.

I/O Field Controllers

UC32.xx, **UCxxPG-R**, **UCUxx**, **UCxx**, **CBM** and **CBT** controllers take inputs from sensors and Building Control plant, and send output to Building Control plant in response. They are available as programmable or unitary controllers, with various input/output configurations.

These I/O controllers can be programmed with strategies, which configure them to send specific outputs to connected devices in response to events occurring on their inputs. For example, you can create a **Strategy** in the Engineering Centre and download it to a Field Controller specifying that a valve be opened if the temperature being input to the controller rises above a predetermined level.

Cylon Field controllers are networked together using RS485 by Communications Controllers, which in turn are networked by Ethernet (or ARCnet in legacy systems). A Field controller can also be linked directly to a PC, as well as to a modem or a printer.

PC

The PC is connected to a Cylon network by Ethernet, RS232 or modem connection. The PC can also be connected directly to an I/O controller for small installations with stand-alone controllers.

The Cylon Engineering Centre software - which is used to configure the controllers, schedule events and extract reports - is run on the PC. Since the Cylon software is Windows-based, the PC must have Windows 2000 or WindowsXP installed and running.

The **minimum** specification for a PC that will be used to run the **Command Centre** and **Engineering Centre** is as follows:

Minimum PC	Intel Core 2 Duo E6300 processor, 1Gb RAM, 80Gb hard disk
Recommended PC	Intel Core 2 Duo E6600 processor, 2Gb RAM, 160Gb hard disk
Operating System	**Microsoft WindowsXP** Professional 32 bit, **Microsoft Windows7** Professional 32 bit

Connections between hardware components

The following types of connections exist between the hardware components:

- Fast Ethernet bus connecting **UC32.net** Communications Controllers and **CBR** routers.
- An ARCnet network, connecting **UCC4** Communications Controllers in a bus configuration (could also be star configuration if co-axial ARCnet is used).
- An RS485 fieldbus, using shielded twisted pair cables, connecting the Communications Controllers to the I/O controllers.
- An RS232 connection between the PC and a Comms Controller.

There may also be other connections between Comms Controllers and printers, modems, pagers, etc. but these are not essential to the basic system.

SOFTWARE COMPONENTS

The Cylon suite of software applications is used to set up, maintain and control the Cylon system in operation. The individual applications ("modules") within the suite are grouped into the **Unitron Command Centre** (also referred to as "the Command Centre") and the **Cylon Engineering Centre** (also referred to as "the Engineering Centre") as shown below. Each of these modules can be started from the **Command Centre** and **Engineering Centre** groups in the Windows Start menu.

Engineering Centre modules

The following applications are available from the Engineering Centre group in the **Windows** Start menu :

- Database Interface
- Database Server
- Documentor
- Parallel Keypad Compiler
- Serial Keypad Compiler
- Serial Keypad Wizard
- Modem
- Schedule Planner
- Site Organiser
- Engineering Centre
- UC16 Modem/CCDial/Modem Interface
- UCC4 Configuration
- Site Backup Utility
- Configuration

Command Centre Modules

The following applications are available from the Command Centre group in the **Windows** Start menu :

- Alarm Handler
- CCDraw
- CCView
- Database Interface
- Database Server
- Datalog Manager
- Modem
- Pager
- Reports
- Schedule Planner
- Time Schedule Manager
- UC16 Modem/CCDial/Modem Interface
- Site Backup Utility
- Configuration

Each of the Cylon Software modules is explained in detail below:

Configuration

The **Configuration** program contains a blueprint of the system, which can be accessed by other programs as required. It is used to define systems, networks, sites, authorised users, modem protocols, port setups, etc. and to activate alarms. Levels of access for different users can also be defined here. (See also *MAN-0041 Configuration User manual*.)

Alarm Handler

The **Alarm Handler** program is used to alert you to any alarm conditions within the system. The alarms can be enabled, disabled or filtered in the **Configuration** program. When they have been enabled, the Alarm handler will run automatically every time the Command Centre is run. If alarms are enabled, and alarm modules are included in Field Controller strategies, any alarm event will be sent to the Alarm handler (also known as the Alarms program) and displayed on the screen. (See also *MAN-0047 Alarm Handler User Manual*.)

CCDraw

CCDraw is a graphics application, which allows you to create dynamic graphic windows to use with the CCView program. These are pictures of the site, through which, in CCView, you can travel around the site, viewing and altering conditions as necessary. (See also *MAN-0040 CCDraw User manual*).

CCView

CCView contains the Command Centre from which you can communicate with the controllers. By opening up the dynamic pictures created in CCDraw, you can travel through a site, viewing and altering conditions as necessary. Reports can be obtained from dynamic points created in CCDraw, and appliances can be adjusted, or switched on or off. (See also MAN-0039 CCView User manual.)

Database Interface

The **Database Interface** program allows you access to the database that contains details of all the point values on each Field Controller in the network. You can set point values graphically in the **Engineering Centre**, or you can enter or delete them in the **Database Interface** program.

Database Server

The **Database Server** is the database where details of all the point values on each Field Controller in the network are kept. You cannot access the Database Server directly. The Database Interface program allows you to edit point descriptions and engineering units in the database manually, and the Engineering Centre allows you to edit point values in the database graphically.

Serial Keypad Wizard

The Serial Keypad Wizard allows you to create keypad programs for use with the UC32. (See also *MAN-0055 Engineering Centre Keypad Wizard manual*.

Parallel Keypad Compiler

The **Parallel Keypad Compiler** program allows you to create programs for use with the UCC4 or Field Controller keypad. You can then download these programs to the keypad. (See also *MAN-0023 UCC4 Keypad User's Guide* and *MAN-0023 UC16 Keypad User's Guide*.)

Documentor

The **Documentor** is a Microsoft Excel macro package, and requires Microsoft Excel to be installed on the PC for it to work. When the Documentor is run, it extracts a record of the configuration of the network. These are printed out when required (for example, as a daily report of the state of the site). Information about specific parts of the network can also be accessed. The Documentor is not automatically loaded when the system is started up. You must run it when it is required. (See also *MAN-0019 Documentor manual*.

Serial Keypad Compiler

The Serial Keypad Compiler program allows you to create programs for use with the UCKRA420 Serial Text keypad. You can then download these programs to the Comms Controller or Field Controller that the keypad is connected to. The Compiler can create programs for UC32.net Communications Controller, UC32 and UCxx Field controllers, and UCC4 v3.8.0 or earlier Communications controllers. (See also MAN-0004 Serial Text Keypad and Compiler manual)

Datalog Manager

A datalog is set-up in the Engineering Centre, and logs the value of a specified point in a Field Controller at a specified interval, over a period of time. So a datalog contains a record of the changes in a point value over a period of time. The **Datalog Manager** program allows you to display the contents of a datalog in either graphic or tabular form. (see also *MAN-0043 Datalog Manager User's Guide*)

Modem

The **Modem** program allows you to view the present state of any modem connected to the network (i.e. it allows you to see whether the modem is off-line, transmitting, starting up, etc.). Provided there is a modem in the Cylon system, the Modem program is run automatically when the Command or Engineering Centre is started up.

Pager

The **Pager** program acts as an interface between various paging services and the Command Centre. It can accept alarms sent from the **Alarm handler** and transmit them automatically to an engineer's pager using the pager service. (See also *MAN-0021 Pager manual*.)

Reports

The **Reports** program allows you to collate information from the network for permanent storage. Reports can be produced manually or automatically and saved to a file from which they can be printed out. Automatic reports can be produced at regular intervals – hourly, daily, weekly, monthly, etc. The PC must be switched on permanently if the reports program is to run correctly. (See also *MAN-0044 Reports Module User Guide*.)

Schedule Planner

The Schedule program defines the schedules for a site configured in the Configuration module and set-up in the Engineering Centre. Standard time schedules can be assigned for normal working days and weekends. Exceptions can be set-up, e.g. for holiday periods. These schedules are then downloaded to the Comms Controller and distributed throughout the network by the use of globals. (See also *MAN-0054 Schedule Planner User Manual*.)

Time Schedule Manager

The Time Schedule Manager allows the creation of multiple time schedules in the supervisory PC, which can be downloaded simultaneously to several Comms Controllers. Logical groups of Comms Controllers can be defined, to which the Time Schedules can be sent, and these are called "Site Groups"

Time Schedules can be downloaded manually when needed, or can be downloaded automatically by the Report module. The original settings for each schedule can be re-loaded on the site's controllers at any time by using the Schedule Planner. (See also *MAN-0035 Time Schedule manager Manual*)

Site Organiser

The **Site Organiser** is an easy way to configure and examine a complete site or part of a site. Instead of downloading strategies individually to all the controllers on a site, this can be done in one simple task. Any combination of strategies can be downloaded to any combination of controllers or to one type of controller in a *.ins* batch file. (See also *MAN-0020 Site Organiser manual*.)

Engineering Centre

The **Engineering Centre** is a graphical interface created for programming the Cylon range of universal controllers. In the Engineering Centre, strategies (which tell a controller how its outputs should respond to conditions on its inputs) can be designed, edited and downloaded to, or uploaded from, Field Controllers. Globals can also be assigned to Comms Controllers to pass values to other controllers on the network. The Engineering Centre could be described as the most important of all the Cylon applications, as it is the application that programs the Cylon controllers. This manual describes how to carry out a variety of tasks in the Engineering Centre.

Modem Interface

The **Modem Interface** program allows for communication between a controller and a remote supervisory PC, via modems. In addition to the long-established feature of the Modem Program, which allows strategies on a remote site to be examined by dialling the remote site from the PC, the Modem Interface program now allows Field Controllers to dial-out to a supervisory PC, e.g. in the event of an alarm.

UCC4 Configuration

The UCC4 Configuration program is used to configure the ports on UCC4-type Comms Controllers for communication with peripheral devices such as printers or modems. (See also *MAN-0053 UCC4 Configuration User Manual*.)

Site Backup Utility

The Site Backup Utility automates the process of backing up a site, and can be used to move sites from one PC to another, for synchronizing files (if several people are working on a single site on a number of different PCs), or for making security copies of a Site's files. (See also *MAN-0038 Site Backup Utility User Guide*)

THE ENGINEERING CENTRE – OVERVIEW

The **Engineering Centre** is the application that is used to program the Cylon controllers and is therefore the key application of the Cylon Software suite. The **Cylon Engineering Centre** provides all of the tools required to design, configure, test, commission and maintain **Cylon BACnet**, **UnitronUC32** and **Unitron2000** systems automatically.

The Engineering Centre switches between **BACnet**, **UC32** and **Unitron2000** modes depending on which type of controller is selected in the Site Tree .

You can use the **Engineering Centre** to:

- Graphically create **strategies** that implement solutions to conditions on site.
- Save those **strategies** for future editing, testing or reference.
- Test the operation of **strategies**.
- Debug and edit **strategies**.
- Download **strategies** to the appropriate **controllers**.
- Define and assign local **globals** to carry data across a **Fieldbus**.
- Define and assign wide **globals** to carry data between **Fieldbusses** and across the network of a **site**.
- Upload existing **strategies** from **controllers**.
- Upload analog and digital point values from **controllers**.
- Upload globals from **controllers** and from networks.
- Upload statistical and reference information from **controllers**.
- Record changes that occur on a site as they happen and save the record to a file.

SECTION 2 : THE ENGINEERING CENTRE INTERFACE

PARTS OF THE ENGINEERING CENTRE

The main Engineering Centre interface is illustrated below:
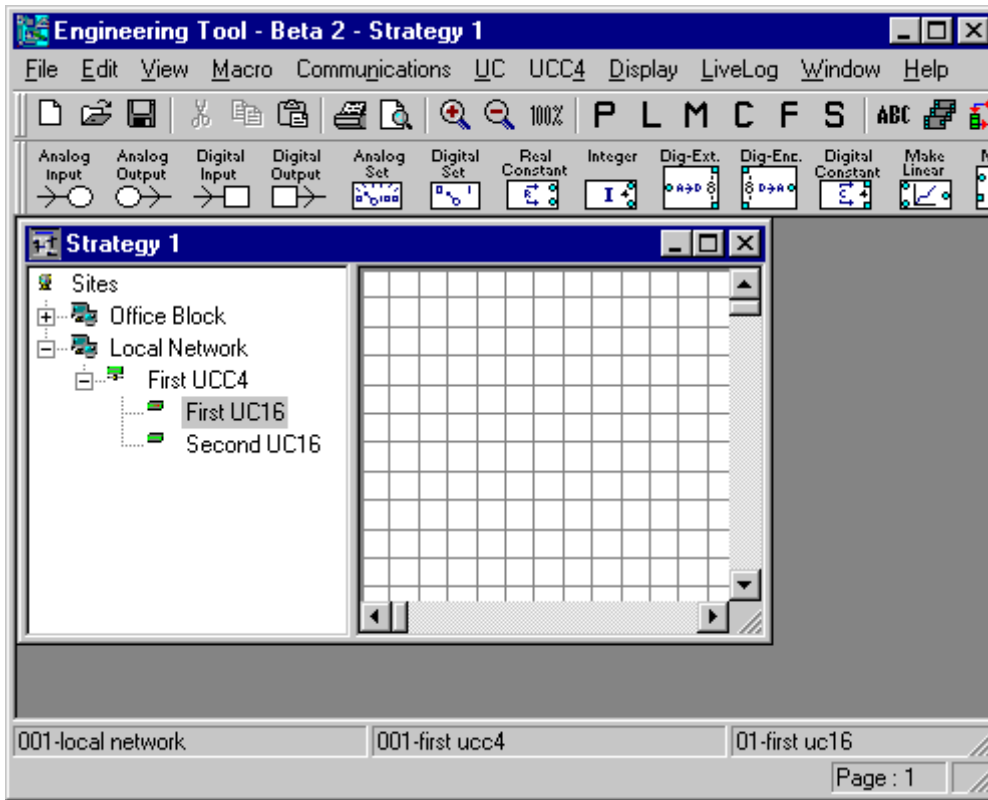
THE TITLE BAR

The title bar contains the name of the application, followed by the name of the active file, i.e. the strategy file that is currently in use. In the example below, the strategy file AHU1.stg is active.
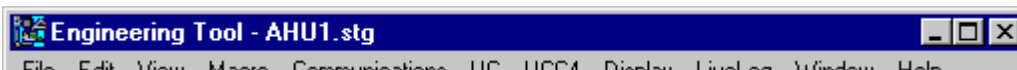
THE MENU BAR

The menu bar contains 12 menus listing the commands necessary for designing and implementing strategies.

The File menu

New	Creates a new strategy.
Open	Opens an existing strategy.
Close	Closes the active strategy.
Save	Saves the active strategy under its current name.
Save As	Saves the active strategy under a new name or saves a strategy for the first time.
Save All	Saves all the open strategies under their current names (If there are any unnamed strategies open, the Save As dialog box will appear to allow you to save them under a particular name).
Sign On	Signs On to the Engineering Centre
Sign Off	Signs Off from the Engineering Centre
Login	Logs in to the target controller.
Logout	Logs out of the target controller.
Global Editor	Shows all of the globals in a site, and allows them to be edited.
Footers	Edits the footer that appears with the strategy when it is printed.
Print	Prints the current strategy.
Print Preview	Shows the strategy as it will appear when printed.
Print Setup...	Edits details relating to the printing of the strategy.
Printer Scaling...	Allows the size of the printed strategy to be adjusted.
1....	Switches from the active strategy to one of the four most recently used strategies.
2....	
3....	
4....	
Exit	Closes the Engineering Centre.

The Edit menu

Cut	Cuts a selected item or items from the active strategy and place it on the Clipboard.
Copy	Copies selected items from the active strategy, and places it on the Clipboard.
Paste	Places the contents of the Clipboard onto the drawing area (by clicking the mouse over the required inset point).
Select All	Selects all of the items in the current strategy drawing
Add Text	Inserts text into the strategy.
Find	Opens the Find dialog, to locate or step through Points, Modules Macros or Globals in the currently-opened strategy.
Find Next	Steps to the next item in the strategy that matches the settings in the Find dialog.
Find Previous	Steps to the previous item in the strategy that matches the settings in the Find dialog.
Add Comment Block	Allows a comment block to be added to the strategy.

The View menu

View	
Toolbar	Displays or hides the Toolbar.
Status Bar	Displays or hides the Status bar.
Current Target	Displays or hides the Current Target bar.
Macro Bar	Displays or hides the Macro bar.
Site List	Displays or hides the Site List.
Modules	Selects one of the six module bars (see below).
Globals	Selects a global from the Globals bar or adds a global.
Virtuals	Displays or hides the virtual modules bar.
Managers	Displays details about current resource availability. Information about Globals, Strategy Blocks, the controller, inputs and outputs is provided.
Zoom In	Zoom in - Enlarges the current view of the strategy
Zoom Out	Zoom out - Reduces the current view of the strategy
Zoom to 100%	Returns the strategy view to actual size.
Zoom Level...	Allows the zoom level to be specified by number.

View		
Toolbar		
Status Bar		
Current Target		
Macro Bar		
Site List		
Modules ▶	P Points	Displays the Points module bar
Globals	L Logic	Displays the Logic module bar
Virtuals	M Mathematical	Displays the Mathematical module bar
Managers	C Control	Displays the Control module bar
Zoom In	F Function	Displays the Functions module bar
Zoom Out	S Static	Displays the Statistics module bar
Zoom to 100%		
Zoom Level...		

The Macro menu

Macro	
Create	Creates a macro using selected modules on the drawing area.
Manager	Adds or edits macro group details.

The Communications menu

Communications	
Communication Setup	Configures the download and scan global set-ups.
Upload	Uploads the strategy from the controller to the PC.
Download	Downloads the strategy from the PC to the controller.
Scan	Examines the strategy's points in the controller and displays their values in real-time.
Change Point Value	Changes the value of a setpoint in a controller.
Change Controller Address	Changes the address of the currently targeted controller.
Change UCU Baud Rate	Changes the baud rate of the targeted controller, if it is a UCU type controller.
Configure BACnet Device	Allows BACnet device properties to be set.

Note: Scan option is only available when the PC is logged in to the Cylon network, and when **Display points** has been checked in the **Module Setup** dialog box.

Change UCU Baud Rate is only available if the targeted controller is a UCU.

The UC32 and UC menus

If the target of a strategy is a UC32-type controller, the UC32 menu is visible in the Engineering Centre's menu bar:

UC32	
Version	Gets the version of the targeted UC32 controller.
Setup	Sends the setup to the controller and displays the current setup of the controller.
Time and Date	Sends the time and date to or uploads it from the controller.
Wipe Controller	Clears the memory of the targeted UC32 controller.
Statistics	Get details of the engineering, system and alarm statistics for the controller.
Strategy Lock/Unlock	Allows you to password-protect (lock) a strategy, or access a locked strategy.
Keypad	Allows you to create and download keypad programs.
Configuration Info	Opens a display panel showing the configuration of the UC32's hardware.
Diagnostics	Displays board diagnostic information.
Terminal Setup	Opens the Terminal Settings panel.

UC32		
Version		
Setup		
Time and Date		
Wipe Controller		
Statistics		
Strategy Lock/Unlock		
Keypad ▶	Create & Download Keypad	Opens the Keypad Wizard as 'Standalone'
	Download Keypad	Sends a saved Keypad program to the UC32
Configuration Info	Configure Keypad	Allows the operating parameters of the keypad program and the keypad hardware to be set.
Diagnostics		
Terminal Setup	Clear Keypad Info...	Deletes Keypad information from the Cylon Software database

If the target of a strategy is a UC or UCU-type controller, the UC32 menu is replaced with the following UC menu:

UC	
Version	Gets the version of the targeted controller.
Setup	Sends set-up to the controller and displays the current set-up of the controller.
Statistics	Gets details of the engineering, system and alarm statistics for the controller.
Time and Date	Sends the time and date to or uploads it from the controller.
Configuration Information	Displays information (e.g. max. address) about the targeted controller.
Wipe UC Memory	Clears the memory of the targeted controller.
DI Setup	Allows the inputs on a UC16DI controller to be configured.

Note: DI setup option is only available when the PC is logged in to the Cylon network, and when the target of the open strategy is a UC16DI.

The UC32.net and UCC4 menus

If the target of a strategy is on the Fieldbus of a UC32.net Communications Controller, the UC32.net menu is visible in the Engineering Centre menu bar:

UC32.net	
Version & Identification ...	Gets the version of the UC32.net to which the targeted controller is attached.
Setup ...	Sends setup to the UC32.net and displays its current setup.
Time and Date ...	Sends the time and date to or upload it from the UC32.net.
Wipe Memory ...	Clears selected parts of the memory of the UC32.net to which the targeted controller is attached.
Port Setup ...	Allows each of the UC32.net's ports to be configured
Alarm Setup ...	Defines which alarm priorities will be scanned by multiple supervisor PCs.
Keypad	Opens the Keypad sub-menu (see below)
Web Server Access ...	Enables Web access, and defines its security settings
Strings...	Defines Alarm, Modem, and Print strings in the UC32.net
Send Site Number ...	Sets the site number in the UC32.net
Generate Report ...	Generates a report of the UC32.net's operating statistics

UC32.net		
Version and		
Setup		
Time and Da		
Wipe Memor		
Port Setup		
Alarm Setup		
Keypad ▶	Keypad Configuration ...	Enables the 'configuration program' in the UC32.net's keypad, and sets the password
Web Server	Create & Download Local UC32.net Keypad Program	Opens the Keypad Wizard as 'Local'
Strings...	Create & Download Wide UC32.net Keypad Program	Opens the Keypad Wizard as 'Wide'
Send Site N	Download Keypad Program...	Sends a saved Keypad program to the UC32.net
Generate Re		

If the target of a strategy is on the Fieldbus of a UCC4 or UCC4.net Communications Controller, the UC32.net menu is replaced by the UCC4 menu:

UCC4	
Version	Gets the version of the UCC4 to which the targeted controller is attached.
Setup	Sends set-up to the UCC4 and displays its current set-up.
Statistics	Gets details of the engineering, system and ARCnet statistics for the UCC4.
Time and Date	Sends the time and date to or upload it from the UCC4.
Wipe Memory	Clears the memory of the UCC4 to which the targeted controller is attached.
Remove Time Schedules	Deletes UCC4 Time Schedule from the Cylon database.

If the target of a strategy is on a BACnet Site, neither the UCC4 nor UC32.net menus will be displayed.

The Display menu

Display	
Windows Setup	Define the style of background desired.
Colours	Choose the colours for the background and grid (see below).
Module Setup	Choose whether point values and constant values of modules are displayed during scanning, whether lines and point numbers joining modules are displayed, and controls routing of joined points (illustrating all connections to a selected point).

Display		
Windows Setup		
Colours	Grid	Choose colour for the Grid
▸		
Module Setup	Background	Choose colour for the Background

The LiveLog menu

LiveLog	
Setup	Determine how and what the LiveLog is to scan, i.e. all open strategies or active strategy only, interval between scans, and whether to log scan results to a text file.
Log	Scan the strategy's point values and time schedules.
View	Reads the results of all previous scans logged to a text file (See Setup above).

The Window Menu

Window	
Cascade	Arrange the strategy windows diagonally across the Engineering Centre window.
Tile Horizontal	Arrange the strategy windows horizontally.
Tile Vertical	Arrange the strategy windows vertically.
1....	View the names of all open strategies.

The Help Menu

Help	
Help	Use on-line help.
About Cylon Engineering Centre...	Get details of the application version number, copyright etc.

MENU OPTIONS AVAILABLE ONLY WHEN LOGGED IN

The menu options listed below require the PC to communicate directly with the controller and so are only available when you are logged in: *(To log in click the login/logout button on the toolbar or choose* Login *from the* File *menu)*

- Upload (Communications menu)
- Download (Communications menu)
- Scan (Communications menu)
- Change point Value (Communications menu)
- Change Controller Address (Communications menu)
- Change Baud Rate (Communications menu)

- Version (UC32 and UC menus)
- Statistics (UC32 and UC menus)
- Strategy Lock/Unlock (UC32 menus)
- Time and Date (UC32 and UC menus)
- Wipe Controller Memory (UC32 and UC menus)
- Configuration Information (UC32 and UC menus)
- Diagnostics (UC32 menu)
- DI Setup (UC menu)

- Version & Identification (UC32.net and UCC4 menus)
- Statistics (UCC4 menu)
- Setup (UC32.net menu)
- Time and Date (UC32.net and UCC4 menus)
- Wipe Memory (UC32.net and UCC4 menus)
- Port Setup (UC32.net menu)
- Alarm Setup (UC32.net menu)
- Web Server Access (UC32.net menu)
- Strings (UC32.net menu)
- Send Site Number (UC32.net menu)
- Generate Report (UC32.net menu)

THE TOOLBAR

The toolbar contains a number of buttons, which can be used as alternatives to menu options.

File buttons

Creates a new strategy file.

Opens an existing strategy file.

Saves the active strategy file.

Edit buttons

Cuts selected item or items from the active strategy and places them on the Clipboard.

Copies the selected item or items from the active strategy, and places them on the Clipboard.

Pastes the contents of the Clipboard onto the drawing area.

Modules buttons

Displays the Points module bar.

Displays the Logic module bar.

Displays the Mathematical module bar.

Displays the Control module bar.

Displays the Function module bar.

Displays the Statistic module bar.

Inserts text into a strategy.

Macro button

Creates a macro from selected modules on the drawing area.

View Globals button

Displays or hides the Globals bar.

Virtuals button

Displays or hides the Virtuals bar.

Communication buttons

Downloads a strategy from the PC to the controller.

Uploads a strategy from the controller to the PC.

Scans the values in the active strategy.

Zoom button

Zoom in - Enlarges the current view of the strategy

Zoom out - Reduces the current view of the strategy

Returns the strategy view to actual size.

Print button

Prints the active strategy.

Print preview - shows the strategy as it will appear when printed.

LiveLog button

Opens the LiveLog window.

Login/Logout button

Logs in to the controller.

Logs out of the controller.

Automatic Online Downloading button

Uses the Engineering Centre in Automatic Online Download mode.

Help button

Opens the on-line help.

THE MODULES BAR

When you select a module bar from the View menu or the module buttons, the module bar is displayed below the toolbar.

The current modules bar can also be 'undocked' and dragged to a different position on the display using the mouse.

THE DRAWING AREA

The drawing area is the part of the Engineering Centre interface where modules are placed and linked to form a strategy.
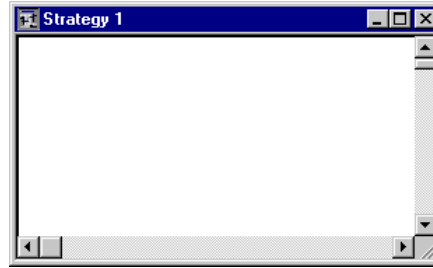
The following items can be placed on the drawing area:

- Modules
- Globals
- Macros
- Virtuals
- Routes showing how the points of different modules are connected
- Text

To define the background for the drawing area, select Window Setup from the Display menu.
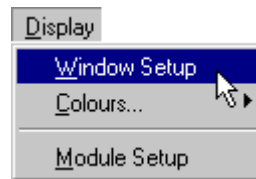
The Window Setup dialog allows you to specify whether or not there is a grid in the window, and if so set the grid spacing and style.
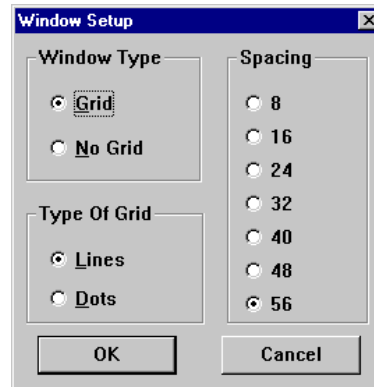
The drawing area can have a plain white background

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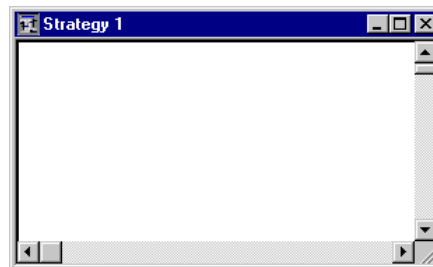
or alternatively, you can choose a background grid to facilitate the positioning of modules in a strategy. The grid can consist of lines…
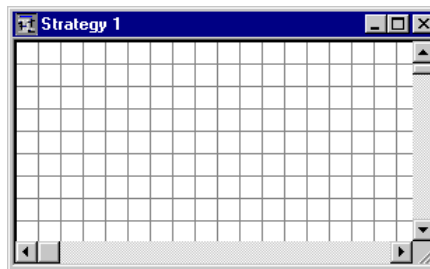
…or dots,
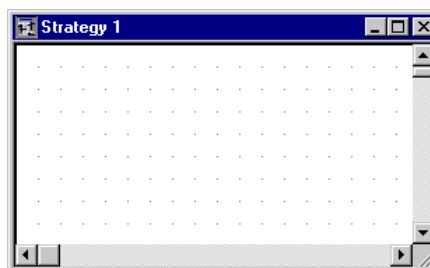
and the spacing within the grid can vary in size from 8 pixels…
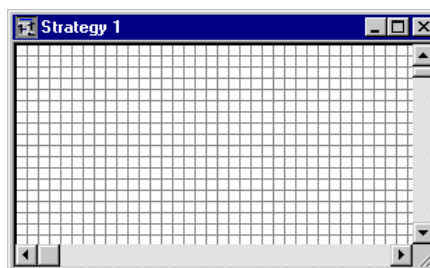
…to 56 pixels.
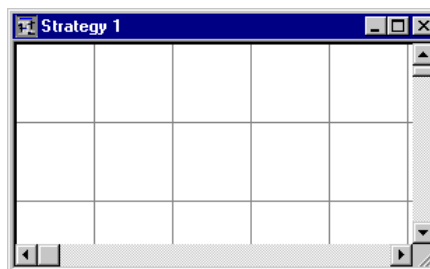
THE CURRENT TARGET BAR

The current target bar shows the site, and the names and addresses of the Communications Controller and the Field I/O Controllers that have been targeted. For example, if the controller named *001-01 ahu1* on the Fieldbus of a Communications Controller named *001-rooftop* of the site called *office block* is being targeted, the current target bar will look like this:

| 002-office block | 001-001 rooftop | 01-001-01 ahu1 | |

THE STATUS BAR

The status bar gives information about what is happening in the Engineering Centre It displays the page number of the active strategy and it also gives information on the toolbar and menu options that have been selected:

Explanatory information on toolbar options

If the mouse pointer is placed over buttons on the toolbar without clicking, the status bar gives some information about the item over which the pointer is placed. To produce the example below, the mouse pointer was placed over the macro button on the toolbar.

| Create a macro from selected modules and lines | Page : 1 | NUM | |
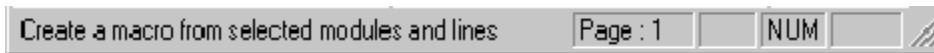
Explanatory information on menu options

If you place the mouse pointer over a menu option, similarly, the status bar gives information about the function of the menu option. For example, if you place the mouse pointer over **Version** from the **UCC4** menu, the status bar displays the following information:

| Gets the UCC4 Version number | Page : 1 | NUM | |
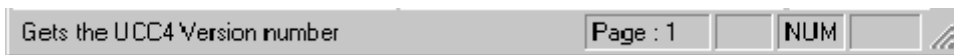
THE SITE LIST

The Site List shows in an explorer-like structure all the controllers in all the sites installed on the PC.

The site list may or may not be visible beside the strategy drawing.

To make it visible, ensure that the Site List option in the View menu is ticked:
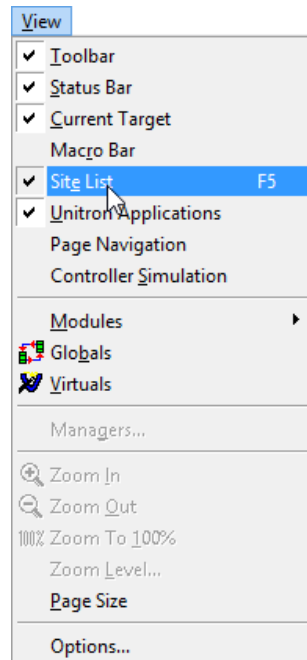
Selecting a controller from the site list sets it as the target controller for the current strategy.

Details of the Currently-selected Site are displayed below the list.
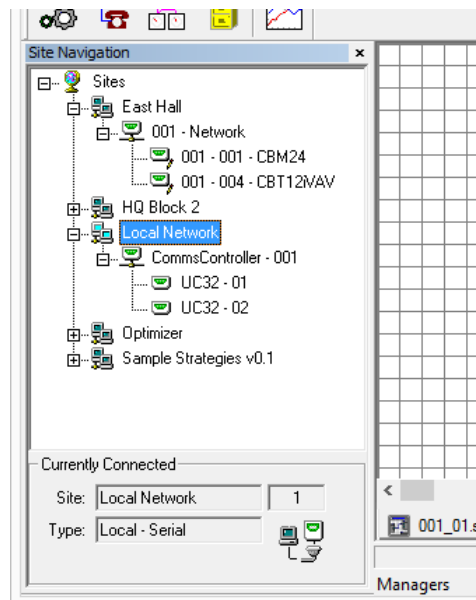
> **Note**: When you open the Site List, it opens with the default site selected.
>
> **Note**: On BACnet sites, holding the mouse over a Field Controller node causes a tooltip to be displayed, which shows the Device Instance Number for that Field Controller
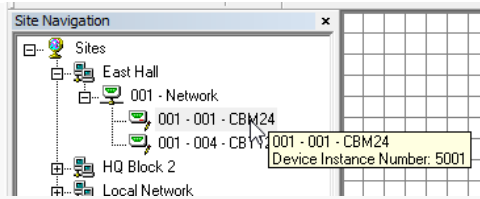
Strategy Drawings can be created or opened from a popup menu that is accessed by right-clicking on Field Controllers within the Site Tree.
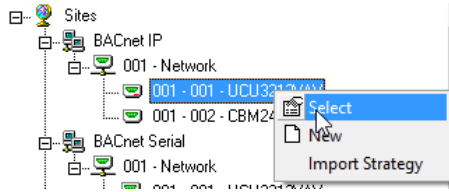
If the strategy drawing corresponding to a Field Controller is open, the a single left-click on that Field Controller will 'activate' the corresponding Strategy Drawing - i.e. bring it to the front of the display.

If the strategy drawing is open, the right- click popup menu changes to give options relevant to the strategy:
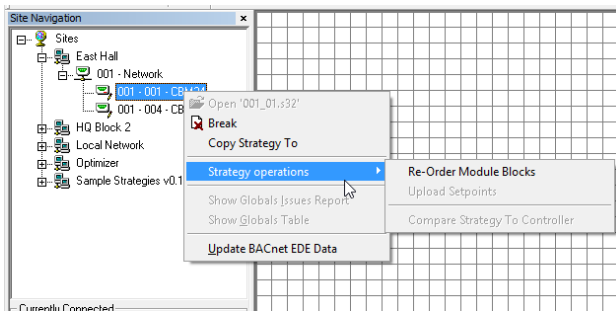
> **Note**:   Any tree node can be selected (not just the Field Controllers), but only Field Controller nodes will enable Top level menus and activate opened strategies.

The Site Tree is automatically refreshed if changes are made in the **Cylon Configuration utility**.

> **Note**:   All opened Strategy Drawings are closed during a Cylon Configuration utility refresh, so that they are synchronized with any new changes. The user is prompted to save any Strategy Drawing changes.
>
> Following the refresh, all of the Strategy Drawings that were open before the refresh are re-opened.

SECTION 3 : BASIC TASKS

STARTING THE ENGINEERING CENTRE

Open the **Cylon Engineering Centre** section on the **Windows** `Start menu` or `start screen` , or search for "Cylon Engineering Centre" in the `Application search box` .

Click on the **Engineering Centre** icon.

The **CEC** interface will open:
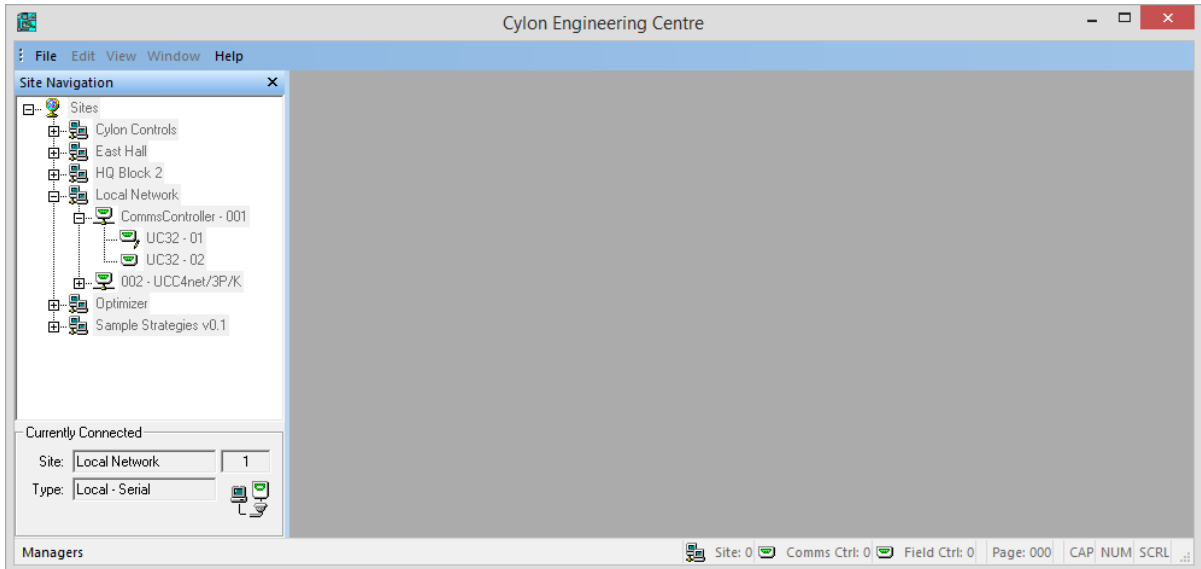
The **CEC** is disabled until you Sign On as a user (see *Signing on* on page 47)

SIGNING ON

If you have not signed on the **Cylon** system before starting the **Engineering Centre** (for example, in **CCView**), the menus in the **Engineering Centre** will be disabled. You must sign on for the full range of menus to become enabled.

To sign on, open the **File** menu and choose **Sign On**.
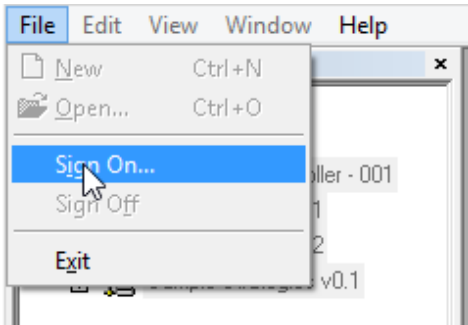
Enter your username and password
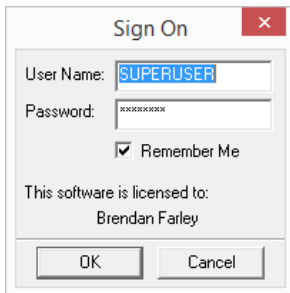
If you tick the Remember Me checkbox, the username and password will be pre-filled the next time you try to sign on.

When you have signed on, the Toolbars will be accessible:
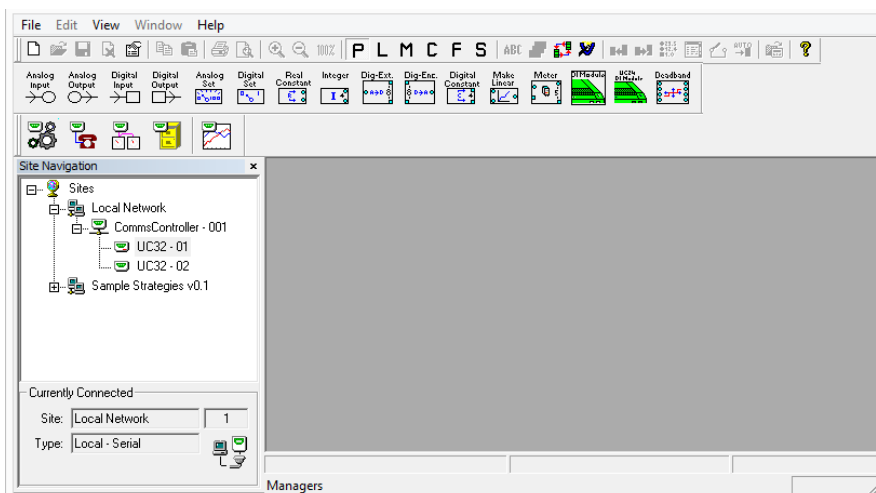
You can also sign on by minimizing the **Engineering Centre** and signing on in **CCView**. When you return to the **Engineering Centre**, the menus will be enabled.

TARGETING A CONTROLLER

Before creating a strategy, you should first select the site and the controller for which the strategy is designed and to which it will eventually be downloaded. The Engineering Centre allows you to do this by clicking on the site and controller icon in the Site List provided:
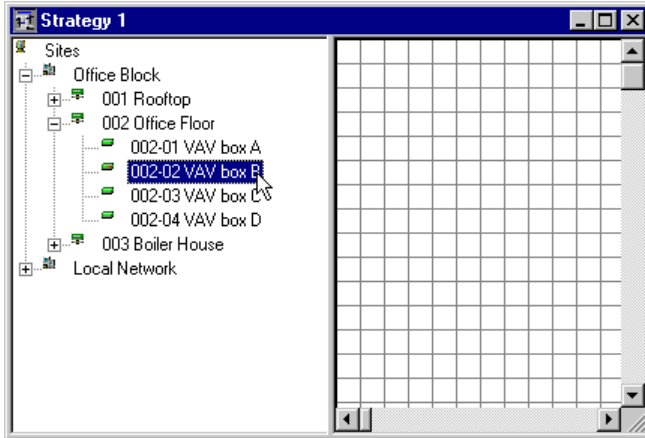
Note: The frame in which these icons appear can be resized by dragging it as required:
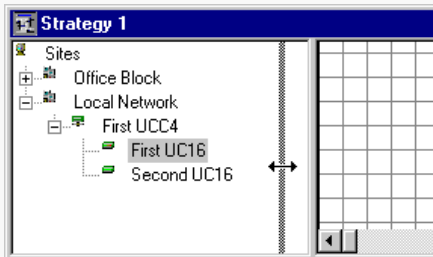
If the **Site List** does not contain the name of your site(s) or the controllers within the site(s), check that the **Database Server** program is running. If it is not, run it and when you return to Engineering Centre, your site(s) will be available in the Engineering Centre site map.

Note: The targeted controller can be changed at any stage by clicking the site or controller to which you would like to change in the Engineering Centre site list.

LOGGING IN AND OUT

Work in the Engineering Centre can be done on-line or off-line. When on-line, the PC can communicate directly to the controller. When off-line, there is no direct link between the PC and the controller. For tasks that involve direct communication between the PC and the controller, e.g. uploading or downloading information, it is necessary to work on-line.

- To work on-line, you must **Log In** to the controller.
- To work off-line, you must **Log Out** from the controller.

TO WORK ON-LINE (LOG IN):

Log in by choosing Login from the File menu

or by clicking the login/logout button on the toolbar so that the gate is closed as shown below:
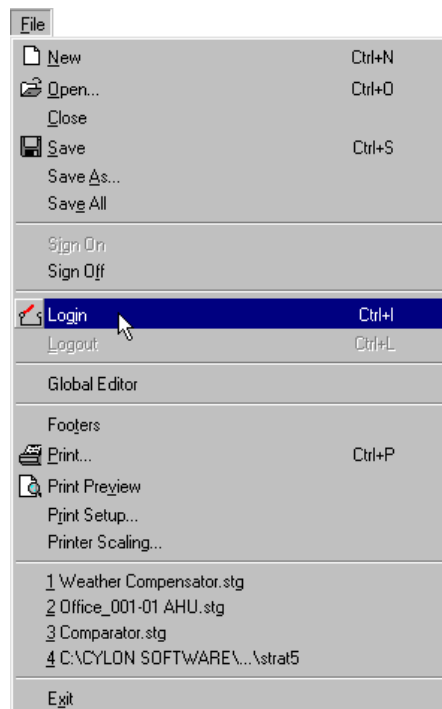
TO WORK OFF-LINE (LOG OUT):

Log out by choosing Logout from the File menu

or by clicking the login/logout button on the toolbar so that the gate is open as shown below:
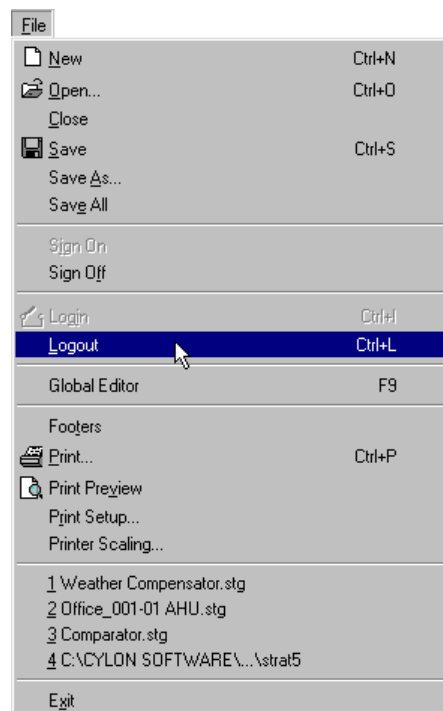
OPENING FILES

To open a strategy file in the Engineering Centre, you can

- Create a new strategy

or

- Open an existing strategy file.

It is possible to open multiple files: multiple new strategies in different controllers, multiple existing files, or a mixture of both (see page 51)

CREATE A NEW STRATEGY

Create a new Strategy by clicking the

button on the toolbar, or by selecting New from the File menu.

File	
New	Ctrl+N
Open...	Ctrl+O
Close	
Save	Ctrl+S
Save As...	
Save All	
Sign On	
Sign Off	
Login	Ctrl+I
Logout	Ctrl+L
Global Editor	
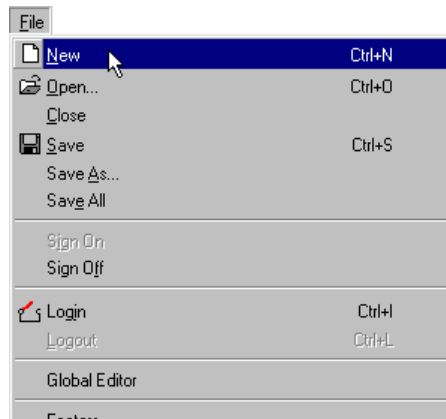
OPEN AN EXISTING STRATEGY FILE

Open an existing strategy file by clicking the

button on the toolbar,

or by selecting Open from the File menu.

Either of these options will produce the generic Windows Open dialog box.

File	
New	Ctrl+N
Open...	Ctrl+O
Close	
Save	Ctrl+S
Save As...	
Save All	
Sign On	
Sign Off	
Login	Ctrl+I
Logout	Ctrl+L
Global Editor	
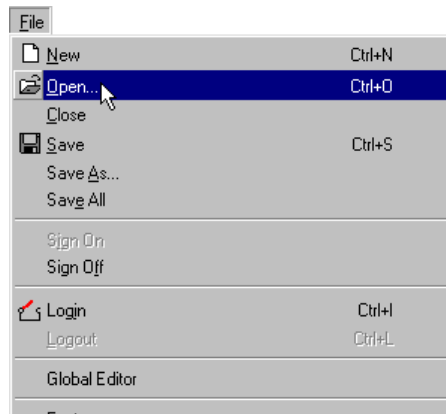
NAVIGATING A MULTI-PAGE STRATEGY

For clarity, many strategies are drawn over several print-pages. To facilitate navigation through these pages, the Engineering Centre provides a Page Navigation toolbar.

Opening the Navigation Toolbar

Select Page Navigation from the View menu.
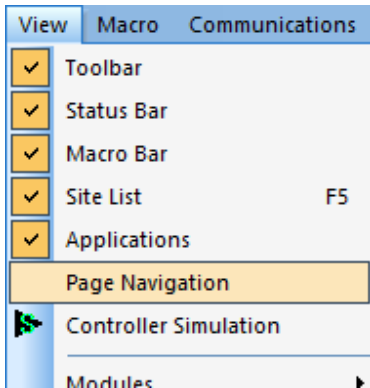
This opens the Page Navigation toolbar:
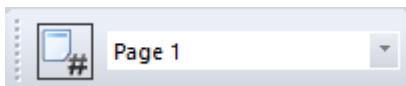
Moving between pages in a strategy drawing:

Click the Show Page Nums button to toggle the display of page numbers in the strategy drawing:
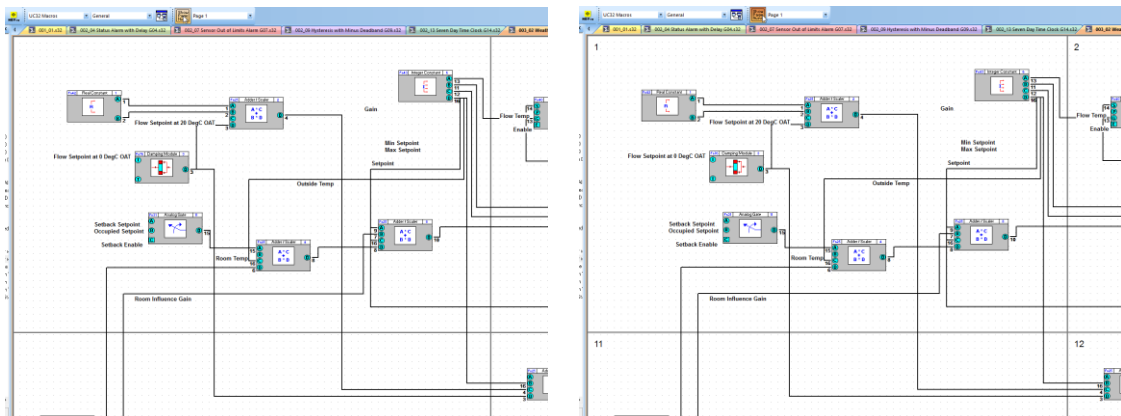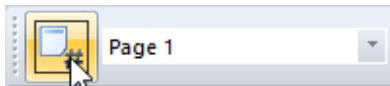
The navigation drop-down list box allows you to jump to a specific page:
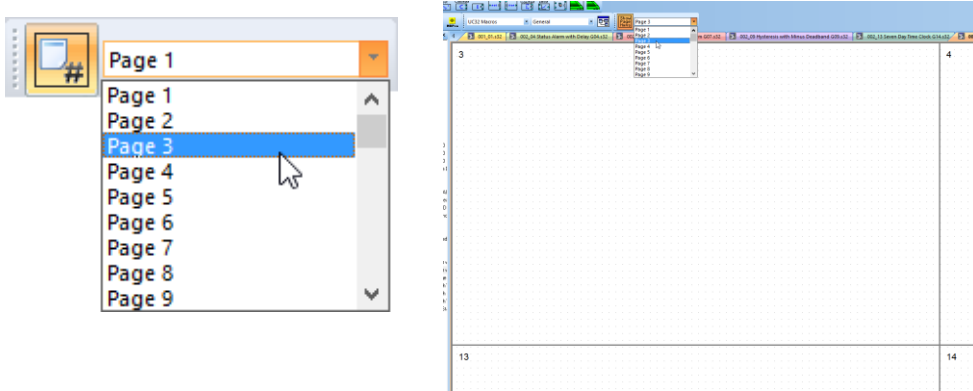
Labelling the pages within a strategy drawing

The page numbers can be edited to act as labels. To do this, right-click on the label to open the Insert Text dialog:
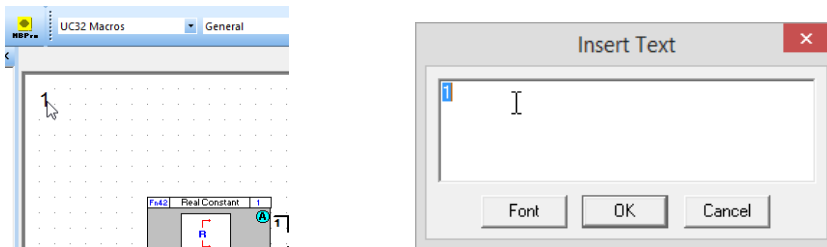
Enter the required label:
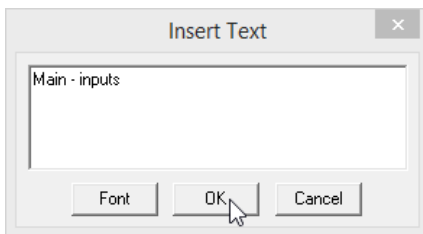
The label text is displayed on the **strategy** drawing, and alongside the page number in the navigation drop-down list:
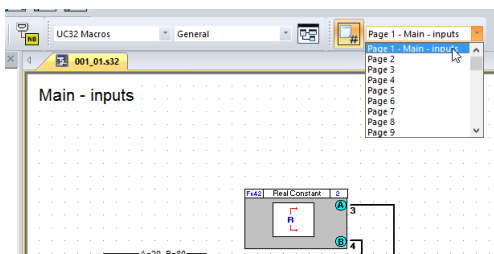
FINDING AN ELEMENT IN A STRATEGY

The **Engineering Centre**'s Find dialog is a facility for locating specific objects in a strategy,

It is opened by either pressing [Ctrl]+F, or by selecting Find from the Edit menu.
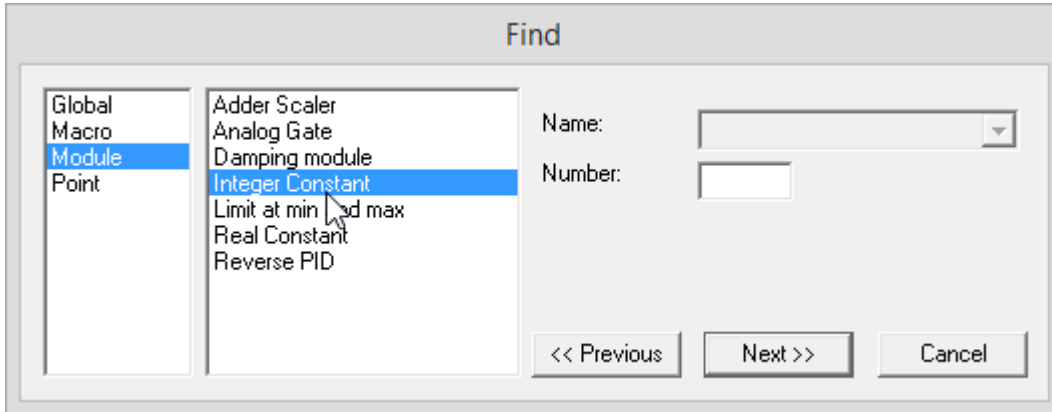
This dialog contains a number of lists in which you can specify a number of filters to reduce the kinds of items that will be located – for example Integer Constant modules only as shown in the screenshot above.

You can then step through all of the matching items in the strategy drawing using the << Previous and Next >> buttons. The current match will be highlighted in the drawing:
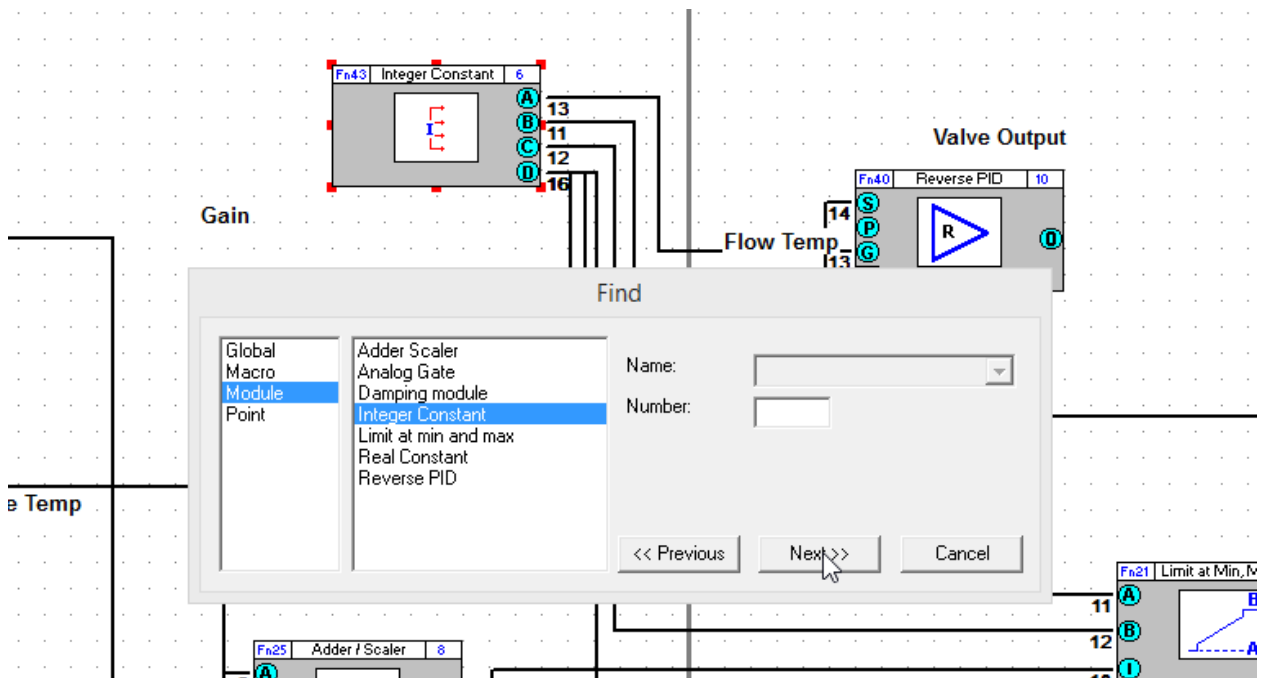
It is also possible to use the keyboard to step through the latest Find filters even after the dialog is closed, using [**Ctrl**]+[**Page Down**] for next and [**Ctrl**]+[**Page Up**] for previous.

OPENING MULTIPLE FILES

The **Engineering Centre** allows you to have several files open at once. Each file must be opened individually as described above. Each file can be minimised, maximised and arranged in a number of ways in relation to the other open files.

Arranging open files

If you are working on more than one strategy at a time, you may wish to be able to see all of the strategy files simultaneously. The Engineering Centre allows you to arrange open files in a number of ways: cascaded windows, horizontal tiled windows and vertical tiled windows.

Cascade

In this arrangement, open file windows are all the same size and are placed along a diagonal line through their top left corners, starting from the top left corner of the screen. The active file is always on top.
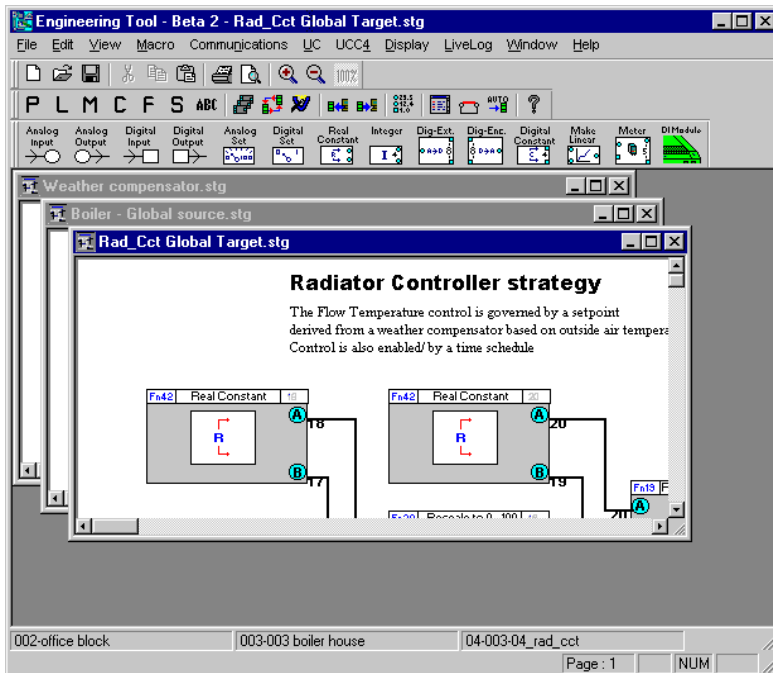
To arrange open strategies in a cascade arrangement, choose **Cascade** from the **Window** menu.
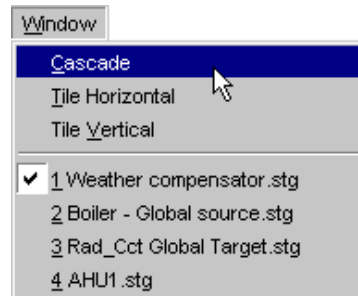
Horizontal tile

In this arrangement, open file windows are all the same size and are arranged horizontally.
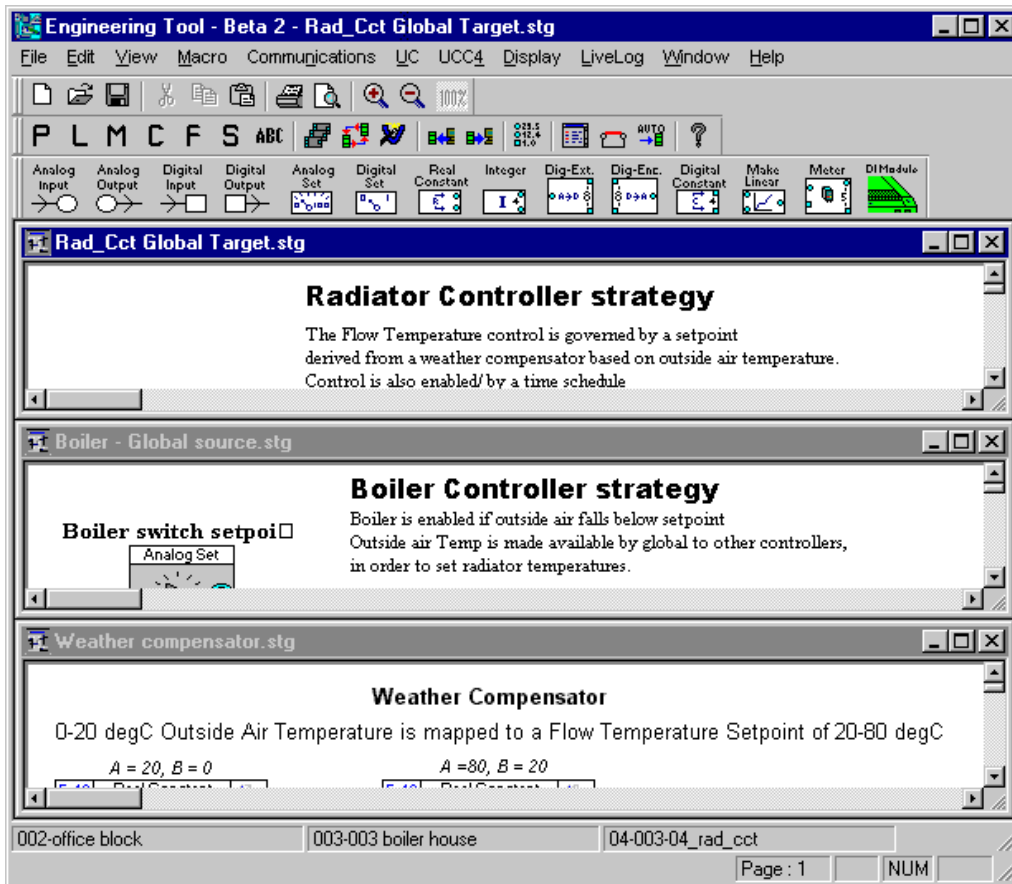
To arrange open strategies in a horizontal tile arrangement, choose **Tile Horizontal** from the **Window** menu.
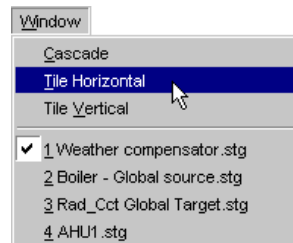
Vertical tile

In this arrangement, open file windows are all the same size and are arranged vertically.
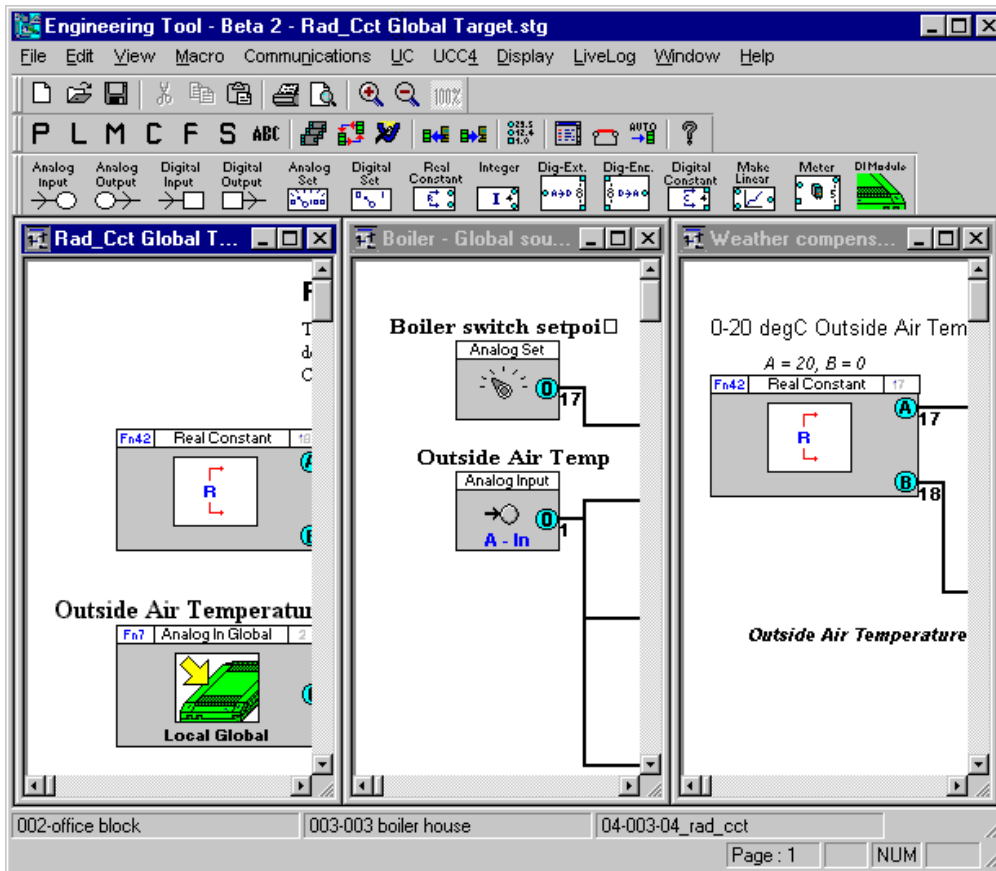
To arrange open strategies in a vertical tile arrangement, choose **Tile Vertical** from the **Window** menu.
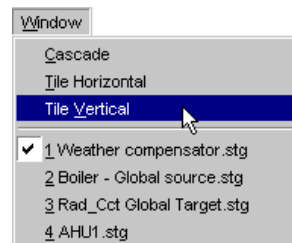
ZOOMING IN AND OUT OF THE DRAWING AREA

The drawing area can be displayed in an enlarged or reduced view. The default view is 100%, i.e. full size.

To zoom in to the drawing area, click on the

button in the toolbar, or select **Zoom In** from the **View** menu.

This will zoom in steps of 100%.
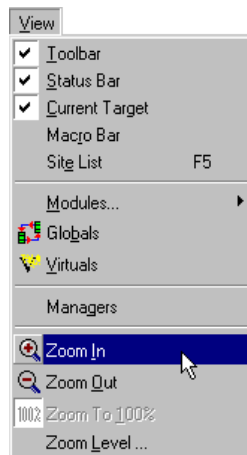
To zoom out from the drawing area, click on the

button in the toolbar, or select **Zoom Out** from the **View** menu.

This will zoom out in steps of 10%.
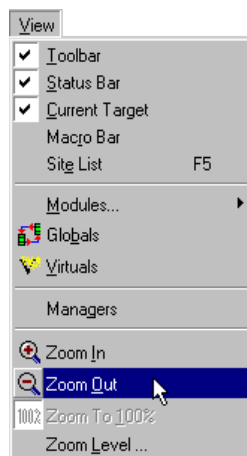
If more precise zoom control is required, click on **Zoom Level** in the **View** menu:
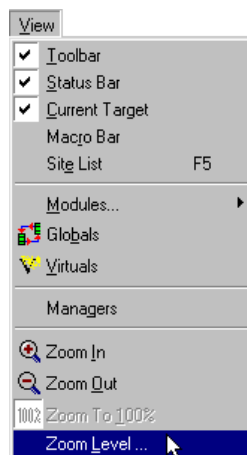
This opens the Zoom Level dialog box.

You can use this to set the scale of the strategy view directly, and see a preview of the scaled view.
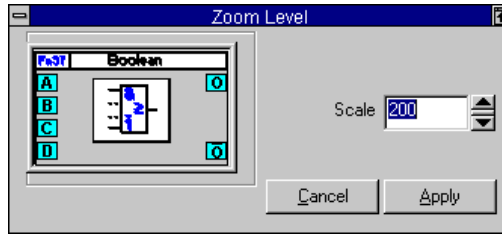
To return to the default view, click the

button in the Toolbar, or select **Zoom to 100%** from the **View** menu:
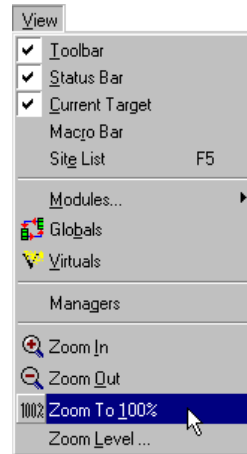
CHANGING THE DISPLAY

The following features of the **Engineering Centre** can be customized:

- **Module Bars.** By editing the UC16int.ini file *(see page 434)*, you can rearrange the module bars. For example, you can group together the modules that you require most frequently on one module bar, arrange them alphabetically or according to module number.

- **Drawing Area (Grid Settings).** To simplify positioning modules on the drawing area, you can choose a grid of either lines or dots. You can also customize the size of the grid from 8-pixel to 56-pixel squares *(see page 60)*.

- **Colours.** The colour of either the background or the grid can be customized using the **Colour** menu option from the **Display** menu. In addition to the standard colours available, custom colours can also be defined *(see page 61)*.

- **Macros.** If the work you do in the Engineering Centre involves repetitive strategies or parts of the strategies, you can create macros *(see page 236)* to automate much of that work. You can arrange those macros in groups and, using an art tool, such as Microsoft Paint, you can draw icons to represent the macro groups and individual macros you have created.

- **Application Apearance.** The colour theme of the **Engineering Centre** application itself can be adjusted, and the there is a choice of 2 Icon styles for the modules bar.

MODIFYING THE DRAWING AREA (GRID SETTINGS)

From the Display menu, choose Window Setup .
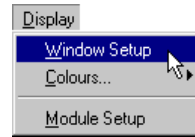
This produces the Window Setup dialog box:
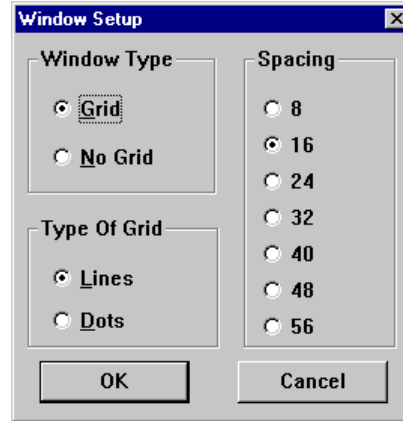
By selecting either of the two buttons listed under Window Type , you can choose to display the drawing area of the Engineering Centre with or without a grid.
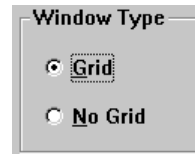
The Type of Grid box allows you to choose a grid that is composed of either lines or dots.
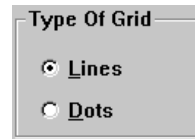
The Spacing box allows you to choose from a range of square sizes for the grid. The minimum possible size for a grid square is 8-pixels while the largest is 56-pixels.
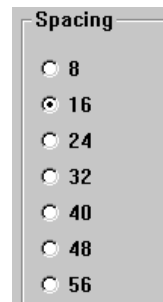
MODIFYING DISPLAY COLOUR SETTINGS

From the Display menu, choose Colours....
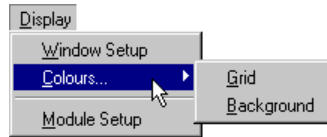
This menu option offers a choice of Grid or Background .
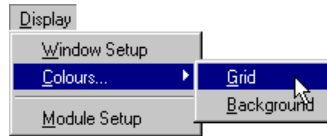
To change the colour of the drawing area's grid, choose Grid .

To change the colour of the background, choose Background .
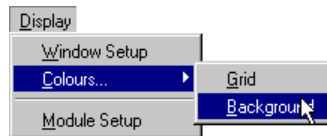
In both cases, the Colour dialog box is called. This allows you to select from a range of colours. You can also make custom colours, by clicking on the Define Custom Colours button. When you have selected the colour you require, click OK . The colour is applied immediately.
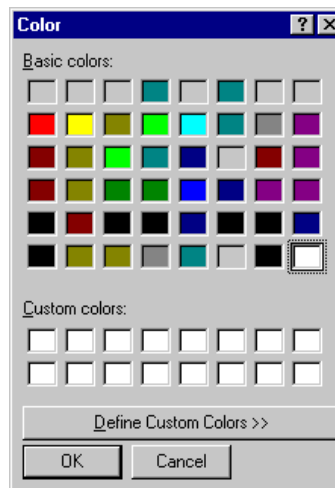
MODIFYING THE APPLICATION APPEARANCE ("THEME")

The appearance of the **Engineering Centre** interface can be adjusted by selecting View menu > Application Look and clicking on one of the following options:

Office 2003:
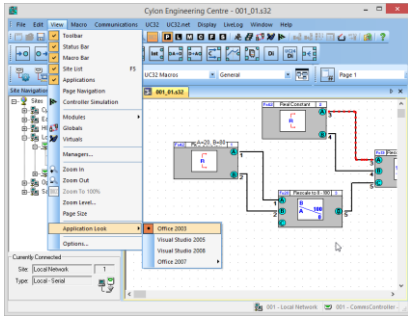
Visual Studio 2005
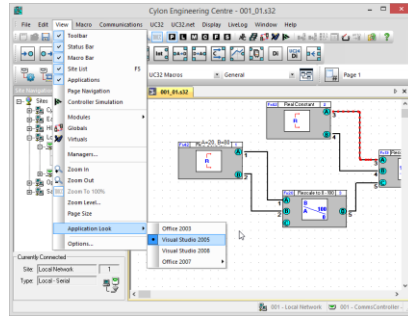
Visual Studio 2008
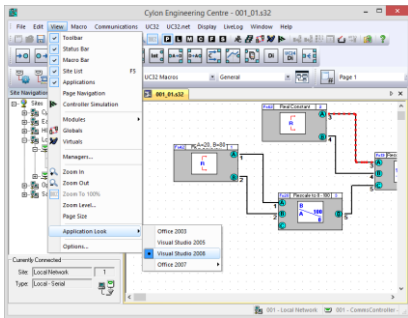
Office 2007 Blue Style
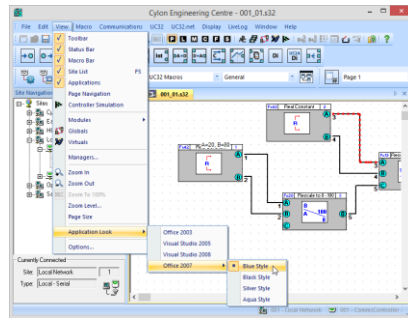
Office 2007 Black Style
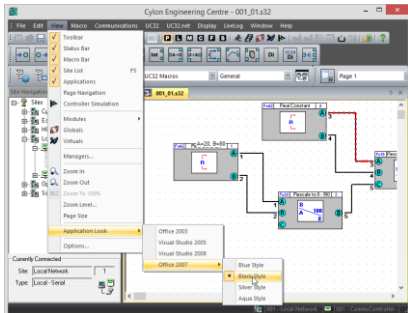
Office 2007 Silver Style
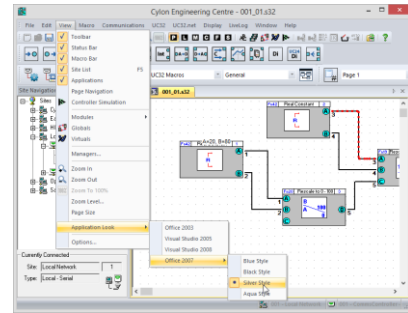
Office 2007 Aqua Style
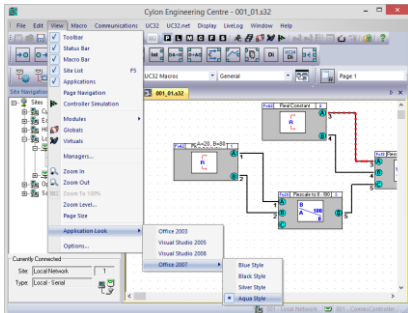
In addition, two different styles of icon are available for display in the `Modules bar` – the default set and the "legacy module toolbar" set. To replace the default set with the legacy set, open the `Options` dialog from the `View` menu and tick the `Use legacy module toolbar icons` checkbox.
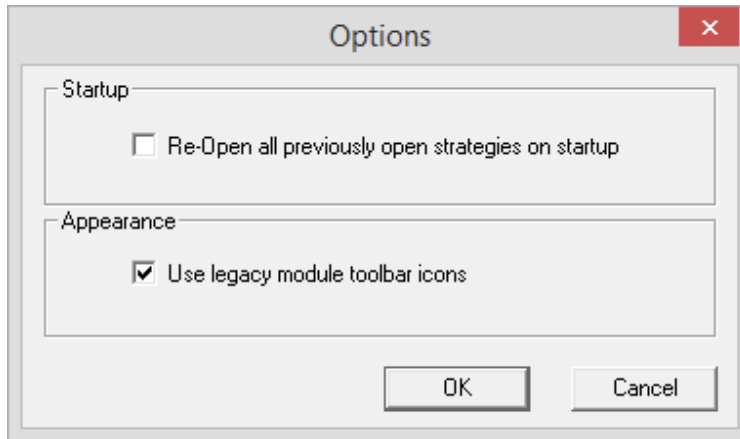
Default style:

Legacy style:
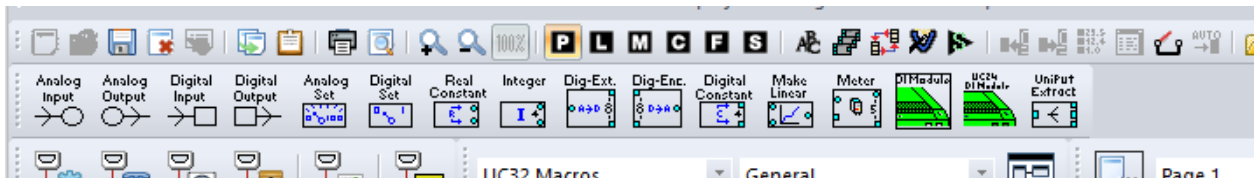
Note: The overall interface appearance will change immediately when the selection in `View` menu > `Application Look` is changed, but the icon style will not change until the Engineering Centre is shut down and restarted.

SAVING FILES

The **Engineering Centre** allows you store files on disc by:

- Saving a new file
- Saving changes to an existing file
- Saving multiple files at once

Files will be saved in the "strat5" folder of the relevant site directory, under a numbered directory. The number of the directory matches the number of the Comms Controller to which the targeted controller is attached - for example:

```
C:\UnitronUC32\Lan\strat5\001\001_01FanCoil.stg
```

would be a **strategy** in a controller on the first **Comms Controller** of the site called "LAN".

Saving a new file

If a file is being saved for the first time, click on the

button on the toolbar, or select Save from the File menu
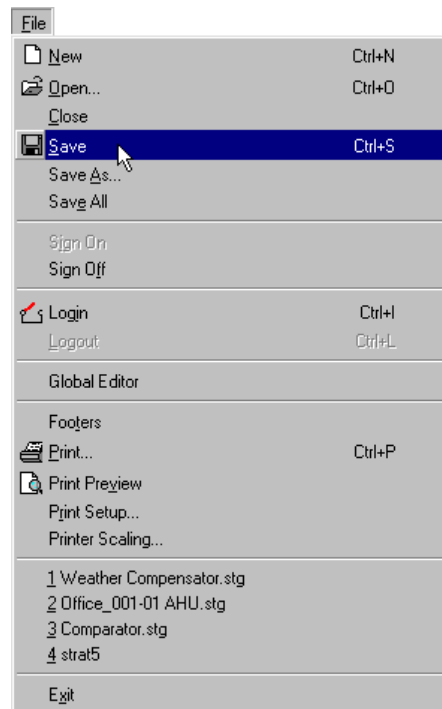
This produces the Save As dialog box allowing you to specify how the file is to be saved:
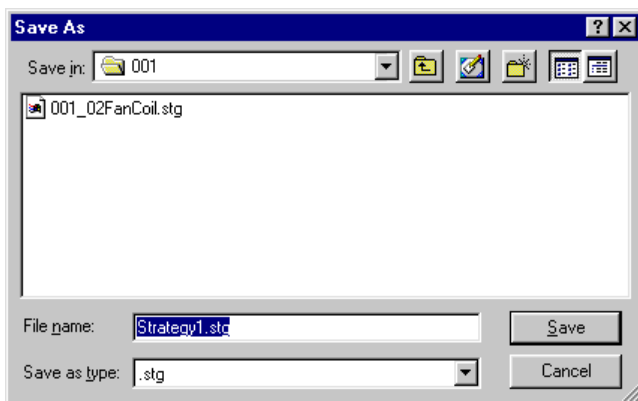
Save in:

Choose the directory in which you wish to save the file.

File Name

Enter a name for the file.

> **Note:** Filenames can be up to 50 characters in length.

Save File as Type

Choose the correct extension for the file you are saving from the Save file as type list box (e.g. .stg for a strategy file).

Saving changes to an existing file

If you have made changes to an existing file and wish to save those changes, but do not wish to rename the file, nor save it to a different location on the PC, you can save the file in two ways:

click on the

button on the toolbar, or select **Save** from the File menu
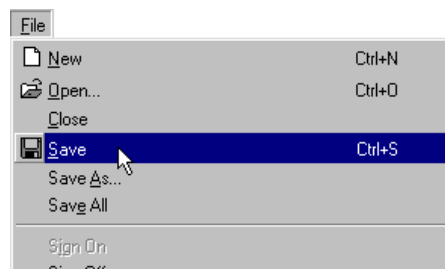
Saving more than one file

If you have a number of files open and wish to save them all, choose Save All from the File menu. This saves each of the files.

If one of the open files is being saved for the first time, the Engineering Centre will prompt you to specify a drive, directory, name and file extension for that file by calling the Save As dialog box.

PRINTING

The **Engineering Centre** can generate a hard-copy **printout** of the current strategy, or display a **preview** of the printout on-screen.

Viewing a file before printing

To see how a strategy will look on a page, choose Print Preview from the File menu.

This shows a full page view, displaying the strategy as it will appear when printed.

The Print Preview toolbar

Print...

Click to print the active strategy.

Next Page

Click for a preview of the next page of the strategy.

Previous Page

Click for a preview of the previous page of the strategy.

One Page / Two Page

The one page / two page toggle button allows you to view either one or two pages at a time.

Zoom in

Click to enlarge the preview of the strategy.

Zoom out

Click to reduce the preview of the strategy.

Close

Click to exit **Print Preview** and return to the Engineering Centre window.

Including a footer in a printed strategy

When you print files created in the **Engineering Centre**, they include additional information at the end of the printed page in the form of a footer. The footer includes the name of the site, as well as the **Communications Controller** and **Field Controller** for which the strategy is designed. You can edit the footer to include your name, your company's name, the name of the project to which the file belongs, the number of the drawing, if any, and the date and details of any revisions made to the drawing.

How to edit the footer that will appear with the strategy when it is printed:

Choose Footers from the File menu.

This opens the Footers details dialog box

Enter the required details and click Save.

Altering the print set-up

To define how the strategy is to be printed, choose Print Setup from the File menu to open the standard MSWindows Print Setup dialog box, where you can specify the required printer, paper, etc.

Printing a file

To print a file, press the ⊟ Button on the toolbar, or select Print… from the File menu. This opens the standard MSWindows Print dialog box to specify the required printer, pages to be printed and number of copies.
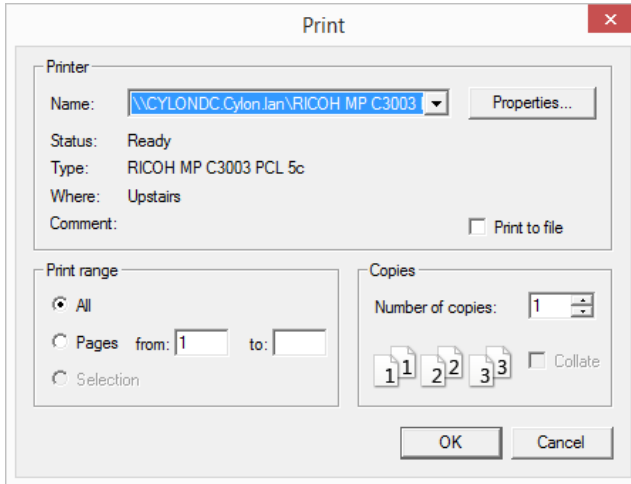
Changing the size of a Printout

If a strategy is large, it may not be possible to view enough modules on each page with a standard printout. The Engineering Centre has a Printer Scaling option, which allows you to decrease the printed size of the strategy so that more of it is visible per page.

Also, if you have set a strategy up for printing on a particular printer, you may find that if you try printing on a different printer it may not fit properly on the page. The Printer Scaling option allows you to adjust the printout size to compensate for this.

To resize a printout, select Printer Scaling… from the File menu

This opens the Printer Scale dialog box:
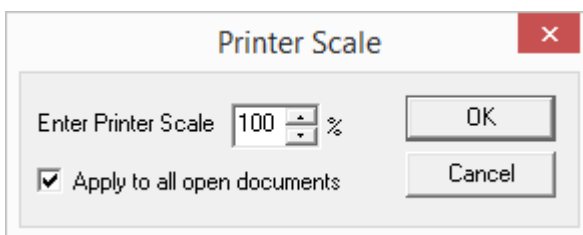
Enter a scaling factor between 20% and 300%.

- Factors from 20% to 99% will decrease the size of the modules in the printout.
- Factors from 101% to 300% will increase the size of the modules in the printout.

Ticking the Apply to all open documents box will set all currently-open Strategies to print with the same scale.

Fitting a Strategy to a page size when printing.

The Strategy drawing indicates where Modules will appear on the printed page, by drawing gray borders on the Strategy drawing:
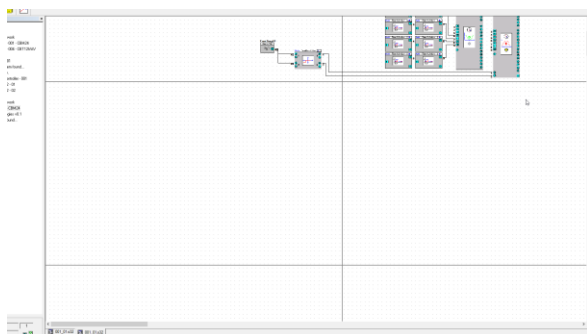
The Printer scale setting will change the size of modules relative to these pages:
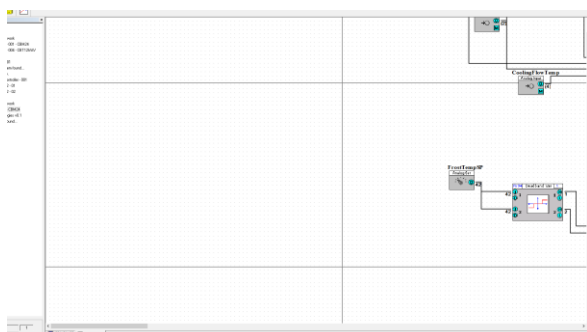
The physical page size represented by the gray borders is set by selecting Page Size from the View menu. This opens the Page Size dialog:
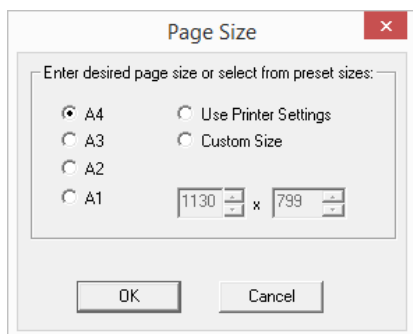
Selecting Use Printer Settings will allow you to select the page size from the Print dialog at the time of printing:
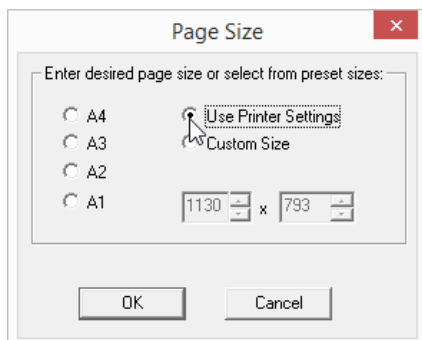
CLOSING FILES

You can close an open **Strategy** file in two ways:

Click the Close button at the top right-hand corner of the file window,
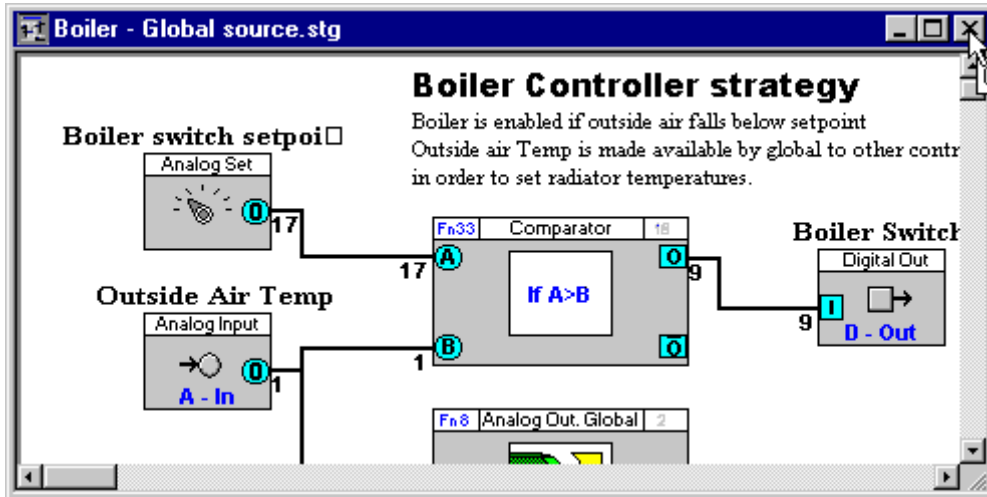
or

Select Close from the File menu.
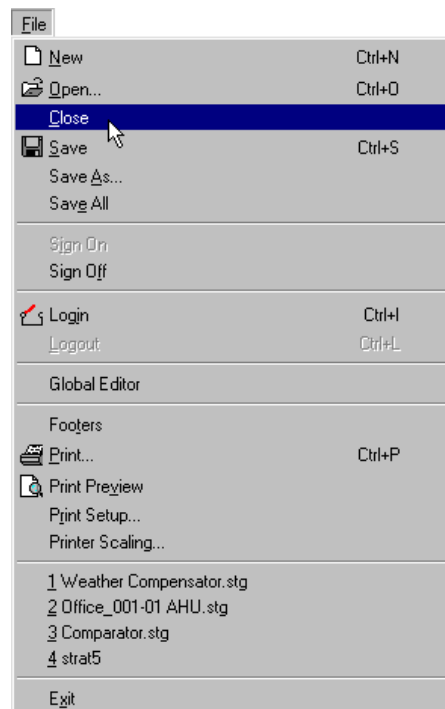
If changes have been made to the file since the last save, the **Engineering Centre** will prompt you to save it before closing.

If more than one file is open, selecting Close from the File menu closes the active window.

MODULES

Modules are the components from which **strategies** are designed. The complete list of modules is given in the tables below. By opening the `UC16int.ini` file you can change the preset constant values for many of these modules. Once these values have been changed the dialog box of the module will read the updated constant values. For details about each module, see Modules Reference (Sections 21 – 28) on pages 461 to 691

Points Modules

Module No.	Module Name
-	Analog input
-	Analog output
-	Digital input
-	Digital output
-	Analog set point
-	Digital set point
42	Real Constant
43	Integer Constant
48	Digital extract
49	Digital encode
54	Digital Constant
61	Make linear
	Digital Extract DI (UC24PG Digital Input module)
	DI Module (UC16DI Digital Inputs)
63	Meter
89	Uniput Extract
99	DI module

Logic Modules

Module No.	Module Name
37	Combination of digital inputs (Boolean)
38	Edge triggered latch
56	Timer with constant inputs
36	Timer
79	Timer with minimum off time
57	Wide OR gate
58	Wide AND gate
82	Wide inverter gate
44	Time schedule
60	Holiday schedule
55	Long period timer
83	Real time clock
84	Adjust Schedule

Function Modules

Module No.	Module Name
19	Rescale from 0 to 100
20	Rescale to 0 and 100
21	Limit to min and max
31	Analog gate
33	Comparator
34	Window comparator
22	Limit to 0 and 100

Mathematical Modules

Module No.	Module Name
25	Adder/Scaler
66	Minimum of 8 inputs with minimum input indicator
28	Minimum of 8 inputs
65	Maximum of 8 inputs with maximum input indicator
29	Maximum of 8 inputs
30	Average of 8 inputs
70	Sum of 8 inputs
26	Multiplier/Scaler
27	Divider/Scaler
51	Accumulator
71	Absolute value
23	Log of input
32	AntiLog of input
68	Log to base e of input
69	AntiLog to base e of input
24	Square root
87	Rounding module

Control Modules

Module No.	Module Name
39	Forward PID
80	Tuneable forward PID
40	Reverse PID
81	Tuneable reverse PID
18	Hysteresis
67	Tuneable Hysteresis
52	Time proportional driver
53	Raise/Lower driver
74	Ring counter
75	Heating curve
76	Damping module
64	Hx-diagram
35	Enthalpy
45	Optimizer A
46	Optimizer B

Statistic Modules

Module No.	Module Name
17	Datalog definition
41	Alarm record
77	Control flags
78	System flags
73	Runtime module
62	Seconds run
72	Number of active digital inputs
50	Counter
25	Comment
85	HOA POT value
86	HOA switch state

SECTION 4 : USING MODULES

MODULES - OVERVIEW

Modules are the building blocks from which strategies are constructed. They are the basic units of operation in the Engineering Centre.

Modules perform tasks within a strategy such as

- bringing controller inputs into the strategy
- changing the values of points in the strategy according to mathematical rules
- comparing the values of points in the strategy
- recording the values of points in the strategy
- sending point values to the controller's outputs.

Modules can be grouped and saved as in order to avoid repetitive tasks, i.e. if you use a particular strategy or part of a strategy frequently, you can save it as a macro and reuse it without having to repeatedly re-create it.

Modules are represented graphically in the Engineering Centre in 3 ways:

- as a **Module button** in the modules bar
- as a **Module symbol** in a strategy diagram
- as a Module dialog box.

By default, the modules are arranged in six categories in the **Engineering Centre**. One of these at a time can be can be selected to appear in the Modules bar.

MODULE BUTTON

Each module is represented by a button on the floating modules bar,
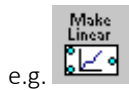
e.g.

MODULE SYMBOL

When a module has been placed on the drawing area, it is represented by a module symbol.
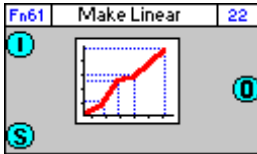
Most module symbols display
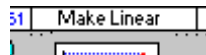
| A module number, | a module name, | and a block number, |

As shown in the example above.

The inputs to the module are represented by blue circles or squares on the left of the module symbol:

and the outputs by blue circles or squares on the right of the module symbol:
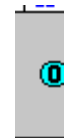
MODULE DIALOG BOX

To access the module dialog box, click the module symbol with the right mouse button. You will then be able to enter in the dialog box the parameters you require for that module. This example shows a completed dialog box for the **Make Linear** module:

THE ARRANGEMENT OF MODULES IN THE ENGINEERING CENTRE

There are six categories of modules available in the Engineering Centre:

P   Points

L   Logic

M   Mathematical

C   Control

F   Function

S   Statistic

Each group is represented by a button on the toolbar, and listed under the **Modules** command in the **View** menu.

Selecting a module group

In order to insert a module into a strategy, you must choose it from a group on the **modules bar.**

You can choose the group of modules with which you want to work in two ways:

Click the appropriate module button on the toolbar.
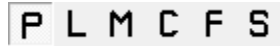
Or..

Choose Modules from the View menu and select a group from the list.
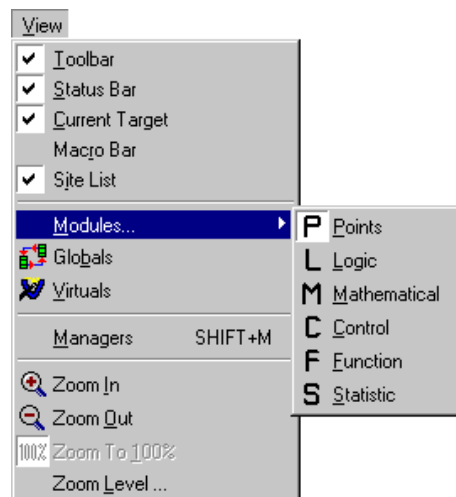
The selected group will then be displayed on the **modules bar**, and a specific module can be selected.

The modules bar

When you choose a particular module group, the modules within that group are presented in the modules bar.

The modules bar is usually docked below the Toolbar, but can be resized and moved to any location on screen.

There are six different module bars available in the Engineering Centre by default:

Points:
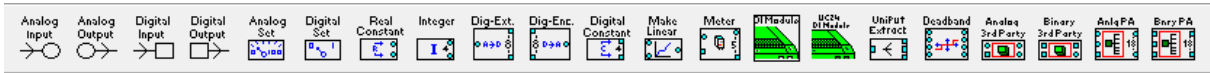
Logic:
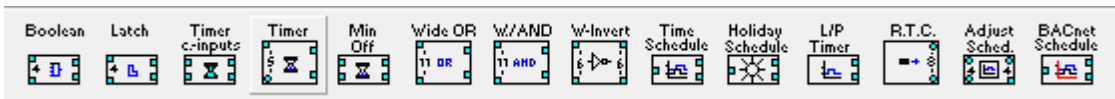
Mathematical:

Control:
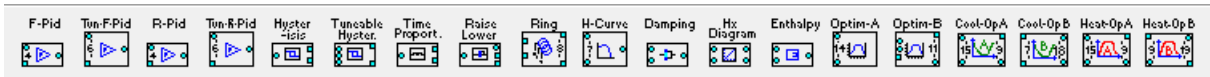
Function:

Statistical:
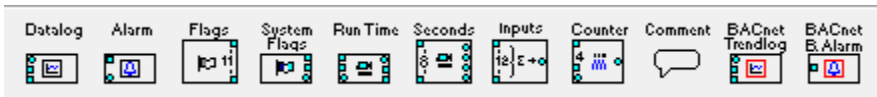
Choosing a module from the modules bar

To choose a module from the **modules bar**, click the button of the module you require.
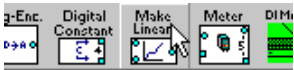
The module button will depress, to show that the module has been chosen.
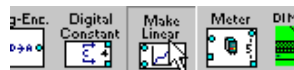
PLACING A MODULE ON THE DRAWING AREA

In order to use a module in a strategy, you must place it in the strategy's 'drawing area'.

To do this, click on the module in the modules bar to select it.
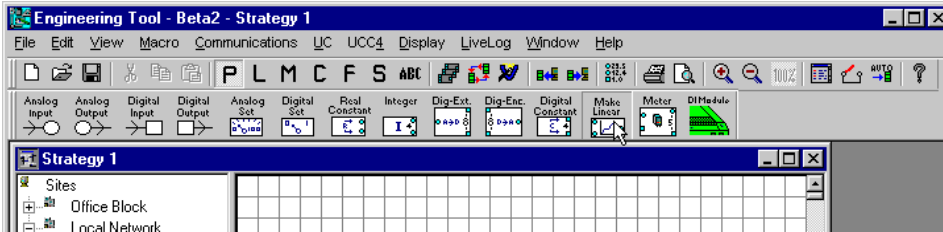
Then move the mouse pointer to the point in drawing are where you want to place the module.
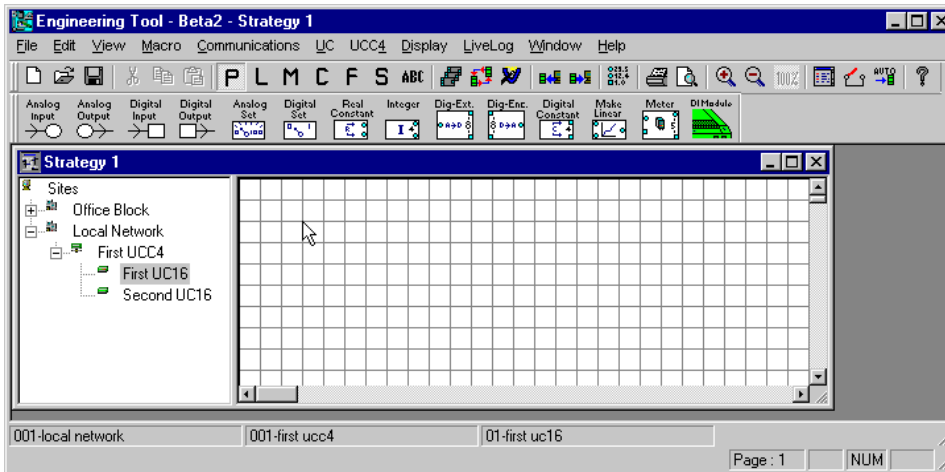
When you press the mouse button, the module symbol will be placed on the drawing area, with the top left-hand corner of the symbol at the point where the mouse was clicked.
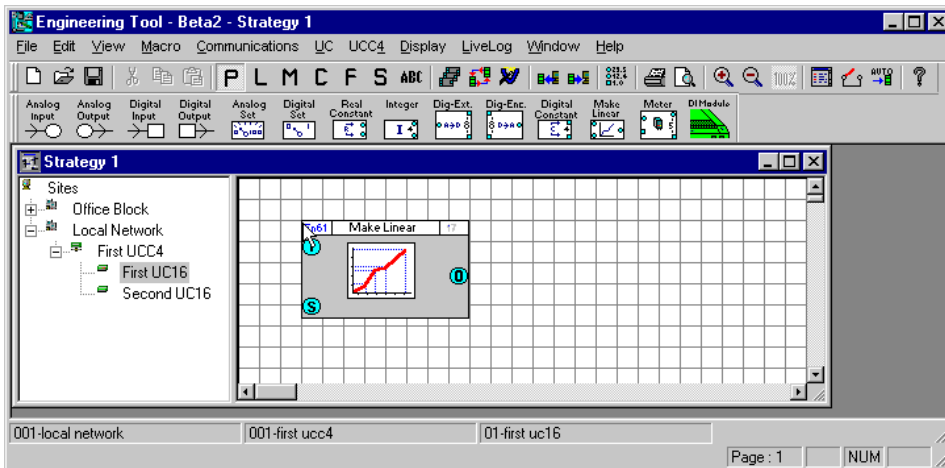
Note: If you have multiple strategies open at once, ensure that you select the strategy into which you would like to place the module before you select the module from the modules bar.

The module can now be **selected**, and **edited**, **moved**, **copied**, **cut**, or **joined** to other modules.

Selecting modules on the drawing area

Before you can move, copy, cut or delete a module, you must first select it. This can be done by:

Double-clicking on the module symbol,
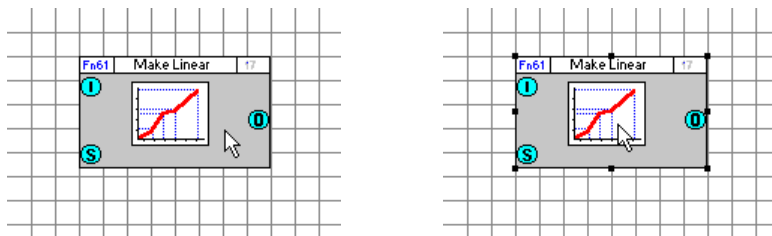
or

Clicking and dragging from the top left to the bottom right of the module symbol as shown. When you release the mouse button, the module will be selected.
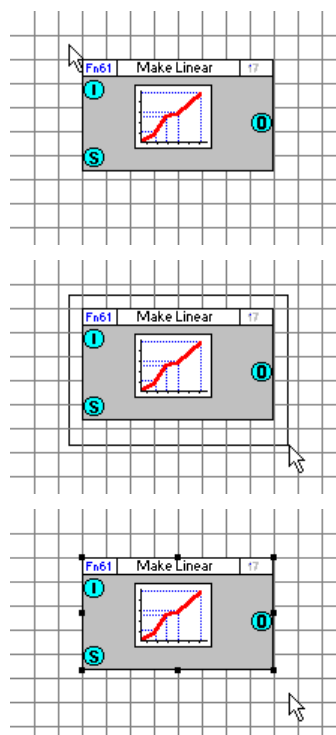
A selected module is surrounded by eight small black boxes (place-holders) around its edges.
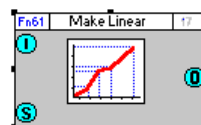
To select more than one module on the drawing area:

Click and drag a box around all the modules you want to select. When you release the mouse button, all the modules within the box will have been selected.

or

Press and hold down the CONTROL button while double-clicking the modules required.

or, if you want to select every item in the drawing simultaneously, click on **Select All** in the **Edit** menu.

Moving modules on the drawing area

To move a module on the drawing area:

- Select the module.
- Click the selected module and hold down the mouse button.
- Drag the module to its new location on the drawing area.
- Release the mouse button. The module will be displayed at the new location.

To move several modules on the drawing area:

- Select the modules.
- Click on any one of the selected modules and hold down the mouse button.
- Drag the modules to their new location on the drawing area.
- Release the mouse button. The modules will be displayed at their new location.

Deleting a modules from the drawing area

To delete a module or several modules from the drawing area:

- Select the module or modules.
- Press the DELETE button on your keyboard.

Cutting modules from the drawing area

To cut a module or several modules from the drawing area:

- Select the module(s).
- Click the **Cut** button on the Toolbar.

or

- Choose **Cut** from the **Edit** menu.

The module(s) is now removed from the drawing area and will be stored on the Clipboard until placed (pasted) elsewhere.

Copying modules on the drawing area

To copy a module or several modules from the drawing area:

- Select the module(s).
- Click the **Copy** button on the Toolbar.

or

- Choose **Copy** from the **Edit** menu.

A copy of the module(s) will be saved on the Clipboard until placed (pasted) elsewhere.

Pasting modules from the clipboard to the drawing area

Modules and groups of modules can be cut/copied and pasted within the same strategy, or cut/copied from one strategy and pasted to another strategy.

To paste a module or several modules from the clipboard to the drawing area:

- Make sure that the strategy into which you want to paste the module(s) is active by clicking anywhere on its window or by choosing it from the list of open files in the **Window** menu option.
- Click the **Paste** button on the toolbar.

or

- Choose Paste from the **Edit** menu.
- To place the module(s) on the drawing area, click on the drawing area with the mouse. The top left-hand corner of the module(s) will be positioned on the point where the mouse was clicked.

> **Note**: Pasted hardware point modules may adapt some parameters to the destination point but retain others. For example, an analog input configured as PT1000 when pasted to a UniPut will change to a voltage input, but retain the max and min limits (in the `Advanced` button) which for PT1000 could be min 0 and max 0, leading to incorrect operation of the UniPut.

Tool Tip Data on Modules

To view details of a specific **Module**, hover the mouse pointer over the **Block** in the **Strategy** drawing.

For example, here is the **tooltip** data for a datalog:
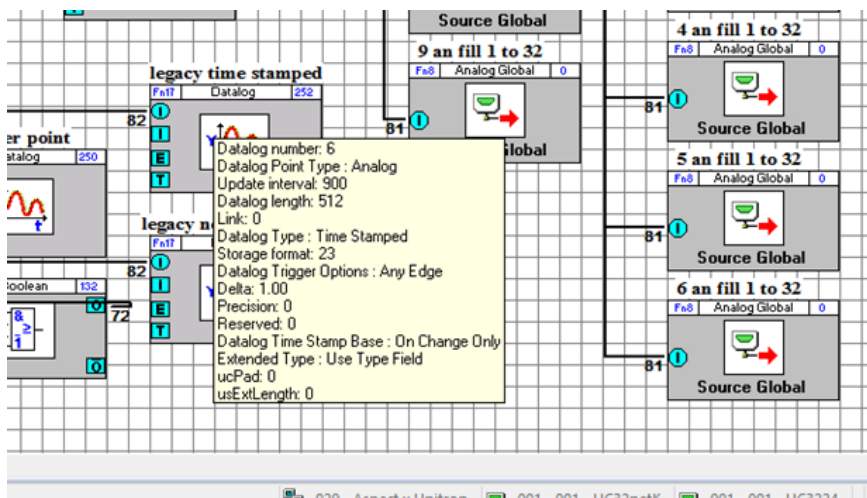
JOINING MODULES IN A STRATEGY

Modules in a strategy must be **joined** together to allow information to flow from input to output. The flow is from left to right, so that controller input **connection points** are on the left of the drawing area, controller outputs are on the right, and the modules are positioned between the inputs and outputs in the centre of the drawing area.

Notes on joining modules

- A connection is possible only if both the input and the output are of the same type (analog or digital).
- An output of a module can be linked as often as required with inputs of other modules.
- An input of a module can be linked with only one output of a module.

Module connection points

Connection points are marked on module symbols as blue circles or squares on the left and right edges of the module. When the mouse pointer is placed over a connection point, it changes to a cross-hair.

- Circular connection points are analog.
- Square connection points are digital
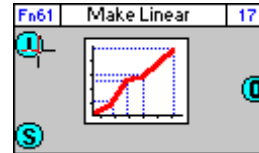
If you want to connect two points, make sure they are both either digital **or** analog. You cannot connect analog to digital or vice versa.

How to join modules

Place the mouse pointer over the required output of the first module so that it changes to a cross-hair.
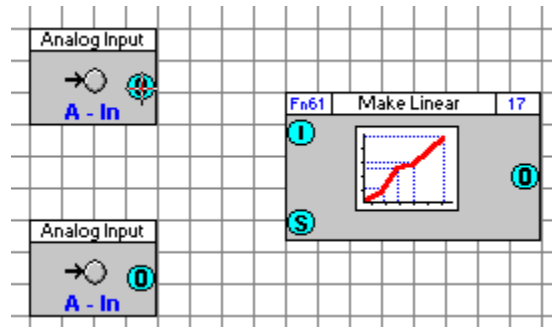
Click and drag the mouse from the output to the required input of the other module. You will see that the cross-hair changes back to a mouse pointer once you have left the blue connection point and return to cross-hair format when you reach the next blue connection point.
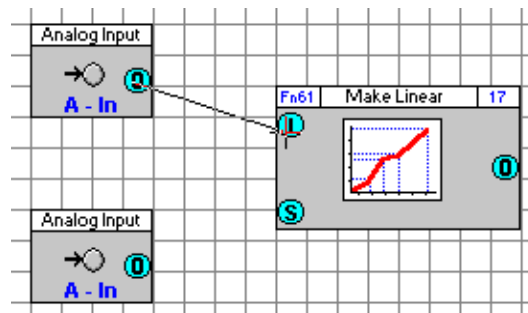
Release the mouse when you have reached the required input. The two modules are now joined. The connection between the two modules is marked by a coloured line. The default colour is black, but this can be customised by clicking on the connection line with the right mouse button.
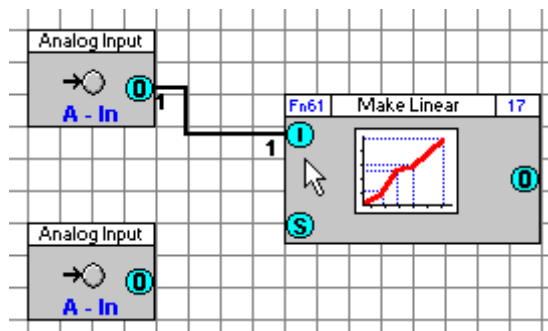
How connections are represented

By default, the connection between 2 modules is represented by a black line with the numbers of the points at each end of the connection also displayed (as in the above example). You can customise the way in which connections are represented using the **Module Setup** option from the display menu or by clicking on the connection line with the right mouse button and completing the **line** dialog box. (See *Editing Connections* on page 86). You can also right-click on either **node** (the points on the module boxes that are connected by the line) to open the **line** dialog box.

Module set-up

By default, when 2 modules are joined on the drawing area, the connection between them is represented graphically by a black line and the numbers of the points are displayed at either end of the connection. These settings can be changed in 2 ways: either using the **Module Setup** option from the **Display** menu or clicking the line that joins the 2 modules with the right mouse button and completing the **Line** dialog box.

Clicking the **Module Setup** option from the **Display** menu produces the **Module Setup** dialog box:
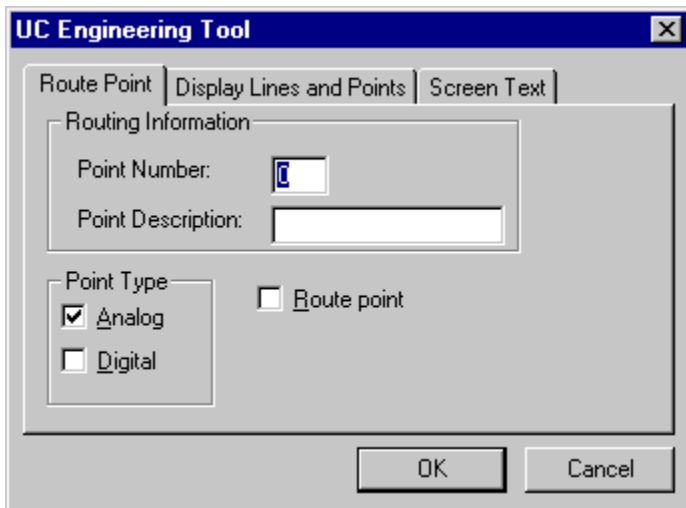
Lines/Point Numbers

The **Display Lines and Points** tab in the **Module setup** dialog box contains two check boxes – **Display Lines** and **Display point numbers**. Checking these options will display lines representing the connections between modules and print the numbers of the points at either end of a connection.

© Cylon Controls
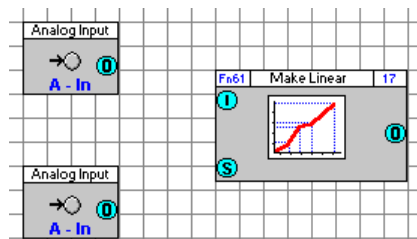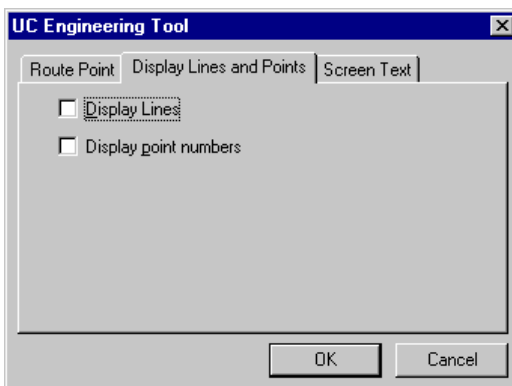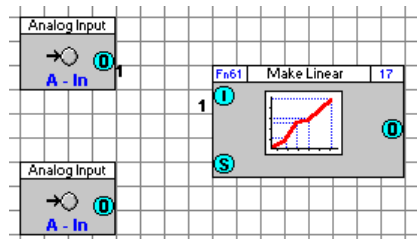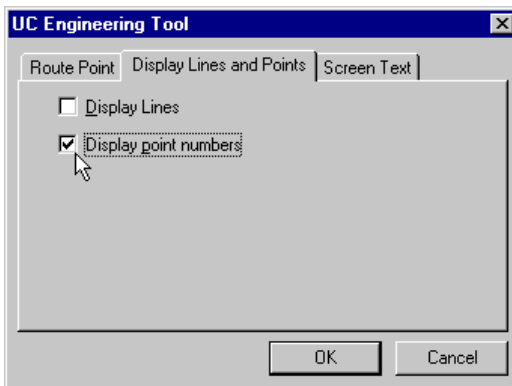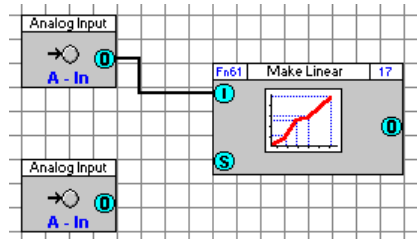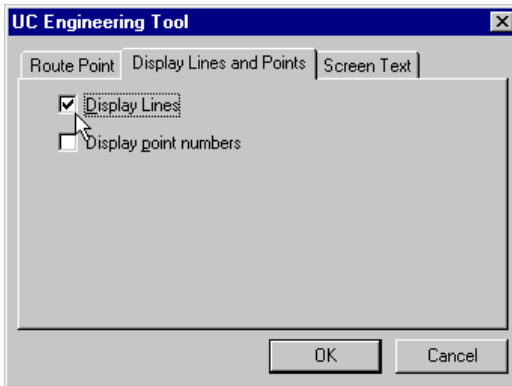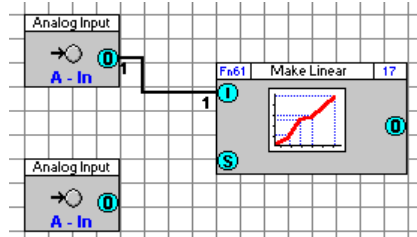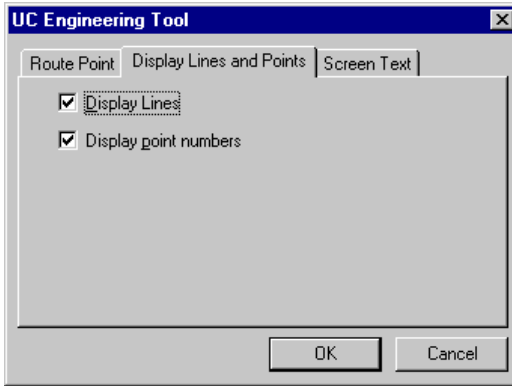
Screen Text

The **Screen Text** tab in the **Options** dialog box features two check box options: **Display Point Values** and **Display Constant Values**. When ticked, these options display the values of the variable and/or constant points in the module.
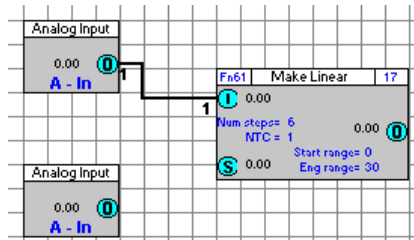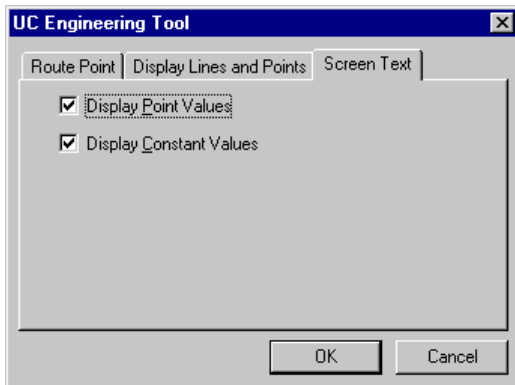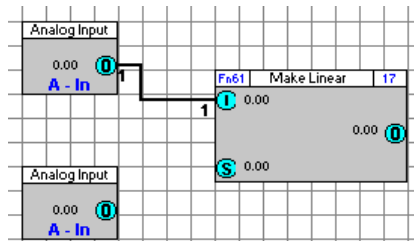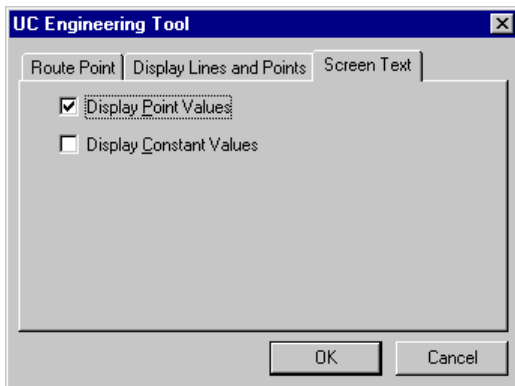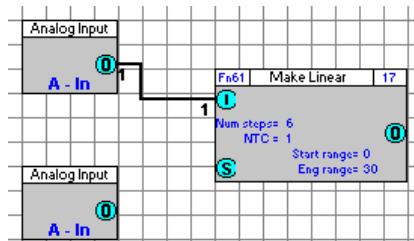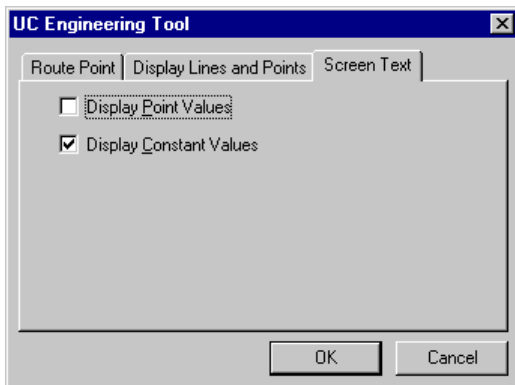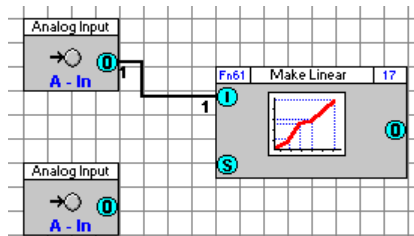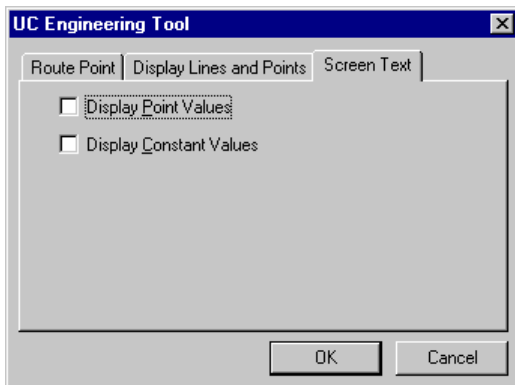
Route Point
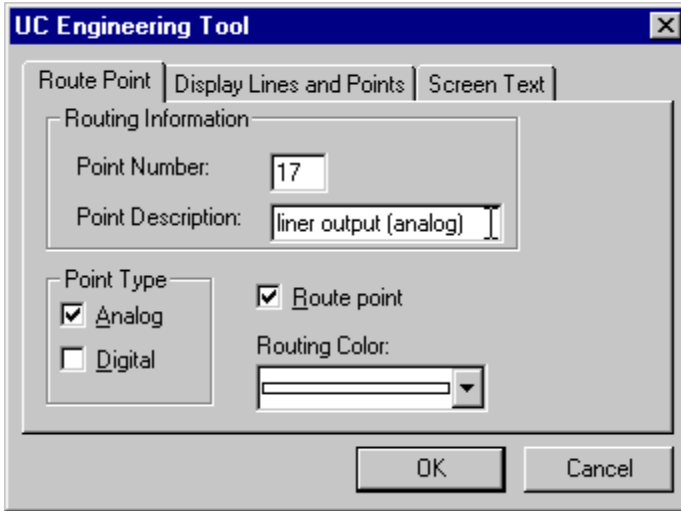
The **Route Point** tab in the **Options** dialog box allows you trace the route of a point in the Engineering Centre. Below is a list of the options available in the **Route Point** tab:

To route analog points only, i.e. show the connections between analog points, click on the **Analog** checkbox under **Point Type**.

To route digital points only, i.e. show the connections between digital points, click on the **Digital** checkbox under **Point Type**.

To turn off the Routing facility, deselect the **Route Point** check box.

To route one or each connection differently from the others, enter the point number and point name in the **Routing Information** section. Then choose an individual colour for that connection from the eight colours contained in the **Routing Colour** list box. In the example above, the module output is to be routed with a white line. In this instance, the Engineering Centre background is coloured (using the Colours option from the **Display** menu - *see page 61)* and the result can be seen below. This can also be done by Editing Connections directly *(see page 89)*.
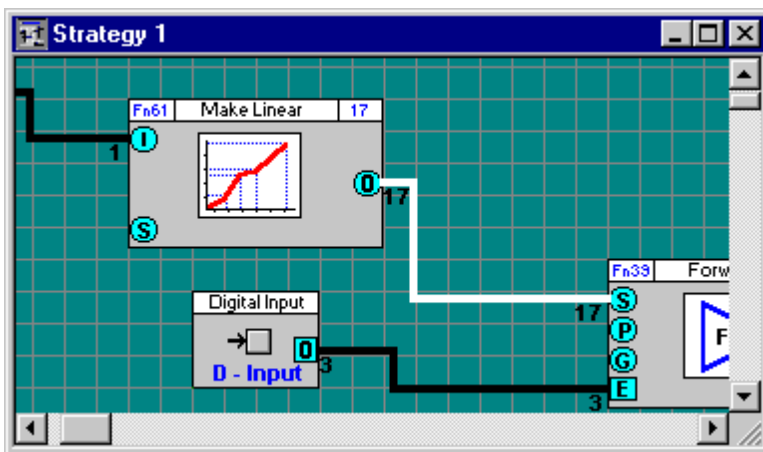
Editing Connections

Click the line that joins the 2 modules with the right mouse button to call the **Line** dialog box:
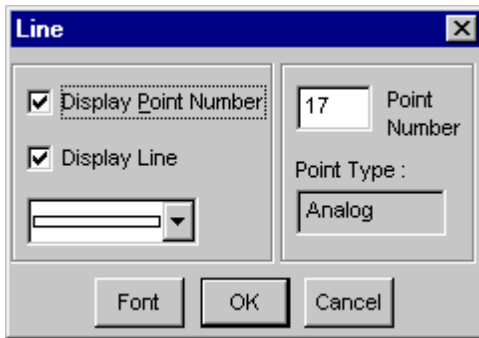
Display Point Number check box

To display the numbers of the points that are joined, check the **Display Point Number** box.

Point Number box

This shows the point numbers that the selected line is connecting. If you change the point number in this box, the connected points will mirror the change.

Point Type box

This states whether the line is connecting analog or digital points.

Display Line check box

To represent the connection between the two modules with a line, check the **Display Line** box.

Display Line list box

Select a colour for the line from the list of colours in the box underneath **Display Line**. The default colour is green.

Font button

To change the font in which the point numbers are displayed, click the **Font** button. This will produce the generic Windows **Font** dialog box in which you can change from the default font (12 point, System bold) to your own preference.

SCROLLING THROUGH A STRATEGY USING CONNECTED MODULES

You can scroll backwards or forwards through the connected modules in a strategy by clicking the scroll buttons in the module dialog box:
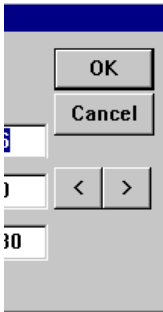
The module dialog box appears when you right-click on any of the modules on the drawing area.

Note: If you are designing your strategy with the **Automatic Download** option enabled *(see page 266)* you can see the module values being retrieved from the controller and updated in real time.

HOW TO ADD TEXT TO A STRATEGY

Click the ![ABC] button on the toolbar, or choose **Add Text** from the **Edit** menu.
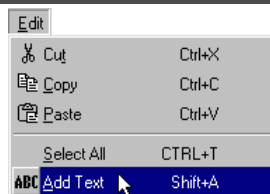
Click the drawing area at the point where you want the text to be displayed.
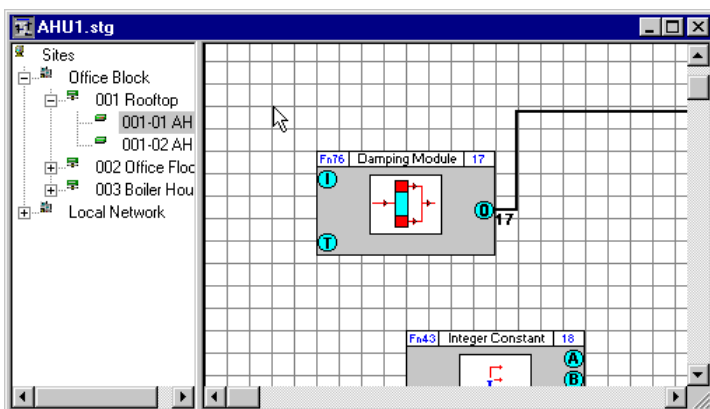
The **Insert Text** dialog box will be displayed:

To select the type of font in which the text should be displayed, click **Font**. The standard Windows **Font** dialog box will be displayed in which you can choose a font, style, point size, etc. Once you have chosen the required font, click the **OK** button in the **Font** dialog box.
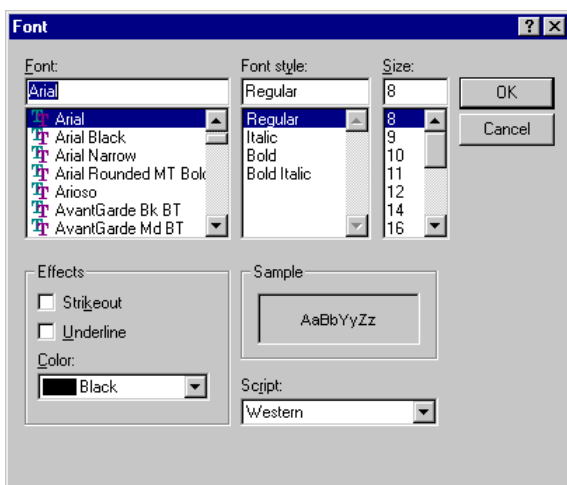
> **Note**:   It is recommended that you always use "True-type" fonts. When the printing is scaled, non true-type fonts do not scale properly.

Type in the **Insert Text** dialog box, the text that you would like to include in the strategy:
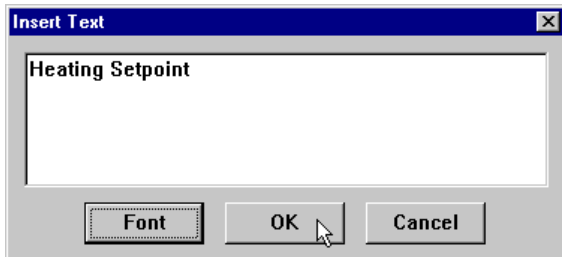
Click **OK**.

The text will then be displayed on the drawing area on the point at which you clicked the mouse.
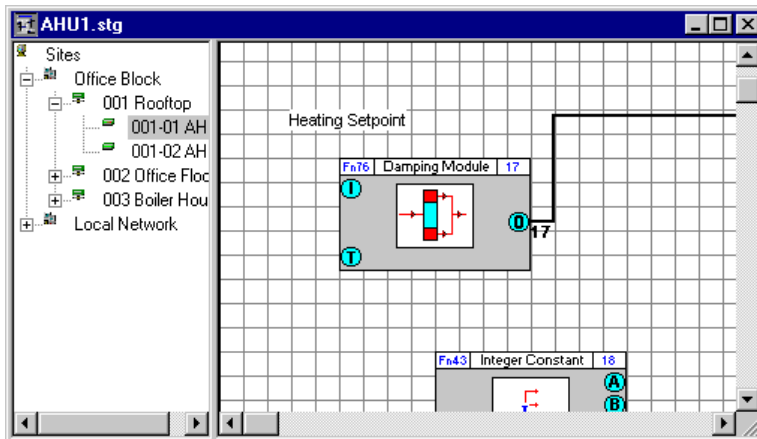
VIRTUAL MODULES

Virtual modules are so-called because they do not result in point values being downloaded to the Cylon controllers, i.e. they do not represent real points. The basic function of a virtual module is to allow for greater flexibility in connecting modules, e.g. backward connection of modules. Virtual modules are also used when creating macros, as they allow one external point of a macro to be connected, via a virtual, to many internal macro points. There are two virtual modules on a floating toolbar – one analog and one digital. The digital virtual is shown below:

Digital virtual module symbol with values not shown

Digital virtual module symbol with values shown

Placing Virtual modules on the drawing area

The procedure for placing virtual modules on the drawing area is similar to that for any other module.

Call the floating virtual modules bar by clicking the

button on the toolbar or by choosing **Virtuals** from the **View** menu.
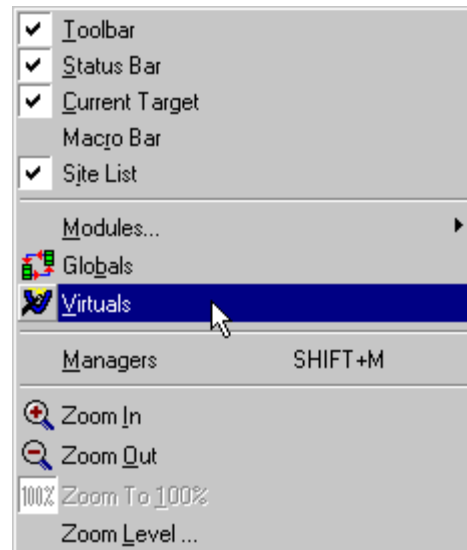
This opens the Virtuals bar:
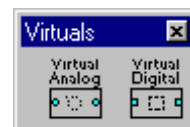
Click the button for whichever virtual module you require, either a virtual analog or a virtual digital.
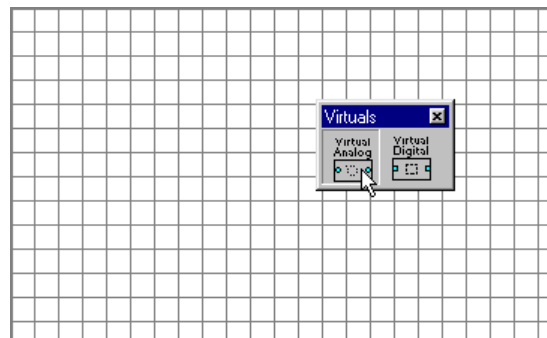
Click the drawing area.
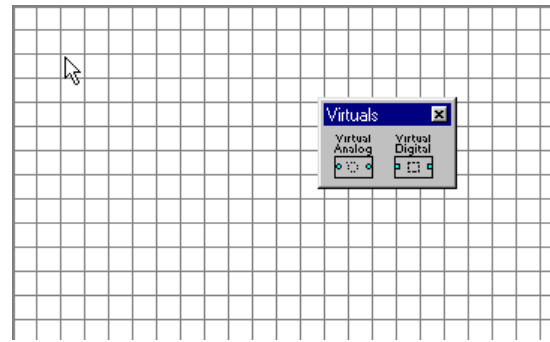
The top left hand corner of the module's symbol will be placed on the point where the mouse was clicked.
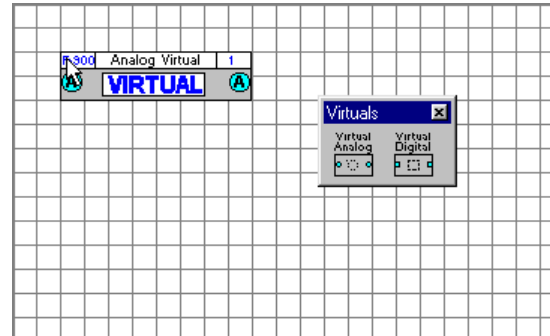
Rules for connecting to virtual modules

1. If the point being connected to the virtual module has a point number, then this becomes the number of all the inputs and outputs of the virtual module. Any modules that are then connected will have the same point number.

2. If the point being connected to the virtual module does not have a point number, the Engineering Centre chooses a new number and this becomes the number of all the inputs and outputs of the virtual module.

- Rules 1 and 2 describe how the inputs and outputs of the virtual module are numbered once a connection has been made. This is why the Engineering Centre will not allow you, once the first connection has been made, to connect another module that has a number. You can, however, connect a module if its point number box is blank.

Numbering virtual modules

Since virtual modules are not downloaded, they do not use any memory in the controller and do not need to be numbered in the Block Manager like other modules.

Virtual modules have their own numbering system. The first virtual module used in a strategy is numbered V1, the second V2, etc.

Virtual modules in macros

Virtual modules are useful when creating macros as they allow one input to be used several times.

For example, to create a macro from the strategy shown, it would be necessary to include two inputs in the macro.
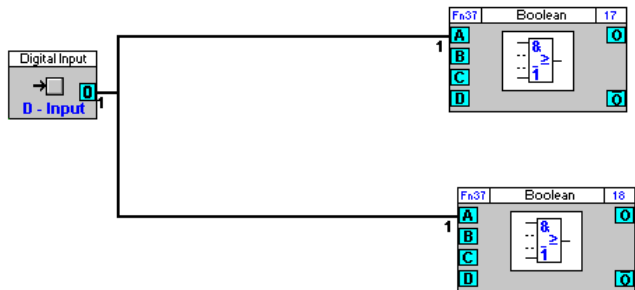
Creating the same macro with a virtual module requires just one macro input.
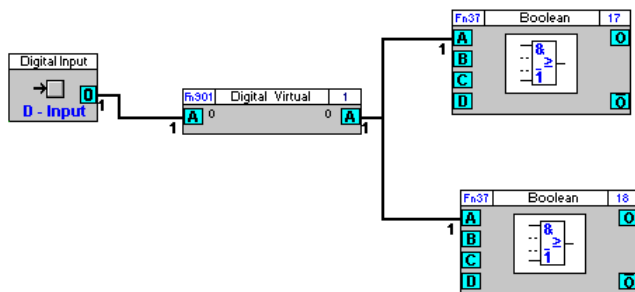
SECTION 5 : POINTS AND POINT VALUES

WHAT ARE POINTS?

A **Point** is an area in a **Controller** where data is collected and stored. The data stored by the point is referred to as the **Point**'s "value". Controllers in the Cylon system include input, output, set and virtual **Point**s.

> Note;   Cylon's Controllers are sometimes referred to as "universal controllers", where "universal" means that they can contain both analog and digital Points.

WHAT ARE BLOCKS?

An important aspect of the **Engineering Centre** is the concept of **blocks**.

Blocks can be seen as units of measurement for the number of modules and points used in a **Strategy** – one block corresponds to one **module**, one hardware input **Point**, one hardware output **Point** or one **virtual point**.

The Managers dialog, accessible from the View menu, allows you to see at a glance which of the **blocks** in the controller are occupied and which are not.

When **Point**s or **Strategies** are downloaded to a **Controller**, the **Controller** must also be informed of how many **block**s are needed to store the required information.

- If you are using **Automatic Download** (*see page 106*), the **Engineering Centre** automatically recognizes how many **block**s are required and it sends this information to the **Controller**.

- If you are not using **Automatic Download** you must, when downloading **Point**s and **Strategies**, send specific "Setup" information to the **Controller**, instructing it as to how many **block**s it must service in the **Strategy**. This procedure is called **Sending Setup** (*see page 267*).

BLOCK NUMBERS

An important aspect of the **Cylon Engineering Centre** is the concept of **blocks**.

Blocks can be seen as units of measurement for the number of both **modules** and **points** used in a strategy.

- With the **UCU** and older controllers the **Hardware Point** numbers are 1 to 16 and **Strategy block**s are from 17 to 255.

- In the **CBM**, **CBT** and **UC32** controllers, the Hardware **Point** numbers are from 1 to 1024 and **Strategy block**s go from 1 to 1024. Note however that only **Hardware Point**s 1-24 are used on the **CBM24**, only **Hardware point**s 1-16 are used on the **UC32.16** etc.

**Block Allocation
in UCU, UCxxPG-R and UCxx controllers**
In these controllers there are a total of 255 Strategy blocks.
Blocks 1 - 16 are reserved for hardware points, and blocks 17 - 255 are available for strategy modules.

**Point Numbering
in UCU, UCxxPG-R and UCxx controllers**
In these controllers, point numbers 1 - 16 are reserved for hardware points.
Point numbers 17 - 255 can refer to analog or digital virtual points.
There are a total of 239 digital virtual points, numbered 17 - 255.
There are a total of 239 analog virtual points, numbered 17 - 255.

**Block Allocation
in CBM, CBT and UC32 controllers**
In these controllers, there are a total of 1024 Strategy blocks.
Hardware points in these controllers do not use strategy blocks, so that all 1024 blocks are available for strategy modules.

**Point Numbering
in CBM, CBT and UC32 controllers**
In these controllers,
There are a total of 24 hardware points (inputs or outputs), numbered 1 - 24.
There are a total of 1024 digital virtual points, numbered 1 - 1024.
There are a total of 1024 digital virtual points, numbered 1 - 1024.

POINT NUMBERS

In the **Cylon Engineering Centre**, the connections between modules are referred to as '**Points**'. These **Strategy Points** can represent physical inputs and outputs on a **Controller**, or Analog/Binary values (referred to in the **Engineering Centre** as '**Virtual Points**').

Each **Analog Input**, **Analog Output**, **Binary Input**, **Binary Output**, **Analog Value** and **Binary Value** is assigned a number, and how these points are numbered depends on the controller type.

CBM/CBT/UC32 point numbers in the Engineering Centre

In **CBM**, **CBT** and **UC32** controllers, controller terminals (i.e. inputs and outputs) - "hardware points" in the **Engineering Centre** - are assigned numbers between 1 and 24. Each terminal can be either an input or an output, so that there cannot be two hardware points with the same number. For example if there is an **Analog Input** 3 there cannot be an **Analog Output** 3 or **Binary Input** 3 at the same time.

> **Note**:   In theory, hardware Point numbers could be up to 1024, but is limited by the Controller hardware so that the current maximum is 24.

Analog Values ("Analog virtual points") can be numbered 1-1024, and **Binary Value**s ("Digital virtual points") can be numbered 1 – 1024, so that there could be for example both **Analog Value** 3 and **Binary Value** 3.

> **Note**:   The combined number of Analog Values and Binary Values that can be exposed on a BACnet network by a single CBM or CBT is 225. As a result, it is recommended to keep the total number of defined setpoints in a Strategy below this value.
>
> However it is possible to have up to 100 additional setpoints **that are not exposed on BACnet**. Such setpoints in effect act as constants, because they cannot be changed by the Strategy nor via BACnet, but can be set using the Engineering Centre.

In **Strategy** drawings generated by the **CEC** for **CBM**, **CBT** and **UC32** controllers, it is possible to identify a **Strategy** Point's nature as follows:

- If the number has brackets around it is a "hardware point" – **Analog Input**, **Analog Output**, **Binary Input** or **Binary Output**.
- If the number is not bracketed, but is connected to a circular connection point, it is an **Analog Value** ("analog virtual point").
- If the number is not bracketed, but is connected to a square connection point, it is a **Binary Value** ("digital virtual point").
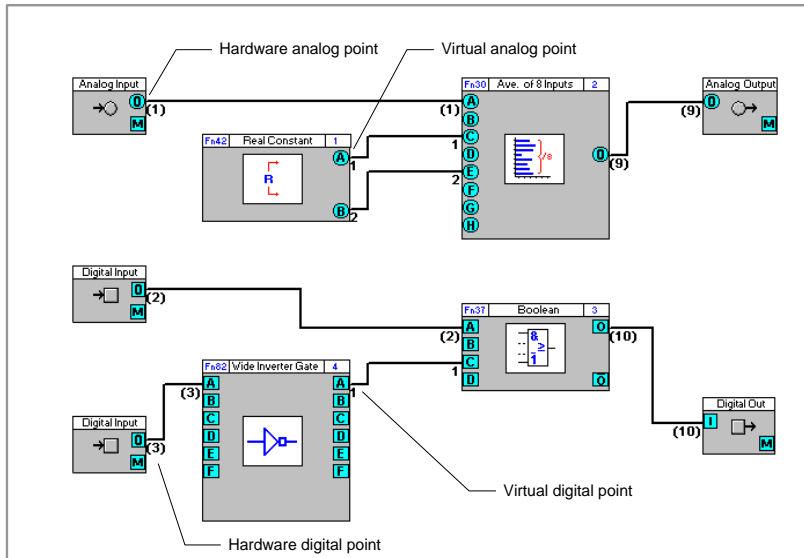
UCU, UCxxPG-R and UCxx point numbers in the Engineering Centre

In these controllers **hardware point**s can be numbered 1-16, **analog virtual point**s can be numbered 17 - 255, and **digital virtual point**s can be numbered 17 - 255.

For a particular point number in a **Strategy** drawing, it is possible to identify its nature as follows:

- If the number is between 1 and 16 it is a **hardware point**
- If the number is above 17, but is connected to a circular connection point, it is an **analog virtual point**
- If the number is above 17, but is connected to a square connection point, it is a **digital virtual point**
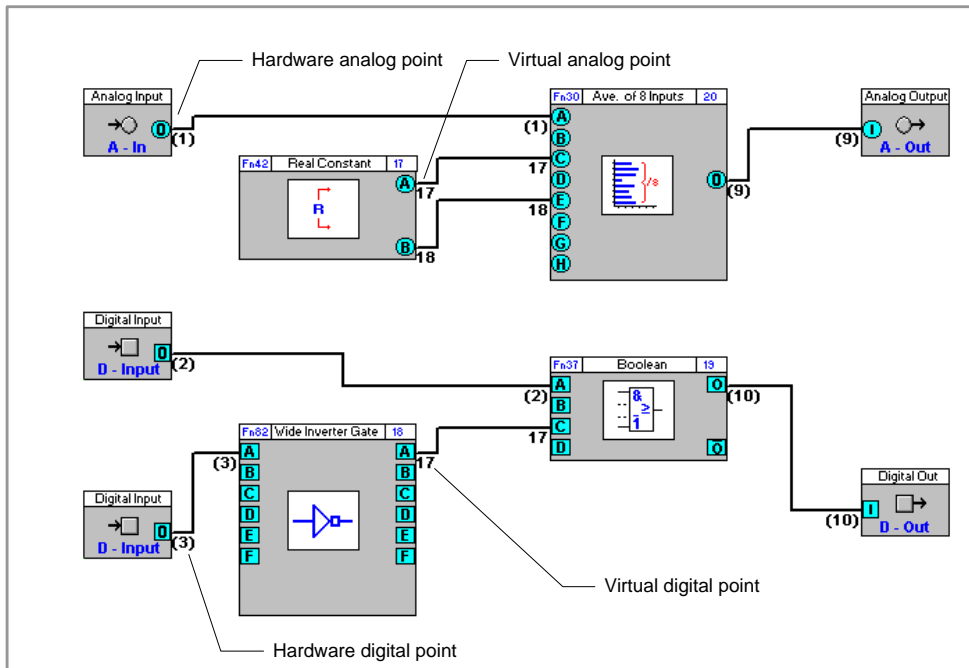
DEFINING HARDWARE POINTS

Hardware points are the inputs and outputs of Field Controllers.

To define a hardware point it is necessary to define the following features:

- Point number
- Point name
- Point type (input, output, digital, analog)
- Unit of measurement
- Damping (for analog inputs only)

Once the required hardware points have been defined in the **Engineering Centre**, they are then downloaded to the **Field Controller** for which they are intended.

How to define hardware points

The procedure for defining hardware points is as follows:

- **Specify (Target) the controller** for which the hardware point is being defined
- **Choose the module** from the modules bar
- **Place the module** on the drawing area
- **Complete** the module dialog box
- **Save** the hardware point definition
- **Log in** to the Field Controller
- **Download** the hardware point definition to the Field Controller

Defining Hardware points – Target the controller

in the Site List select the **Communications Controller** and **Field Controller** that you want to target. This specifies the **Field Controller** on which the hardware point is being defined and the location in the database on the **PC's** hard disk in which the point definition will be stored.

Defining Hardware points - Place the module on the drawing area

Once you have selected a module from the `modules bar`, place it on the drawing area by simply clicking the drawing area. A dialog box will appear prompting you to enter information on the hardware point. Below is an example of an analog input dialog box:

Insert the required information in the dialog box (for detailed information about filling in the `Analog Input` dialog, see *Example: completing the Analog Input module dialog box* on page *115*)

Click `OK` to accept the settings and close the dialog box. The values assigned to `Point Number`, `Sensor Type`, `Point Name`, `Units` and `Exp. Filter Constant` will be appended to the database on the PC for the selected path (Site, Comms Controller, Field Controller, point number).

Additionally the analog input point function module will be placed on block 4 of the edited strategy.

The top left hand corner of the module's symbol, i.e. the graphical symbol for the analog input point, will be placed on the point on the drawing area where the mouse was clicked:
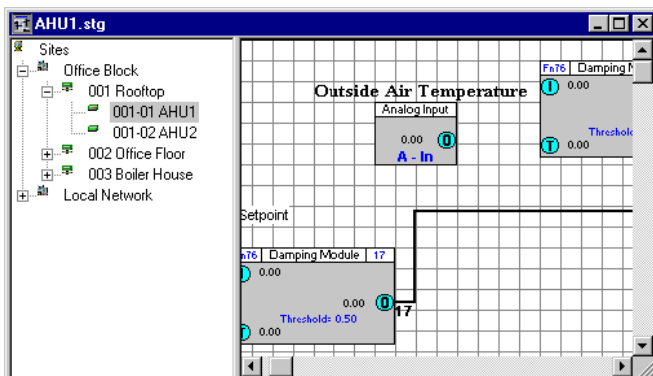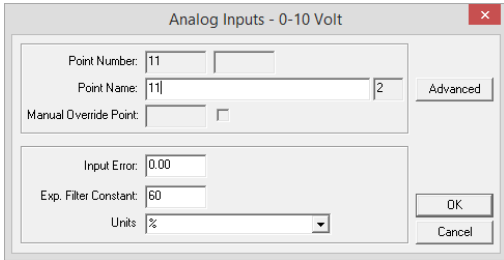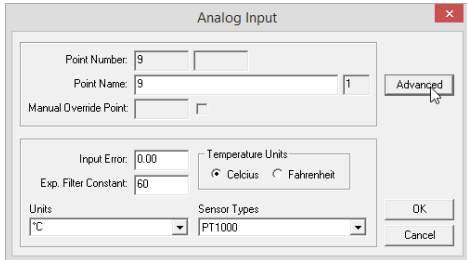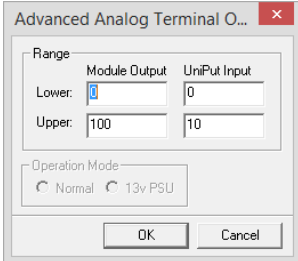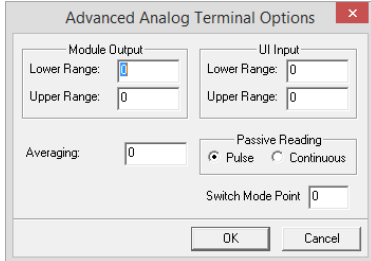
- Expandable I/O – Hardware Points on CBX + FLX devices

In the **Strategy** drawing, IO blocks can be added up to the total on the configured **FLX** modules plus the **CBX** onboard IO.

> **Note**: If a FLX module is deleted from a CBX configuration (in CCConfig) after the Strategy drawing has been set up, the blocks associated with that FLX's IO will be 'greyed out' to indicate that they are inactive.

Note: Unlike CBM UniPuts, UniPuts on CBX devices, if configured as Analog Inputs, have all of the parameters that are available in Universal inputs. Also, the " Operation Mode " parameters, which are applicable only to certain CBM UniPuts, are not used by CBX.

	CBM	CBX
"Analog input" UniPut configuration		
Advanced options		

Defining Hardware points - Save the hardware point definition

Save the edited strategy by choosing **Save** or **Save As…** from the **File** menu. The **Save As** dialog box appears:
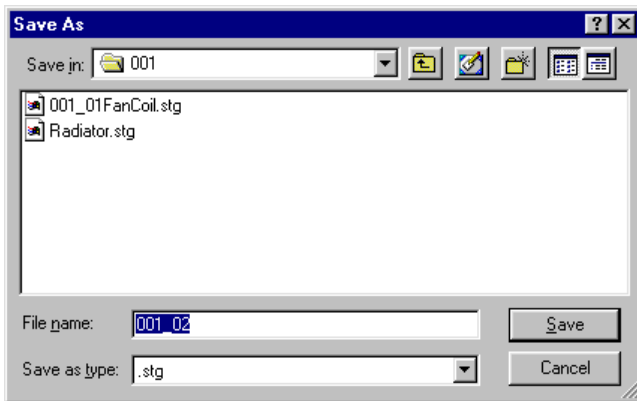
Enter a name under which the strategy should be saved. The Engineering Centre enters a default file name that identifies the Communications Controller and Field I/O Controller for which the strategy has been designed, e.g. if UC #3 on Comms Controller #1 was connected to a VAV, its strategy might be named: "001_03VAV.stg".

When the **Save As** dialog box is complete, click **OK**.

After clicking **OK**, the name of the strategy will appear in the title bar of the Engineering Centre:
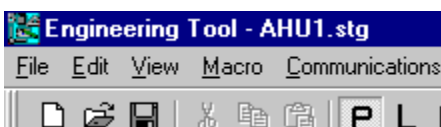
Defining Hardware Points - Log in to the controller

Log in to the controller by choosing **Login** from the File menu or by clicking the Login/Logout button on the toolbar so that the gate is closed:

Defining Hardware points - Download the hardware point definition.

You can download a strategy to a controller in just one step, provided you are using **Automatic Download**.

To enable automatic download, choose **Communication setup** from the **Communications** menu.
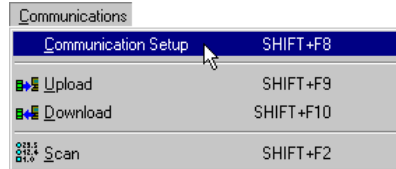
This will produce the Download Options dialog box, which allows you to enable Automatic Download by clicking the **Automatic Download** check box:
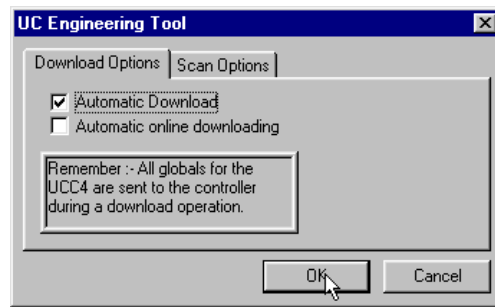
Click OK to close the **Options** dialog box.

Download the hardware point definition to the UC by choosing **Download** from the **Communications** menu.
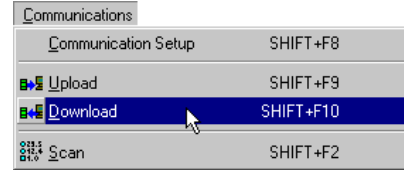
The Engineering Centre will automatically wipe the Field Controller's memory, download the hardware point and send the set-up to the UC, i.e. the number of blocks it is to service. While it is doing this, it will display the **Downloading** window. As the point is being downloaded, the Downloading window displays the progress and in the **System status** section it shows which of the 3 stages (wiping memory, downloading strategy or sending set-up) the Engineering Centre is currently completing. If only one hardware point is being downloaded, the process will take place so quickly that the downloading window will appear only for a brief moment.

It is more usual to download an entire strategy, with several hardware points and other modules. In that case, the **Downloading** window will remain visible for longer and the progress of the download will be measured in the progress bar. In the example below, the download is 20% complete.
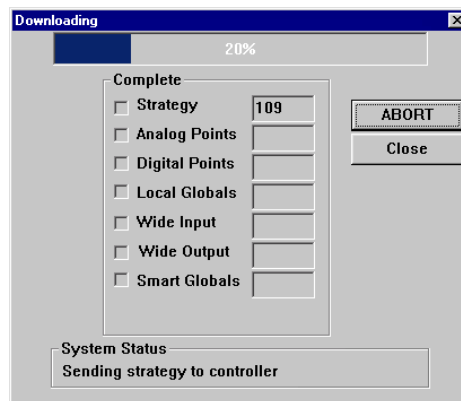
Summary of procedure for defining hardware points

In practice, the procedure for defining hardware points is as follows:

- Define all hardware points whose values are already known, in the module dialog boxes and place the corresponding modules somewhere on the drawing area.
- Save the strategy.
- Click Communications Setup from the Communications menu and enable Automatic Download.
- Log in
- Choose Download from the Communications menu.

Point numbers for inputs and outputs

When another input module is selected, the **Engineering Centre** automatically assigns to it the next unused input, i.e. the unused input with the smallest point number.

Defining digital and analog outputs follows the same principle. As outputs are numbered in the range 9 to 16, the Engineering Centre assigns point number 9 to the first output.

For CBX devices, point numbers are defined by the I/O module in which they reside – internal I/O on the CBX device are I/O module "0", any attached FLX devices are I/O modules 1,2 or 3

I/O Module	Terminal Number	Type
CBX8R8	1 … 8	Universal Input
	9 … 16	UniPut™
FLX8R8 adress 1	101 …108	Universal Input
	109 … 116	UniPut™
FLX8R8 adress 2	201 …208	Universal Input
	209 … 216	UniPut™
FLX8R8 adress 3	301 …308	Universal Input
	309 … 316	UniPut™

A short cut to defining hardware points

To save time when defining the hardware points you can bring the definitions directly to the database by using the **Database Interface**.

The types ("A" for analog, "D" for digital), point names and point numbers and units can be written as comma-separated or tab-separated lists in a word processing application, copied and pasted via the clipboard to the Database Interface. This avoids unnecessary writing work and typing errors. Using external applications for text handling also saves time because of their Copy, Search, Replace and Pasting features.

The point list shown below was created in Microsoft Windows Notepad. Other software applications, such as Excel and Word may also be used.

```
A    Room Temperature 1           °C    1
A    Room Temperature 2           °C    2
A    Outair Temperature South-East      °C    3
A    Outair Temperature North-West      °C    4
A    Supply Water Temperature 1  °C    5
A    Supply Water Temperature 2  °C    6
A    Valve 1                      %     9
A    Valve 2                      %     10
D    Pump 1              ON/ OFF       11
D    Pump 2              ON/ OFF       12
```

When preparing a hardware point definition list you must separate the values (type, point name, unit, point number, etc.) by using tabs or commas, not spaces.

Note: This shortcut for defining hardware point values should only be used for UCs that do not already have hardware point definitions in the database on the PC's hard disk, since existing database entries are not deleted. The Database Interface does not check for uniqueness. This means that there is a danger of defining more than one entry per point, which will cause a lot of confusion in later use of the point in other programs.

WHAT ARE 'UNIPUTS'?

A "UniPut" can act as an input or an output, so that you can now have a controller that fits your BMS design exactly - no need to use an extra controller to gain an extra output while leaving an input on the original controller unused. BMS sites can make more efficient use of a smaller number of controllers, saving on cost and complexity.

A UniPut can be configured as any one of the following:

- an Active Input, reading between 0 – 10 V at 40 KΩ, with 9-bit resolution.

- an Active Output, outputting 0 – 10V at a maximum load of 20mA

- a Digital Volt-Free contact.

- a digital input detecting the presence or absence of 24Vac

or

- a relay switched output.

The UC32 range of controllers has a number of different combinations of UniPuts and standard Universal Inputs.

UniPuts are used in controller strategies through standard Analog and Digital Input and Output modules. However, before it is possible to add a module for a UniPut to the strategy, the UniPut must be configured using the **Cylon Engineering Centre**'s "Terminal Settings" dialog box.

CONFIGURING THE UC32'S INPUTS AND OUTPUTS

A UC32 controller has a mixture of Universal Inputs and UniPuts. The Universal Inputs are fixed as inputs, but UniPuts may be configured as analog or digital inputs or outputs using the "**Terminal Settings**" panel.

How to open the "Terminal Settings" panel.

The "**Terminal Settings**" panel opens automatically when a UC32 controller is targeted in the **Cylon Engineering Centre**
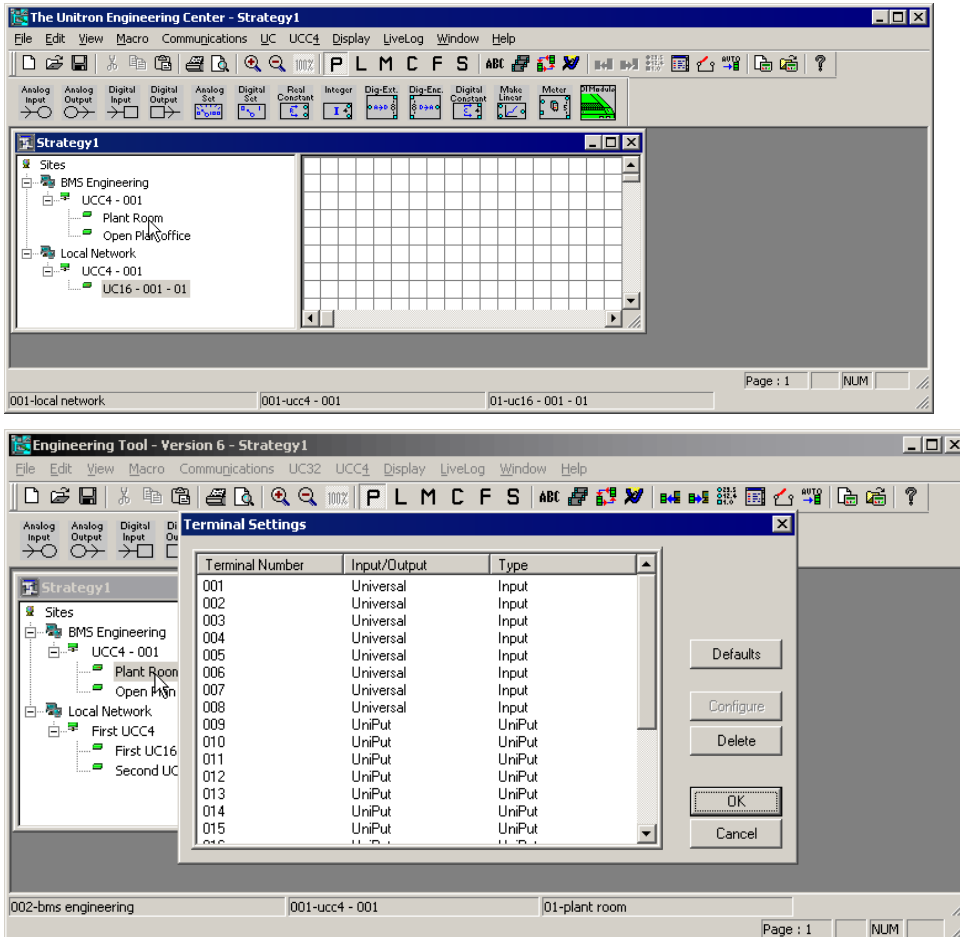
If you want to open the "**Terminal Settings**" panel at any other time, select **Terminal Settings** from the **UC32** menu:
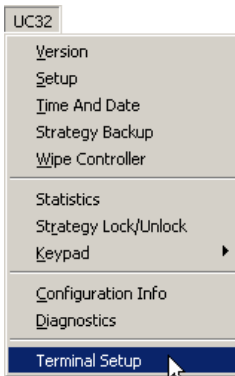
How to configure a UniPut

To configure a particular UniPut (UIO), double-click on its terminal number in the "**Terminal Settings**" panel.
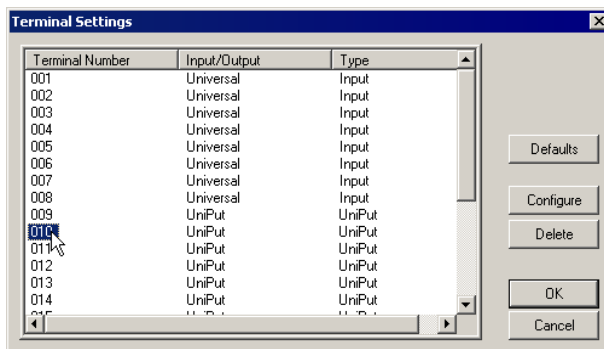
The "Configure IO Types" box opens
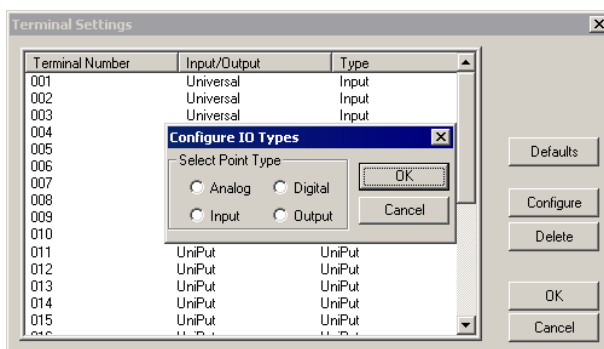
Note: Terminals marked '**Universal**' are not UniPuts, so the '**Configure IO Types**' dialog for these terminals does not allow the terminal to be changed from Input to Output

---
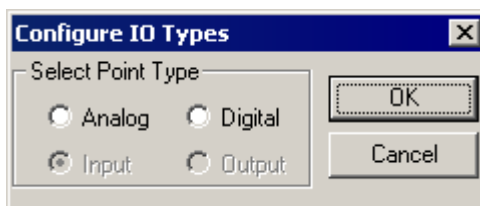
Set whether the UniPut is to deal with Analog or Digital signals (the following illustrations show the UniPut being set as an analog output),
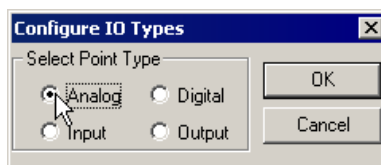
and whether it is to be an input or an output
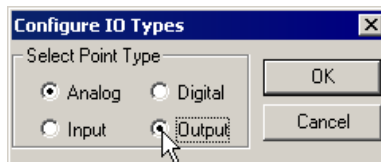
Click on **OK** to close the **Configure IO Type** box,
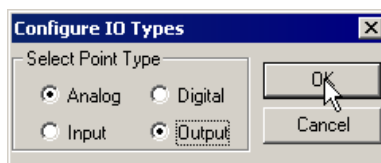
and the relevant Point dialog for the selected point type opens:

Fill in all of the necessary details for the point and click on '**OK**'.

and the "**Terminal Settings**" panel will display the UniPut's configuration (in the illustration, terminal 010 has become an Analog Output)

Repeat this process until all of the required UniPuts have been configured.

Changing the configuration of a UniPut

If you want to change the configuration of an existing UniPut, you must 'delete' its configuration from the **Terminal Settings** panel.

> **Note:** The **Delete** button on the **Terminal Settings** panel will not work if there is a module in the strategy for that point. If you click on **Delete** when a point is selected for which there is a module in the strategy, a message will appear to alert you of this fact.
>
>

If a module exists for the point, select the module,
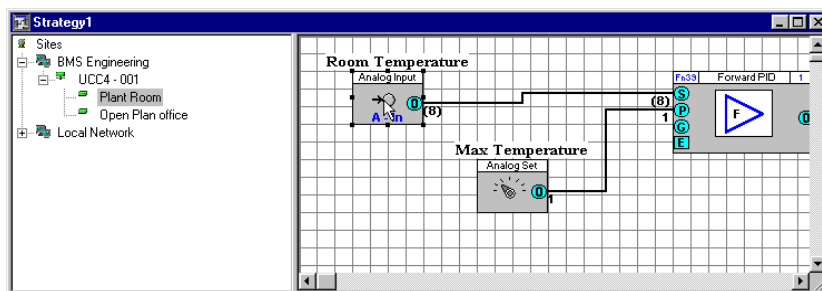
and press delete.
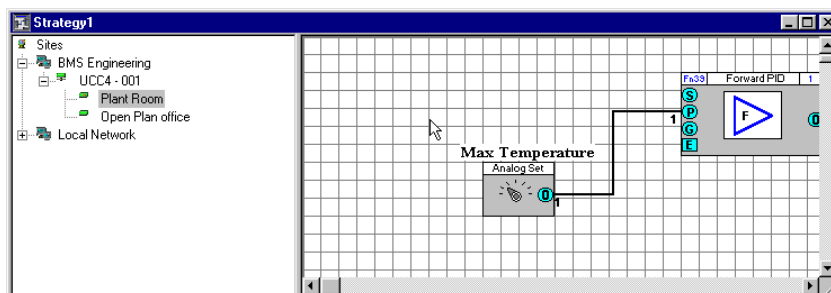
Open the **Terminal Settings** panel, by selecting it from the **UC32** menu.
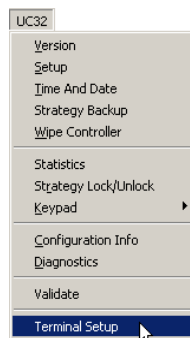
Select the terminal number
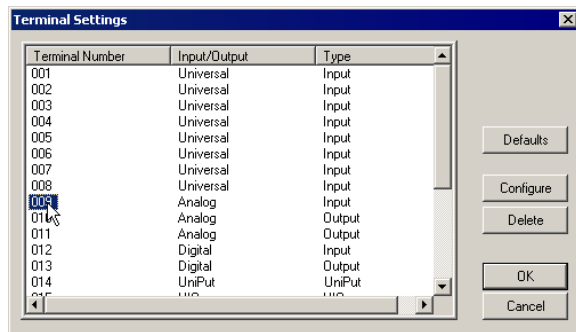
and click on **Delete**
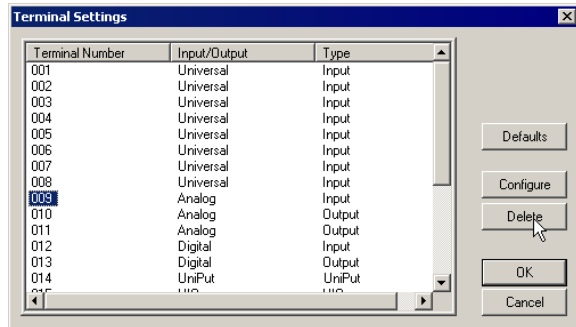
The selected terminal has now been returned to the blank 'UniPut' configuration.
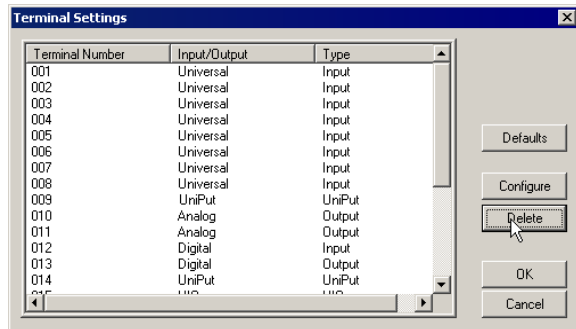
The terminal can now be selected,
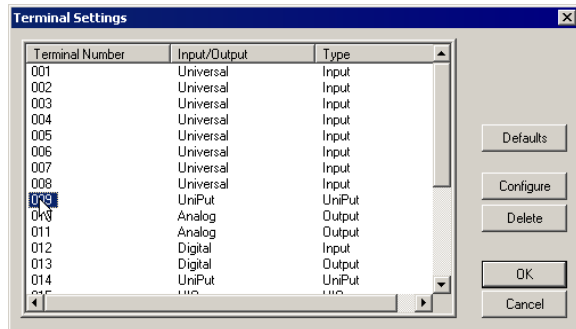
and configured as detailed in *How to configure a UniPut* on page 111.
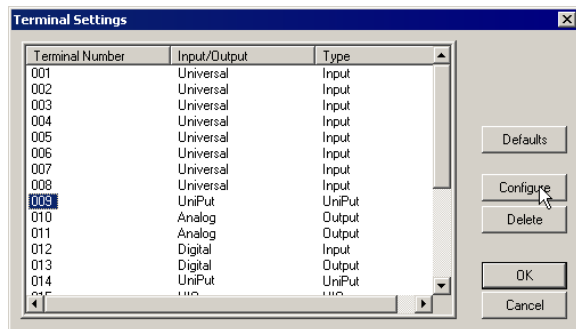
Example: completing the Analog Input module dialog box

- Point number

In the **Point Number edit box** is the number of the channel of the selected input, given in the range 1-8. The Engineering Centre automatically enters the next available point number in this box. To assign a point a number other than the one that is automatically chosen by the Engineering Centre, highlight the existing number and type in the required number.

- Point Name

Enter a name for the point in the **Point Name** edit box, using no more than 24 alphanumeric characters. Spaces, commas, full stops may also be used. Each point in a UC must have a point name that is unique within that controller.

- Units

The **Units** list box contains a collection of text strings, one of which will be displayed together with the point value. Choose from the list the type of unit that corresponds to the type of input, e.g. if an analog input point represents a temperature reading in degrees Celsius, you may choose DegC from the Units list box. If necessary, additional units may be defined in the WN3000.ini file. Appendix A contains details of how this is done.

- Sensor Types

Choose from the list under **Sensor Types**, the type of input you require. Some of the inputs available are:

- **Pt1000:** This configures the analog input for reading temperatures from a standard Pt1000 sensor. The UC will convert the measured resistance (voltage) to a temperature signal.

- **0-10 V:** This converts the hardware voltage signal 0-10 V DC to a software value in the range 0... 100 %. For example, the voltage signal 6.7 V DC will be converted to 67.0 %.

- **0-20 mA:** This converts the hardware current signal 0-20 mA to a software value in the range 0... 100 %. For example, a current of 15.0 mA gives the software a value of 75.0 %.

- **Pulse(V/F):** This is designed for reading voltage-free contacts, which can be operated at a frequency of up to 12 Hz. The value of the input will be incremented by 1 after each detected pulse. Evaluation and resetting of the counter will be done by using the Meter Module (module 63).

Additional sensor types can be allowed for by defining extra units of measurement Adding_units_of_measurement in the WN3000.ini file (see page 430).

- Input Error

The **Input Error** is a constant with the same unit as the input value. It is added to the input value to compensate for errors in input arising from factors such as resistance of long cables or positioning of sensors. Temperature values (sensor type PT1000) are corrected in mV. To compensate for 1°C, the input error is 2.5mV. For example, a decrease in temperature of 2°C requires an input error of -5.0mV to be entered. This feature will only work for analog passive inputs.

- Exp. Filter Constant

The **Exp.** (Exponential) **Filter Constant** is an individual time constant for the analog input. The filter constant works like a damping filter. The measured input value will be averaged over the time specified in seconds by the exp. filter constant. Variations of the measured value caused by specific conditions of the site can be filtered out if the exp. filter constant is bigger than the sensor response time.

- Alarm Point

The **Alarm Point** field contains the number of a digital point which will be activated if an alarm event of this point occurs. It can be set to alarm if a temperature value is out of a certain range. This can happen, for example, if the sensor cable is broken or has a short circuit. For further details on setting up alarms, see *Chapter 8 Alarms*.

- Advanced

Clicking on the Advanced button will bring up the following dialog box:
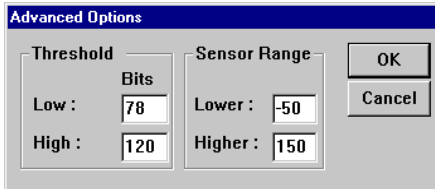
The threshold setting specifies the on/off turnover point on a digital input or output. The threshold will be set by default to a low figure of 78 bits and a high of 120 bits. The sensor range will be set to a low of –50 and a high of 150.

Below is an example of a completed dialog box for the 1st analog input.

- The **Point name** is defined as "Outside air temperature".
- The **Unit** of measurement chosen is DegC.
- The **Sensor Type** is defined as PT1000 – input for reading temperature values.
- The **Exp. Filter Constant** is set at 20 seconds.
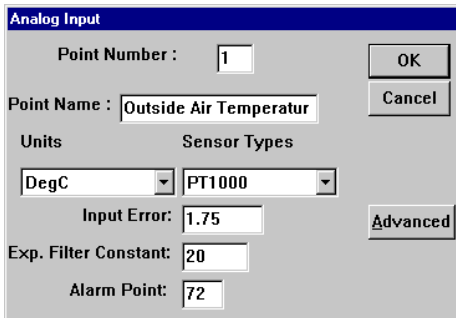
Click **OK** to accept the settings and close the dialog box. The values assigned to Point Number, Sensor Type, Point Name, Units and Exp. Filter Constant will be appended to the database on the PC for the selected path (site, Comms Controller, Field Controller, point number).

Additionally the analog input point function module will be placed on block 4 of the edited strategy.

The top left hand corner of the module's symbol, i.e. the graphical symbol for the analog input point, will be placed on the point on the drawing area where the mouse was clicked:
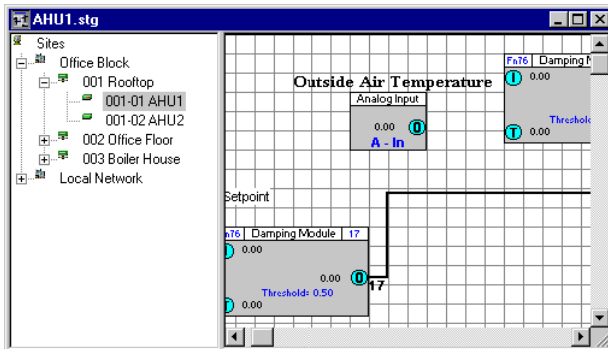
Viewing used blocks

To check which blocks have been used in a strategy, click **Managers** in the **View** menu.
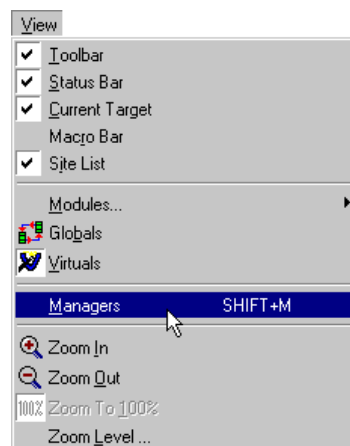
This opens the Managers dialog:
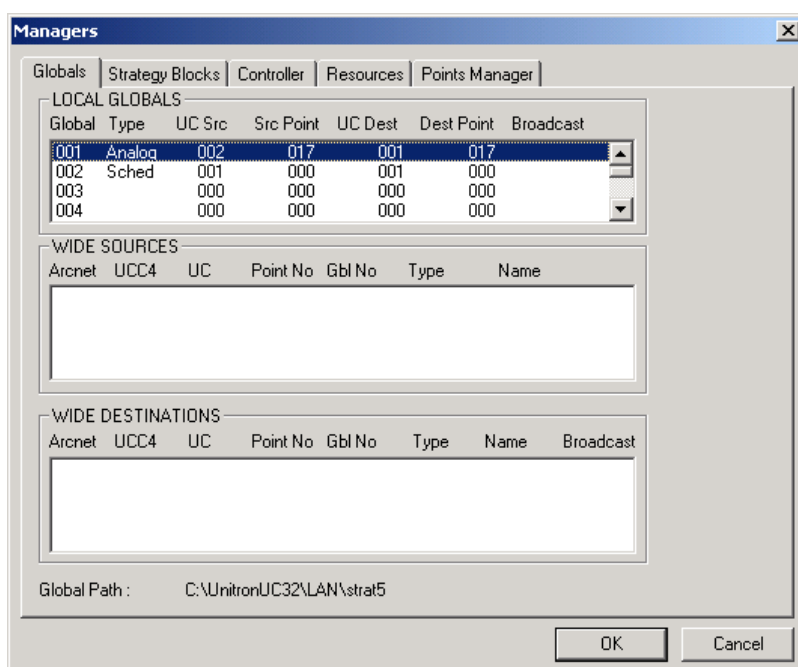
Viewing the list of blocks

Click on the Strategy Blocks tab to open the Strategy Blocks window

The Strategy Blocks window displays which of the available blocks have been used in the active strategy and which have not.
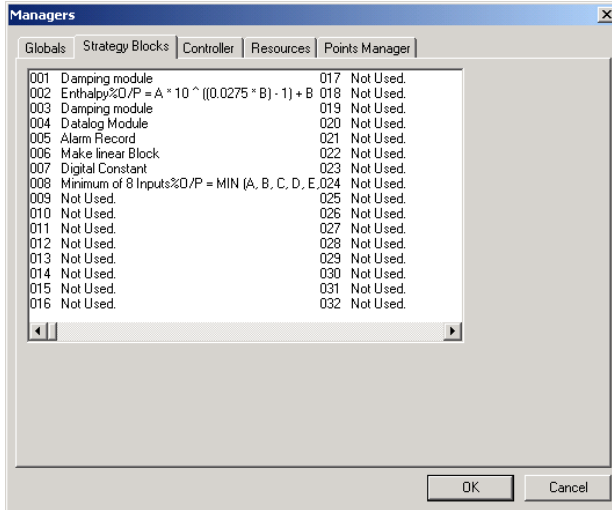
In the above example, the Strategy Blocks manager window indicates that the first block (block no. 001) is being used as a Damping module.

Blocks 2 is an enthalpy module, block 3 is a damping module etc.

Blocks 9 to 32 have not been used in the strategy.

To view the remaining blocks (in the above example, blocks 33-1024), use the horizontal scroll bar to move across the Block Manager window.

Viewing the blocks associated with each point

The Points Manager tab allows you to examine points in a strategy, listing the strategy blocks to which each point is connected.
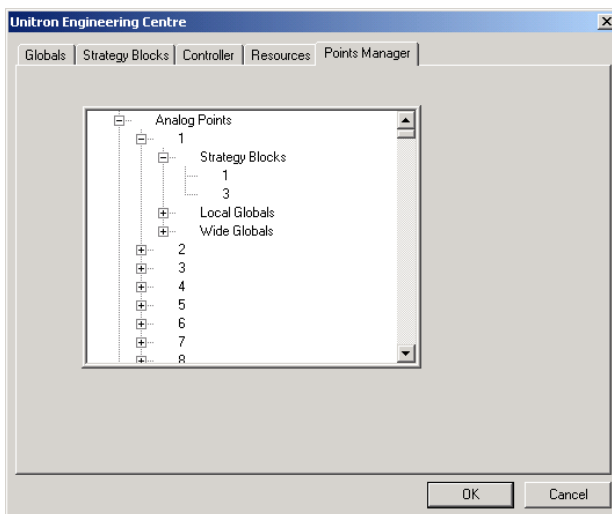
In this example, Analog Point number 1 is connected to strategy blocks numbered 1 and 3.

UPLOADING STRATEGIES FROM A FIELD CONTROLLER

Hardware points, blocks, and globals that have been downloaded to a controller can be uploaded and viewed, and if necessary edited and then downloaded again.

> **Note**: This upload method does not include all Globals, Layout data etc. To upload Site-Wide data, see*Site Discovery and Upload* on page 420.

Uploaded strategies will not look the same as they did before they were downloaded, because the strategy drawing is not stored in the controller. Instead, the blocks will be arranged geometrically on the drawing area (see *Viewing uploaded strategies* on page124)

To upload strategies from a Field Controller, carry out the following steps:

- **Open** a new, blank, strategy file
- **Log in** to the controller
- **Open** the Select Items to Upload dialog box
- Select the type of points to upload – **analog** or **digital**
- **Close** the Select Items to Upload dialog box
- Close the Uploading window

Uploading strategies - Open a new file

Select from the Site List the site, Communications Controller and Field I/O Controller from which the points are to be uploaded. Open a new strategy file by choosing **New** from the **File** menu or by clicking the **new** button on the toolbar.

Uploading strategies - Open the Select Items to upload dialog box

Click the button on the toolbar, or choose **Upload** from the **Communications** menu.
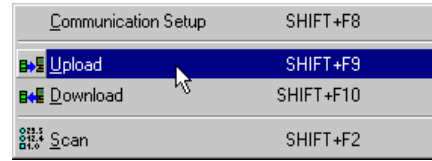
This produces the **Select Items to Upload** dialog box. The dialog that will be displayed depends on whether a UC32 or UC/UCU controller is targeted.

UC32 Select Items to Upload dialog:
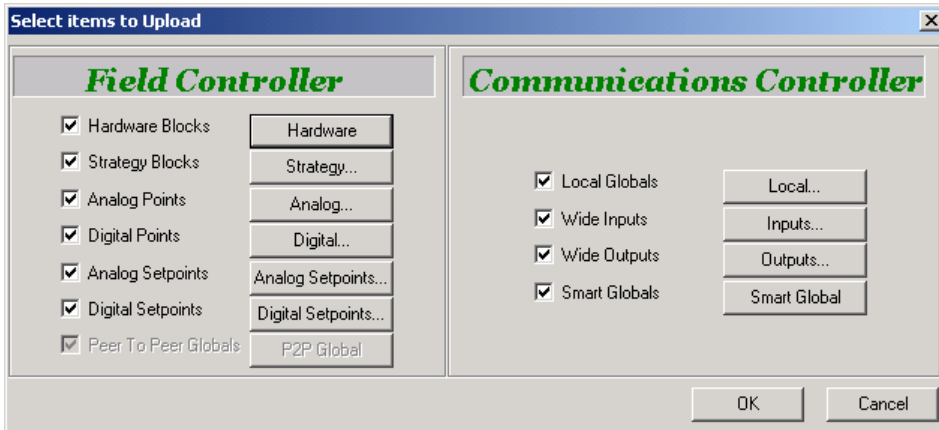
UC Select Items to Upload dialog:
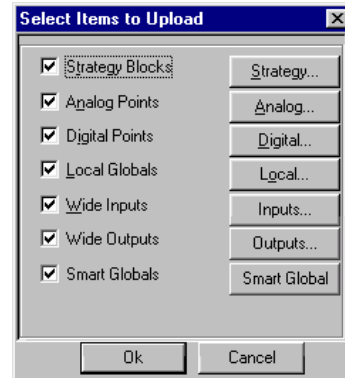
Uploading strategies - How to upload analog points

In the **Select Items to Upload** dialog box, tick the **Analog Points** checkbox. The default setting uploads all of the available analog points from the targeted controller.

If you want to specify which points to upload, click the **Analog...** button.

This calls the **Upload Analog Points** dialog box:
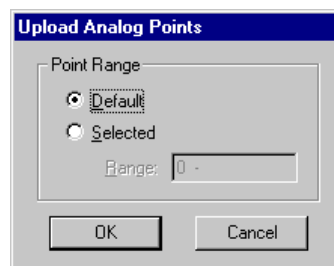
Click the **Selected** radio button and enter the range of points you wish to upload in the Range box.

> **Note:** **For UC/UCU controllers** this option is normally used to upload virtual points, so the numbers in this range will usually be between 17 and 255.
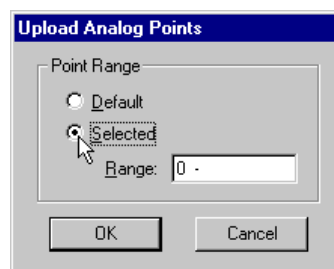
Click **OK** to confirm your settings.
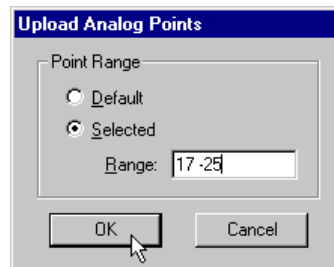
Uploading strategies - How to upload digital points

In the **Select Items to Upload** dialog box, tick the **Digital Points** checkbox.

The default setting uploads all of the available digital points from the targeted controller.
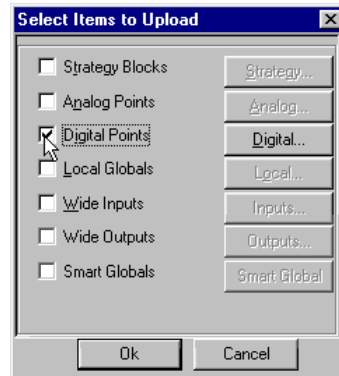
If you want to specify which points to upload, click the **Digital...** button.
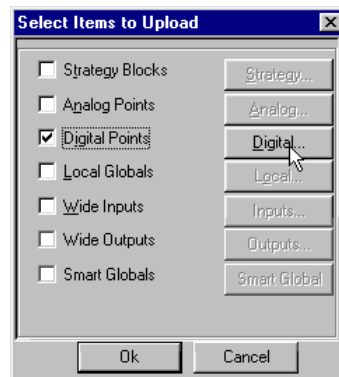
This calls the Upload **Digital Points** dialog box:
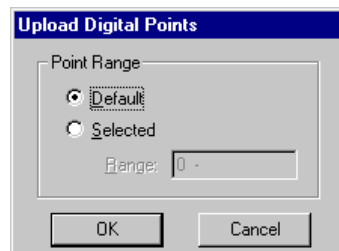
Click the **Selected** radio button and enter the range of points you wish to upload in the **Range** box.
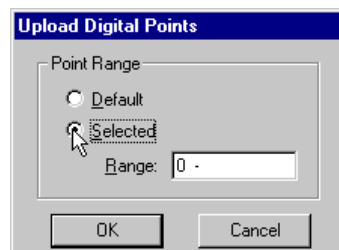
Click **OK** to confirm your settings.
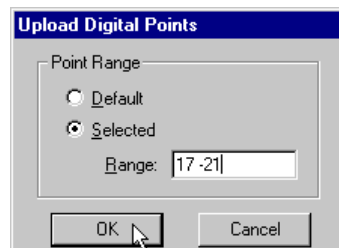
Uploading strategies - Close the Select Items dialog

When all items to be uploaded have been ticked, click **OK** in the **Select** Items **to Upload** dialog box.

The **Uploading** window appears.

It shows the rate at which the information is uploaded by means of a progress bar.

The progress bar in the example shows that the upload is 68% complete. The **System Status** section at the bottom of the Uploading window provides information on the upload process, e.g. Receiving digital points from controller:
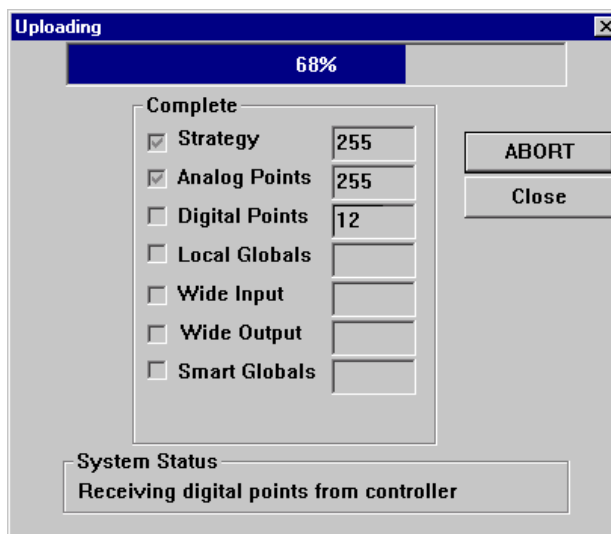
When the Engineering Centre has uploaded all of the requested information, System Status displays the message **Upload Complete**.
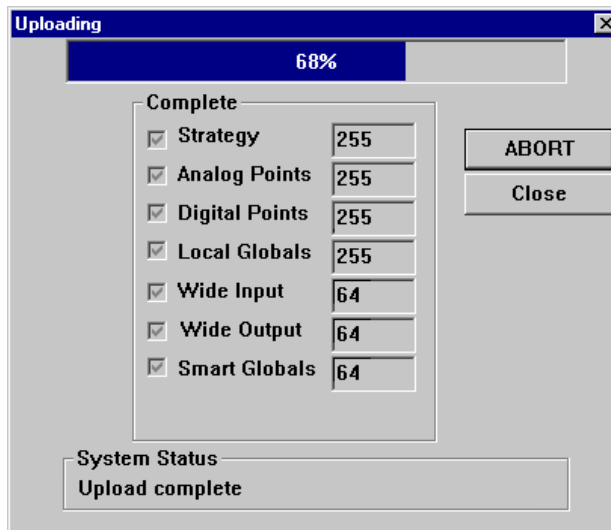
Uploading strategies - Close the uploading window

Click **Close**; the uploaded points are now displayed on the drawing area.

VIEWING UPLOADED STRATEGIES

When the Engineering Centre has finished uploading the desired points, it displays them on the drawing area. The Engineering Centre gives the points a logical layout, which may not match the layout used in the Strategy drawing when the strategy was first downloaded to the controller. This is because drawing information is not stored in the controller.

For example, if the points looked like this when you defined them:
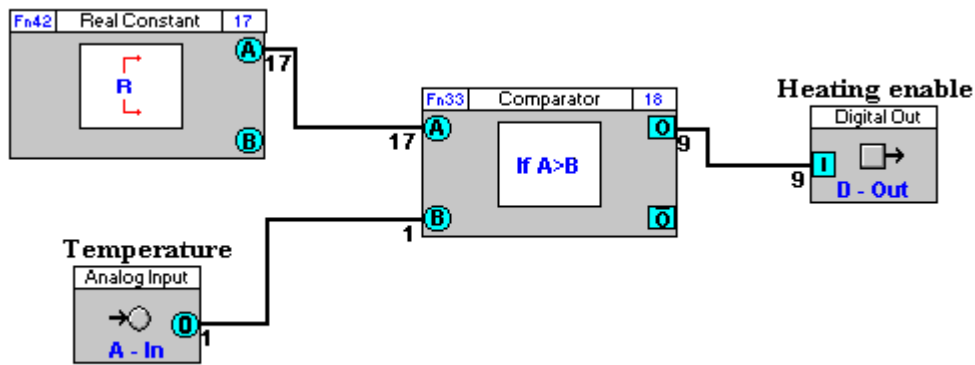
they might look like this when uploaded from the controller onto a different PC:
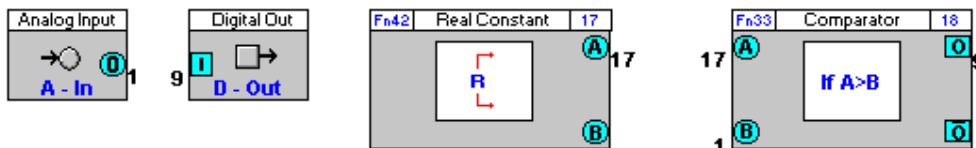
Note: Following an upload, the system parses the strategy, and if it finds an input or output that does not have a source or destination point it inserts a setpoint for that connection.

VIEWING UPLOADED POINT VALUES

The values of points and setpoints in a strategy can be viewed using the **LiveLog** feature. The last of the three menu options in the LiveLog menu, View , allows you to read the point values of the uploaded strategy in a text file.

Select View from the LiveLog menu. This will produce an MS Notepad (or similar text editor, e.g., **MS WordPad**, which must be specified in the `wn3000.ini` file) window displaying the values of all the points in the active strategy that have been uploaded from the controller:

```
iowin.log - Notepad
File  Edit  Search  Help
001     Temperature       Analog     21.00    12:18:48¶
009     Heating enable    Digital    0.00     12:18:48
001     Temperature       Analog     21.00    12:18:48¶
009     Heating enable    Digital    0.00     12:18:49
001     Temperature       Analog     21.00    12:18:49¶
009     Heating enable    Digital    0.00     12:18:49
001     Temperature       Analog     21.00    12:18:49¶
009     Heating enable    Digital    0.00     12:18:49
001     Temperature       Analog     21.00    12:18:49¶
009     Heating enable    Digital    0.00     12:18:50
001     Temperature       Analog     21.00    12:18:50¶
009     Heating enable    Digital    0.00     12:18:50
001     Temperature       Analog     21.00    12:18:50¶
009     Heating enable    Digital    0.00     12:18:50
001     Temperature       Analog     21.00    12:18:50¶
009     Heating enable    Digital    0.00     12:18:51
```

Note: This list of point values may be printed and stored for reference purposes.

KEEPING ENGINEERING CENTER AND CONTROLLER STRATEGIES IN SYNC

Strategy Compare

When logged into a **site**, it is possible to compare the **strategy** in the **Engineering Tool** with that in the **Controller**.

To compare **EC** and **Controller** strategies, right-click on the **Field Controller** in the `Site List` and select `Compare`, or select `Compare` from the `Communications` menu.

Only **strategy modules** are compared.

> **Note**: Parts of the strategy that can be modified using tools other than the Engineering Tool (e.g. CCView) are not compared. For example, the sample interval on a `Datalog` module is excluded from the comparison, but the Type of datalog is included.

Compare Process

When the **Compare** process is requested, the `Select Items to Compare` dialog is displayed:

This allows specific subsets of the **strategy** to be compared if required.

Clicking the Compare button starts the process, and shows the Uploading progress dialog:
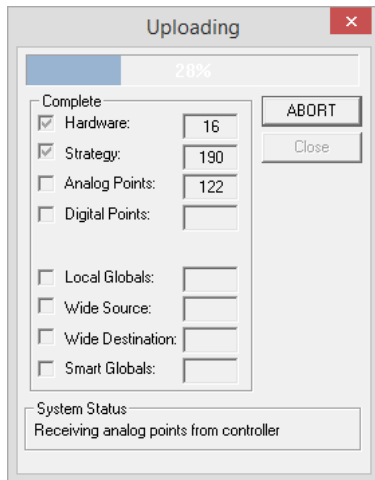
and when upload is complete, a comparison report dialog is displayed:
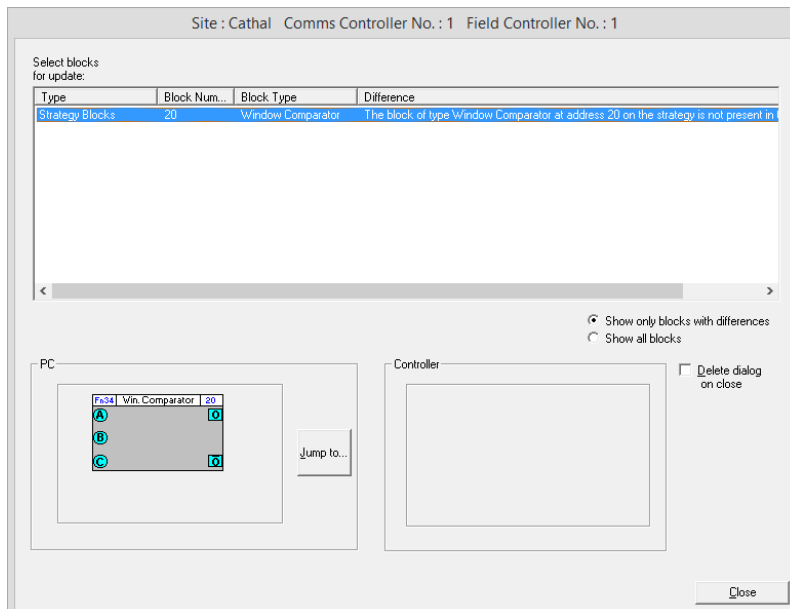
This dialog lists all of the differences between the **PC** version of the **Strategy** and the **Controller** version, with a facility to jump to each of the **modules** that contains a difference, so that the difference can be manually resolved.

When the differences have been resolved, clicking on the Close button terminates the **Compare** process.

Strategy Synchronization

The **Engineering Center** will evaluate whether its copy of the **strategy** and the **Controller's** are fully synchronized at the following times:

- When a **module dialog** is opened
- When a **strategy** is closed following a **partial download**
- When `Scan Mode` is enabled

If any potential discrepancy is found, the user will be prompted to run the `Strategy Compare` feature.

The user is not blocked or forced to take any action, and no changes take place in the background.

> **Note**: The checks apply to all strategy modules with the following exceptions:
>
> • Macros
> • DI Modules
> • Set Point Modules
> • IO Modules (On UC16 controllers)
> • Comment Modules

When a module dialog is opened:

If no discrepancy is detected when a **module dialog** is opened, the `Close & Run Compare...` button in the `Synchonisation Status` section of the module dialog is greyed out:
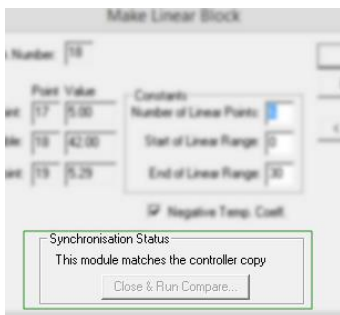
If a discrepancy exists, then the `Close & Run Compare...` button in the `Synchonisation Status` section is enabled:
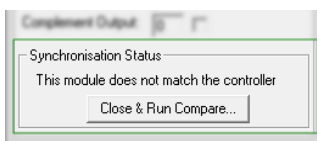
If you click on compare, the **Compare process** (see *Compare Process* page 126) starts.

When a strategy is closed following a partial download:

A **partial download** takes place when `Automatic Download` is disabled (see *How to download a strategy manually* on on page 196). In this case selecting `Download...` from the `Communications` menu will open a `Select items to Download` dialog allowing different subsets of the **strategy** to be downloaded individually:
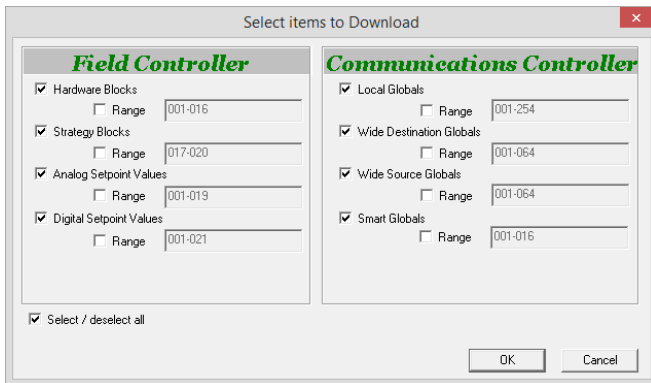
This dialog is similar to the Select Items to Compare dialog used in the compare process (see *Strategy Compare* on page 126).

However, if you carry out a partial download the **setup block** is not downloaded. The next time you close the strategy, the **Synchronisation** process will register a discrepancy between **PC** and **Controller** strategies. When this happens, a warning will be displayed stating that the "setup block was updated but not downloaded"and suggesting that the setup is downloaded:
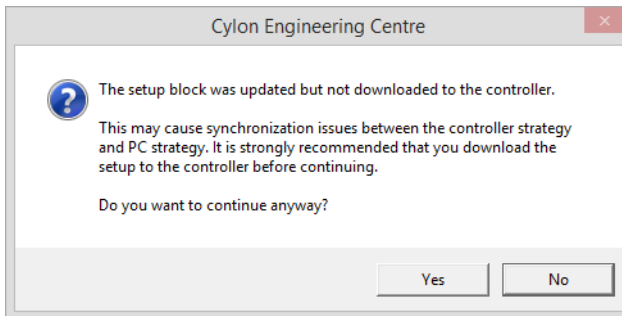
Clicking on the No button will allow you to save the setup block. If you do not wish to do so, click the Yes button and the **strategy** will be closed without updating the **setup block** on the **Controller**.

When Scan mode is enabled

When Scan Mode is activated (see *Activate scan mode* on page 210) the **PC** version of the **strategy** is compared to the **Controller** version and if any discrepancies are found, the mismatched modules will be identified by a flashing 'highlight box':
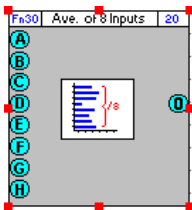
and a message in the status bar will inform the user:
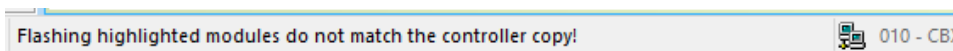
READING LIVE POINT VALUES (LIVELOG)

To read a point value means to display the current value of a point on screen. Reading point values is only possible if the **PC** is connected to **Controller** (either directly, or via a **Communications Controller**) and the **Engineering Centre** is online (i.e. you have logged in).

1. **Select the Controller** from which the point value is to be read

2. **Log in** to the **controller**

3. Activate **LiveLog**

4. Choose the **update method** for the LiveLog window

5. Choose the **strategies** you want to view

6. **Choose the options** you need from the LiveLog window

Reading Live Point Values - Select the Controller from which the point value is to be read

Select from the Site List the site the **Communications Controller** and **Field Controller** containing the point that is to be read.

The LiveLog Window

Activate the LiveLog by choosing **Log** from the **LiveLog** menu. This produces the LiveLog window, also known as the " I/O Window ":
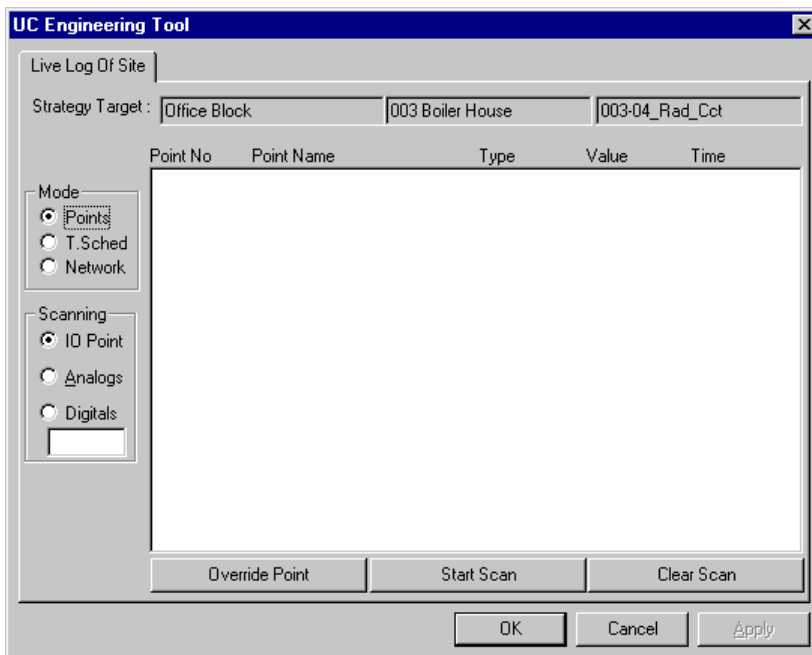
Choose the update method for the LiveLog window

As the LiveLog scans the point values in the controller, it lists them in the LiveLog window (I/O Window). As those values change, the list is updated by the LiveLog. There are two ways of displaying the updated values – a new list can be added to the previous list of values (**Append**) or the values in the first list can be replaced with the updated values (**Overwrite**).

This can be done in the **IOWindow setup** dialog (see How to set up Live Log to append or overwrite its display on page 148).

Choose which strategies you want to view

You can choose to scan a single strategy, or all strategies currently opened in Engineering Centre.

This can be done in the I/O Window setup dialog (see *How to set up the strategies that the LiveLog will display* on page 149).

LiveLog - Scanning Definition

In the LiveLog Window (or " I/O window "), you can view the following parameters for the LiveLog, and change them where it is appropriate to do so:

- The **name** of the current strategy (see page 131)
- The **Mode** of the LiveLog, i.e. whether the LiveLog will log points, schedules or the network status (*see page 131*)
- The **Target Controller** for the current strategy (*see page 133*)
- The **type of points** to be scanned (see page 133)
- Whether or not points will be **overwritten** (*see page 134*)

LiveLog Window - Strategy name tab

The name of the **strategy** which is actively being scanned is displayed on the strategy name tab. If you chose the scan **Active Strategy** option in the **IOWindow Setup** dialog box (see *How to set up the strategies that the LiveLog will display* on page 149), the file name tab will display the name of the active strategy. If you chose the scan **All Opened Strategies** option in the **IOWindow Setup** dialog box, there will be a file name tab for every open strategy.

LiveLog Window - LiveLog mode
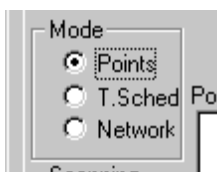
The LiveLog interface changes, depending on the mode that is being logged:

- Points mode
- Time schedule mode
- Network mode

- LiveLog: Points mode

In this view you can see points in the selected strategy, their types and values, and you can overwrite them if required.
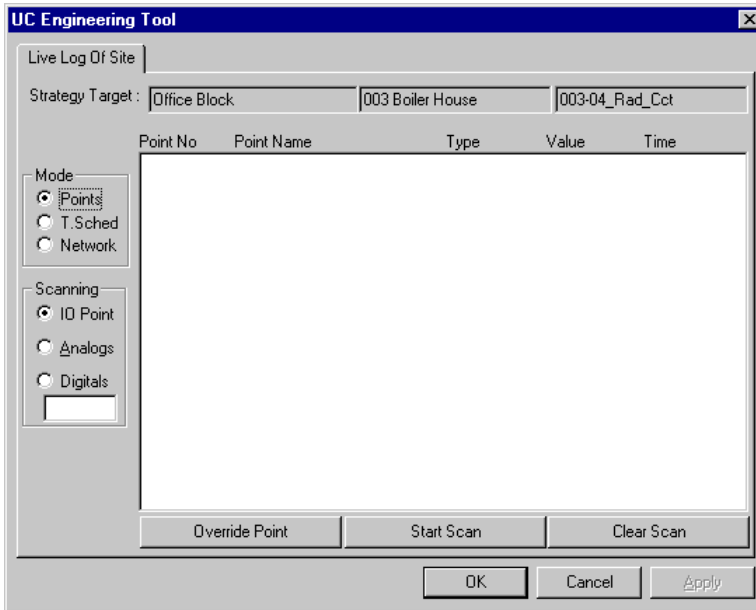
- LiveLog: Time Schedule mode

You can examine the time schedules in the selected strategy with this dialog box.
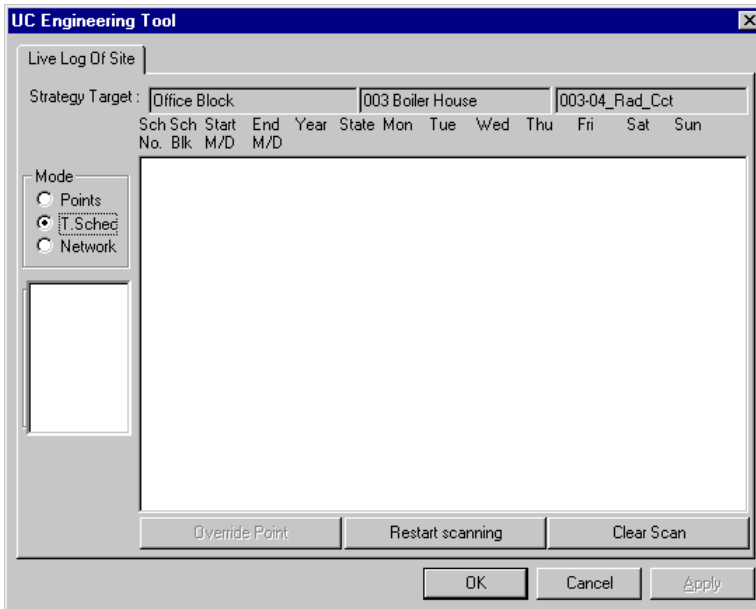
- LiveLog: Network mode

You can view the status of the ARCnet or RS485 Fieldbus with this screen, i.e. which controllers are online or offline, and which controllers are servicing or not servicing.
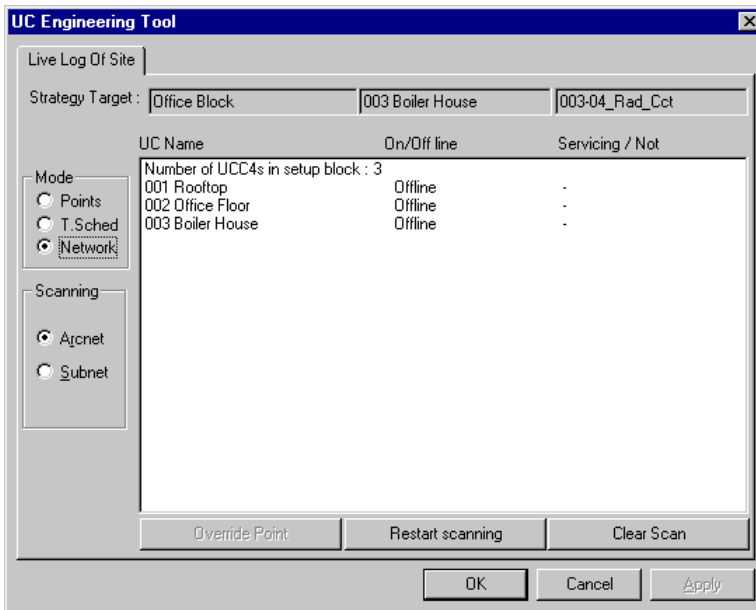
LiveLog Window - Strategy Target
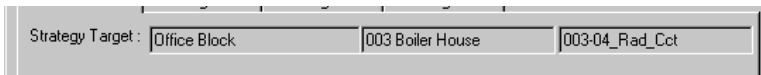
This window shows the target of the currently selected strategy. The values cannot be changed in the LiveLog dialog.

LiveLog Window - Scanning definition
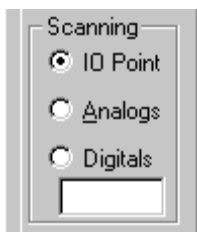
The **Scanning** section of the LiveLog window allows you to decide which values to scan. To scan the values of the controller's hardware points, click **IOPoints**.

To scan analog points only, click **Analogs** in the scanning section. To scan a specific number of analog points, enter a range of point numbers in the edit box under **Digitals**.

To scan digital points only, click **Digitals** in the scanning section. To scan a specific number of digital points, enter a range of point numbers in the edit box under **Digitals**.

LiveLog Window - Override Status
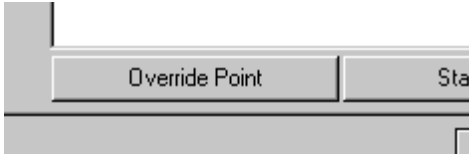
When a scan has been stopped, you can change the Override status of any point listed in the LiveLog window (I/O window) as follows:

- select the point from the list:
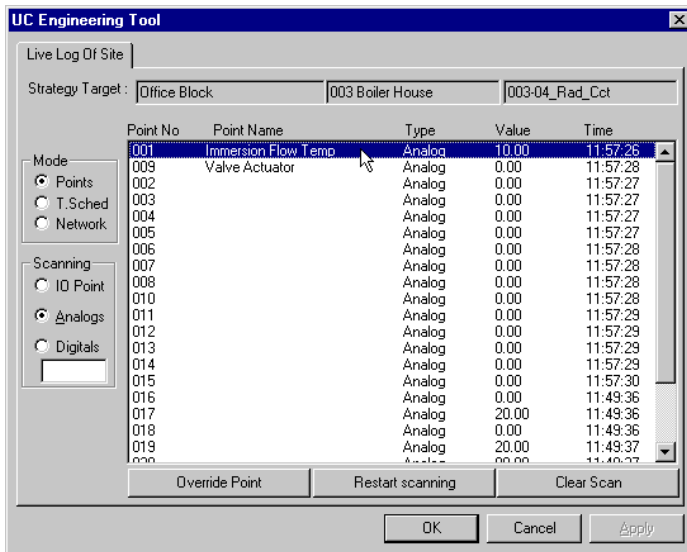
- click on the **Override Point** button at the bottom left of the window.
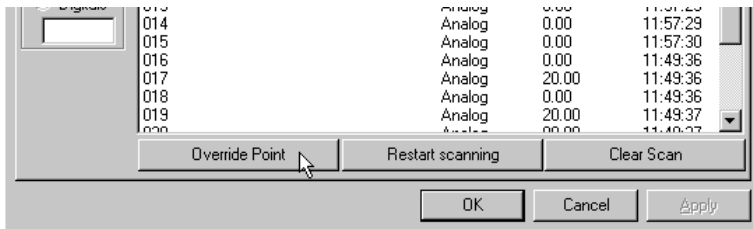
This opens the **Change Point Value dialog** (see page 135), where the current override status of the point is displayed and can be changed if necessary.

DOWNLOADING A STRATEGY USING AUTOMATIC DOWNLOAD

Automatic Downloading - Download the strategy

<u>LiveLog: Change Point Value dialog</u>
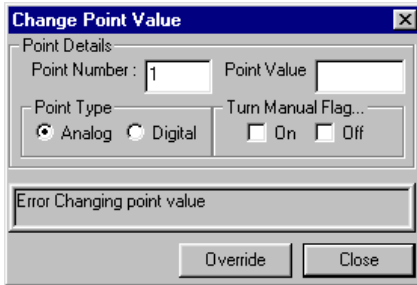
The **Change Point Value** dialog is opened by clicking on the **Override Point** button in the **Livelog Window**, or by selecting **Change Point Value** from the **Communications** menu.

For the point currently selected in the **LiveLog window** (I/O window), the **Change Point value** dialog displays the following:

- The radio buttons labelled Analog and Digital specify whether the point is analog or digital.

- The **Point Number** box displays the number of the currently selected point.

- A value for the currently selected point can be entered in the **Point Value** box. The point will be set to the entered value if the **Turn Manual Flag... On** box is ticked when the **Override** button is pressed.

- The **Turn Manual Flag...** check boxes (only available for hardware points) show whether or not the point is being manually overwritten. This can be changed as required by ticking the appropriate box.

Note: If you want to change the override status of the point in any way, after editing the appropriate boxes you must press the **Override** button to close the dialog box and apply the changes. For instance, if you tick the **Off** checkbox for "**Turn Manual Flag...**", you must press the **Override** button again before the point will revert to scanning normally.
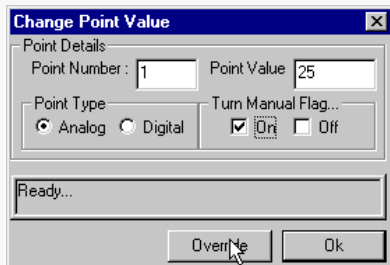
HOW TO READ HARDWARE POINT VALUES

Activate the LiveLog as outlined in steps 1- 3 of *Reading Live point values (LiveLog)* on page 130.

In the **Scanning** section of the **Livelog** window, click **IOPoint**.
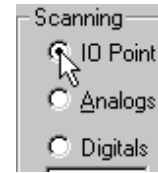
The LiveLog window will then display the numbers, names and values of the hardware inputs and outputs.

HOW TO SCAN ALL VIRTUAL ANALOG POINTS

Activate the LiveLog as outlined in steps 1- 3 of *Reading Live point values (LiveLog)* on page 130.

In the **Scanning** section of the **Livelog** window, Click **Analogs**.
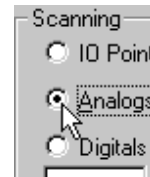
The LiveLog window will then display the numbers, names and values of the controller's virtual points.

HOW TO SCAN ALL VIRTUAL DIGITAL POINTS

Activate the LiveLog as outlined in steps 1- 3 of *Reading Live point values (LiveLog)* on page 130.

In the **Scanning** section of the **Livelog** window, Click **Digitals**.
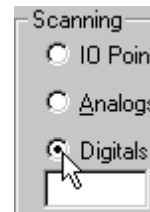
The LiveLog window will then display the numbers, names and values of the controller's virtual points.

HOW TO SCAN A SINGLE POINT

Activate the LiveLog as outlined in steps 1- 3 of *Reading Live point values (LiveLog)* on page 130

In the **Scanning** section of the **Livelog** window, enter a point number in the text box.
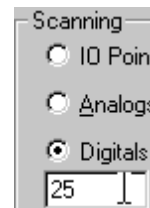
The LiveLog window will then display the numbers, names and values of the selected point.

MANUALLY OVERRIDING POINT VALUES - THE CHANGE POINT VALUE DIALOG

The **Change Point Value** dialog box allows you to set a point in a strategy to a particular value, regardless of conditions at a controllers inputs or outputs, or conditions within the strategy itself.

When a hardware **output** is manually overridden (disabled), the modules and/or globals in the strategy do not affect the point value.

When a hardware **input** is manually overridden (disabled), the hardware signal which is connected to the input (PT1000, transmitter, dry contact, etc.) is ignored by the input.

In both cases, the overridden hardware point keeps the value that is assigned to it in the **Change Point Value** dialog box.

The only way to change the value of a hardware point which has been manually overridden to another specified value is to use the **Override** option again, assigning a new value in place of the first.

Removing manual override status from a hardware point (enabling) means that the point can now be influenced by the peripheral hardware or strategy once again. The length of time that a UC32 hardware point will remain in the overridden state can be set in the Engineering Centre. For UC/UCU controllers, a separate step must be carried out to remove override status from a point.

It is only possible to disable and enable hardware point values if the PC is connected to a controller (either directly or via a COMMUNICATIONS CONTROLLER) and the Engineering Centre is on-line.

How to open the Change Point Value dialog

The **Change Point Value** dialog box allows you to

- Override or "disable" a hardware point, i.e. set it to a constant value regardless of conditions at the controllers inputs and outputs
- "enable" a hardware point, i.e. return the point's value to the automatic state.
- Change the value of a setpoint

To open the Change Point Values dialog, you can:

- Select Change Point Value from the communications menu
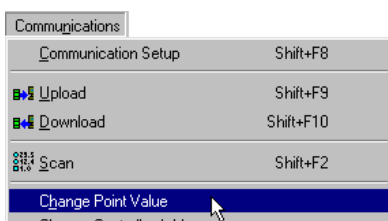
- Select Override Point from the LiveLog (I/O) window

If the LiveLog window is not already open, activate the LiveLog as outlined in steps 1- 3 of *Reading Live point values (LiveLog) on page 130*

Click on the Override Point button at the bottom left of the window.
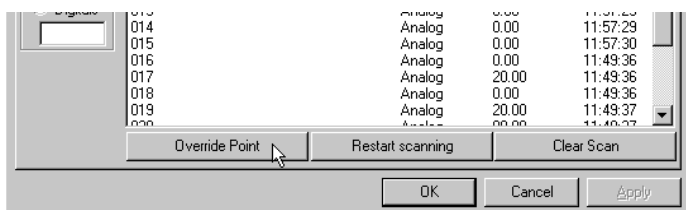
The Change Point Value dialog will change appearance depending on whether a UC32 or UCU controller has been targeted.

UC32 Change Point Value dialog:

UC Change Point Value dialog:

How to select a point to be changed in the Change Point Value dialog

When changing the value of a point using the **Change Point Value** dialog box, you must specify the point by one of the methods shown below:

- Enter the number in the Point number box:

Fill in the Point Number field in the dialog of the UC32 Change Point Value dialog

Or the UC Change Point Value dialog

You must specify whether or not the point is analog or digital, because there could be one point of each type for each number.

In the case of hardware points on UC/UCU controllers (numbers 1-16) there can only be one point for each number. Whether or not that point is analog or digital is defined in the strategy. In the case of hardware points you must select the correct type.

- Select point before opening from LiveLog window:

If the LiveLog window is not already open, activate the LiveLog as outlined in steps 1- 3 of *Reading Live point values (LiveLog)* on page 130.

Click Stop Scan:

Select the point from the list in the LiveLog window (I/O window):
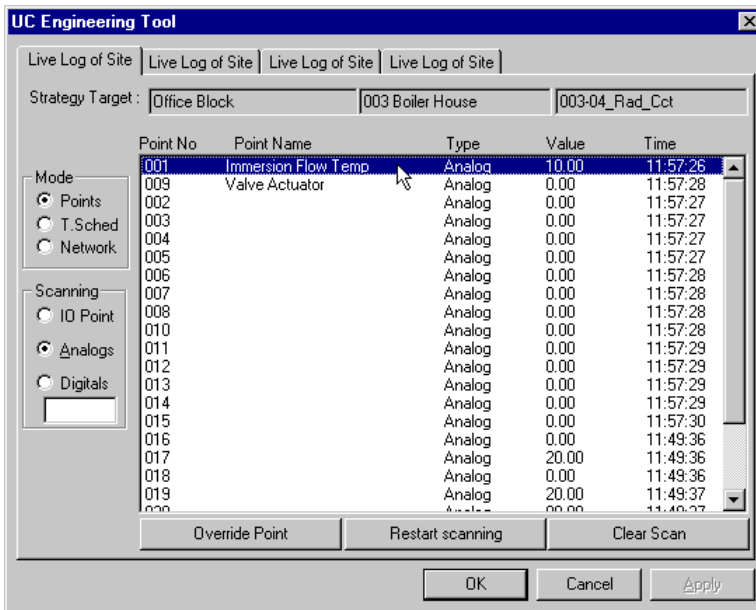
Click on the **Override Point** button at the bottom left of the window to open the Change Point Value dialog:
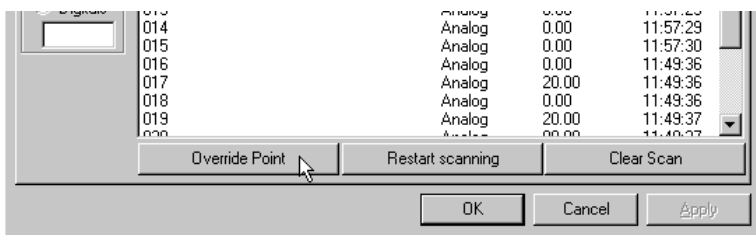
HOW TO OVERRIDE (DISABLE) A HARDWARE POINT

Open the **Change Point Value** Dialog (see How to open the Change Point Value dialog on page 137).

Select the point to be overridden (see How to select a point to be changed in the Change Point Value dialog on page 138).

The procedure varies for overriding UC32 and UC hardware points.

Overriding a CBM/CBT/UC32 Hardware point

When overriding a hardware point on a CBM, CBT or UC32, the override facility can be set to one of the following states:

- inactive at all times - Off

- active until the controller time passes 00:00 - Midnight

- active for one hour from the time at which it becomes active - 1 Hour

- active at all times - Continuous

Note: The "On Until Midnight" and "On For 1 Hour" options are for UC32-type controllers only. These options are NOT available when viewing points in UC or UCU controllers

The 'midnight' and '1 hour' options are provided to conveniently avoid problems that could arise if the override is not removed when it is no longer required.

Note: Even if 'Off' is selected in the override section, setting a value (analog) or state (digital) for the point will still have an effect. When the 'Override' button on the dialog is pressed, the value is sent to the point in the controller strategy, which stays at that value until the next time that the controller scans its strategy.

Tick the **Hardware Points** checkbox in the **Hardware Point Attributes** section of the dialog.

This will enable the **Override Duration** options.
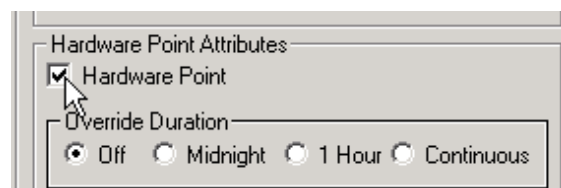
Enter a value for the point.

In this instance, a value of 25 is being is being entered for an analog point.

A value of 1 or 0 can be entered for digital points.
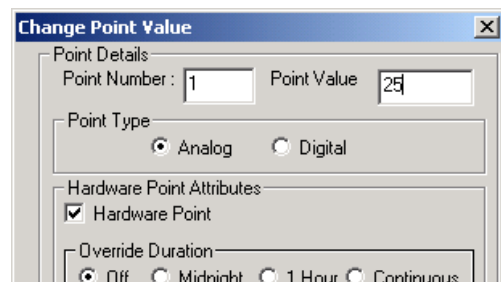
Select the length of time that the value of the point will be changed in the **Override Duration** section of the dialog.

The point will be set to the entered value when the **Override** button is pressed:

Clicking the **OK** button closes the dialog.

Notes about overriding BACnet points

Inputs

When a CBM/CBT input is overridden via Unitron, both the "**out of service**" and the "**override**" flags are automatically set.

When an overridden input comes out of its Unitron override both the "o**ut of service**" and the "override" flags are reset. It will be put into service regardless of the state it was in prior to going into override.

To override an input via BACnet, the "**out of service**" flag is manually set by writing to the "out of service" property. Then the desired value is written to the present-value. The OWS can clear any Unitron override by putting the point back into service and then back out again. From the Unitron side, the "override" flag will disappear and be replaced with an "overridden" flag.

Putting an input in service will clear all overrides both Unitron and BACnet and will flag the change appropriately on both protocols.

Outputs

When an output is overridden via Unitron, both the "out of service" and the "override" flags are set. The information in the present-value property will still be delivered to the hardware layer despite being out of service.

When an overridden output comes out of its Unitron override, the point is put back in service and both the "out of service" and the "override" flags are reset.

To override an output via BACnet, it is presumed that the priority array will be used, and clear all overrides and flag the change appropriately on both sides.

All I/O blocks have an output labelled "M" which is meant to indicate the override status of the point in question. This output is true any time the point is "out of service" or "overridden" via Unitron. This way the point reflects the status of the data regardless of whether it is being overridden via BACnet or Unitron.

Overriding a UC Hardware point

With older UCU and Ucxx controllers, the **Turn Manual Flag…** check boxes at the bottom of the Overwrite section specify whether or not a Hardware point is to be manually overridden.

To override the currently selected Hardware point, select the **Hardware Point** checkbox and then tick the **Turn Manual Flags… On** check box.

> **Note:** The Manual Flag is a 'firmware' feature of Hardware points (i.e. inputs or outputs – points numbered 1-16). This step is not relevant to virtual points (points numbered 17-255)
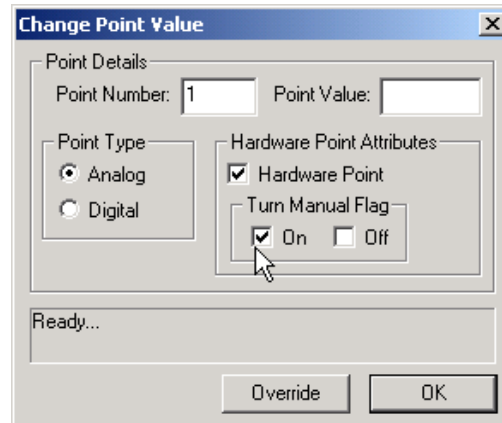
Enter a value for the point
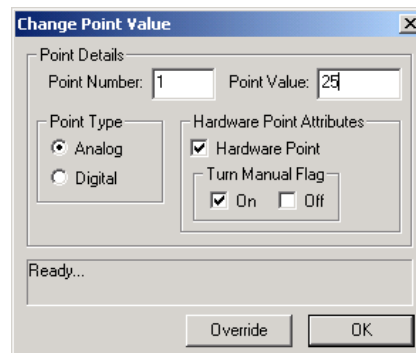
The point will be set to the entered value when the override button is pressed:
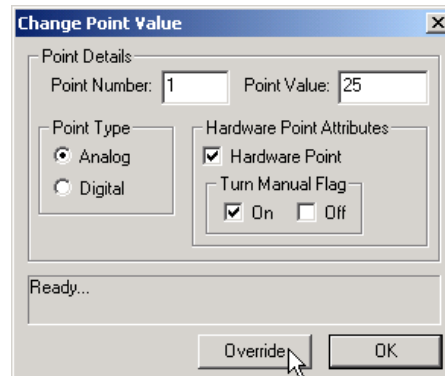
To close the dialog, click on the **OK** button.

To see the new value of the point, click **Restart Scanning** in the LiveLog window.

The next time the LiveLog scans that point, its new value will be displayed. The LiveLog marks point values that have been overridden by displaying the symbol ¶ beside the value.
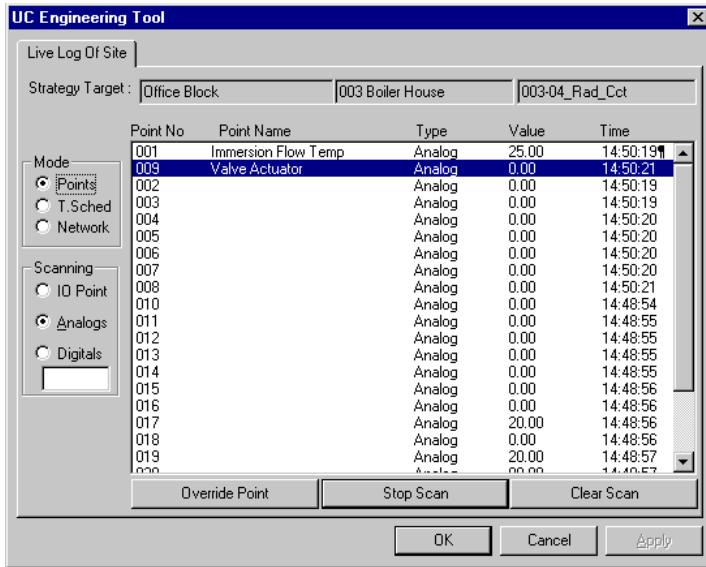
Tip: Double-clicking a point number in the LiveLog window places an asterisk beside it allowing it to be monitored more effectively:
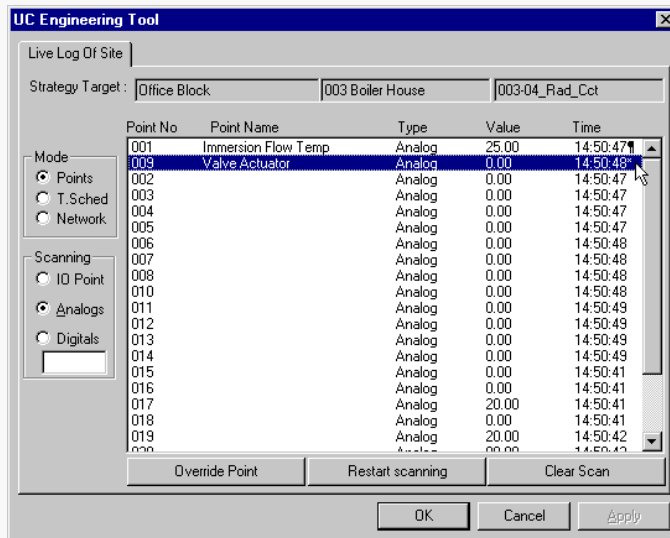
HOW TO ENABLE A HARDWARE POINT VALUE (REMOVE MANUAL OVERRIDE STATUS)

Removing manual override status from a hardware point (enabling) means that the point can now be influenced by the peripheral hardware or strategy once again. If the override duration on a UC32 hardware point has been set to one hour or until midnight the point will be enabled when the specified period has elapsed. If the override duration on a UC32 has been set to continuous, or if a point on a UC or UCU controller has been overridden, the following procedure must be carried to enable the point:

Open the Change Point Value Dialog (see How to open the Change Point Value dialog on page 137).

Select the point to be overridden (see How to select a point to be changed in the Change Point Value dialog on page 138).

If the targeted controller is a UC32,

Select the Off option in the Override Duration section of the dialog,
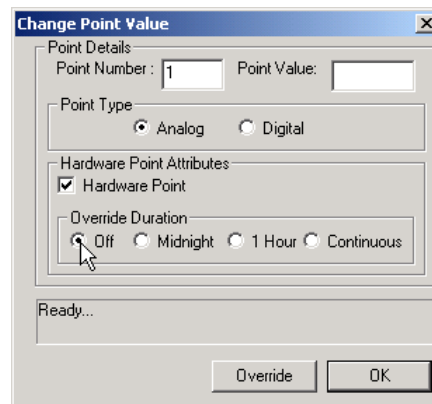
And click the Override button to apply the change.
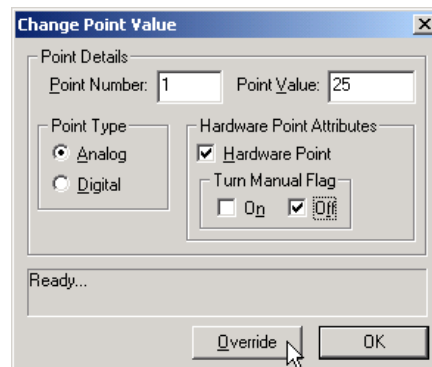
To close the dialog, click on the OK button

If the targeted controller is a UC or UCU,

Click the Turn Manual Flag > Off check box,
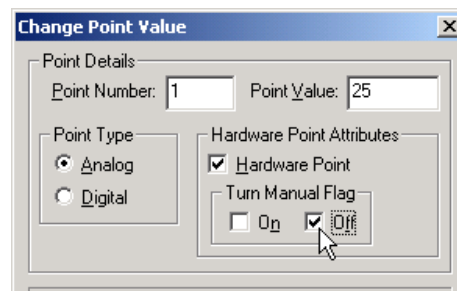
And click the Override button to apply the change.
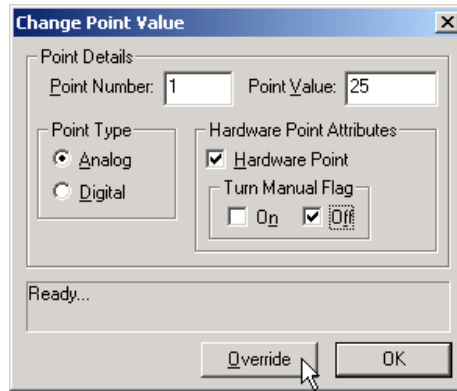
To close the dialog, click on the Ok button

To see the new value of the point, click Restart Scanning in the LiveLog window.

The next time the LiveLog scans that point, it will display the value of the point as it is read by the controller.

The ¶ symbol will be removed (see point 001 in the diagram below):
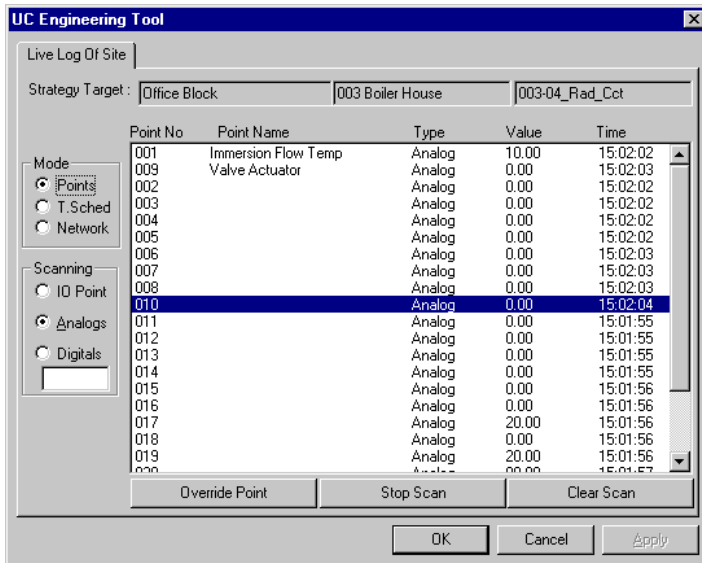
HOW TO CHANGE THE VALUE OF A VIRTUAL POINT

The value of a virtual point can be changed using the Change Point Value dialog box, in a similar way to changing the value of a hardware point.

However, virtual points cannot be overridden – if conditions in a strategy change, a virtual point may change from the value given to it in the Change Point Value dialog. As a result, changing the value of a virtual point is usually only relevant in the case of setpoints, because their values are not affected by the strategy.

The procedure for changing the value of a setpoint is as follows:

Open the Change Point Value Dialog (see How to open the Change Point Value dialog on page 137).

Select the point to be overridden (see How to select a point to be changed in the Change Point Value dialog on page 138).

Enter the new value for the virtual point.

> **Note:** Because the point is a virtual point, the **Override Duration** options in the UC32 dialog and the **Turn Manual Flag...** options in the UC dialog are 'greyed out' and cannot be selected.
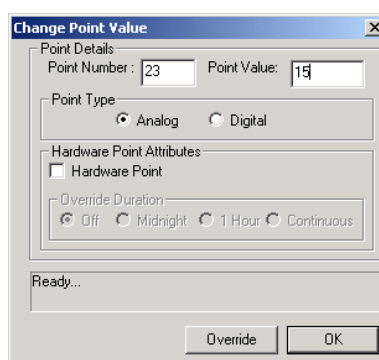
Click the **Override** button to apply the change.
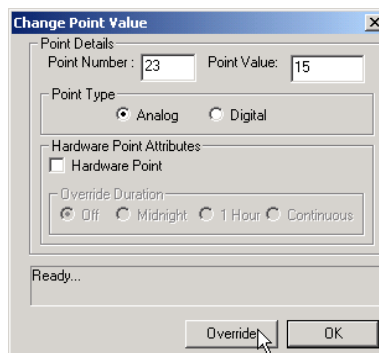
To close the dialog, click on the OK button

To see the new value of the point, click Restart Scanning in the LiveLog window.

The next time the LiveLog scans that point, its new value will be displayed. The LiveLog marks point values that have been change by displaying the symbol ¶ beside the value.

> **Note**: Double-clicking a point number in the LiveLog window places an asterisk beside it allowing it to be monitored more effectively.

CHANGING THE LIVELOG'S SET-UP

The LiveLog feature in the Engineering Centre allows you to read the values of points in the controllers on your site (i.e. it reports "live" or in real-time from the site).

As well as reading point values, the LiveLog also scans time schedules, the ARCnet network and its Fieldbusses and, if configured to do so, it will log those values to a text file.

How to set up Live Log to append or overwrite its display

Select **Setup** from the **LiveLog** menu….
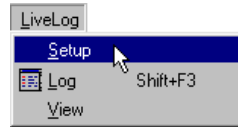
…to open the IOWindow Setup dialog.
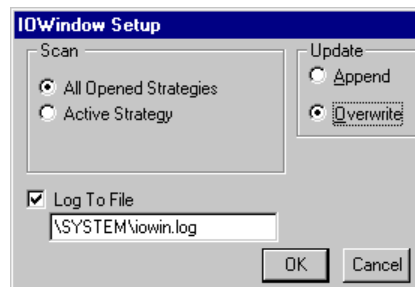
In the Update section of the IOWindow Setup dialog, choose the update method you require:

Append will cause the LiveLog add new scan data to the end of the existing list,
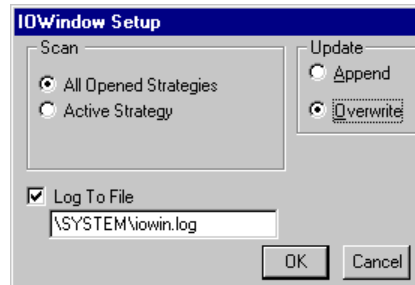
Overwrite will cause the LiveLog list to be replaced each time a scan is completed.
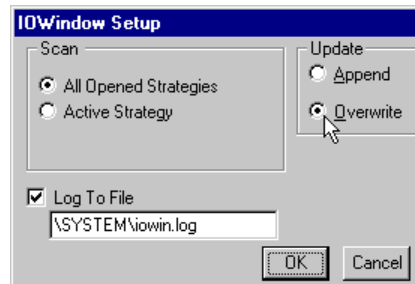
How to set up the strategies that the LiveLog will display

Select **Setup** from the **LiveLog** menu….
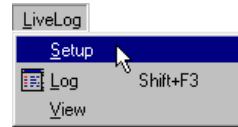
…to open the IOWindow Setup dialog.
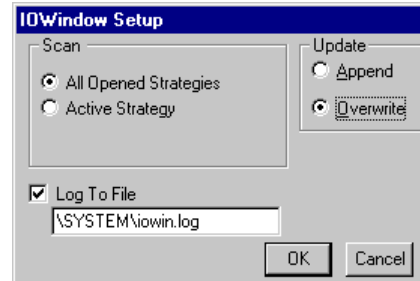
To read the point values of each strategy that you have opened, click the **All Opened Strategies** radio button.
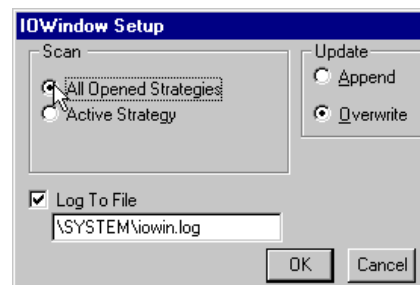
or

To read the point values of the active strategy only, click the **Active Strategy** radio button.
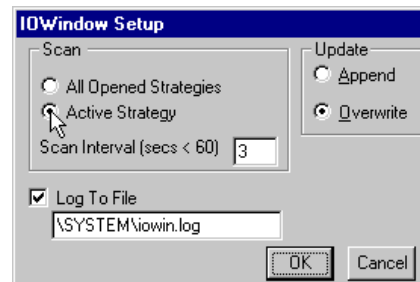
If you chose to scan the active strategy, enter a number between 1 and 60 in the **Scan Interval** edit box. This represents the number of seconds the Engineering Centre will remain idle after scanning the strategy before it will scan the strategy again. (The LiveLog continuously scans the strategy until you press **Cancel** or **Stop Scan**.)
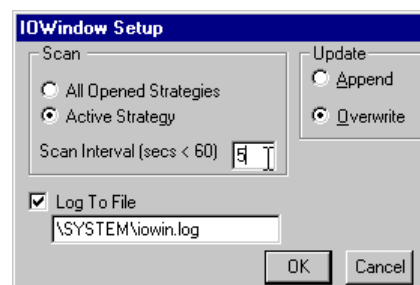
How to set up the LiveLog to store its results in a file

Select **Setup** from the **LiveLog** menu….
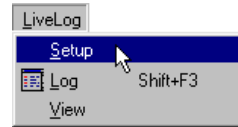
…to open the IOWindow Setup dialog.
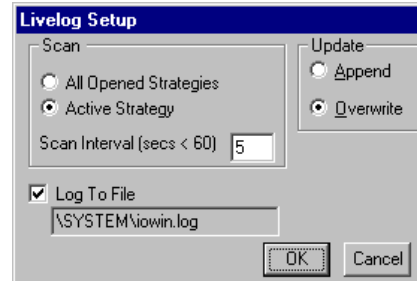
If you would like the results of the LiveLog to be written to a text file and saved, click the **Log to File** checkbox. By default, a file path and name (\SYSTEM\iowin.log) already exists to which the LiveLog results will be written.
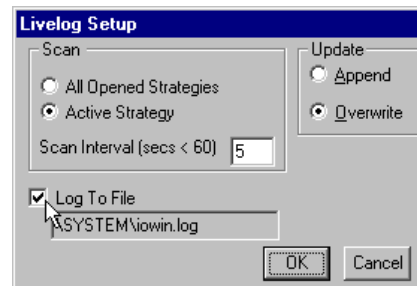
To view the contents of the LiveLog text file, click **View** in the LiveLog menu.

Scanning point values

There are three ways to scan point values – using **Log** from the **LiveLog** menu, **Scan** from the **Communications** menu, or **dialog scanning** (opening a module dialog box after downloading the strategy). While all options will scan point values, they differ in functionality. The main features of each option are listed below:

The Log menu option:

- scans the values of all the points in the targeted controller.
- displays the changing values in list form.
- scans the point values in the LiveLog window.

The Scan menu option:

- scans the values of the points in an uploaded strategy.
- displays the changing point values graphically in the module symbols
- activates scan mode, i.e. the Engineering Centre window changes to the Scan mode window which has just two menu options and a red title bar.

The dialog scanning option

- scans the points attached to a single module
- displays the value in the module's dialog box

For further details of Scan mode, see *Testing a strategy with Scan Mode* page 207.

HOW TO CONFIGURE A CONTROLLER'S BACNET SETTINGS

When a **Field Controller** is first commissioned, its address must be set by connecting **CEC** directly to the controller by RS232 link (Service Port). If points on the controller are to be exposed on a **BACnet** network, or if the **CEC** is to communicate with the **Field Controller** by **BACnet Tunneling**, then the **Field Controller**'s **BACnet** address (**Device Instance Number**) must also be set.

These device settings, and others, can be set from the **CEC** as follows:

> **Note**: Some parameters can be set over Ethernet connection, but Controller Address and Baud Rate can **only** be set when the Engineering PC is connected to the controller by RS232 link.

In the **Cylon Engineering Centre**, select Configure BACnet Device from the Communications menu
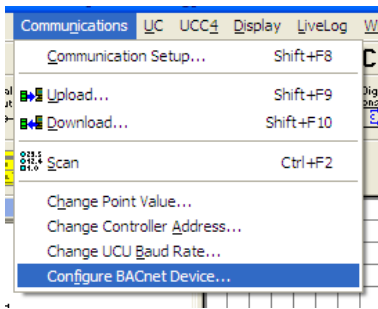
This opens the Device Properties dialog, which defines how the Controller will communicate on the **BACnet** network, and how it will communicate with **Cylon Engineering Centre** for configuration over **BACnet**.

In this dialog, each current value and the proposed new values can both be displayed at once. Defaults can also be automatically generated.

Device Properties

Note: Only `Device Name` , `Site Number` , `Comms Ctrl Number` and `MSTP Max Masters` will be editable when the Engineering PC is connected over Ethernet. In order to edit the other parameters, it must be connected by RS232 serial link.

The parameters that define how the Controller communicates on the **BACnet** system are:

- Device Instance Number

Enter the required BACnet address (0 – 4194303).

Note: The number set here in the **Field Controller** (when connected serially) must match the **Device Instance Number** set in the **Cylon Engineering Centre**.

- Device Name

Any descriptive text.

- Tunneling Properties: Site Number, Comms Ctrl Number and Controller Address

Note: All of the Cylon controllers throughout the BACnet system **must** have the same Unitron "Site Number". Broadcast globals will not work if this is not the case.

In the `Device Properties` dialog set the `Site Number` and `Comms Ctrl Number` matching the position of this Controller in the **Site** defined in the **Cylon Configuration utility (CCConfig)**.

- MSTP Max Masters

This must be equal to or greater than the highest address used on the BACnet **MS/TP** fieldbus, because this controller will not pass data to devices with addresses higher than this. The optimum situation is that this value is set in all devices to exactly the value of the highest address on the fieldbus. (1 - 127)

> **Note**: It is recommended that you address your controllers consecutively starting at 1, with the MAX Master value matching the Maximum Controller address value. For optimum efficiency there should be no gaps in the device addresses.

- APDU Timeout

(0 - 60 seconds) this value should be left at its default unless there is a problem.

- MSTP Address (not visible by default)

This is the BACnet address of the **Field Controller** on the Cylon BACnet fieldbus (0 - 127).

It is recommended that this is set to the same value as the Controller Address, which is the Unitron address of the **Field Controller** on the fieldbus (1-255). By default these are set to the same value, 1-127, and the MSTP Address field is no available to be edited. However, it is possible to set a different **BACnet** address if required. To do this, click the Advanced... button, to open the BACnet Device Setting Advanced Options dialog:
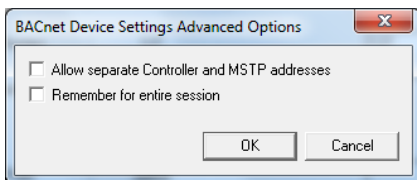
Tick the Allow separate Controller and MSTP addresses checkbox
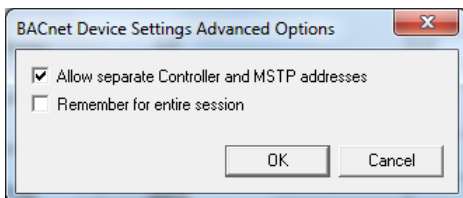
And click OK . The Device Properties dialog will now show the MSTP Address parameter, allow it to be edited if the Controller is connected by **RS232** Serial Connection:
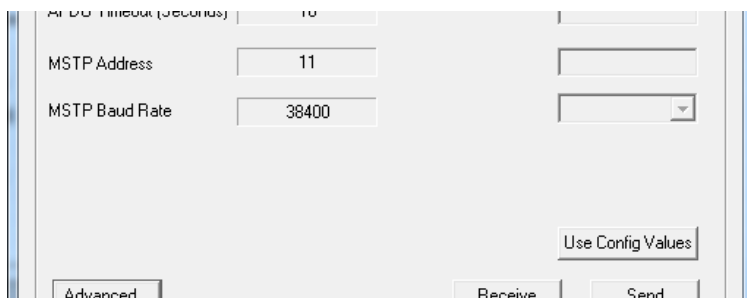
If this value is changed, then a warning will be displayed that the Cylon Engineering Centre must be restarted before the Engineering Centre will be able to communicate with the controller over IP (it is currently connected serially to make the change)
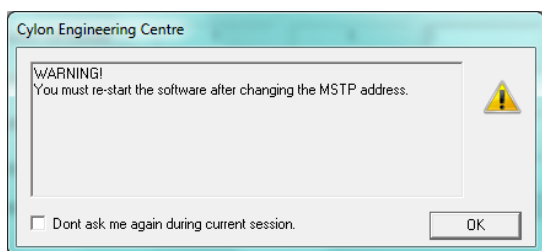
SECTION 6 : CREATING STRATEGIES

WHAT IS A STRATEGY?

A Cylon controller controls HVAC and other equipment by varying its outputs in response to inputs such as temperature, switch settings, air flow speed etc.

The way that the controller's outputs react in response to the controller's inputs can be defined by the user. The definition is called a 'strategy'.

A strategy is the 'user program' stored in a Cylon controller, that configures the controller for a specific role in a BMS site. It can be described as the "implementation of a solution" to a requirement on a site.

In the Engineering Centre, a strategy is designed graphically using the algorithmic modules available on the **modules bar** (see page 79). It is saved as a strategy file on the supervisory PC and then downloaded to the controller for which it was designed, where it tells the controller how to behave within the BMS site.

The simplest of strategies is made up algorithmic modules, hardware and virtual points. Strategies are often more complex, however, and can also include globals (for communicating values to or between other Field Controllers on the ARCnet network – see page 304) time schedules (see page 384), datalogs (see page 388 and alarms (see page 396).

AN EXAMPLE OF A STRATEGY

The Problem

The heating system of a building is too costly to run constantly.

The Solution

The heating system should be switched off when the outside air temperature rises above a certain point (for example 23°C). It should not be switched on again until the outside air temperature drops below another pre-defined point (in this case, 18°C).

The Strategy

A strategy to implement this solution to the problem can be designed in the Engineering Centre and downloaded to the controller connected to the heating system, where it will be applied.

The strategy shown below uses the hysteresis module to compare the outside air temperature to the two set points defined in the module (in this case, these are set at 18°C and 23°C). If the outside air temperature is greater than 23°C, the H output is unset (off). If it is less than 18°C, the H output is set (on).

The strategy is saved and then downloaded to the UC connected to the heating system.
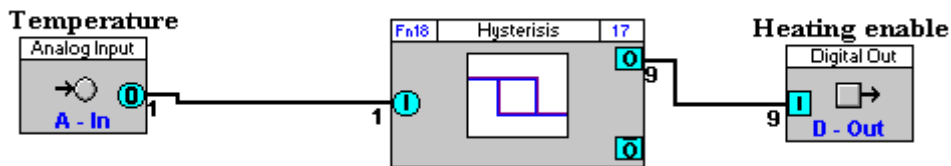
HOW TO CREATE A STRATEGY

To create a strategy, follow these steps:

- Select Site, Communications Controller, and Controller (see page 159)
- Select a modules group (see page 78)
- Select a module from the modules bar (see page 79)
- Place the selected module on the drawing area (see page 160)
- Place all the required modules on the drawing area (see page 162)
- Join the modules (see page 163)
- Set the values of the module's inputs and outputs (see page 170)
- Add explanatory text if necessary (see page 170)
- Save the Strategy (see page 177)
- Download the strategy to the controller (see page 189)

Creating Strategies - Select Site, Communications Controller, and Field Controller

Select from the **Site List** the site, Comms Controller and Field Controller that is to be programmed. All names given to objects (points, datalogs, time schedules etc.) will be saved to this controller in the Cylon database.
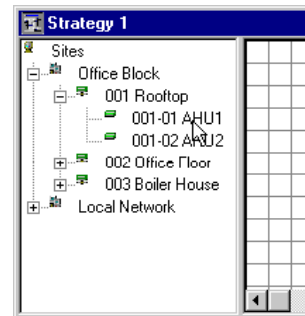
When you click on the target controller, the **site list** closes:
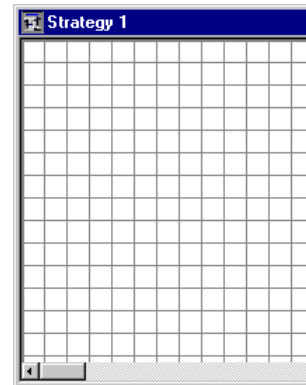
> **Note**: you can open the site list again by selecting **Site List** from the **View** menu, or by pressing F5.

Creating Strategies - Place the selected module on the drawing area

When you have selected a module to insert,

Place the mouse pointer at the part of the drawing are where you want to place the module.
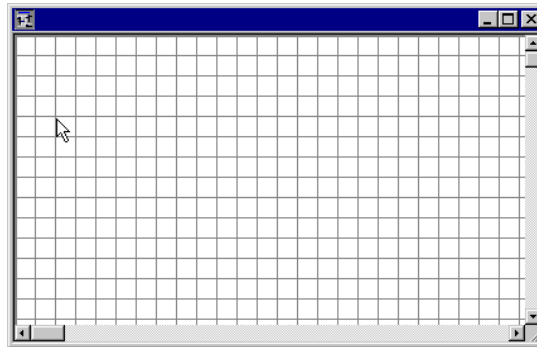
Click the mouse button.

For some modules, such as inputs, outputs, or setpoints the module dialog will appear
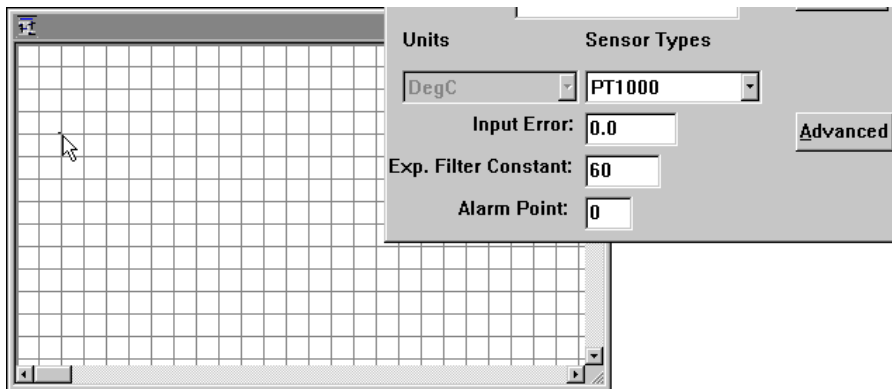
Complete the dialog, if one appears, and click on OK.
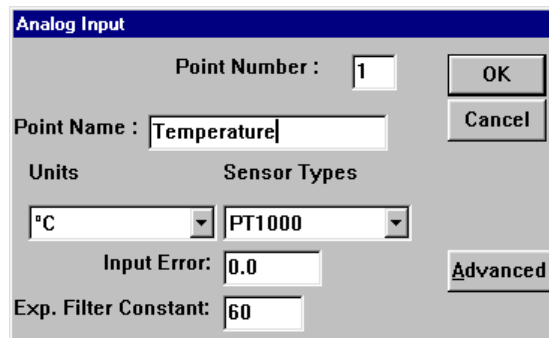
The module is now on the drawing area.

It can now be moved, deleted, copied, or linked to other modules.
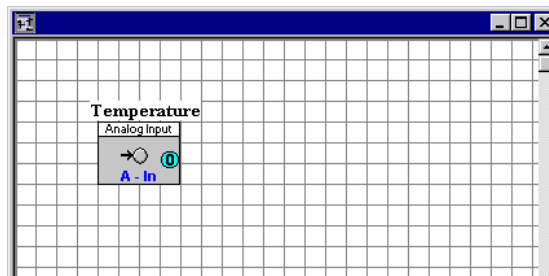
To operate on a module, it must be selected, by double clicking ….
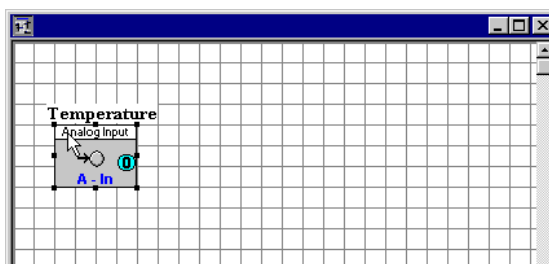
..or by dragging a selection box around the module symbol (or symbols)
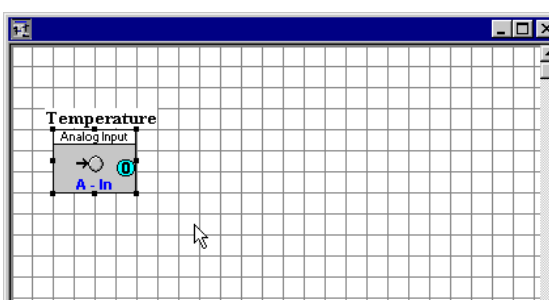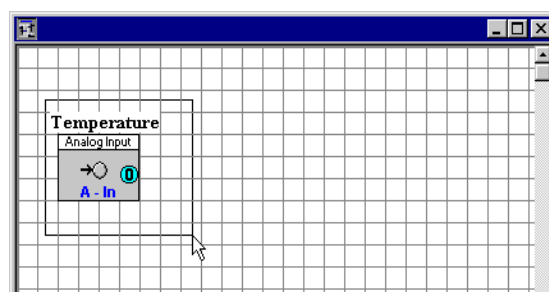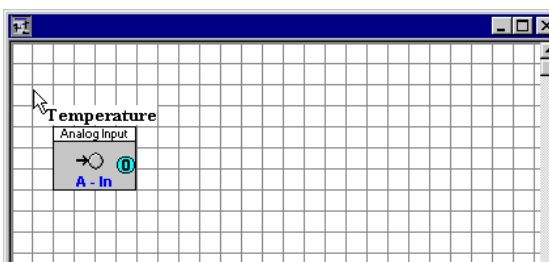
Once a module has been selected, it can then be:

moved	by using the mouse to drag the module to its new location;
deleted	by pressing the DELETE key on the keyboard;
cut	by pressing Ctrl and X on the keyboard or by choosing Cut from the Edit menu or by clicking the Cut button on the toolbar;
copied	by pressing Ctrl and C on the keyboard or by choosing Copy from the Edit menu or by clicking the copy button on the toolbar;
pasted	by pressing Ctrl and V on the keyboard or by choosing Paste from the Edit menu or by clicking the paste button on the toolbar and then clicking the drawing area on the place where you would like to paste the module.

Note: Pasted hardware point modules may adapt some parameters to the destination point but retain others. For example, an analog input configured as PT1000 when pasted to a UniPut will change to a voltage input, but retain the max and min limits (in the Advanced button) which for PT1000 could be min 0 and max 0, leading to incorrect operation of the UniPut.

Creating Strategies - Place all the required modules on the drawing area

Place other modules required to implement the strategy on the drawing area by following the procedure outlined in *Creating Strategies - Place the selected module on the drawing area* on page 160.

Modules must be positioned from left to right on the drawing area. Hardware inputs must go on the left side of the drawing area, hardware outputs on the right. Between the inputs and the outputs, organize the modules so that a signal flows from left to right across the strategy.
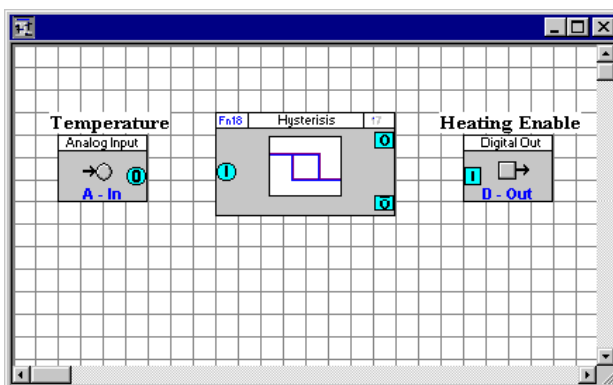
Creating Strategies - Join the modules

Modules in a strategy must be joined together to allow information to flow from input to output.

Join the modules together as required, by placing the mouse pointer over module inputs or outputs….
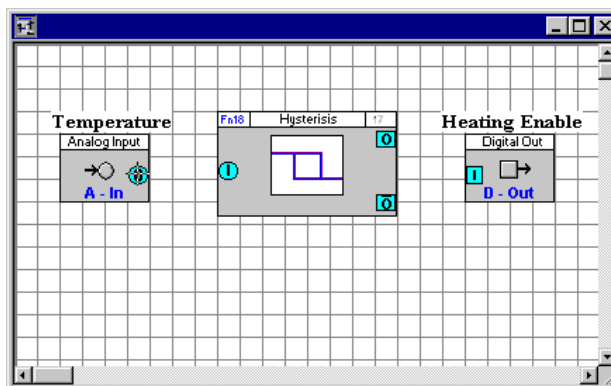
… and dragging to another modules output or input.
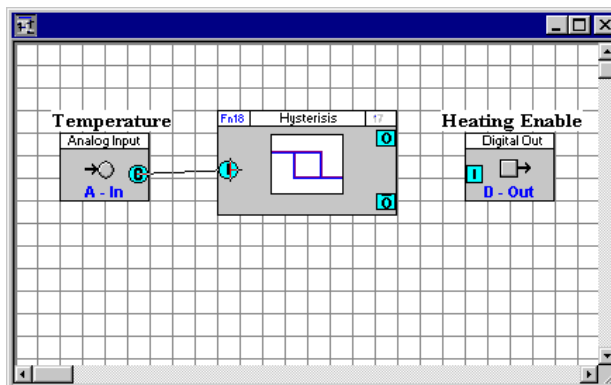
The Engineering Centre displays lines between linked modules:
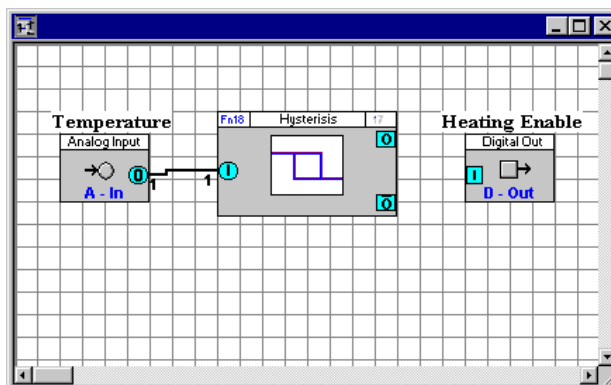
If you cannot see a line connecting the two modules, click Module Setup from the Display menu.
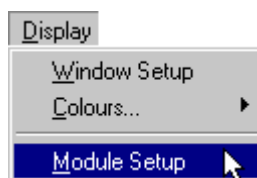
This displays the Module Setup dialog box:
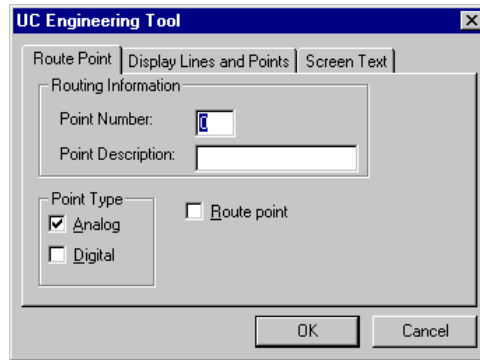
On the Display Lines and Points tab, make sure that the Display Lines check box is checked:
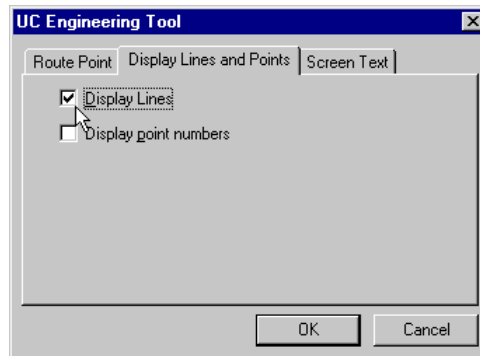
Continue joining modules until all the required connections have been made.
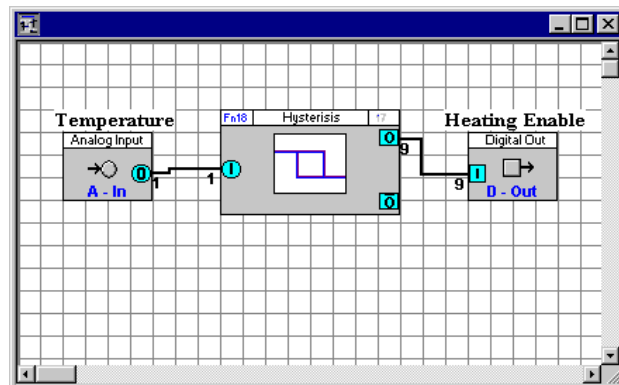
Automatic point selection

When two unconnected modules are linked together, the **Engineering CentEr** automatically selects the next available virtual point. This is the lowest numbered unused point. This number is entered in the two modules that are linked, as an input and an output, and it is also displayed at either end of the connecting line. In the example below, the number of the virtual point connecting the two modules is 1 and it is displayed at both ends of the connection:
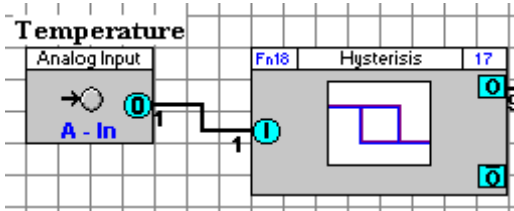
If you cannot see the point number at either end of a connection line, click Module Setup from the Display menu.

This displays the Module Setup dialog box:
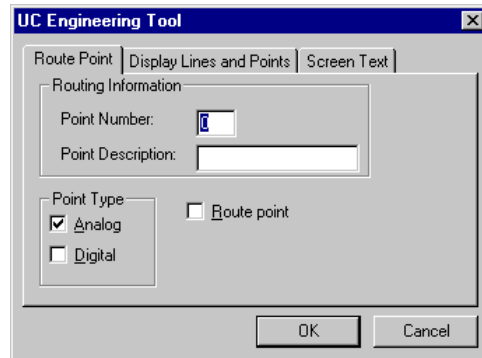
On the Display Lines and Points tab, make sure the Display point numbers check box is checked.
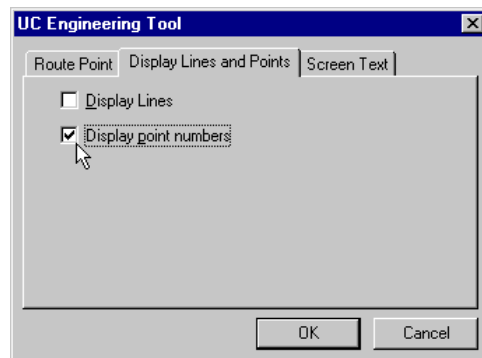
When the output of a module which is already connected is connected to the input of another module, the point number of this output will be written in the input.

Selecting a connection line

To select a line connecting two modules, double-click the line with the left mouse button. Selected lines are displayed with black squares along the line. Selected lines can then be:

moved   by using the mouse to drag the line to its new location;

deleted   by pressing the Delete key on the keyboard.

When a connection line is deleted, the point number in the input of the target module will be removed.

If this connection was the only one for the output of the source module, the point number will be removed from there too. The point will now be available for other connections.

Naming a point

To give a point a name, click on the input or the output of the connected modules with the right mouse button.
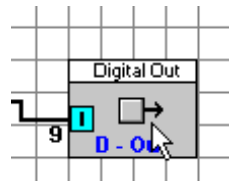
Enter a name into the Point Name section of the dialog box which appears.

Click OK.
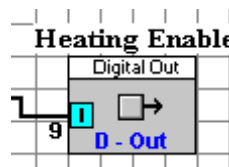
The name can have no more than 24 alphanumeric characters. Spaces, commas and full stops may also be used. Each point in a controller must have a point name that is unique in that controller.

<u>Assigning a unit to a point</u>

In the case of Analog points, the **Units** list box (which is displayed in **modules** dialog boxes and Points dialog boxes) contains a collection of text strings, one of which will be displayed together with the point value.

To specify a type of unit for a point, click on the line or on the input or the output of the connected modules with the right-hand mouse button.
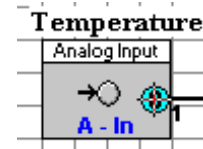
A dialog box appears corresponding to the type of input, e.g. if the point is analog, the **Analog point** dialog box appears.
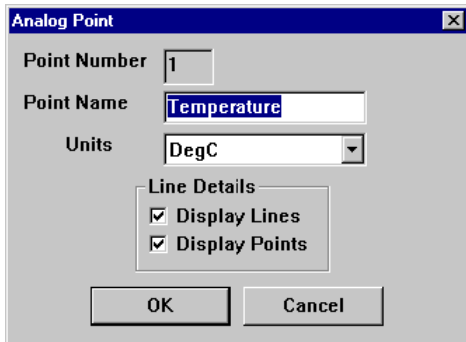
Choose from the **Units** list the type of unit that corresponds to the type of input, e.g. if an analog point represents a temperature reading in degrees Celsius, you may choose DegC from the **Units** list box. The unit of an analog point is a text string which will be displayed with the analog value of the point.
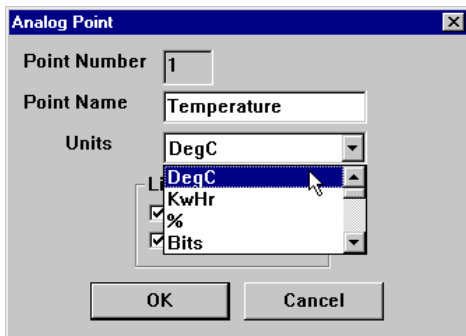
If the point is a digital point,
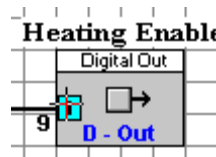
a Digital Point dialog box appears.

Select the required unit in the **Open circuit** and **Closed circuit** list boxes. The units of a digital point are text strings, which are displayed instead of the digital values 0 or 1.

The list boxes in the Analog Point and Digital Point dialog boxes present different units for selection. If necessary, additional application specific units can be entered manually in the WN3000.ini file. For further details on how this is done, see *How to add units of measurement to the system* on page 430.

Additional units of measurement can also be added if points are defined using the shortcut method(see

A short cut to defining hardware points on page 108). When the tab (or comma) separated list of point definitions is prepared, units of measurement which are not already defined in WN3000.ini can be used. When the definitions are pasted to the Database Interface, the new units of measurements will be added automatically to WN3000.ini.

Creating Strategies - Set the values of the module's inputs and outputs

Many modules require the setting of certain values. These appear in the modules' dialog boxes.

To view a particular module's dialog box, click on the module (not on the inputs or outputs) with the right mouse button. For example, right-clicking on the **Timer with Constant Inputs** module produces this dialog box:
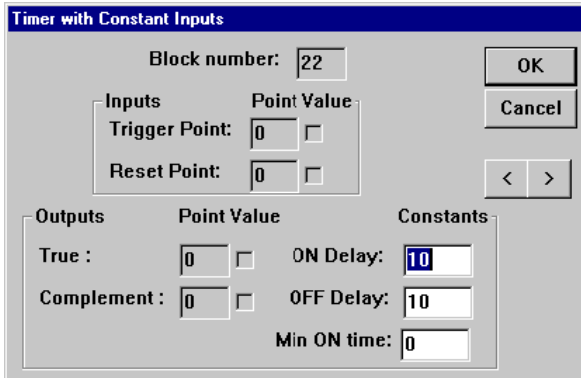
> **Note:** Do not edit or delete a point number using the module dialog boxes. These should be used only for entering constant values in list boxes and check boxes. Point Numbers are allocated as explained in *Automatic point selection* on page 165.

Creating Strategies - Add explanatory text if necessary

Text can be added to the drawing area to label parts of the strategy to

- explain the purpose of certain modules, or groups of modules, within the strategy,
- give extra information about globals.

You can add text or edit text that is already in the strategy drawing. You can also delete, cut or copy text in a strategy.

How To add text to a strategy

Click the

button on the toolbar, or choose **Add Text** from the **Edit** menu
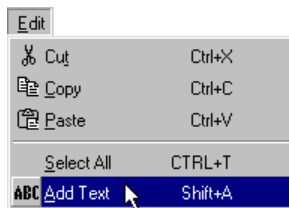
Click the drawing area at the point where you want the text to be displayed.
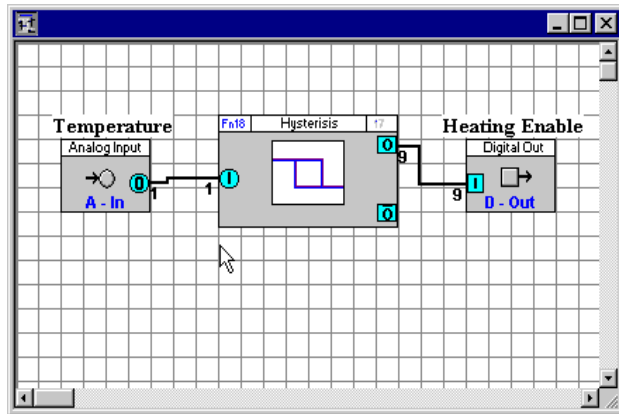
The **Insert Text** dialog box will be displayed:
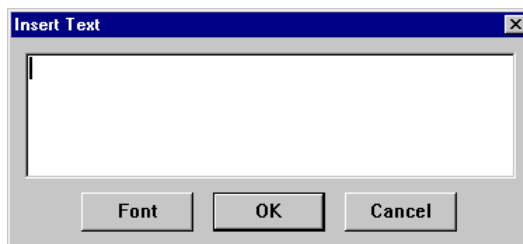
Type in the **Insert Text** dialog box, the text that you would like to include in the strategy:
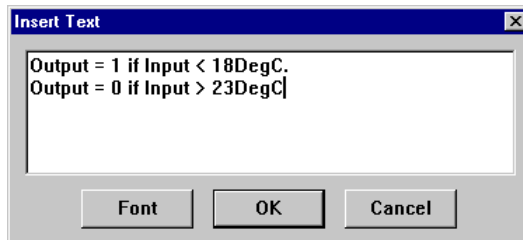
To select the type of font in which the text should be displayed, click **Font**.
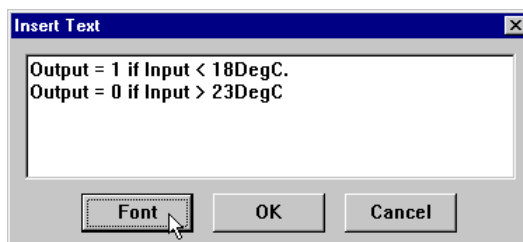
The standard Windows **Font** dialog box will be displayed in which you can choose a font, style, point size, etc. Once you have chosen the required font, click the **OK** button in the **Font** dialog box.
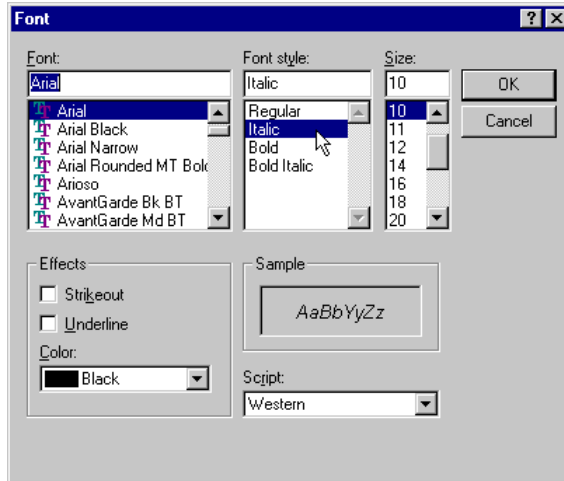
Note: It is recommended that you always use "True-type" fonts. When the printing is scaled, non true-type fonts do not scale properly.

Click **OK**.
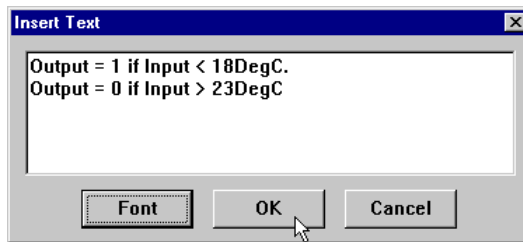
The text will then be displayed on the drawing area on the point at which you clicked the mouse.
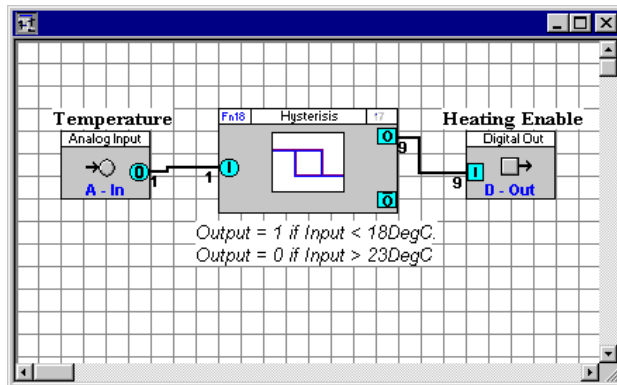
How to change text that has been placed on the drawing area

Click on the text to be changed with the right mouse button.
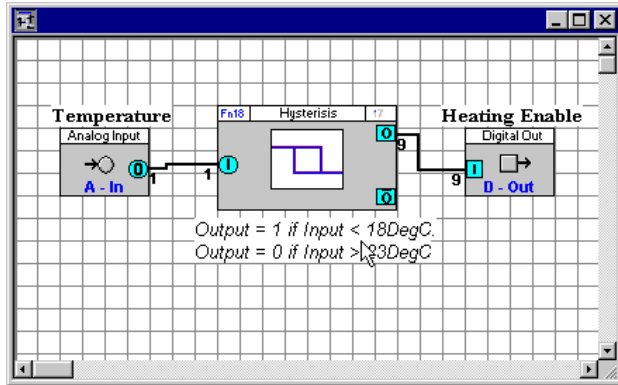
The **Insert Text** window appears for entering or editing the text
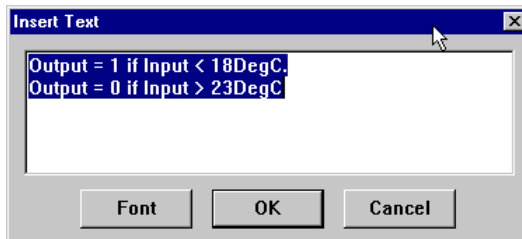
Select the text that is shown in the **Insert Text** window
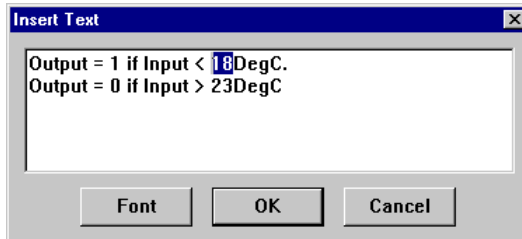
and type the required text.
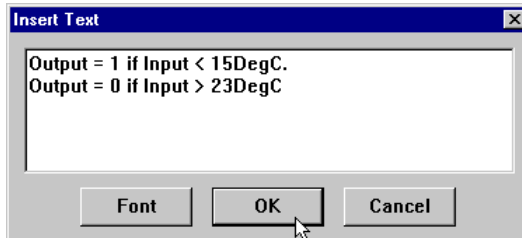
Click **OK**.

The changes appear immediately on the drawing area.
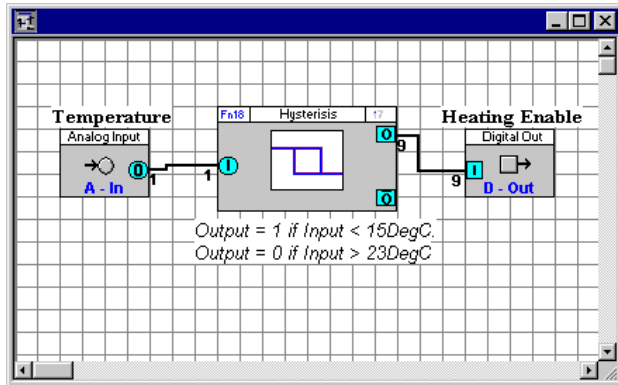
How to Select text

Double-click the text to be selected with the left mouse button. Holding down the Ctrl key while double-clicking with the left mouse button allows more than one text string to be selected.
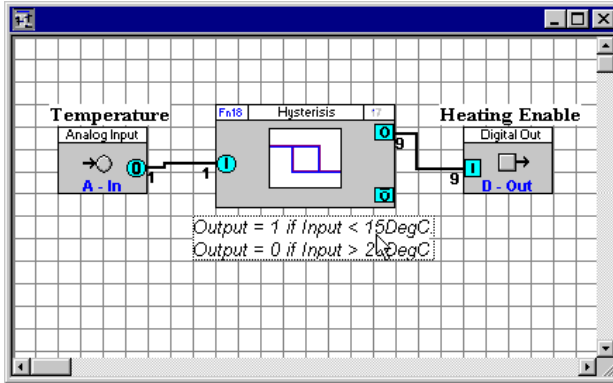
Selected text is displayed with a dotted line around it.

Selected text can then be edited as follows:

Move	Use the mouse to drag the text to its new location;
Delete	Press the DELETE key on the PC's keyboard;
Cut	Press Ctrl and X on the keyboard or choose Cut from the Edit menu or by clicking the cut button on the toolbar;
Copy	Press Ctrl and C on the keyboard or choose Copy from the Edit menu or by clicking the copy button on the toolbar;
Paste	Press Ctrl and V on the keyboard or choose Paste from the Edit menu or click the paste button on the toolbar and then click the drawing area on the place where you would like to paste the text.

<u>How to reorder blocks in a Strategy</u>

It is possible to change the order of blocks within a Strategy, which can help to optimize the servicing process.

From the Site List , right-click on the controller and select Strategy Operations > Re-Order Module Blocks
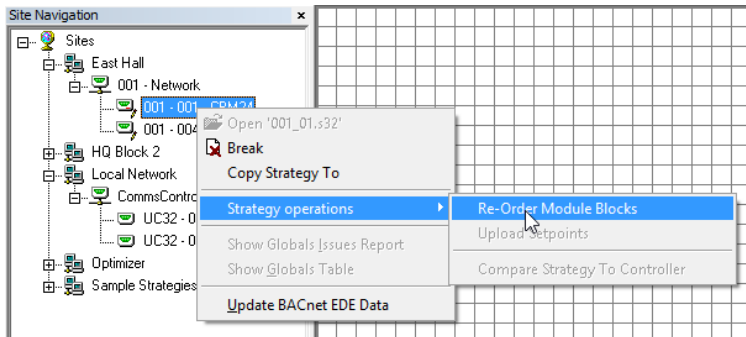
This opens the Reorder Block dialog:
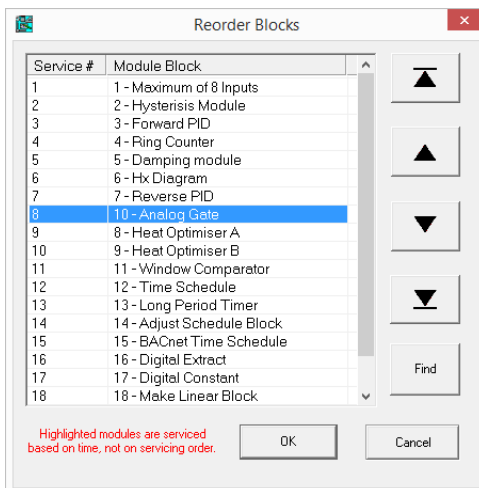
The list shows modules in their "servicing order".

> **Note**:   Some modules serviced based on a time schedule, not necessarily according to their 'service order'. Any modules in the list that are in this category will be highlighted.

Select a module in the list and use the buttons on the right-hand side of the dialog to change its position in the list:

⤒	Move the highlighted block to the top of the list (Service number = 1)
▲	Move the highlighted block up one position in the list
▼	Move the highlighted block down one position in the list
⤓	Move the highlighted block to the bottom of the list
Find	Highlight the selected block in the Strategy drawing.

Repeat until the list is in the required order.

How to Upload Setpoint Values

It is possible for all of the controller values for all **setpoint**s in a single **Strategy** to be retrieved in a single operation.

From the ⬚ Site List ⬚ , right-click on the controller and select ⬚ Strategy Operations ⬚ > ⬚ Upload Setpoints ⬚
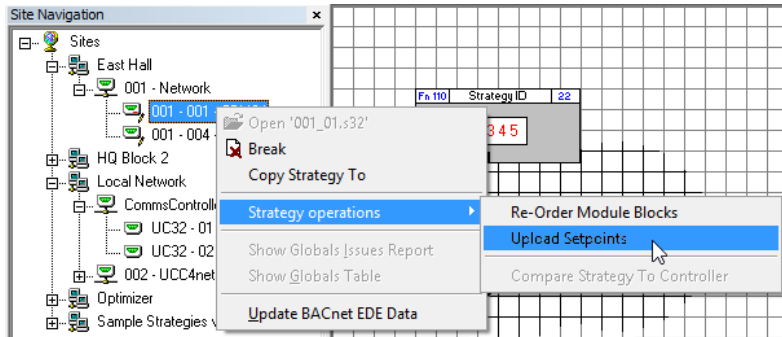
This opens the ⬚ Upload Setpoints ⬚ dialog:
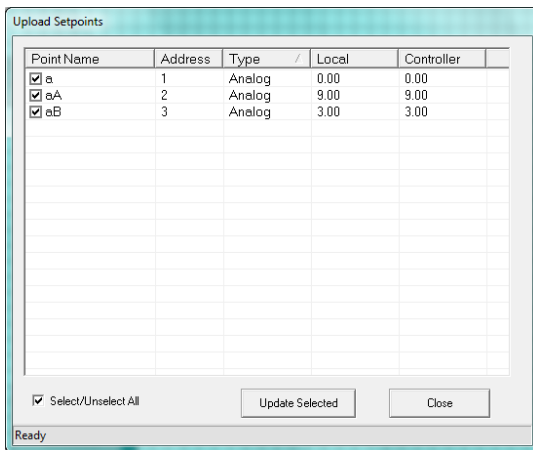
Select the points to be uploaded and click the ⬚ Update Selected ⬚ button

SAVING A STRATEGY

To save a new strategy, click on the

button on the toolbar, or select Save from the File menu
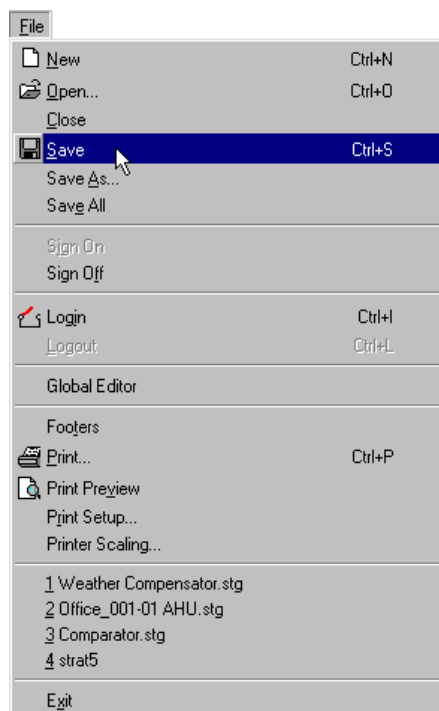
This calls the **File Save As** dialog box, to allow you to specify how the file is to be saved.
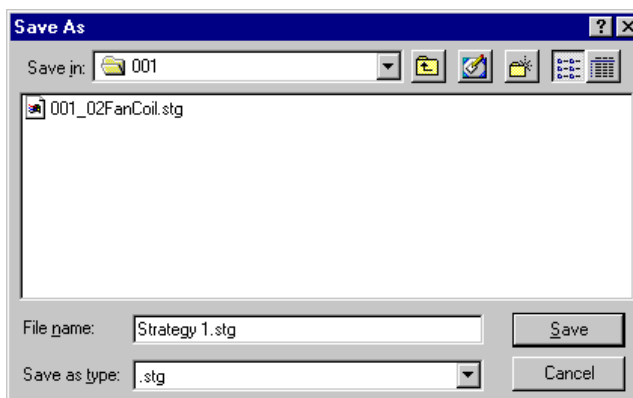
Type a descriptive file name in the **File Name** box

It is advisable to use a name which indicates the site, the Comms Controller number and the Field Controller number.
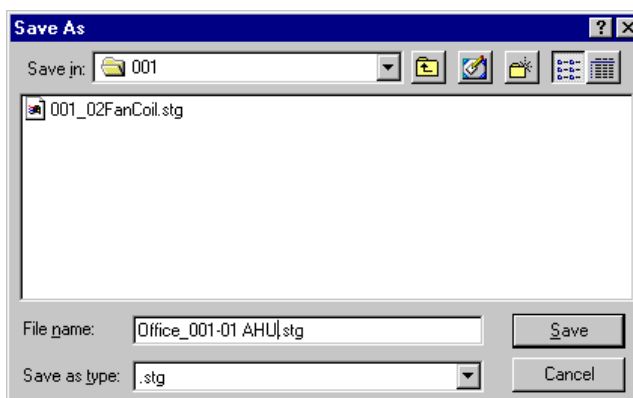
For example, the strategy for the Air Handling Unit controller, which is Field Controller number 1 on the rooftop UCC4 (which is Comms Controller number 1) on the Office Block site might be named "Office_001-01 AHU.STG"
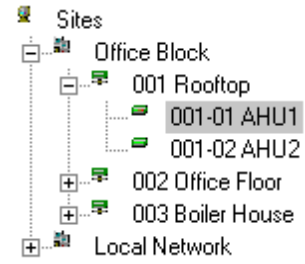
Choose the extension _.stg in the Save File as Type list box. _.stg is the extension for strategies, while _.etm, is the extension for macros. (See *Macros - Overview on page* 236)
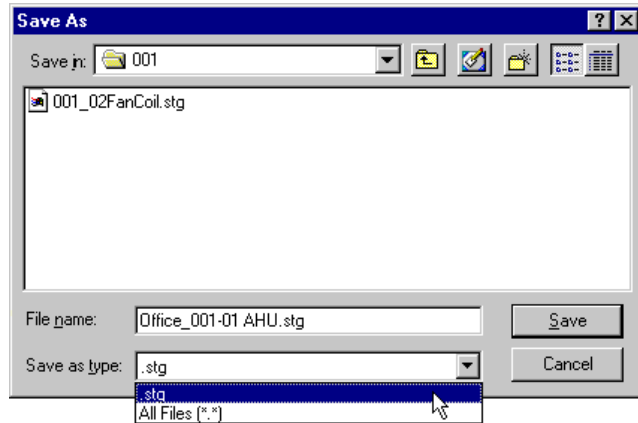
Press **Save**
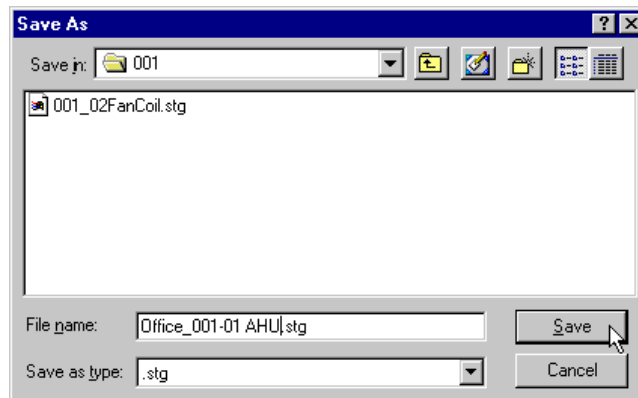
The new name appears in the title bar of the Saved Strategy
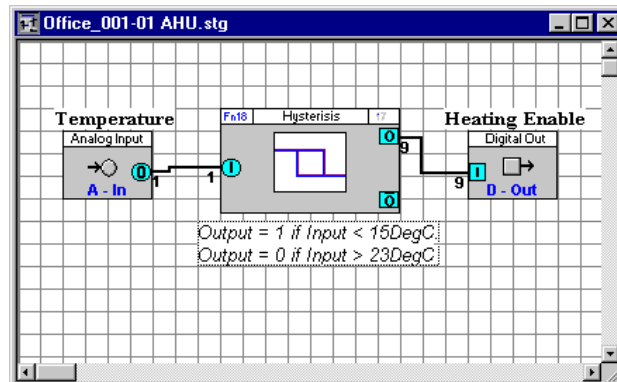
HOW TO OPEN AN EXISTING STRATEGY:

To open a saved strategy, press the

button, or select **Open** from the **File** menu.
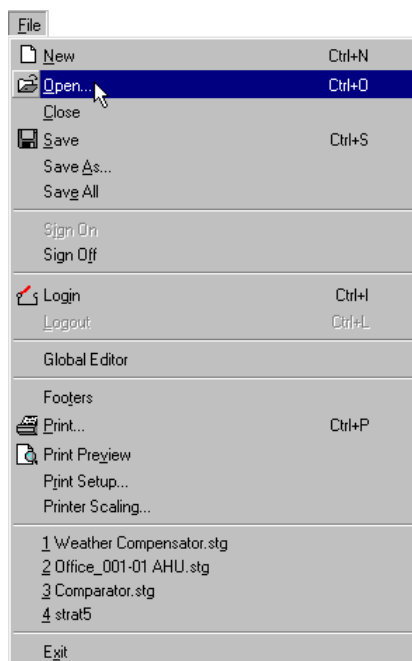
This opens the **Open File** dialog:
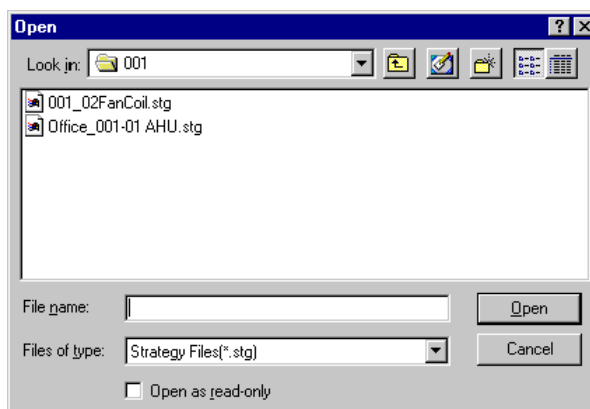
When opening a strategy, select _.stg as the file type.

(The _.etm file type is used for opening macro files - see *Macros - Overview on page* 236)
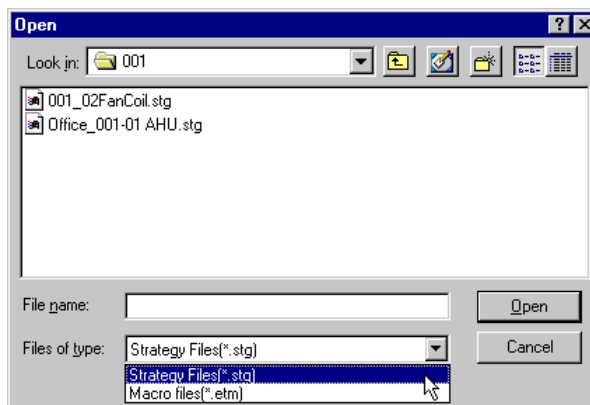
Select the strategy you want to open
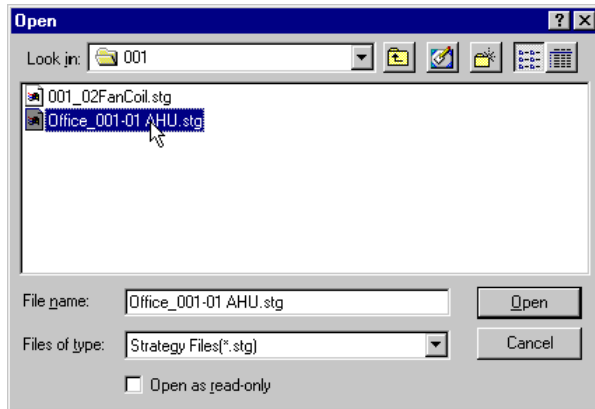
And click **Open**
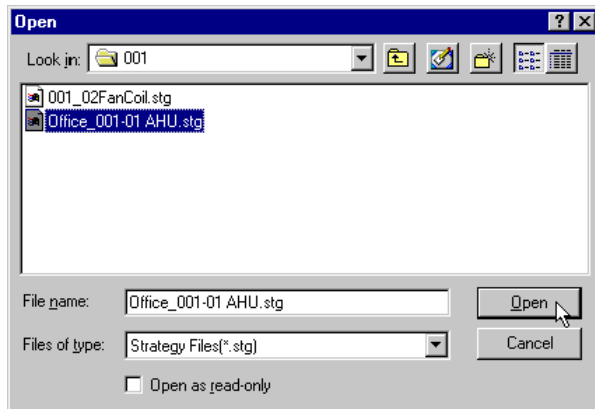
The Engineering Centre will open the strategy in the Engineering Centre window and its name will appear on the title bar.
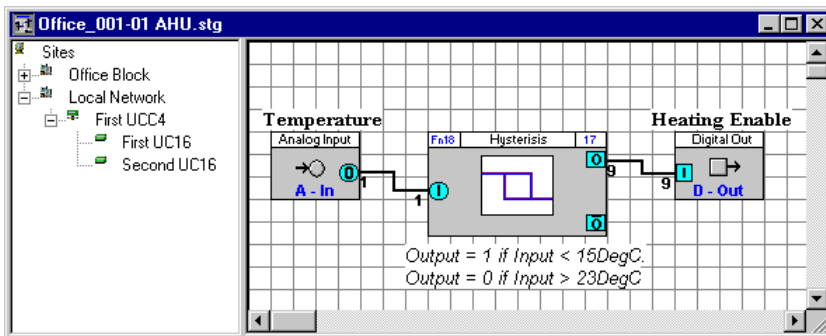
Note: When a strategy is saved, its target is also saved so that when the strategy is opened the site list will display the Communications Controller and Field I/O Controller to which it belongs.

STRATEGY ASSOCIATIONS

What is an "Associated" Strategy?

Each of the Field Controllers in the **Site List** can have a Strategy Drawing file 'associated' with it, which means that the **Engineering Centre** is aware of the filename of the strategy corresponding to the Field Controller. When a Field Controller is selected, its associated strategy can be opened automatically from the right-click menu.
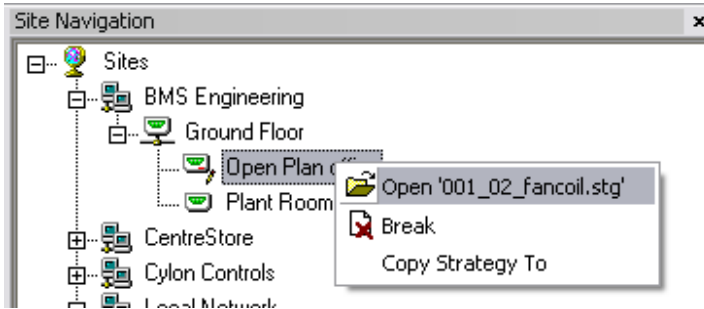
The icon representing the field controller changes when Strategy File is associated with it.

> **Note**: In previous versions of the Cylon Engineering Centre, strategy files had to be named according to strict conventions, and when opening a controller's strategy, the file had to be located through a " File Open " dialog. This is no longer the case.

The relationships between controllers and strategy filenames for a particular site are stored in the file

```
C:\UnitronUC32\[siteFolderName]\SYSTEM\associations.xml
```

Creating Associations

New strategies

When a new Strategy Drawing is created, a target controller must be selected. When that Strategy is saved for the first time, it is associated with the selected target controller.

Existing strategies - manual
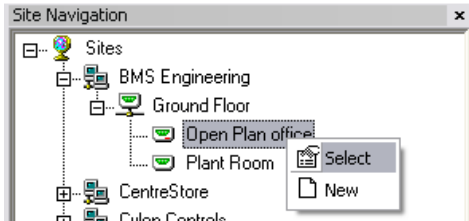
A strategy can be associated with a field controller by right-clicking on the Field Controller and selecting "**Select**". A list of all existing strategy files that are eligible to be associated with the selected controller will be displayed.

Existing Strategies - automatic

For existing strategies without associations, a menu item on the right-click popup menu on each Site node in the Site List provides an option to automatically Create Associations.
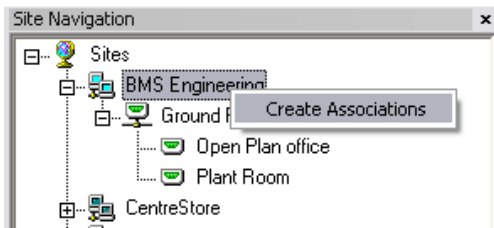
Associations will be automatically created for each Field Controller where one and only one Strategy Drawing was found that is eligible for that Field Controller. If no eligible file is found for a Field Controller, or if more than one eligible file is found, no association will be created for that controller.

Note:	The Create Association process cannot be run for a site if associations already exist for that site. This generally means that the Create Association process can only be run once for each site.
	However, if you need to scan the site for associations again, you can do so by deleting all of the associations. This is done by deleting the file
	C:\UnitronUC32\\[*siteFolderName*]\SYSTEM\associations.xml

Breaking Associations

Associations can be broken using a toolbar or right-clicked popup menu option; the link between the Site Tree Field Controller and the Strategy Drawing is removed.
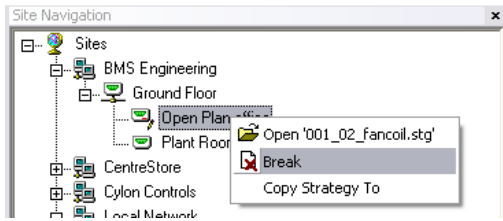
If an association is broken for an opened Strategy Drawing, then the Strategy Drawing will be closed and the user will be prompted to save it if changes have been made. Breaking an Association allows the User to associate a different Strategy Drawing to the Field Controller, using a toolbar or right-click popup menu option on the Site Tree Field Controller.

Copying associated strategies

From the Site List, it is possible in a single operation to create a copy of the strategy associated with any Field Controller node and associate that copy with another Field Controller node, as long as the target is of a compatible controller type and does not already have a strategy associated with it.

> **Note:** A Strategy can**not** be copied if:
>
> ● it contains Globals – The user is informed that the Strategy contains Globals
>
> ● it is open and has been modified but not saved (the user is prompted to save the Strategy so that the Strategy can be copied).

To copy a strategy in the Site List interface:

1. Right-click on the source Field Controller node

The source Field Controller is the controller to which the existing strategy is associated.

2. In the pop-up menu, select "Copy Strategy To"
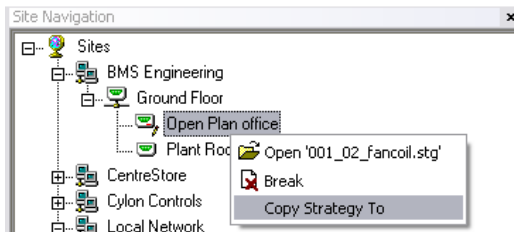
3. In the Copy Strategy dialog that appears, click on the Field Controller to which you want the copied strategy to be associated
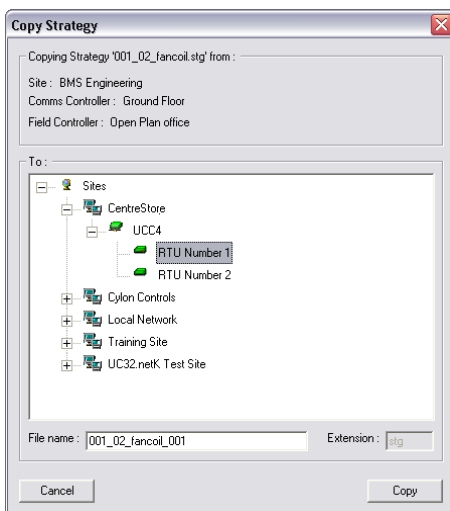
The Copy Strategy Dialog displays the source Site, Communications Controller and Field Controller node details as well as the Strategy that will be copied.

To:

The **To:** box contains a "tree" list of potential target Field Controllers, grouped by Site. Potential target Field Controllers are those that :

- are of a Controller Type that is compatible with the source Field Controller Node
- do not already have an Associated Strategy
- do not have a newly created Strategy

The next available Field controller node is always selected on the source Site. If no Field Controllers are available on the source Site then no Field Controller is selected and the Site Tree is shown collapsed (closed).

<u>File Name</u>

The filename of the copied strategy cannot be the same as the original filename. In the **File Name** box, a unique filename for the Copied Strategy is automatically generated by appending the suffix *_001* to the original filename. This suffix is incremented by one each time the strategy is copied.

<u>Extension</u>

The file extension can be omitted for the filename and if it is included will be ignored.

<u>Copy button</u>

The **Copy** button is enabled when a Field Controller Node is selected. Once 'Copy' is invoked, a new Strategy is created and opened with the contents of the source Strategy being copied, including the Database names and Keypad Details. The Copied Strategy is then Associated with the Target Field Controller node.

Importing a Strategy

The Copy Strategy To function applies to **strategy** files that reside in the current Site file structure. It is possible that files which were associated with a specific folder have been copied to locations outside the Site folders, and will not be found by the Copy Strategy To process. In that case the Import Strategy function may be used.

To Import a strategy in the Site List interface:

1. Right-click on the target **Field Controller** node

The target **Field Controller** is the **controller** to which the Imported strategy will be associated.

2. In the pop-up menu, select Import Strategy .
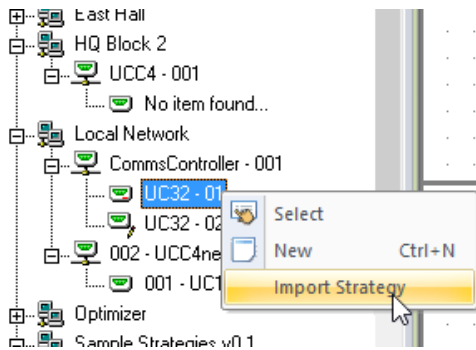
The system will scan for suitable strategies for import
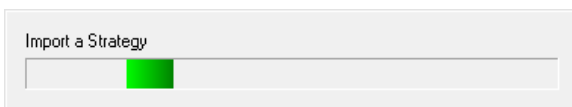
And display a list of the results.
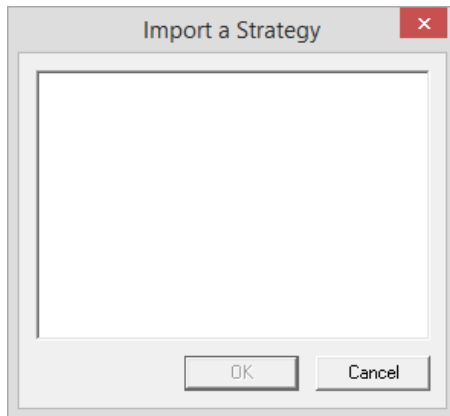
> **Note**:   It is possible that the list will be blank, because a strategy file will only be listed if:
>
> a. It does **not** reside in the current site.
>
> b. It has the correct embedded site, comms controller address and field controller address.
>
> c. It is not already associated with any controller.
>
> You cannot for example import a strategy from controller no 006 on Comms Controller 5 on a remote site onto controller no.005 on Comms Controller 5 on the local site. Neither can you for example import a strategy from controller no 006 on Comms Controller 5 on a remote site onto controller no.006 on Comms Controller 2 on the local site.
>
> i.e. The file to be imported must have originated on the same controller on the same site.

3.   Select a strategy file and click OK . The strategy will be copied to the current site, and the copy will be associated with the selected controller.

ABOUT UC32 FILE FORMATS

The UC32 range of Field Controllers stores strategy information in its own native format, called ".s32". Files created in the **Cylon Engineering Centre** specifically for UC32 controllers are saved on the PC in the same format, with the file extension .s32.

Strategies created for older UCxx Field Controllers are stored on both the PC and in the controller in a different format, ".stg". The UC32 range can read files in this format in addition to its native .s32 format.

The **Cylon Engineering Centre** can open files of either format, and send files of either format to a UC32 controller. The user is given the option to convert to .s32 format, but there may be reasons why they might choose not to, for instance to preserve the behaviour of globals on an existing site.

In dealing with .s32 and .stg formats in the **Cylon Engineering Centre** and the UC32 range of controllers, it is possible for the following four situations to arise:

An .s32 format file can be opened in the **Cylon Engineering Centre**,

- it can be sent to a UC32 controller in .s32 format,
- and later it could be uploaded back from the controller in .s32 format.

An .stg format file can be opened in the **Cylon Engineering Centre**,

- it can be converted to .s32 format,
- it can be sent to a UC32 controller in .s32 format,
- and later be uploaded back from the controller in .s32 format.

An .stg format file can be opened in the **Cylon Engineering Centre**,

- the user can choose NOT to convert it to .s32 format,
- it can then be sent to a UC32 controller in .stg format,
- and later be uploaded back from the controller in .stg format.

> **Note**: This happens automatically if the .stg file is open in the **Cylon Engineering Centre** when upload is initiated, and that is the only condition under which it happens. In all other cases upload from a UC32 controller is in .s32 format.]

An .stg format file can be opened in the **Cylon Engineering Centre**,

- the user can choose NOT to convert it to .s32 format,
- it can be sent it to a UC32 controller in .stg format,
- and later be uploaded back from the controller in .s32 format - this file conversion takes place in the controller itself.

If conversion is required from .stg to .s32, it can be done in the PC (option 2 above) or in the Controller (option 4 above).

HOW TO CONVERT AN .STG FILE TO .S32 ON THE SUPERVISORY PC

If the 'product type' of a controller on a Cylon site is changed so that a UC32 controller replaces an older Field Controller, then when the **Cylon Engineering Centre** tries to open a strategy file for that controller, it will have to open an .stg file, even though the target controller is a UC32.

The required .stg file can be opened, because in the **Cylon Engineering Centre**, when **Open** is selected from the **File** menu, the user is presented with a dialog box that permits either .s32 or .stg files to be opened:
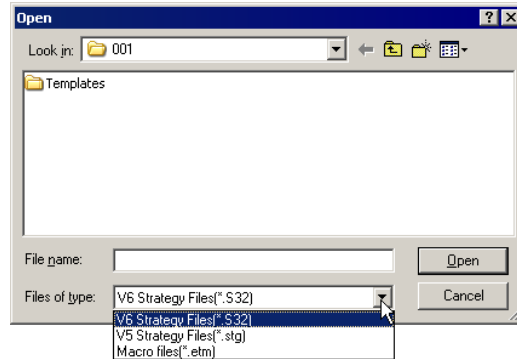
And if an .stg file is selected,
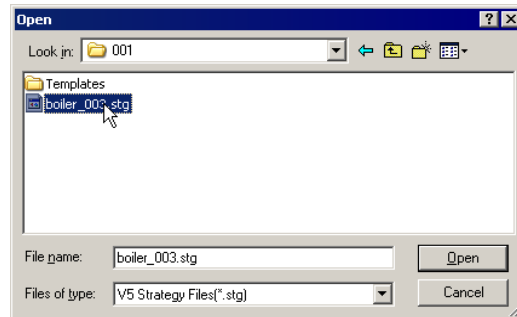
the user is presented with a choice of converting the format of the strategy to .s32 format.
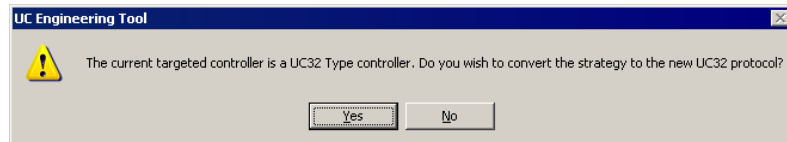
If either **Yes** or **No** is selected, the strategy will be opened in the **Cylon Engineering Centre** and its drawing will be displayed. However, if **Yes** is selected, the file will be maintained in .s32 format from now on. If **No** is selected, it will remain in .stg format.

HOW TO CONVERT AN .STG FILE TO .S32 ON THE CONTROLLER, WHEN UPLOADING

Conversion of .stg format strategies to .s32 format happens automatically in the UC32 controller. By default, all uploads from UC32 are in .s32 format, so that if a strategy is created from a blank drawing in the **Cylon Engineering Centre**, with a UC32 controller as its target, when upload is initiated the strategy is uploaded in .s32 format.

However, if an .stg format strategy is sent to a UC32 controller the controller converts it to .s32 strategy automatically without interaction from the user.

OPENING MULTIPLE STRATEGIES

The Engineering Centre allows you to have several strategies open at once. Each strategy must be opened individually as described above. Each strategy can be minimised, maximised and arranged in a number of ways in relation to the other open strategies (see *Arranging open files* on page 54).

DOWNLOADING A STRATEGY

When you have created a strategy in the Engineering Centre, you must download it to the targeted controller before it will function.

The Engineering Centre provides three different ways in which you can download a strategy to a controller:

- **Using Automatic Download,** where the Engineering Centre automatically wipes the controller's memory and sends set-up. You only have to download the strategy.

- **Using Automatic Online Downloading,** where the Engineering Centre automatically downloads a module to the controller as soon as it is placed on the drawing area. (If the strategy is newly created, you must first wipe the controller's memory, place and join the modules on the drawing area and send the set-up).

- Downloading **manually,** where you must wipe the controller's memory, send the number of blocks to be serviced and then download the strategy.

DOWNLOADING A STRATEGY USING AUTOMATIC DOWNLOAD

To download a strategy to the targeted controller using Automatic Download, proceed as follows:

1. Open the strategy

2. Specify the controller for which the strategy has been designed

3. Log in to the controller

4. Enable Automatic Download

5. Download the strategy

Note: When you download a Strategy to a BACnet controller from the Cylon Engineering Centre, any configuration that has been set by a separate B-OWS – e.g. an Alarm Recipients list – will be **wiped**. You must re-download the Alarm Recipients list, and any other B-OWS specific configuration after the Strategy download is complete.

Automatic Downloading - Open the strategy

Ensure that the strategy you wish to download is open (see *How to open an existing strategy:* on page 179). If more than one strategy window is open, check that the strategy you wish to download is the active strategy by clicking on it once with the left mouse button or by choosing it from the list of open files in the **Window** menu.

Automatic Downloading - Specify the controller for which the strategy has been designed

Choose a controller to target from the Site List. This specifies the controller to which the strategy will be downloaded.

Automatic Downloading - Log in to the controller

Log in to the controller by choosing **Login** from the File menu or by clicking the login/logout button on the toolbar so that the gate is closed:

Automatic Downloading - Enable Automatic Download

To enable automatic download, choose **Communication setup** from the **Communications** menu.
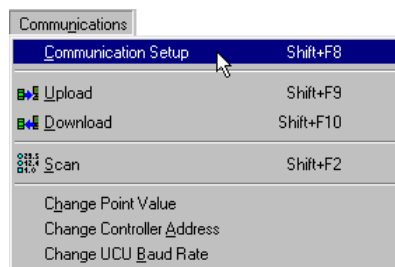
This will produce the **Options** dialog box, which allows you to enable Automatic Download by clicking the **Automatic Download** check box in the **Download Options** tab.

Click **OK** to close the **Options** dialog box.

Automatic Downloading - Download the strategy

Download the strategy to the targeted controller either by:

Download the strategy to the targeted controller by clicking the

button, or by choosing **Download** from the communications menu:
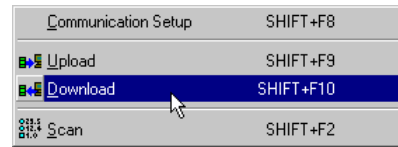
When you use **Automatic Download**, the Engineering Centre automatically deletes all previous points and strategies from the controller as these could conflict with the strategy being downloaded. It then downloads the strategy and sends the set-up (i.e. it informs the controller of the number of blocks it must service in the strategy).

While this is happening, the **Downloading** window is displayed.
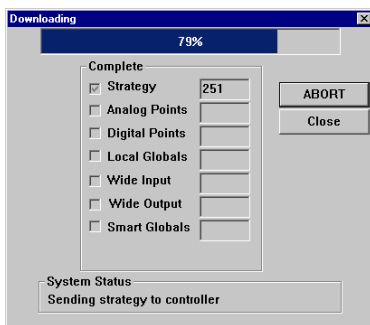
The progress bar at the top of the downloading window shows the progress of the download, while the status box (at the bottom of the window) tells which of the three stages in the download process (wiping the memory, downloading the strategy or sending the set-up) the Engineering Centre is currently completing.

The Downloading window also includes a **Complete** box, which displays the number of the block of the strategy, analog point, digital point or global that is currently being downloaded. In the above example, the progress bar shows that the download is 79% complete, the complete box tells us that the Engineering Centre is downloading block number 251 of the strategy and the status box tells us that the Engineering Centre is busy downloading the strategy to the controller.

DOWNLOADING A STRATEGY USING AUTOMATIC ONLINE DOWNLOADING

Automatic Online Downloading is a feature of the Engineering Centre which causes any changes you make to a strategy to be sent to the controller as soon as they are made.

> **Warning**: **Automatic Online Download** is not recommended for use on live plant equipment, since downloading the Strategy in this manner can cause outputs to toggle.

To use this feature, proceed as follows:

1. Open the strategy

2. Specify the controller for which the strategy has been designed

3. Log in to the controller

4. Enable Automatic Online Downloading

5. Edit the strategy

To check that the strategy has been correctly downloaded, you can test the strategy. (See *Testing a strategy with Scan Mode* on page 207)

> Tip:
>
> If you enable both options (Automatic download and Automatic online downloading) on the Download setup tab, the Engineering Centre will automatically wipe the controller's memory, download the modules as soon as they are placed on the drawing area and then automatically send the set-up.
>
>
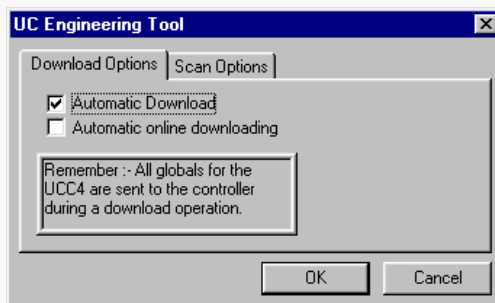
An example of why you would choose both options would be if you wanted to design a basic strategy, download it and then download any additional modules or changes you make. In that case, you would enable the first option, i.e. Automatic Download, create the basic strategy and download it by clicking the download button on the toolbar. The Engineering Centre will send the set-up automatically. Then you would enable the second option on the Download Setup tab, Automatic on-line downloading, so that each time you make a change to the original strategy or add another module, the changes are downloaded and the set-up is sent automatically.

Automatic Online Downloading - Open the strategy

Ensure that the **Strategy** you wish to download is open (see *How to open an existing strategy:* on page 179). If more than one `strategy window` is open, check that the **Strategy** you wish to download is the active strategy by clicking on it once with the left mouse button or by choosing it from the list of open files in the **Window** menu.

Automatic Online Downloading - Specify the controller

Choose a controller to target from the `Site List` . This specifies the controller to which the strategy will be downloaded and the location in the database on the PC's hard disk where the strategy will be stored.

This is necessary if the target has just been created, or if you want to change the **Strategy**'s target. The target is saved with the **Strategy**, so that under normal conditions when a **Strategy** is opened it will be properly targeted.

> **Note**: If you want to change the Strategy's target to a controller on a different Site, you must change Site using CCView or the Configuration program - selecting the controller on the Engineering Centre `Site List` will not change the site.

Automatic Online Downloading - Enable Automatic Online Downloading

To enable automatic download, choose `Communication setup` from the `Communications` menu.
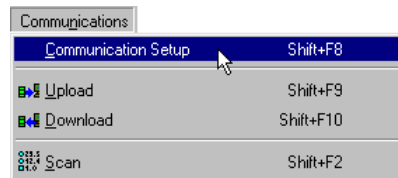
This will produce the `Options` dialog box, which allows you to enable Automatic Download by clicking the `Automatic online downloading` check box in the `Download Options` tab.
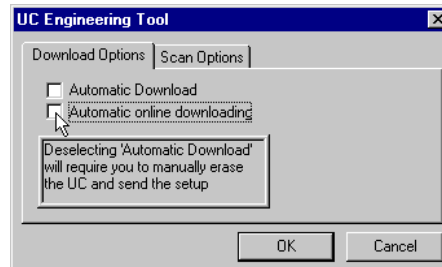
Click `OK` to close the `Options` dialog box.
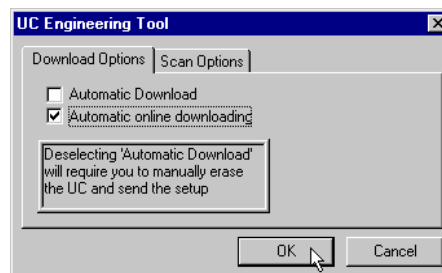
> **Note**: By opening a new `Strategy` you automatically deselect the Automatic Online Downloading command. Click the button on the toolbar to restore option.

Automatic Online Downloading - Edit the strategy

Edit the strategy by placing and joining the required modules on the drawing area and editing their values and units. (For about adding strategy modules see *How to Create a Strategy* on page 159)

Each time a module is placed on the drawing area, two modules are joined or their values are edited, the Engineering Centre will automatically download the information to the controller. The status bar displays the following information to show that the modules have been downloaded to the controller:

| Strategy successfully sent to the controller | Page : 1 | | NUM | | |

HOW TO DOWNLOAD A STRATEGY MANUALLY

To download manually, proceed as follows:

1. Open the strategy to be downloaded

2. Specify the controller for which the strategy has been designed

3. Disable Automatic download and Automatic online downloading

4. Wipe the controller's memory

5. Edit the strategy

6. Download the strategy

7. Send the set-up

To check that the strategy has been correctly downloaded, you can test the strategy. (See *Testing a strategy with Scan Mode* on page 207)

Manual Downloading - Open the strategy to be downloaded

Ensure that the **strategy** you wish to download is open (see *How to open an existing strategy:* on page 179). If more than one **strategy** window is open, check that the **strategy** you wish to download is active by clicking on it once with the left mouse button or by choosing it from the list of open files in the Window menu.

Manual Downloading - Specify the controller for which the strategy has been designed

Choose a controller to target from the Site List . This specifies the controller to which the **strategy** will be downloaded and the location in the database on the PC's hard disk where the strategy will be stored.

This is necessary if the target has just been created, or if you want to change the **strategy's** target. The target is saved with the strategy, so that under normal conditions when a strategy is opened it will be properly targeted.

> **Note**: If you want to change the Strategy's target to a controller on a different site, you must change site using CCView or the UCC4 configuration program - selecting the controller on the Engineering Center Site List will not change the site.

Manual Downloading - Disable Automatic download and Automatic online downloading

Select Communication Setup from the Communications menu.
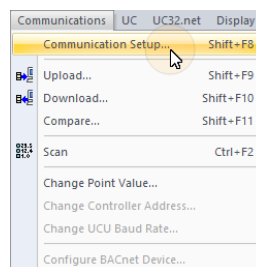
On the Download Setup tab, ensure the Automatic Download and Automatic online downloading options are disabled:
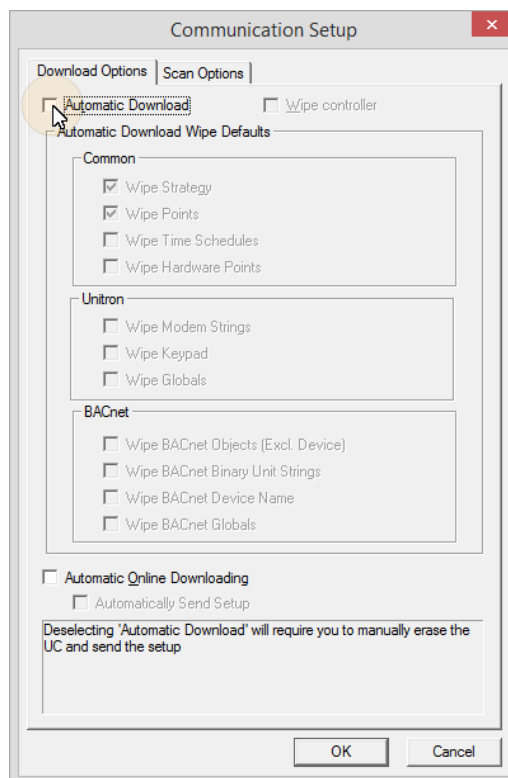
Click OK to close the options dialog box.

Manual Downloading - Wipe the controller's memory

Wipe the controller's memory by choosing **Wipe UC Memory** from the **UC** menu or **Wipe Controller** from the **UC32** menu.

This will produce the **Wipe UC Memory** dialog box
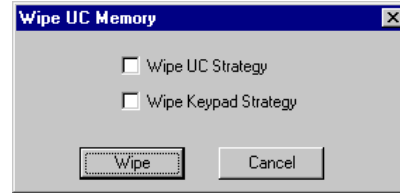
The Wipe UC Memory dialog box features two options:

- **Wipe UC memory** – this option removes all previously downloaded points and strategies from the controller. You should choose this option as existing points and strategies could conflict with the strategy you are about to download.

- **Wipe Keypad Strategy** – this option will erase any keypad strategies from the controller's memory which may have been programmed into the controller. This option will not be relevant if the controller to which you are downloading does not feature a keypad. If it is a keypad controller, however, and you think that the keypad strategy may conflict with the strategy that you are about to download, then choose this option in addition to the first.

Click **Wipe** to close the Wipe UC Memory box.
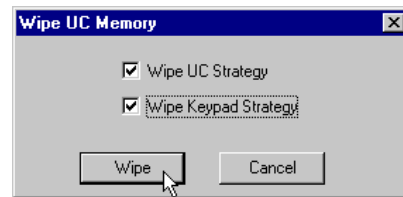
The Engineering Centre will display this message to confirm that the controller's memory has been wiped:

Click **OK** to close the message box.

How to check the controller type to which you are downloading

To find the type of the controller to which you are downloading, log out from the controller, and click the **Managers** command from the **View** menu.
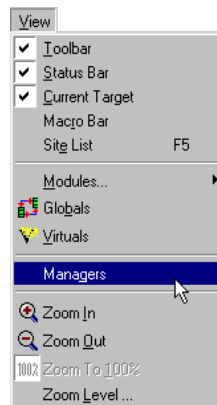
This will produce the **Managers** dialog box, which displays information relating to the controller.
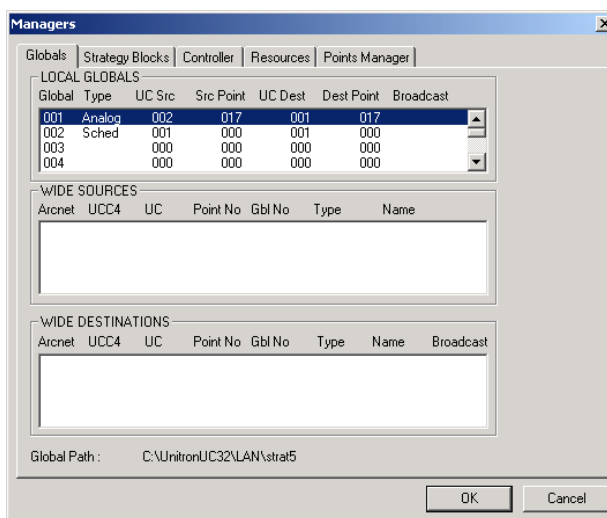
Click the **Controller** tab.

In the example shown, the Controller type box shows that the controller which has been selected as a target is a UC32.24 controller.
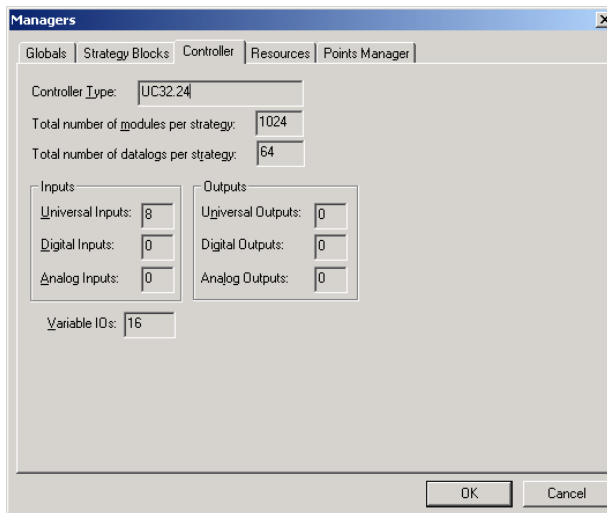
Manual Downloading - Edit the strategy

Edit the strategy by placing and joining the required modules on the drawing area and editing their values and units. (For details of how to create a strategy see *How to Create a Strategy* on page 159)

Manual Downloading - Download the strategy

When you have completed the strategy, you must then download it.

Log in to the controller by choosing **Login** from the File menu or by clicking the login/logout button on the toolbar so that the gate is closed:

Click on the

Button in the toolbar, or choose **Download** from the Communications menu
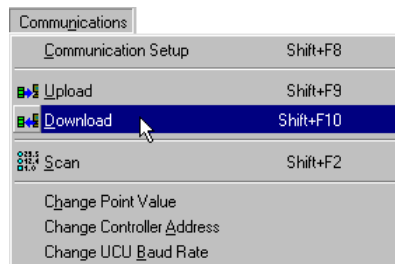
This produces the **Select Items to Download** dialog box. The dialog that will be displayed depends on whether a UC32 or UC/UCU controller is targeted.

UC32 Select Items to Download dialog:
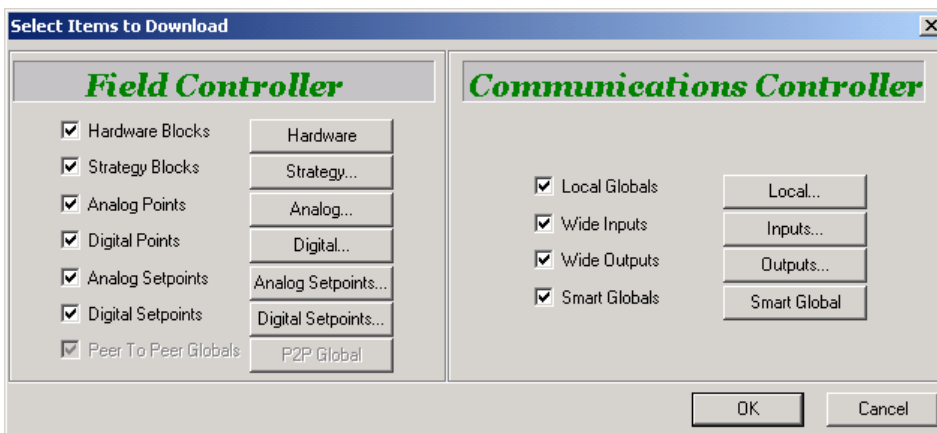
UC Select Items to Download dialog:

You can choose to download the whole strategy, by checking the checkbox to the left of "Strategy Blocks". The maximum number of blocks a strategy can contain is 192, 255 or 1024 depending on the controller type and, by default, the Engineering **Centre** will download this many blocks, but if you want to download only certain blocks, click the **Strategy ...** button.
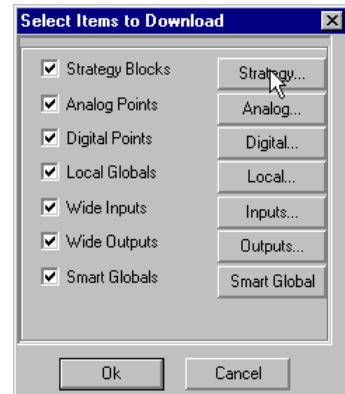
In the **Download Strategy Blocks** dialog box, click on the Selected radio button…
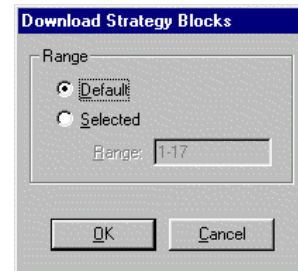
… and choose the range of blocks you wish to download. (For an explanation of blocks, see *What are blocks?* on page 98)
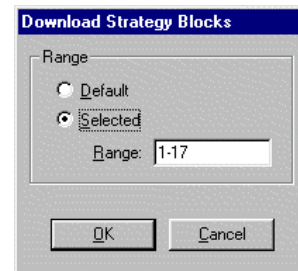
Enter in the Download Strategy Blocks box the range of strategy blocks you wish to download and click **OK**.
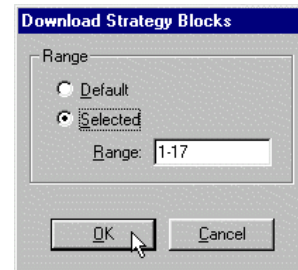
Click **OK** again to close the **Select Items to Download** dialog box.
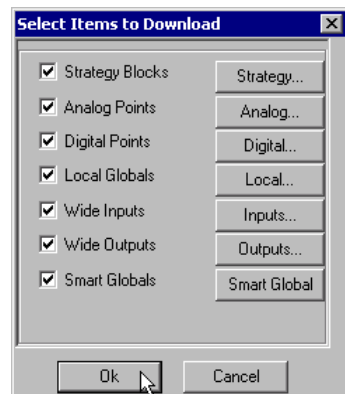
The **Downloading** window will appear, to display the progress of the download.
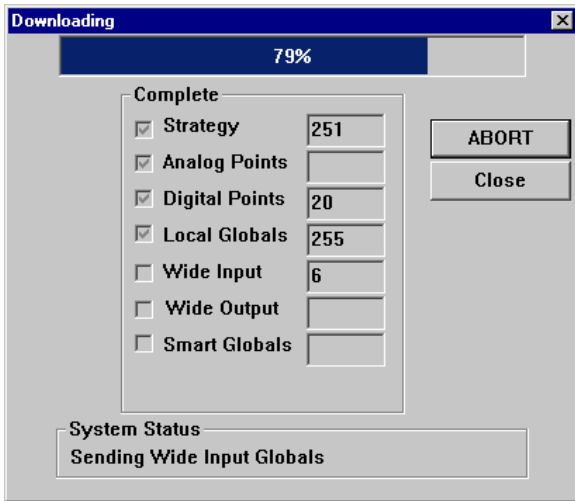
When the Engineering Centre has downloaded all the blocks that you specified, it will automatically close.

Manual Downloading - Send the set-up

Send the set-up, i.e. the number of blocks the controller must service in the strategy.

Set-up is sent by clicking **UC Setup** from the **UC** menu.
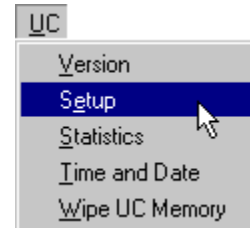
The **UC Setup** dialog box appears in which you must specify the number of blocks occupied in the strategy. (For guidelines on how to complete the UC setup box, see *How to start a strategy (send set-up)* on page 205).
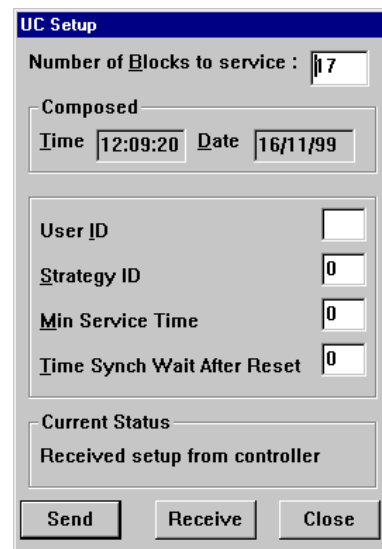
When the dialog is filled correctly, press send:
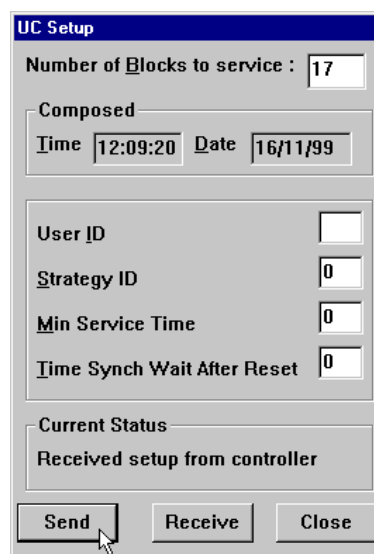
The message **Setup sent successfully** is displayed if the Engineering Centre completed sending the set-up.
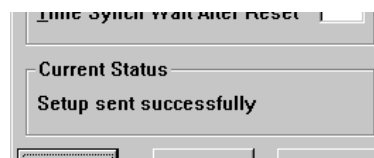
If the message **Attention! Error sending setup** is displayed, the Engineering Centre has failed to send the set-up to the controller.
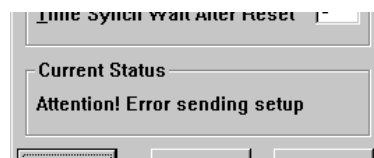
In that case, the error is most likely a communications failure – check that the controller is connected to the Comms Controller on its Fieldbus and that the Comms Controller is properly connected to the Ethernet or ARCnet network. If these connections are all secure, check that your PC is connected to the Cylon network via RS232 cable or Ethernet.

Click **Close** to close the UC Setup dialog box. The controller should now be servicing the strategy.
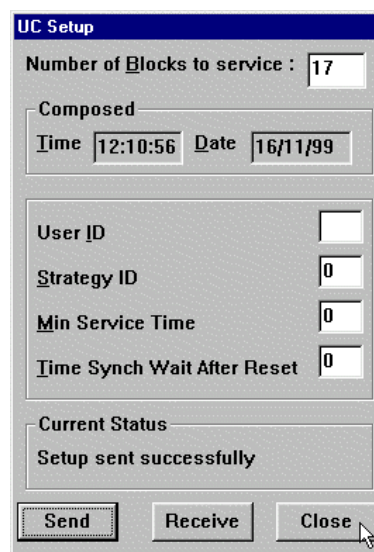
STARTING A STRATEGY

Set-up is sent to a **Field Controller** when its memory has been wiped and the strategy has been downloaded to it. Sending set-up tells the UC how many blocks are to be serviced. Sending set-up is also referred to as **starting the strategy**. If you are using Automatic download, the Engineering Centre sends the set-up automatically when you download a strategy to the controller. (See *Downloading a strategy using Automatic Download* on page 190) Otherwise, you must send the set-up as described below.

HOW TO START A STRATEGY (SEND SET-UP)

When logged in, select **Setup** from the **UC** or **UC32**
menu.
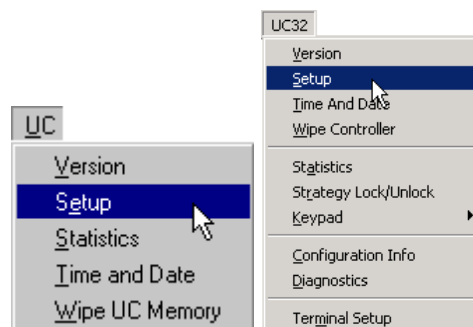
The **UC Setup** or **UC32 Setup** dialog box will appear:

UC32 **Setup** dialog:
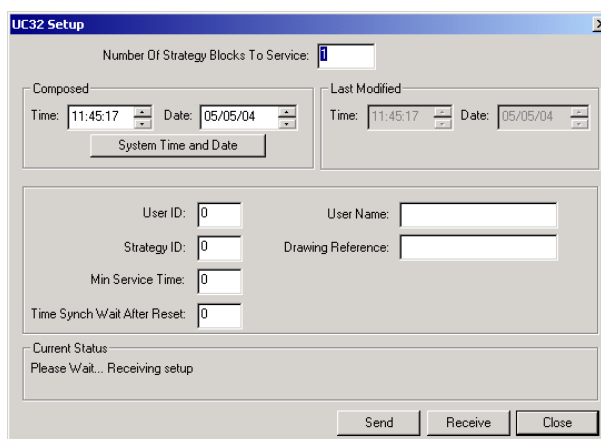
UC **Setup** dialog:
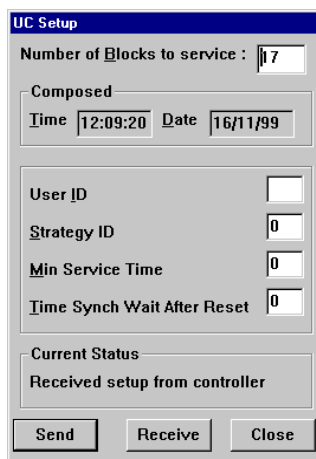
Notes on completing the UC Setup dialog box:

The number in the **Number of blocks to service** box, *x* (which is automatically entered by the Engineering Centre
but can be changed by the user), activates the first *x* blocks of the strategy in the UC.

It is important to enter a number in the Number of Blocks to service box which is greater than or equal to the
number of the highest numbered block occupied by a part of the strategy. Otherwise, the parts of the strategy
which occupy blocks with a higher number than the number entered in the Number of blocks to service box will
not be serviced, and their point values will not be updated. This may cause the strategy to fail.

If you cannot see how many blocks you have used in the strategy, click **Managers** from the **View** menu. This lists all of the blocks in the targeted controller. The highest number on the strategy should be the number of blocks the controller must service.

The **Composed** section automatically contains the current PC time and date. If the strategy is uploaded later, this time and date will indicate when the strategy was started.

In the **User ID** section the application engineer can enter a unique identifying character. If the strategy is uploaded later, this character will indicate who started the strategy. In the **User Name** field the engineer can enter the name of the person that started the strategy and this can be retrieved from the controller if the strategy is uploaded. A string of up to sixteen characters can be entered in this field.

In the **Drawing Name** field the name of a **CCDraw** drawing can be entered. It is recommended that the name of the drawing containing information relevant to the strategy is stored here. If the setup is uploaded from the controller the drawing name will be displayed in this field.

The effects of sending set-up

Sending set-up to a controller has the following effects:

- All blocks entered in the **Number of blocks to service** section will be serviced, even if they are not occupied by modules. For example, if you entered 100 as the number of modules to be serviced, the first 100 blocks will be serviced by the controller.

- A controller which is sent a set-up with blocks to be serviced, but without any strategy, will not send any output signals and will not read any input signals.

> **Note:** If a strategy is downloaded after set-up is sent, the strategy is serviced immediately. This means the outputs will receive values from the strategy immediately after downloading. It is preferable to download the strategy before sending set-up, since untested strategies can cause problems in devices connected to the outputs if the output values are unstable or incorrect.

- Output points of modules which occupy serviced blocks take their values from the module.
- If the controller is running without a network (stand-alone), the green LED is constantly illuminated.
- If the controller is running on a fieldbus (connected to a Comms Controller), the green LED flashes with regular pulses.
- An alarm appears on the monitor of the connected PC if the alarm feature is active.
- The keypad program, if one exists and has been downloaded to the controller, will be started.
- Target points of globals will be updated by the Comms Controller, if the globals are configured correctly.

TESTING A STRATEGY WITH SCAN MODE

It is important to test a strategy at various stages in its creation, to check for mistakes or faults in its design. This is done by using `Scan mode` .

Preparing to test a strategy

To test a **strategy** the following conditions must be satisfied:

- The **strategy** must be open (see *How to open an existing strategy:* on page 179).
- The **strategy** must have been sent to the controller (See *Downloading a strategy* on page 189).

> **Note:** Make sure that the downloaded **strategy** and the open **strategy** are the same.

- The **strategy** must have been started (see *Starting a strategy* on page 204).

How to test a strategy

In **Scan mode**, the **Engineering Center** allows you to view the changes in values in a **strategy** as the **strategy** is serviced in the **controller**. This is useful for testing **strategies** and parts of **strategies** for correct operation. In `Scan mode` , the point values of an uploaded **strategy** are read by the **Engineering Center**, displayed next to their respective inputs/outputs and updated in real time.

To activate scan mode:

- Log in to the **controller** (as described on page 106)
- Upload (page 213) or Open (page 179) the **strategy**
- Display the **strategy's** point and constant values (page 208)
- Set the `Scan mode` (page 209)
- Activate `scan mode` (page 210)

In scan mode, the variable point values of a strategy are updated in real time as they are serviced by the strategy and displayed clearly in the module symbols on the drawing area. In the Rescale to 0 or 100 module of the example above, the values of the 3 input points were changed to 10, 20 and 149.86 and its output was changed to 100 as they were serviced by the strategy.

- Watch the changing values of the modules in scan mode to ensure they are being serviced correctly by the controller.

How to Display the strategy's point and constant values

Display the point and constant values of the strategy by clicking **Module Setup** from the **Display** menu.

The **Module setup** dialog appears
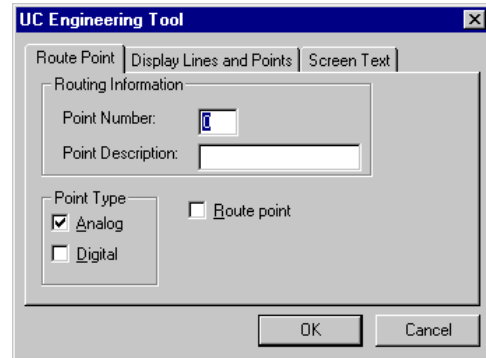
Click on the **Screen text** tab
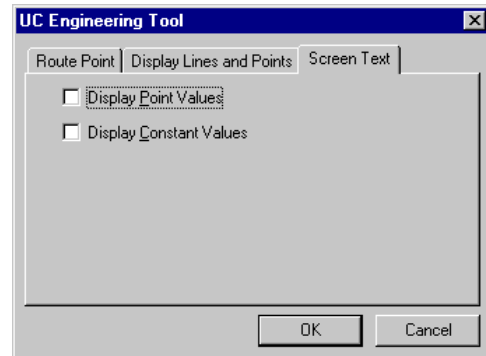
Click on Display Point Values
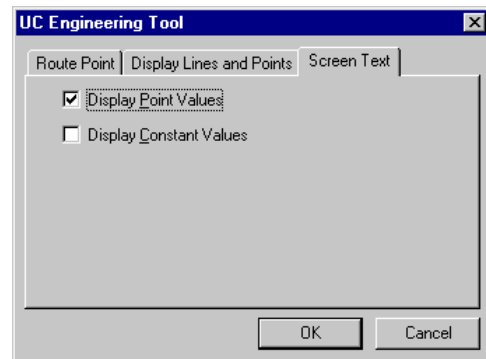
If you try to activate scan mode without having these options enabled, the Engineering Centre will prompt you to enable them with this message:
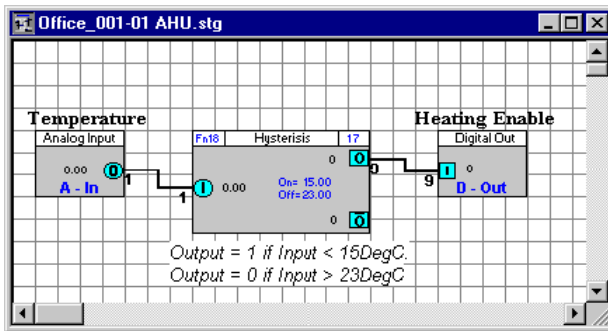
Setting the Scan mode

The **Engineering Center** can scan the current active strategy or all of the currently open strategies.

Select Communications Setup from the Communications menu.
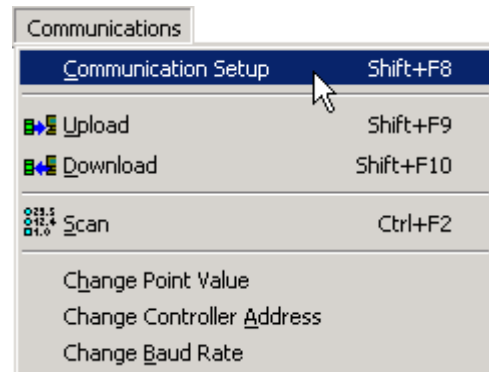
The Communications Setup dialog will appear.
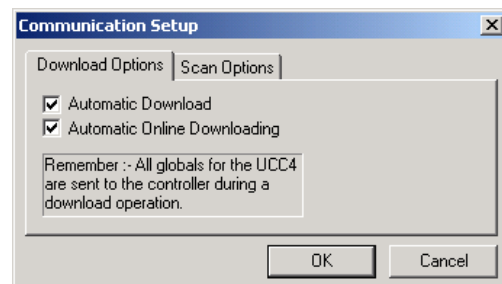
Click on the Scan Options tab.
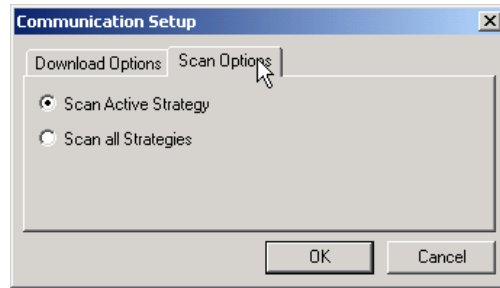
Select the appropriate scan option and then click the OK button to save the setting.
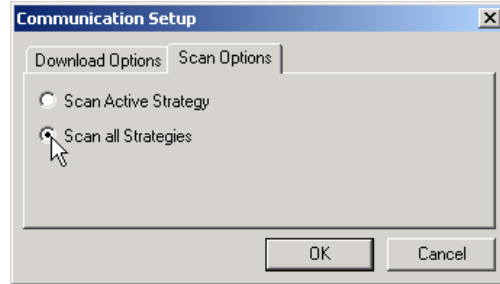
Activate scan mode

Begin scanning by clicking Scan from the Communications menu.
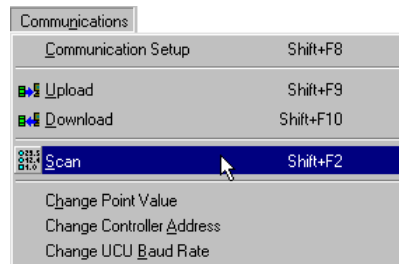
The **Engineering Center** Window will change to the **Engineering Center** scan mode window, which has two menu options, Stop Scan and Window :
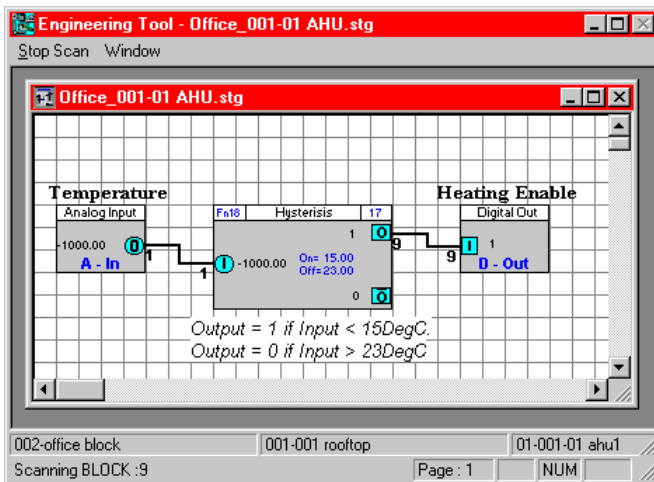
- The Window menu option allows you to arrange any open **strategies** diagonally (click Cascade), horizontally (click Tile Horizontal), or vertically (click Tile Vertical). It also lists all open **strategies**. To switch to one of the listed **strategies**, simply click on it from the list in the Window menu.
- To deactivate scan mode , i.e. to stop scanning the point values of the **strategy**, click Stop Scan .

Suggestions for testing strategies

- If a number of modules are selected in the strategy when **Scan mode** is activated, then only those modules will be scanned.

- The module to be tested must have been downloaded to the controller. That is, the **Block number** of the module must be within the range of modules which were downloaded to the controller (see *Downloading a strategy* on page 189)

- A strategy should be tested in small steps during the creation process. Simple faults such as selecting the wrong module or joining to the wrong inputs and outputs can be difficult to correct in a finished strategy. There is also the danger that faults can result in other faults appearing in different parts of the strategy or in other controllers.

- At the end of the creation of a strategy, the whole strategy should be tested again. This prevents later problems and time losses during the setting-up process in site.

- The strategy should be checked module by module from left to right, starting with the hardware inputs and finishing with the hardware outputs.

- Individual strategy parts can be functioning correctly themselves but cause problems when connected to other correctly functioning strategy parts. For example, the direction of analog values may fall in the range 0% to 100 % or in the range 100% to 0%. Digital values and their inversion may also cause confusion.

- Test a strategy before copying it or using it in another controller. Otherwise, all copies of the strategy will also have to be tested.

- Manually overriding hardware points allows simulation of each environmental situation to which the strategy would be exposed.

- To simplify the testing process, globals used in the operation of the strategy should be disabled. Do this by logging in, selecting Setup from the **UC32.net** or **UCC4** menu and, in the Network Details section, setting the number of globals to zero. The points controlled by globals can be changed for testing purposes.

UPLOADING A STRATEGY

If a strategy is recreated from an old version, it is very important to ensure that the recreated strategy is compatible with other parts of its application (globals, dynamic drawings, keypads, alarm strings, time schedules, etc.).

When a strategy is uploaded to the PC from a controller, the uploaded modules are displayed on the drawing area.

Uploaded modules do not have the same positions on the drawing area as they had before they were originally downloaded, and they are no longer joined. For example, if the strategy looked like this when you downloaded it:
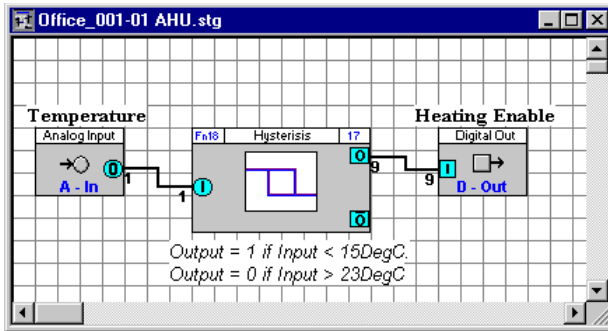
it might look like this when uploaded:
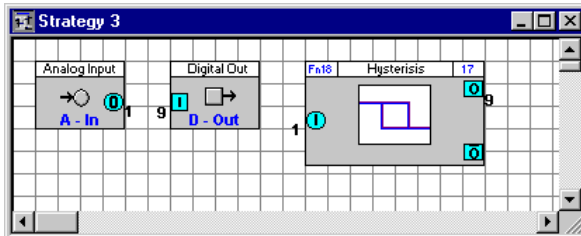
HOW TO UPLOAD A STRATEGY

> **Note**: This upload method does not include all Globals, Layout data etc. To upload Site-Wide data, see*Site Discovery and Upload* on page 420.

To upload a strategy, follow these steps:

1. Log In to the controller
2. Create a new strategy
3. Upload the strategy
4. Save the strategy:

The uploaded strategy should be saved under a special file name. Choose **Save As…** from the **File** menu and in the **File save as** dialog box specify a drive, directory and name under which the strategy is to be saved.

Uploading a Strategy - Log in to the controller

Log in to the controller by choosing **Login** from the File menu or by clicking the Login/Logout button on the toolbar so that the gate is closed: .

Uploading a Strategy - Create a new strategy file

The Engineering Centre requires an empty strategy to be open in order to display the uploaded modules.

Create a new file by clicking the

Button on the toolbar, or by selecting **New** from the **File** menu.
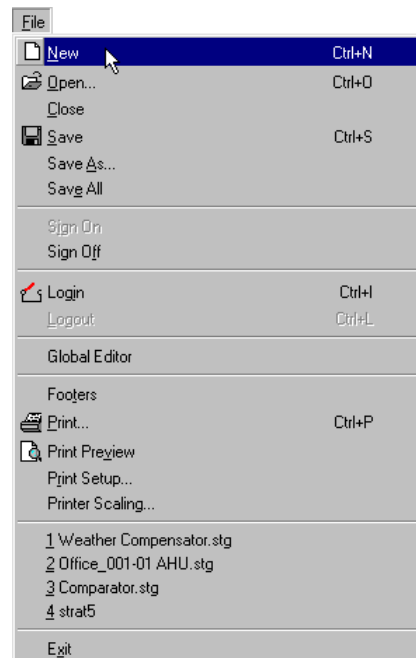
Uploading a Strategy - Upload

Select **Upload** from the **Communications** menu or click the **Upload** button on the toolbar.
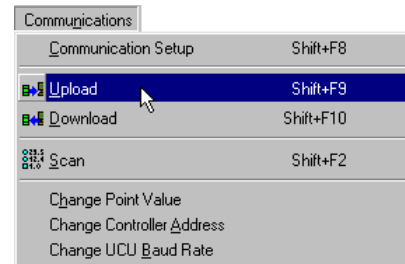
When you have clicked **Upload** on the **Communications** menu, the Engineering Centre displays the **Select Items to Upload** dialog box.

Use this box to specify which items, strategy blocks, analog or digital points and local or wide globals you wish to upload.

To upload every part of the strategy, including possibly analog and digital points and globals, choose the first option – **Strategy blocks**:

It is important to upload all the blocks in which the strategy is contained. Usually, the serviced blocks are uploaded. To check how many blocks are serviced in the controller, select the **Setup** option from the **UC** or **UC32** menu. A guaranteed method of ensuring that the complete strategy is uploaded is to upload all of the blocks in the controller.

The number of blocks that a controller is capable of holding in a strategy varies depending on the type of controller. For instance, a UC32 can have 1024 blocks, a UC24PG-R controller can have 255 blocks, whereas a UCU8 controller can only hold 190.

You can determine the number of blocks that a particular controller can hold using the **Managers dialog box**, available from the **view** menu.

Click the **Strategy...** button to specify the range of blocks you want to upload.

This will produce the **Upload strategy blocks** dialog box,
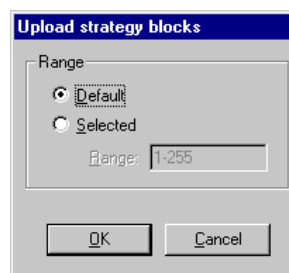
Click the Selected radio button to enter the range of blocks to be uploaded. In the example shown, 1-255 has been entered as the range of blocks to be uploaded:
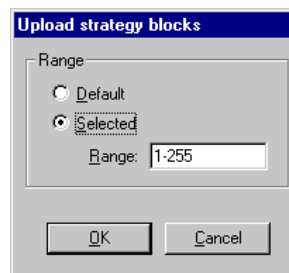
Click OK to close the Upload strategy blocks box
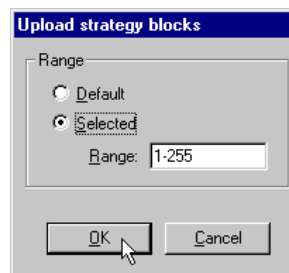
and click **OK** again to close the **Select items to Upload** box.
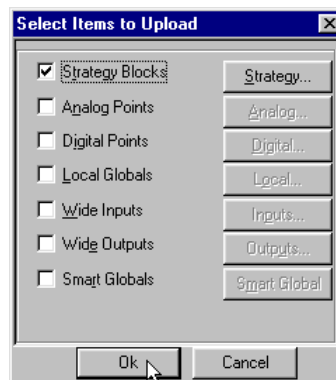
The Engineering Centre will then upload the requested blocks and as this is happening the **Uploading** window will be displayed. The Uploading window, like the Downloading window, shows the progress of the upload.
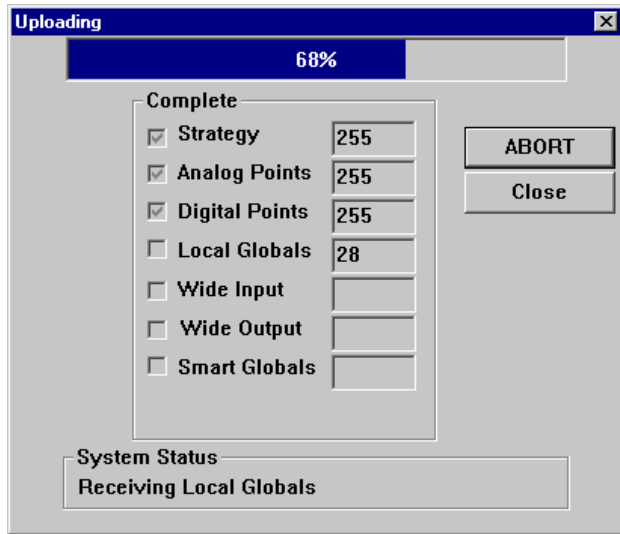
When the Engineering Centre has finished uploading the strategy, it will display the message **Upload complete** in the **System Status** section of the Uploading window. In the following example, the Engineering Centre has finished uploading the strategy, which contained 255 strategy blocks:
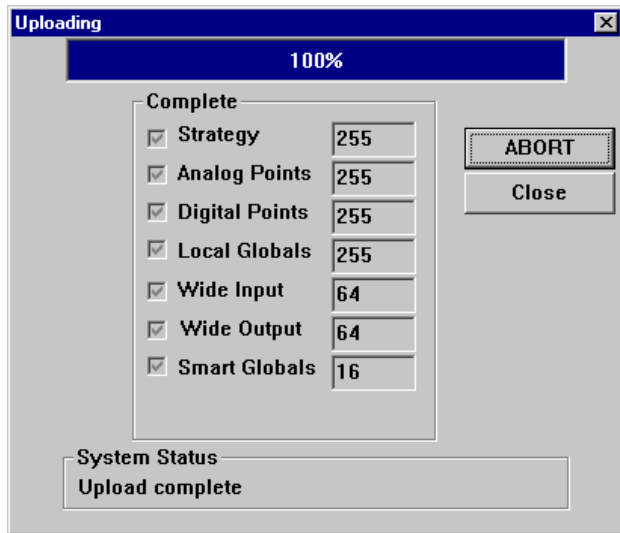
Click **Close** to close the Uploading window.

SECURING UC32 DATA

Unlike other BMS controllers, in the UC32 Strategy information can be secured against accidental loss or unauthorised modification by password-protecting the ability to view or edit strategy information and system information.

The use of this feature ensures that it is difficult for information to be modified in error.

HOW TO PASSWORD-PROTECT UC32 INFORMATION

Specified blocks of UC32 strategy information can be protected against unauthorised viewing or editing by selecting '**Strategy Lock/Unlock**' from the UC32 menu.
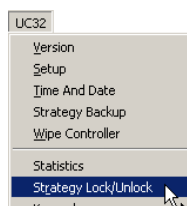
This opens the '**Lock/Unlock**' dialog.

Access to the protected strategy blocks will be governed by a numerical password, which is set during the locking process.
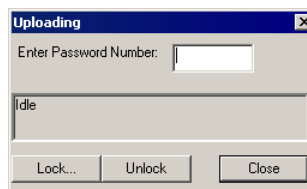
Enter a password (numbers only)
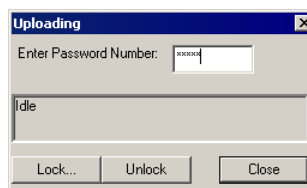
And press the **Lock** button.
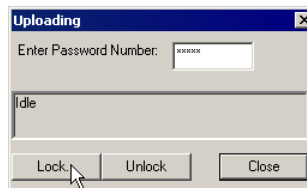
The **Lock Blocks** dialog opens.
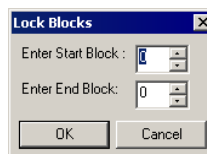
Specify the start and end of the range of blocks that will be protected.
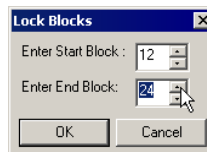
And click on **OK**.
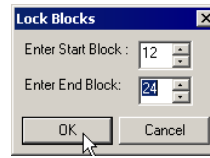
When the lock command has been received by the controller it returns a confirmation signal.
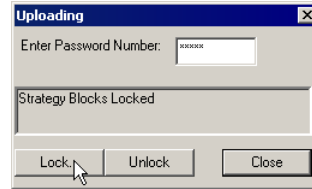
All of the strategy blocks within the specified range are now locked, and cannot be accessed until they are unlocked using the password set above.

HOW TO ACCESS LOCKED STRATEGY BLOCKS

If a range of strategy blocks in a UC32 controller have been locked, it is only possible to access, view, and edit them by first unlocking them, using the password set during the locking process (see *How to password-protect UC32 information* on page 217).

To remove password protection from a locked range of strategy blocks, select '**Strategy Lock/Unlock**' from the UC32 menu.
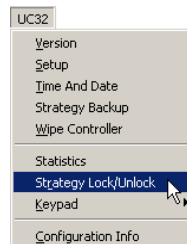
Enter the required password (set during the locking process).
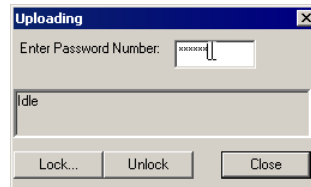
And click on **Unlock**.
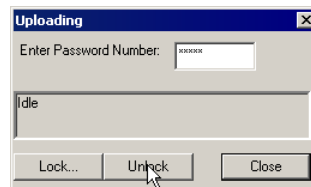
When the blocks are successfully unlocked in the controller, a message is displayed in the **Lock/Unlock** dialog:
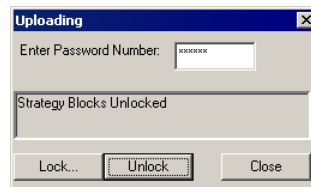
The strategy blocks are now unprotected, and can be accessed from the **Cylon Engineering Centre** as normal.

HOW TO EXPOSE POINTS ON A BACNET SYSTEM

When the Strategy for a controller that is part of a BACnet Site has been configured, the points within the controller that are to be available to the BACnet system must be specified by selecting "Configure BACnet Points…" from the UC32 or UC menu in the Cylon Engineering Centre

The "Configure BACnet Points" dialog opens, listing all of the points used in the Strategy:
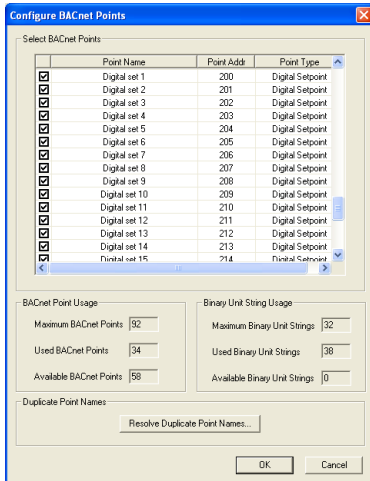
Tick the checkbox beside each of the points that are to be exposed, then click on OK.

Note: In BACnet, the point name must be unique. In the Cylon BACnet system they may not be unique, so some duplicate names may appear in the list. If this is the case, click the Resolve Duplicate Point Names… button.

This opens the Resolve Duplicate Point Names dialog, where names can be changed.
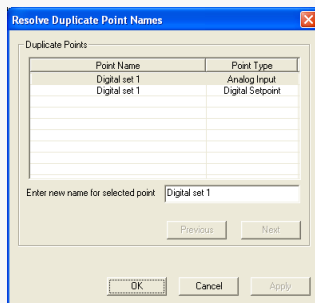
HOW TO VIEW BACNET POINTS FROM A CONTROLLER

You can view BACnet points from a Controller by selecting View BACnet Points From Controller from the Field Controller menu (UC32 or UCU)

This opens the Controller BACnet Points dialog. The points are automatically uploaded so that they can be viewed, and the dialog shows the progress of the upload and the points that have been uploaded:
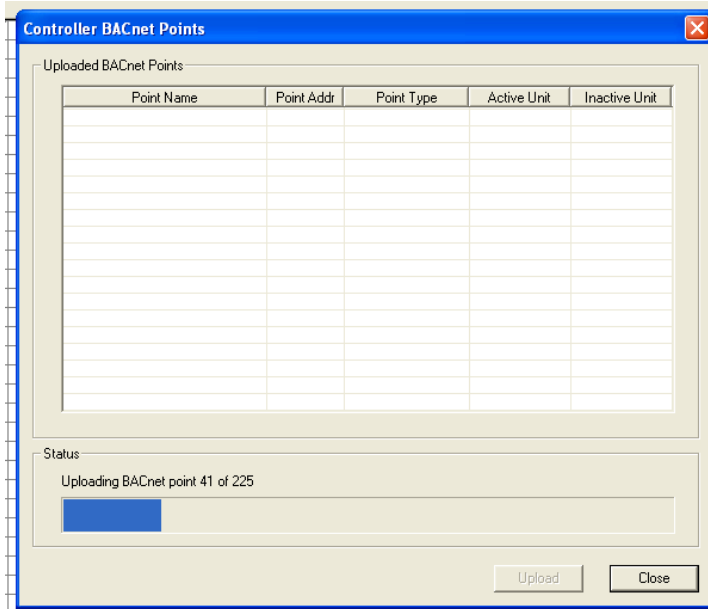
SECTION 7 : NAMING OBJECTS

WHY OBJECTS ARE NAMED

Objects in the Cylon system, such as controllers, points, time schedules, datalogs, etc. are given names to make them more identifiable. For example, it is easier to recognize a datalog named "Water Supply Temperature" than one named "datalog_1", which is the default name of the first datalog used inside a controller, automatically given by the database.

RULES FOR NAMING OBJECTS

When naming an object in the system, the following rules should be remembered:

- Names inside a controller must be unique.
- Names can have a maximum of 24 characters.
- All alphanumeric characters are permitted, except commas.

CHANGING NAMES

When changing the name of an object, the following points must be considered:

- Other Cylon software modules, like CCDraw, CCView, Datalogs, Keypad Compiler use the names of objects as references to those objects. The changing of names can cause problems in these applications. For example, CCView would be unable to find a point, if its name was changed since the graphic was first designed.
- If the name of an object in a controller is changed to a name that already exists in that controller, the name of the original object will be deleted.

PROCEDURES FOR NAMING OBJECTS

The following list contains some of the objects in the system that can be named:

- Sites
- Field Controllers and Comms Controllers
- Points (both hardware points and virtual points)
- Two function modules: datalog and UC time schedule
- Comms Controller time schedules

NAMING SITES

To name sites you should use the Command Centre Configuration module. For further details on how to name controllers, please consult *MAN-0041 Configuration manual*.

NAMING FIELD CONTROLLERS AND COMMS CONTROLLERS

Use the Command Centre Configuration module. For further details on how to name controllers, please consult *MAN-0041 Configuration manual*.

NAMING POINTS

Types of point

There are three main types of point in the Cylon system:

- A hardware point is an input or output of a Field Controller.
- A virtual point is used to save internal information for a controller.
- A set point is a type of virtual point, but its value is constant, whereas the value of a virtual point is determined by the strategy.

Hardware points, virtual points and set points can be either analog or digital.

How to name points

Only hardware and set points can be named in the Engineering Centre. Virtual points are identified by their block numbers. The procedure for naming or changing the name of a set point is the same as that for a hardware point. A brief summary of the procedure is presented below. (For a more detailed description of how to name a point, see *Defining hardware points* on page 103)

- Open the strategy.
- Right-click on the symbol of the point on the drawing area that is to be named or have its name changed. This will produce the module dialog box. It is important to click on the body of the symbol, and not on the joined input or output of the symbol.
- Enter the name in the **Point Name** section of the module dialog box or edit the name that appears there already.
- Click **OK** to close the dialog box. The point's new name will appear as text directly over the point's symbol on the drawing area.
- Choose **Save** from the **File** menu to save the changes made to the strategy.

The Unitron Command Centre's **Database Interface** module can be used to enter/edit/delete names of hardware points non-graphically.

Virtual points which are placed in a strategy as digital set points or analog set points, are points which are controlled from outside the UC. The name of such a virtual point should indicate how its value is passed to it. The following table illustrates this:

Setpoint name	How set point value is controlled
Outair Temperature_LG	Controlled by local global
Room Temperature_WG	Controlled by wide global
Set point_KP	Can be changed via keypad
Gain Factor_PC	Can be changed via PC (CCVIEW)

NAMING UC TIME SCHEDULES

UC time schedules are saved and serviced just like modules in a controller. Naming UC time schedules makes it easy to locate them for editing, either using the PC, CCView or a keypad.

How to name a UC time schedule

The procedure for naming or changing the name of a UC time schedule is defined below:

Open the strategy that contains the UC time schedule.
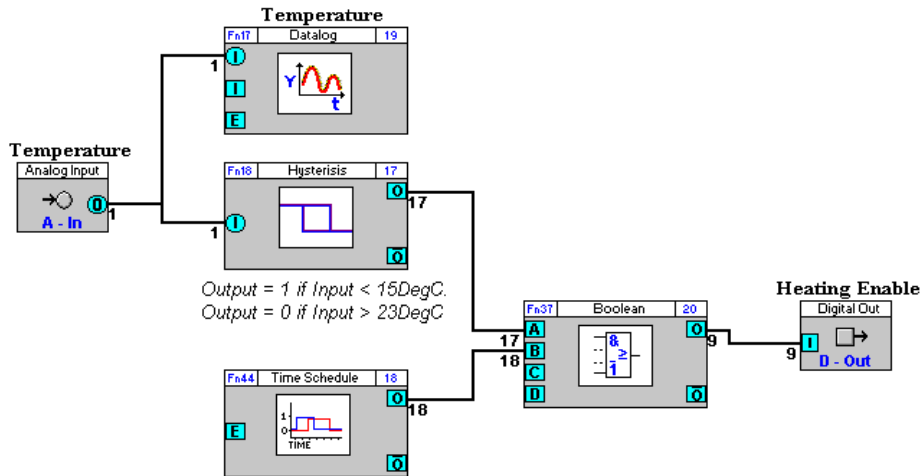
Right-click on the symbol of the time schedule that is to be named (or to have its name changed).
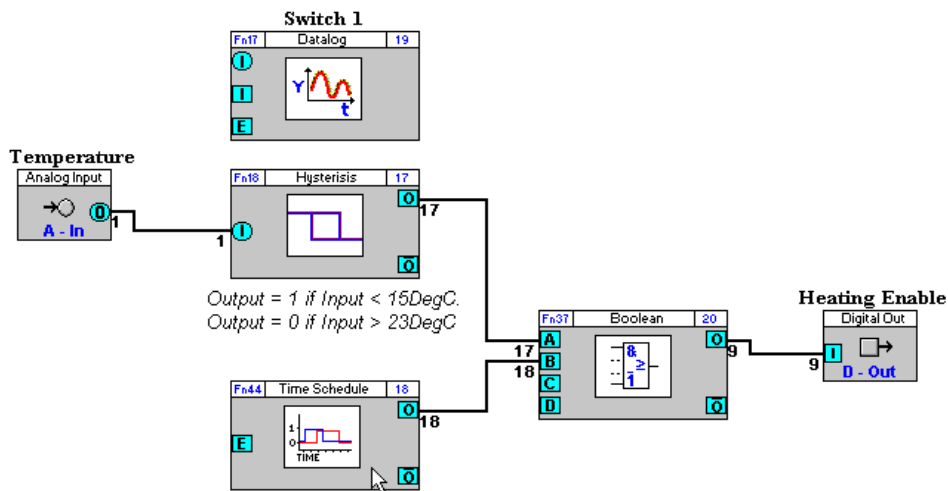
It is important to click on the body of the symbol, and not on the joined input or output of the symbol.

This produces the **Time Schedule** dialog box.

In the **Name** section of the dialog box, enter the name or edit the name that appears there already.

It is a good idea when naming the schedule, to give an indication of the module's function. For example, if the module is a time schedule for the heating system of the site, and is set for Monday to Friday only, the module might be named "Heating Schedule (Mon to Fri)", as shown above.

Click **OK** to close the dialog box.

Note: The name of the UC time schedule is not displayed in the drawing area:

Choose **Save** from the **File** menu to save the changes made to the strategy.

© Cylon Controls
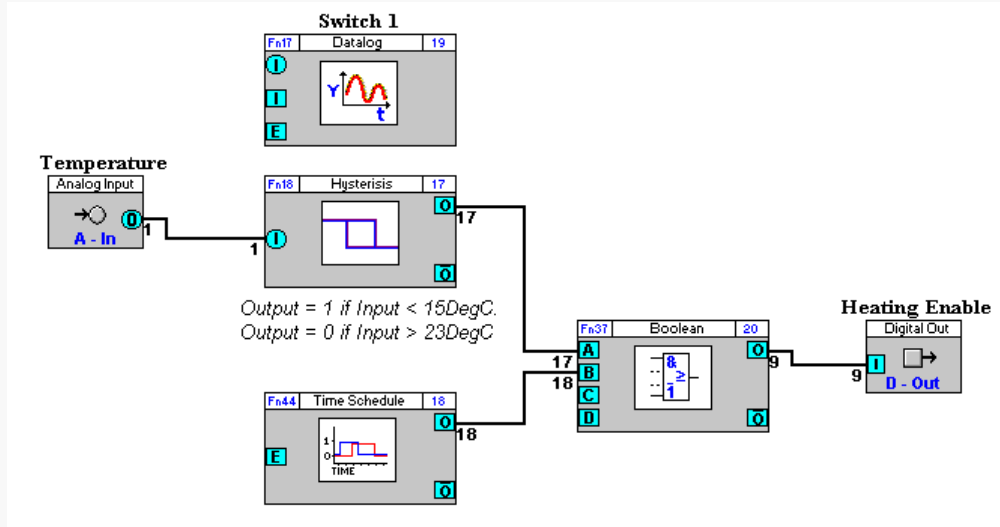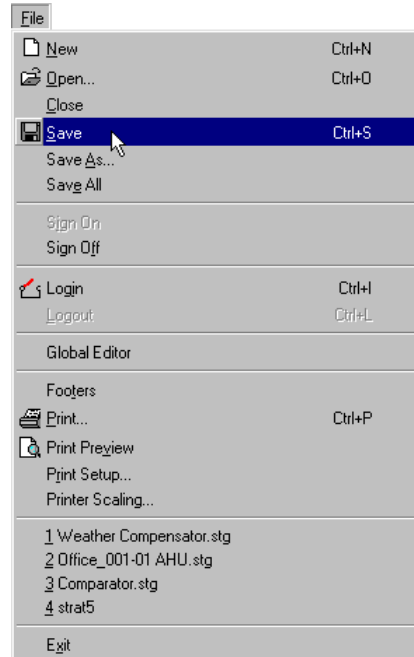
NAMING DATALOGS

Datalogs are saved and serviced just like modules in a controller.

The contents of a Datalog can be viewed and analysed using the Unitron Command Centre's **Datalog Manager** module.

So that they can easily be identified by the Datalog Manager, they are automatically given the same name as the point that they are logging. They are given this name when the point is connected to the datalog.

Datalogs can be linked with push buttons in CCView for quick and easy access. In the Reports program they can be configured, to be archived.

How to name a datalog

Datalogs are automatically named as soon as they are connected to a point:

Open the strategy that contains the datalog.
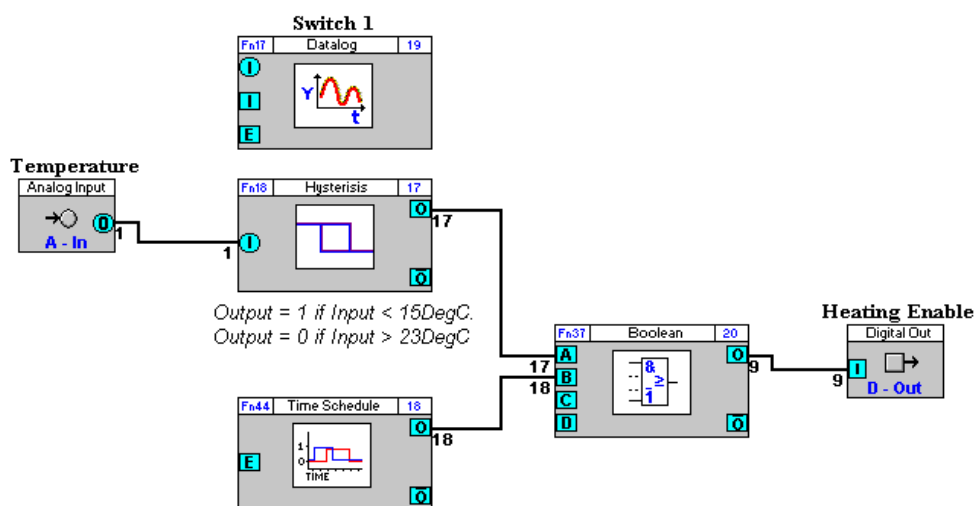
Join the datalog to a point by clicking on the point to be logged, and dragging to the Datalog's input:
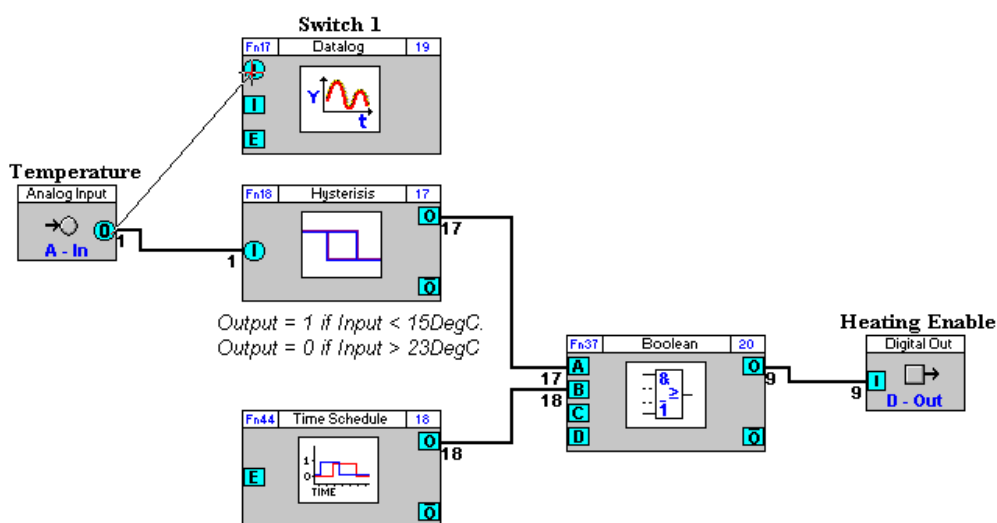
The name of the Datalog is changed to the name of the point, and displayed above the Datalog module in the strategy.
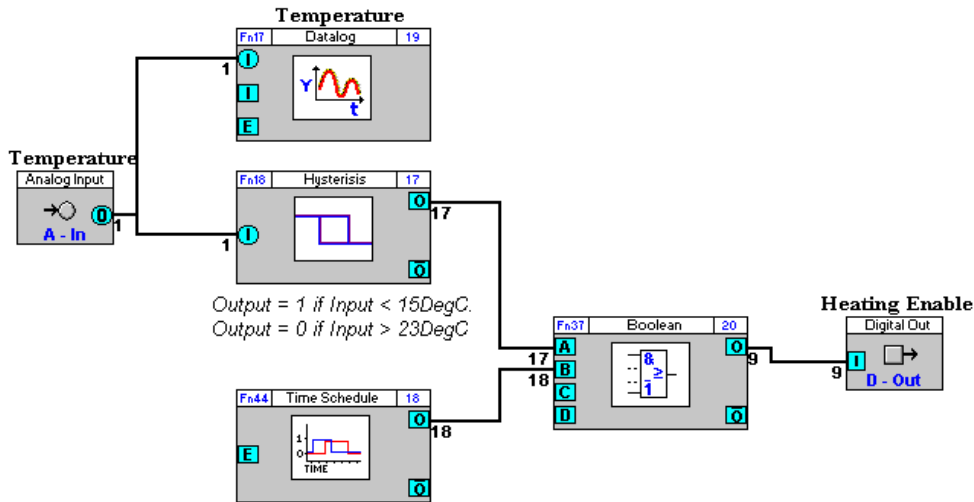
If you want to modify the name that is automatically given, you can edit it as follows:

Right-click on the symbol of the datalog that is to be named or have its name changed.

It is important to click on the body of the symbol, and not on the joined input or output of the symbol.
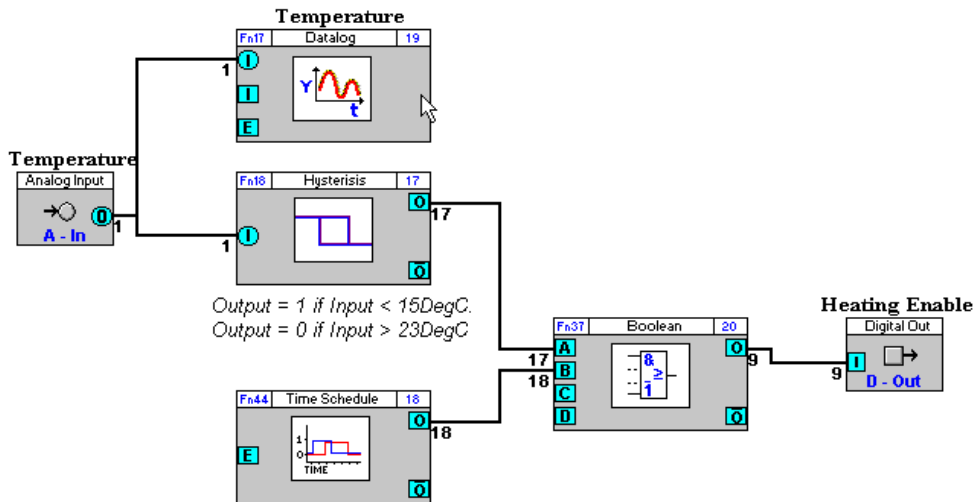
This will produce the **Datalog Definition** dialog box.

In the **Datalog Name** section of the dialog box, edit the name that appears there already.
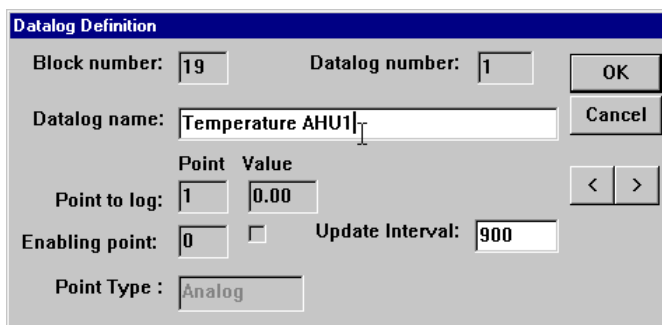
It is a good idea to give an indication in the name of what part of the site the datalog belongs to, but it is not necessary to indicate in the name that the module is a datalog, as it will only appear in list boxes allowing the selection of a datalog. The above example shows a Datalog Definition dialog box, where the datalog name indicates that it is a temperature datalog for air input to and Air Handling Unit.

Names given to speed up the copying of strategies (for example, "Temp. Channel 1", "Temp. Channel 2", "Temp. Channel 3", ...), and which save time for creating dynamic graphics, are not helpful for the end user.

Click **OK** to close the dialog box.
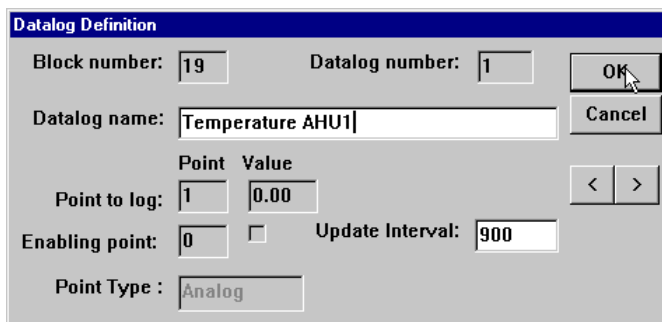
The Datalog name is displayed above the module in the drawing area.
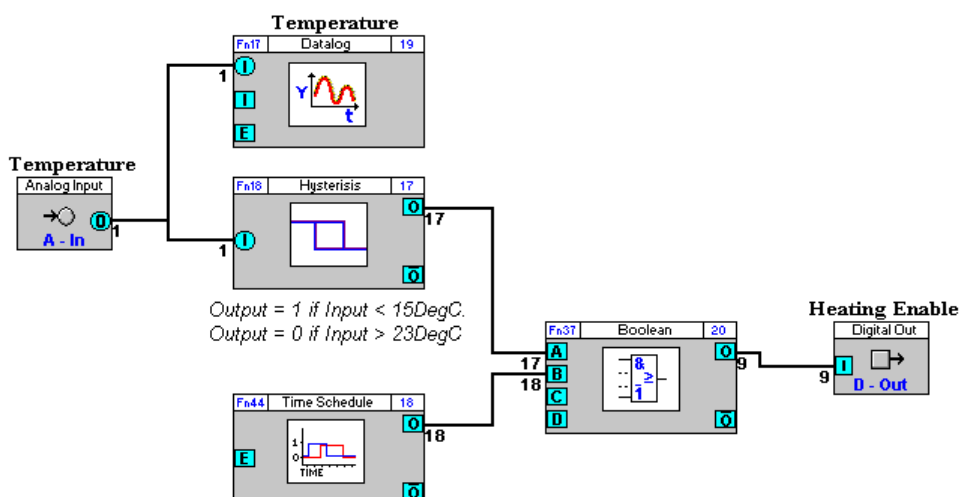
Choose **Save** from the **File** menu to save the changes made to the strategy.

File

New   Ctrl+N
Open...   Ctrl+O
Close
Save   Ctrl+S
Save As...
Save All

Sign On
Sign Off

Login   Ctrl+I
Logout   Ctrl+L

Global Editor

Footers
Print...   Ctrl+P
Print Preview
Print Setup...
Printer Scaling...

1 Weather Compensator.stg
2 Office_001-01 AHU.stg
3 Comparator.stg
4 strat5

Exit

Cylon Engineering Centre
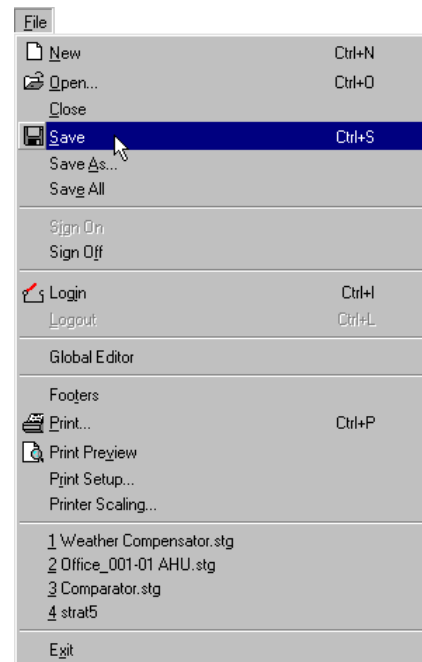
NAMING COMMS CONTROLLER TIME SCHEDULES

Comms Controller time schedules are saved and serviced just like modules in a controller. They are shared via globals with other Field Controllers. Naming Comms Controller time schedules makes it easy for the end user to locate them for editing, using either the Supervisory PC, the CCView program, or a keypad.

How to name a Comms Controller time schedule

Open the strategy of the controller to which the values of the Comms Controller time schedule will be passed. (If the values are to be broadcast to all the controllers on the Fieldbus, open any one of the strategies – all procedures performed here will apply to all controllers).
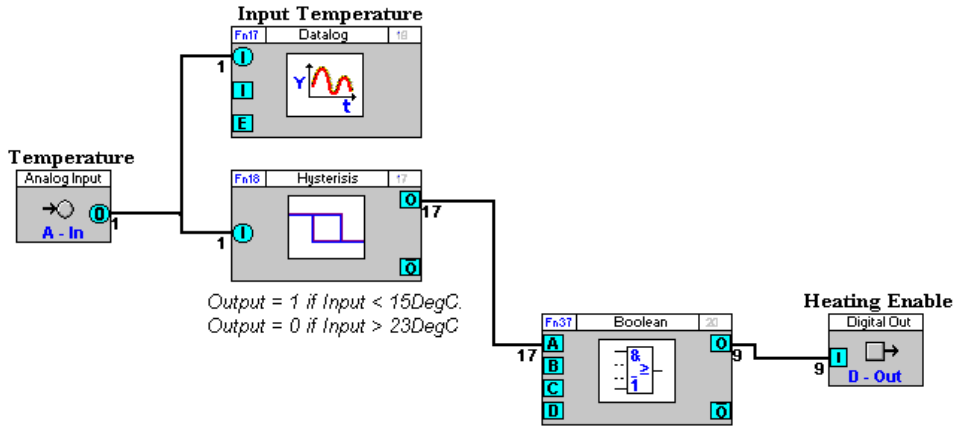
Call the globals bar by clicking on the

button in the toolbar, or by selecting Globals from the view menu
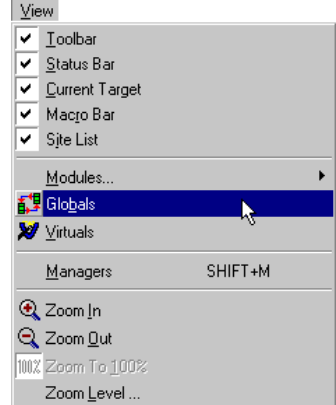
If the global is to pass a value to all controllers on its Fieldbus, choose the local time schedule global button from the globals bar.

If it is to pass a value to all controllers on the ARCnet network, choose the wide time schedule global button from the globals bar.

Click the drawing area of the open strategy window to place the time schedule global symbol on the drawing area.
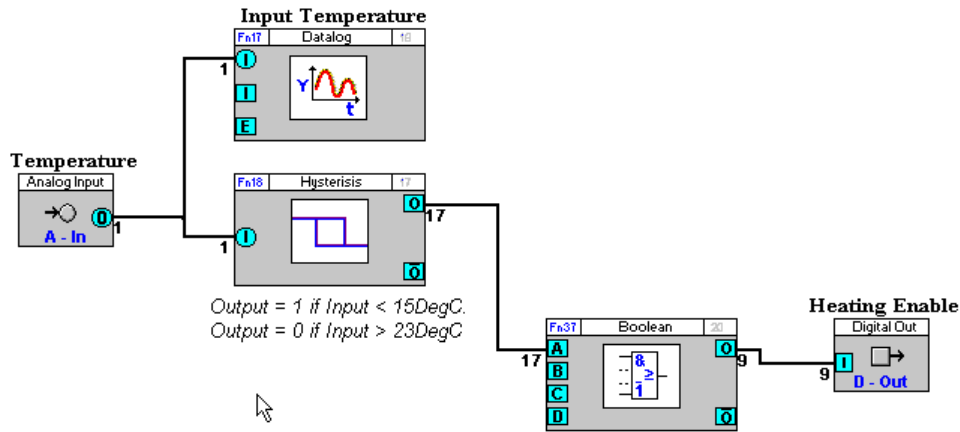
This calls the **Local Time Schedule** dialog box, if you chose a local time schedule global (or the **Wide Time Schedule** dialog box, if you chose a wide time schedule global).
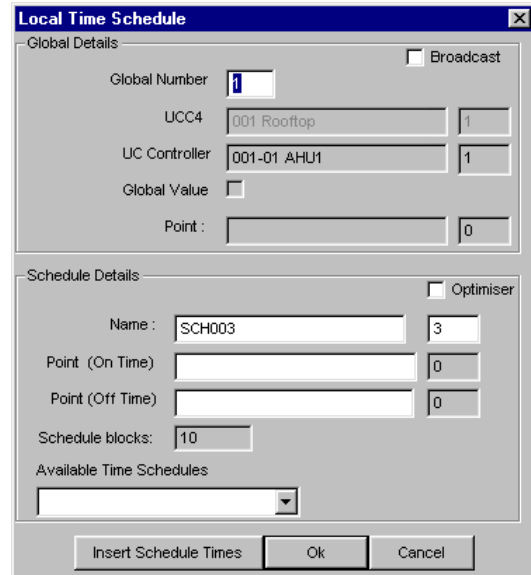
In the **Name** box under **Schedule Details** enter a name for the time schedule global or edit the name that exists there already.

It is not necessary to indicate within the name that the object to which it refers is a time schedule, since only time schedules will be displayed in list boxes from which a time schedule must be selected.

Complete the Local or **Wide Time Schedule** dialog box as outlined in *Using Time Schedule globals in strategies* on page 338.

When the dialog box is complete, click to close the dialog box.

The Schedule and its name are inserted on the Strategy drawing:
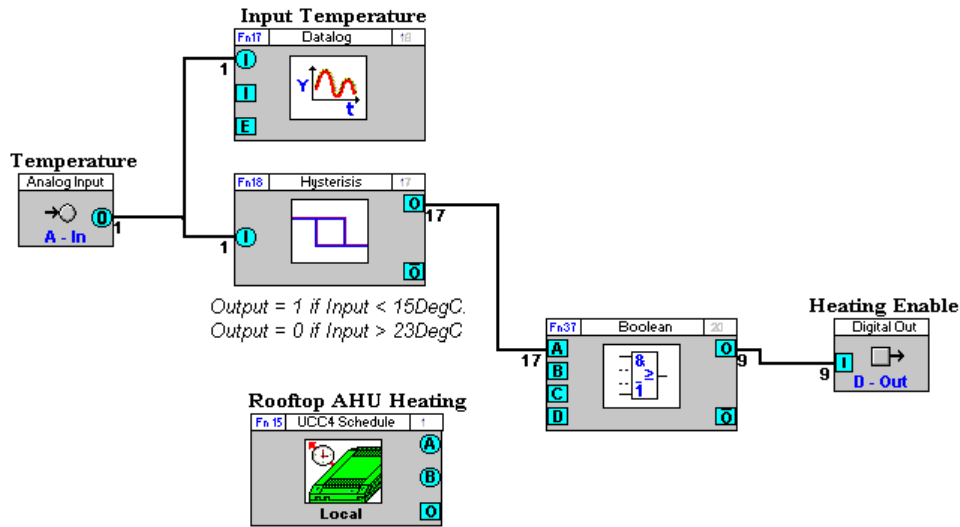
Join the schedule to other modules as required.
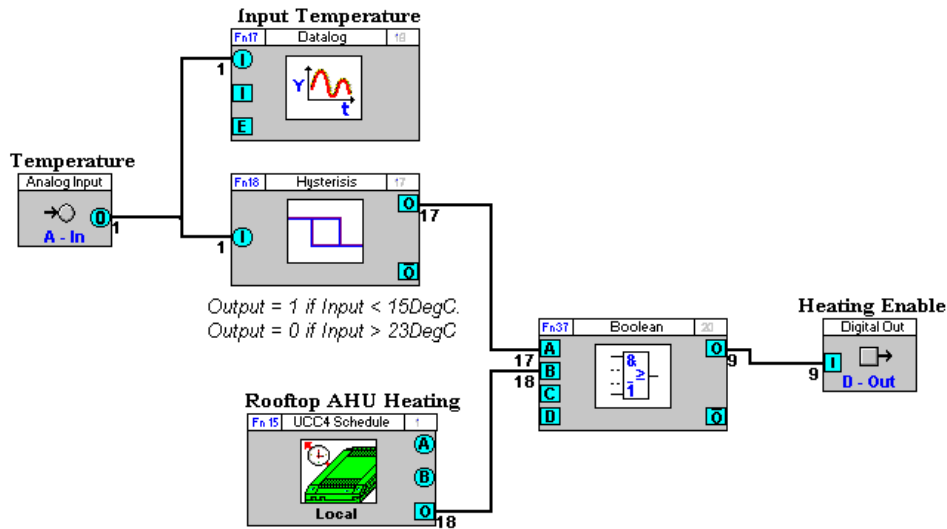
Finally, click **Save** from the **File** menu to save the changes that were made to the strategy.
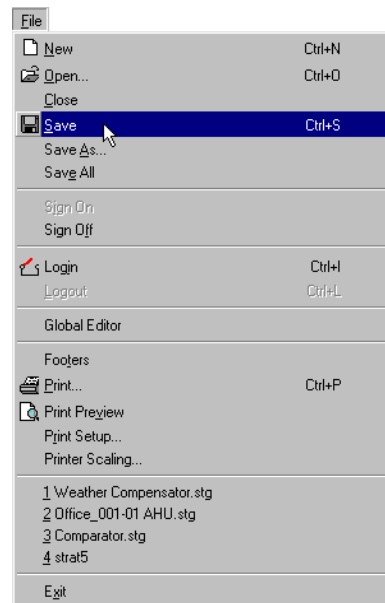
SECTION 8 : USING MACROS

MACROS - OVERVIEW

If your work in the **Engineering Centre** involves creating the same or similar **strategies** repeatedly, you'll find **Macros** useful for reducing the time involved in these tasks. A **Macro** is a set of **strategy** modules grouped together into a single unit.

Macros and Macro Templates

A **Macro Template** is used to create a macro within a strategy. It is a definition of module types and connections, and when it is inserted into a strategy a new **Macro** is created containing new instances of those module types connected together to match the **Macro Template**.

Each time a **Macro Template** is inserted into a strategy, a new **Macro** is created.

Each **Macro** is an instance of a **Macro Template**, but a **strategy** can contain multiple **Macros** that are based on a single **Macro Template**.

Macro Templates can be stored, and copied between **strategies** and controllers.

Each **Macro** can be configured and adjusted independently of the **Macro Template** used to create it.

When a **Macro Template** is saved, it is assigned to a floating toolbar, so that it is as convenient to use as any **Engineering Centre** module.

Example: An "Adder" macro.

An Adder/Scaler module accepts four inputs A, B, C and D, and operates according to the equation

```
Output = A*C + B*D
```

It can be made into an **Adder**, which operates according to the equation

```
Output = C + D
```

by ensuring that its A and B inputs are always set to 1. This can be done by connecting a Real Constant module to the A and B inputs as shown below.
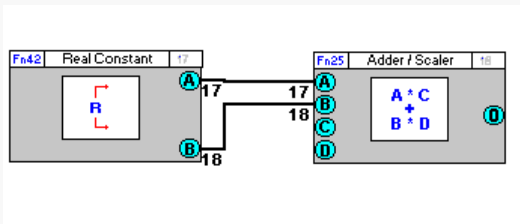
This combination of modules can be saved as a Macro Template and reused whenever an adder is required.

MACRO STRUCTURE

Macro Templates are stored in the **Engineering Centre** in groups and sub-groups. A maximum of 10 **Macro group**s can be created. Each **Macro group** can contain 20 sub-groups and each sub-group can contain up to 100 **Macro Template**s. In total, 20 000 **Macro Template**s can be created and stored in the **Engineering Centre**.

For example, you may want to store all **Macro Template**s relating to heat control **strategies** in a group called Heat. This group may contain a sub-group called Boiler, which would contain **Macro**s for boiler control strategies, such as Optimizer, Heating Curve, etc.

MACRO DESCRIPTION FILES

A **Macro Description File** is a file generated by the person who created the **Macro Template**, and is associated with the **Macro Template** (it is opened by right-clicking on the **Macro** button). It is normally used to describe the function and usage of the **Macro Template**.

When a user right-clicks on a `Macro button` on the floating `Macro bar` the **Engineering Centre** opens the editable description file associated with that specific **Macro Template**. If none exists, the **Engineering Centre** opens a blank text file, which when saved will be associated with that **Macro Template**. This file can be used to provide documentation about how the Macro should be used or to record history, author or changelog details for the **Macro Template**.

The program used by the **Engineering Centre** to open the history file, e.g., MS Wordpad, must be specified in the `wn3000.ini` file under `UC16et`.

HOW TO CREATE A MACRO TEMPLATE

There are a number of steps involved in creating a Macro Template:

1. Create the **strategy**.
2. Add modules to the Macro Template.
3. Select the inputs and outputs for the Macro Template, and change their names if required.
4. Set names for each of the points within the Macro Template if required.
5. Choose a Macro group and sub-group, and give the Macro Template a name.
6. Choose whether to insert the Macro Template into the active strategy as a Macro.
7. Save the Macro Template.

The following guide to creating a **Macro** uses as an example a typical **strategy** that you might want to save as a **Macro** – a "**weather compensator**" strategy. As an exercise in creating **Macro**s, you may want to follow this guide, using the **weather compensator** as an example.

Create the strategy

Create the **strategy** or part of a **strategy** on which you are basing your **Macro Template**. (If you are forming your **Macro Template** from an existing **strategy**, then **open** that existing **strategy**).

Example – Weather Compensator macro

For example, if you were to create a Macro Template from a weather compensator strategy, you would place two Real Constant modules and two Rescale to 0-100 modules on the drawing area and join them as shown below:

The third input of the first Rescale module (Rescale to 0-100) is to be the input of the Macro. It is marked Outside Air Temperature in the diagram below.

The output of the 2nd Rescale module (Rescale from 0-100) is to be the output of the Macro. It is marked Flow Temperature Setpoint in the diagram below.
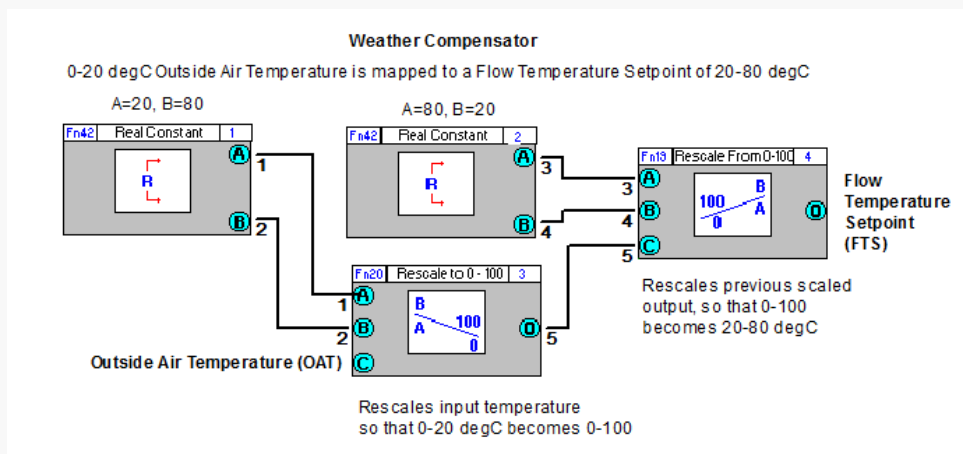
Select the modules for the macro

The next stage in creating a **Macro** is to select on the drawing area the modules and any text that you want to be included in the **Macro**. Selected modules are marked by red squares around their edges.

To select the modules for the **Macro**, you can drag the mouse from the top left-hand corner to the bottom right-hand corner of the strategy to draw a box around the entire strategy so that each module and its inputs and outputs is selected. It is not a problem if, when drawing the box, you included some unwanted modules – they can be easily removed at the next stage.
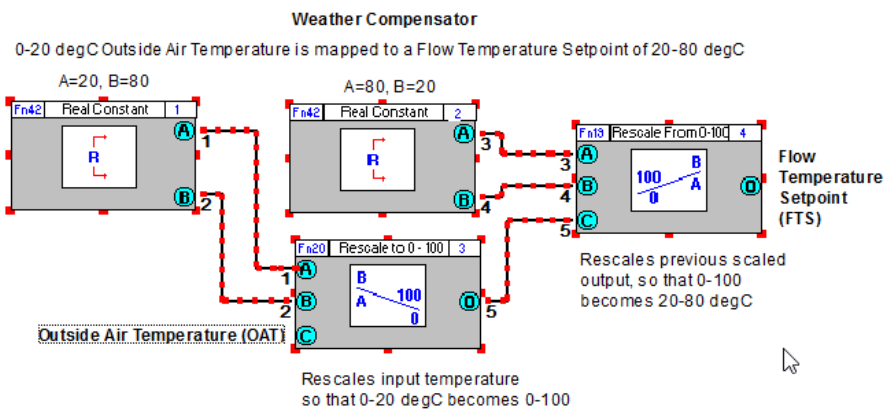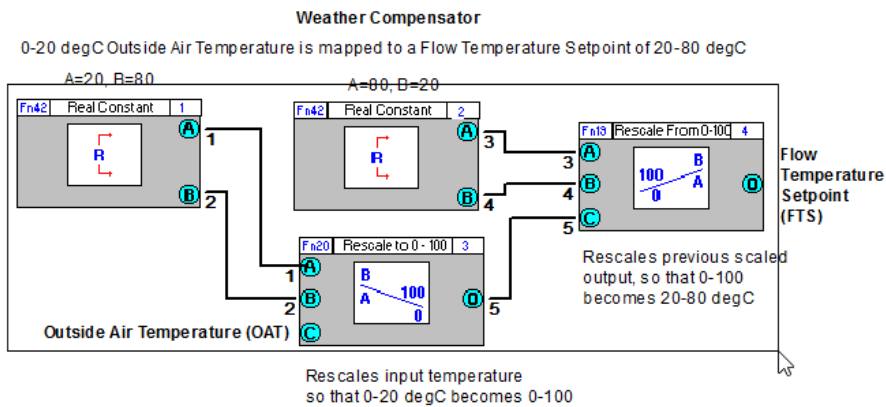
Add the selected modules to the Macro Template

Click on the toolbar, or select Create from the Macro menu.

This will open the Add Modules to Macro dialog box, in which all of the modules that you selected for the **Macro Template** will be listed.
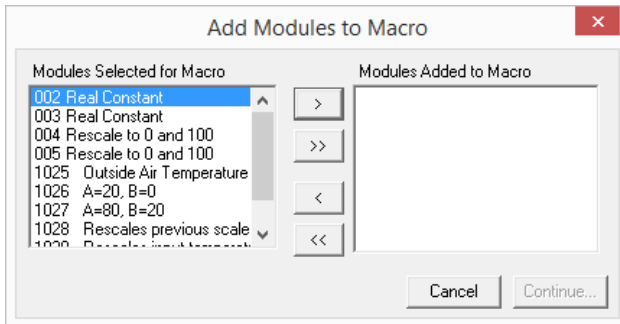
> **Note**: A Macro cannot include hardware points, so if any were included in the selection they will not be listed in the Add Modules to Macro dialog.

> **Note:** If you click the macro button or macro menu without first selecting the modules for the macro, you will be prompted to do so with the following error message:
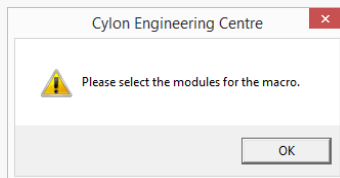
Select the modules in the left list box that you want to include in the **Macro** by holding down the [Ctrl] key and clicking each one with the left mouse button. The selected modules will be highlighted.
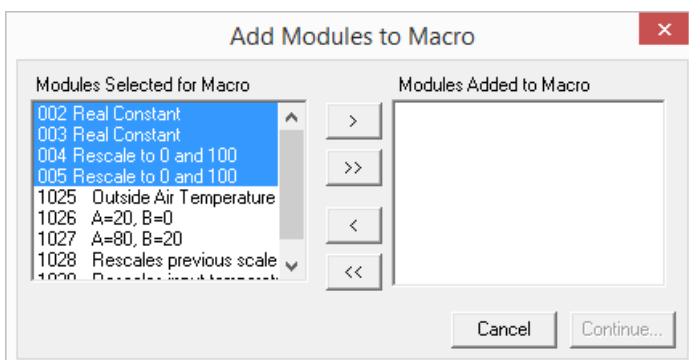
> **Note:** For illustration, only the functional modules have been selected in this example. It is also possible to include text in a Macro Template for clarity.

Add the selected modules to the **Macro Template** using the following buttons:

>	Add a selected module or several selected modules to the **Macro Template**
>>	Add all modules to the **Macro Template**
<	Remove a selected module or several selected modules from the **Macro Template**
<<	Remove all modules to the **Macro Template**

This Add Modules to Macro list box displays all the modules that have been added to the **Macro Template**. If you add a module or modules that you later decide you do not want, you can remove that module or modules from the **Macro Template** using the remove buttons (see above).
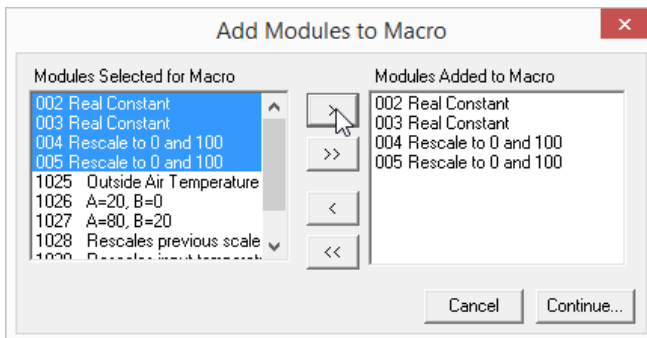
In this example, all 4 modules of the weather compensator strategy are required for the **Macro Template** and so they are added to the list box on the right. The text has been excluded in this case, but could be included for extra information.

Click Continue… when you have added the required modules to the **Macro Template**.

Define the Macro Inputs, Outputs, Group and Name (the Create Macro dialog box)

Pressing Continue in the Add Modules to Macro dialog will open the Create Macro dialog box:
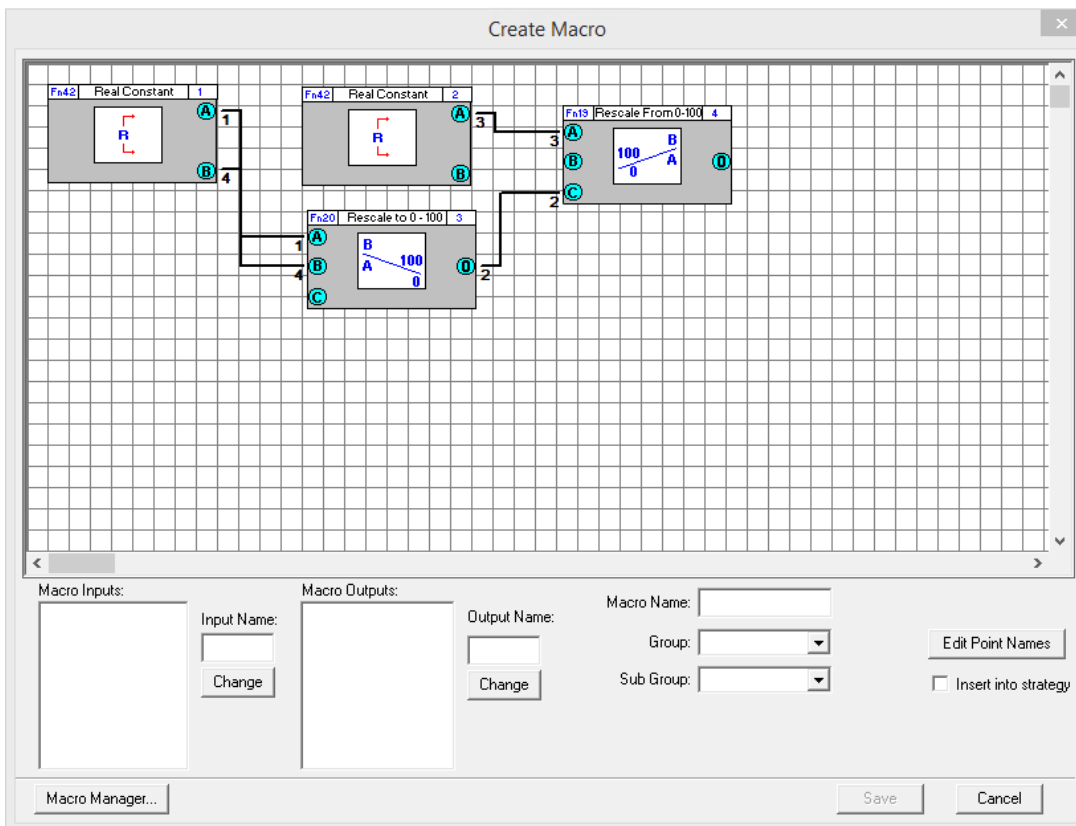
The Create Macro dialog shows the four modules that were added in the Add Modules to Macro box, and allows you to edit input and output names, create Macro groups and sub-groups and create a history file to record any changes that may be made to the Macro Template later.

Define the inputs and outputs for the macro

This step refers to the Weather Compensator example (see page 238).

When you click on a module output, or an unconnected module input in the drawing area of the Create Macro dialog, it is highlighted on the drawing area, and added to the relevant Macro Inputs or Macro Outputs list at the bottom of the dialog.
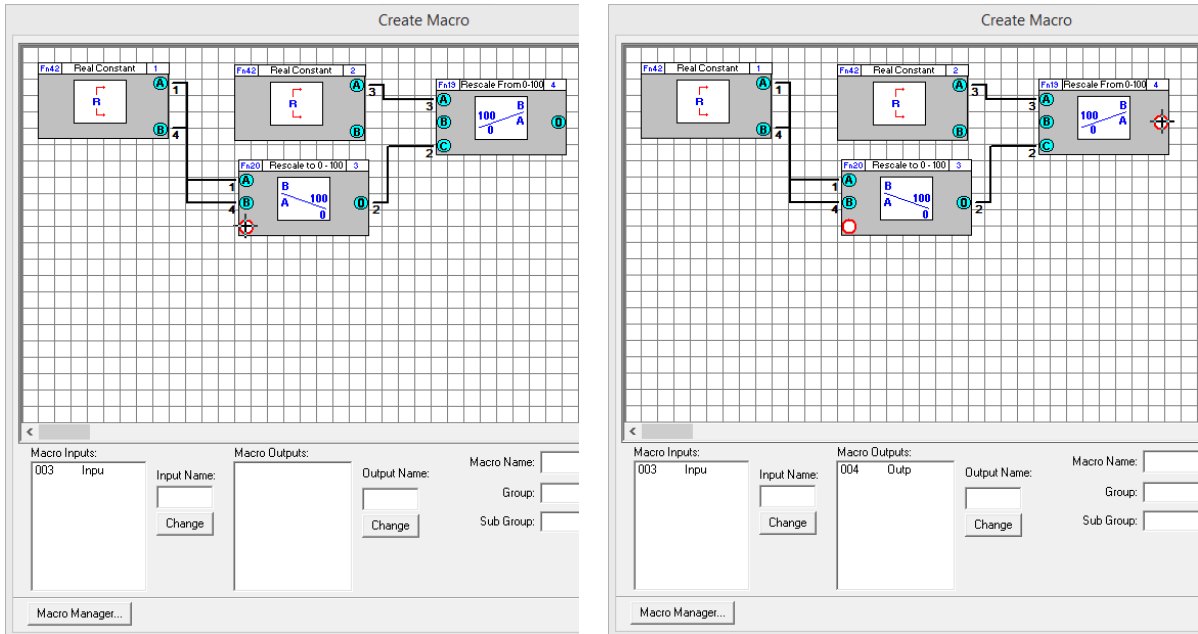
Note: If you click on a connected input, an error message will be displayed: "Cannot select a module input that is already connected to a line."

Note: The number beside each module input is the Node number, and does not relate to the module number.

Note: The default name for node 3 in the illustration is "Inpu", but this can be edited - see *Change input or output label if* necessary on page 244.

To remove an input or output that has been added to the **Macro Template**, click on it in the drawing area. The input/output will then no longer be highlighted in the drawing area, and it will be removed from the relevant Macro Inputs or Macro Outputs list.

You can rearrange the order of the inputs or outputs to the **Macro**, by double-clicking on an entry in the relevant Macro Inputs or Macro Outputs list, and dragging it up or down within the list.

Change input or output label if necessary

By default, the text that will be displayed on the Macro module as a label for each input will be "Inpu" and for each output will be "Outp":
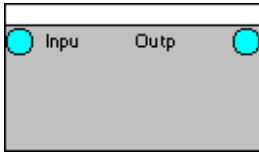
but these names can easily be edited.

To edit a **Macro** input or output name, select the input/output in the relevant list box
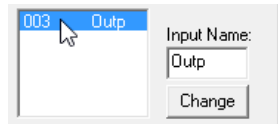
Type a new name in the relevant Name edit box, and click Change .
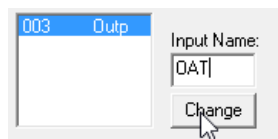
An input or output label can have no more than 4 alphanumeric characters.
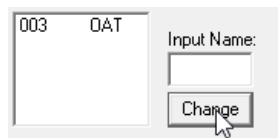
Name and group the Macro

In order to use a **Macro Template** that you have created, you must give the **Macro Template** a name, and assign it to a `Macro group` so that it can be accessed from the `Macro bar` .

- Macro Name

In the `Macro Name` box, enter a name for the **Macro Template**.

The name provided here will appear on the **Macro** instance when it is displayed on the drawing area. It can have no more than 10 alphanumeric characters.

In this example, the name given to the **Macro Template** is "WeatherCom".

Note: The following names cannot be used when naming a macro, because they are used to indicate Inputs, Outputs, constants etc. internally within the Engineering Centre:

`pi (n)` where n = a numeric value in the range 0-9

`po (n)` where n = a numeric value in the range 0-9

`sb`

`c (n)` where n = a numeric value in the range 0-9

`bc`

When the **Macro Template** is named, choose a **Macro** group and sub-group for it

- Macro Group and Sub-Group

From the `Group` box, select the group to which the **Macro** you are creating will belong.

The **Macro Group** chosen for this example is heating.

If no **Macro Group** exists, you must create a new group (see *How to create a new macro group and sub-group* on page 248)

From the `Sub Groups` box, select the sub-group to which the **Macro Template** you are creating will belong.

The sub-group chosen for this example is **Boiler**.

If no sub-group exists, you must (see *How to create a new macro group and sub-group* on page 248)

Set names for all of the points in the Macro

When creating a **Macro Template**, there is a facility to edit the names of all of the points in the **Macro** in a single interface. An `Edit Point Config` button is available on the `Create Macro` dialog:
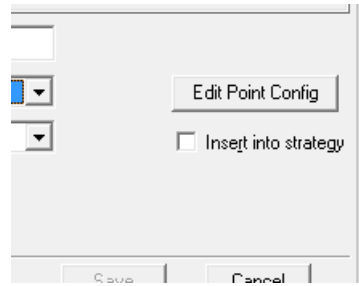
Clicking the `Edit Point Names` button opens the `Macro Point Configuration` dialog:

Simply enter text in the `Name` column against each point, and click the `OK` button.

Note: if the modules selected when creating the Macro included any Setpoints, it is possible to set labels for specific setpoint values - see
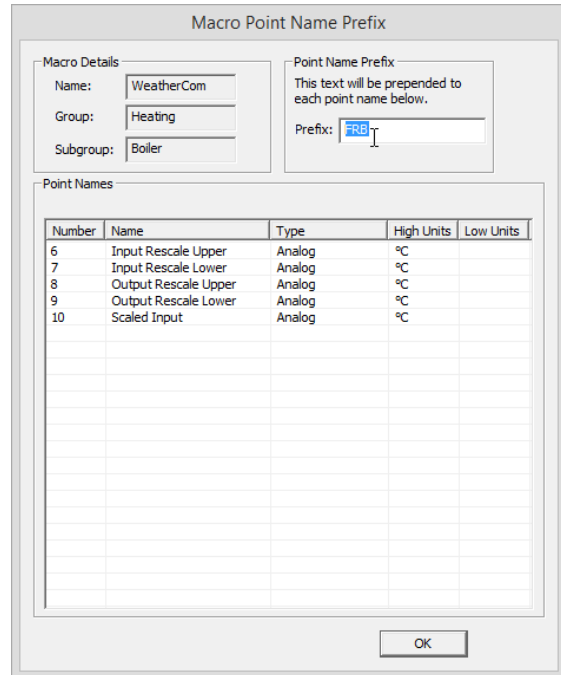
Note: This is different from setting the Input and Output names (labels) as described in *Change input or output label if necessary* on page 244. Those input and output names are labels displayed on the Macro module, the point names set here are the descriptive names stored for each of the points in the strategy.

Note: When adding a new instance of a Macro to a strategy, it is possible to add a prefix to these names, to avoid the situation where multiple points within a strategy could be assigned identical names. In this case the dialog has an input for the prefix but each name is fixed (not editable):
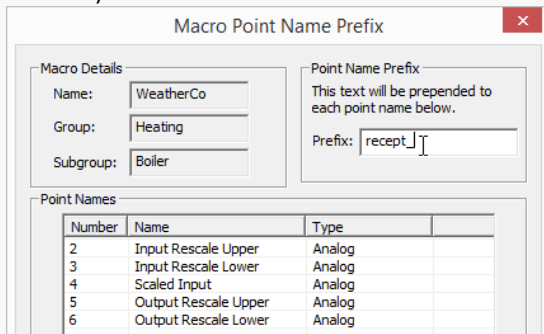
Choose whether to insert the macro into the active strategy

The Insert into Strategy checkbox allows you to immediately insert a new **Macro** based on this **Macro Template** into the active strategy.

If you want to insert the **Macro** into the active strategy, select this option before saving the **Macro Template**.

Save the Macro Template

To save the **Macro Template**, click the Save button.
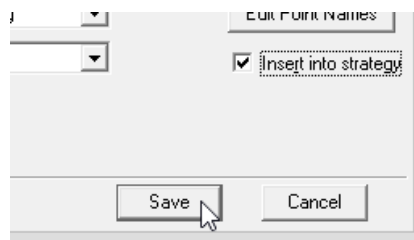
The **Macro Template** is saved to the `C:\UnitronUC32\Macros\` directory if it was created in a **UCU** or **UC16 strategy**, or in the `C:\UnitronUC32\UC32Macros\` directory if it was created in a **UC32**, **CBM** or **CBT strategy**. The group and subgroup information is stored in the `macro_database.db` file in the same directory.

If you decide not to save the **Macro Template**, click the Cancel button to close the Create Macro dialog box without saving.

When you save the **Macro Template**, a **Macro** button and a **Macro** symbol are created:

The **Macro** button is the icon that represents the **Macro** in the floating Macros bar .
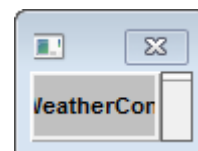
> **Note**: The floating Macros bar can be opened from the button on the right of the fixed Macros Toolbar :
>
> which is itself made visible from the View Menu > Macro bar .
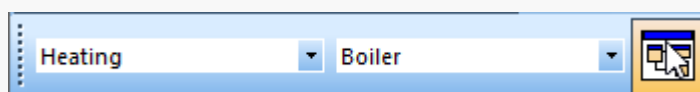
The **Macro** symbol is the bitmap that represents the **Macro** on the drawing area. (See *Working with Macros* on page 255).
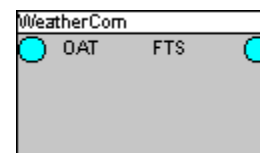
HOW TO CREATE A NEW MACRO GROUP AND SUB-GROUP

Macro Groups and Sub-Groups are defined in the Macro Manager interface.

To open the Macro Manager dialog, press the Macro Manager button in the Create Macro dialog.

Alternatively, if the Create Macro dialog is not opened, select Manager from the Macro menu.
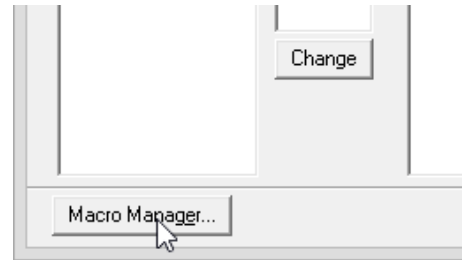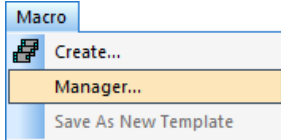
This opens the Macro Manager window
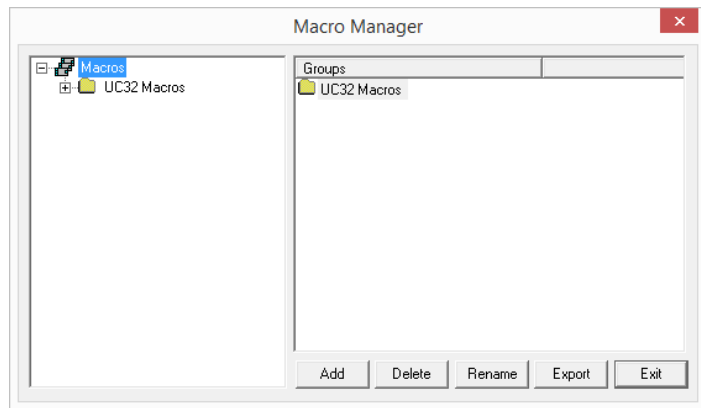
To add a group, click the Add button while the Macros root is selected in the explorer pane (left hand side of the window)
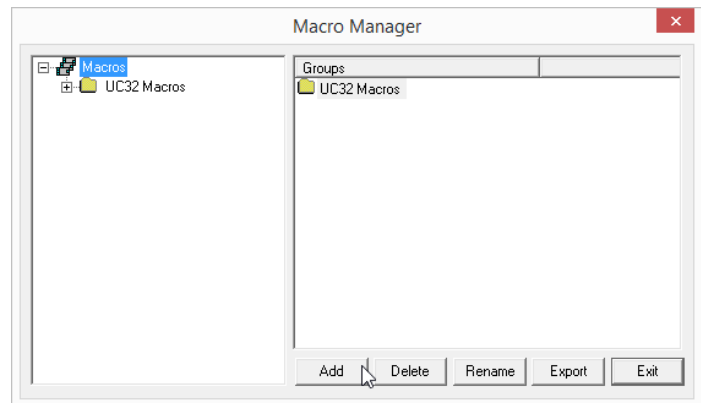
A new group appears in the Right-hand side Group pane.
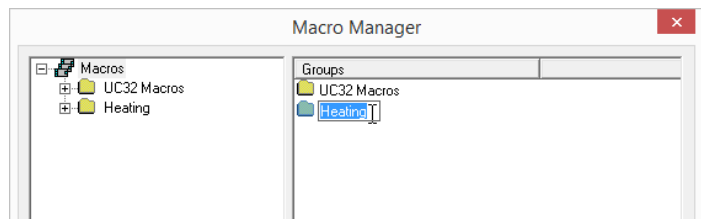
Type in a name for the new group.

To make a sub group in the new group, first make groups visible by clicking on the + sign to the left of the Macros root.

Click on the group under which you want to make a sub group
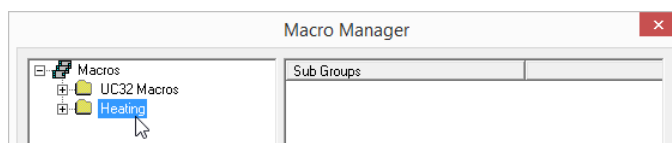
Click on the Add button

A new sub group appears in the right-hand " Sub groups " pane
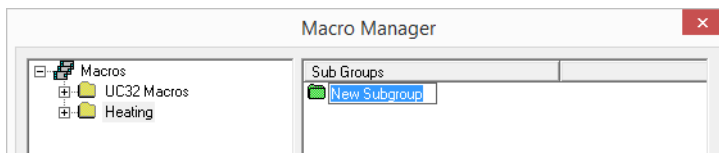
Type in a name for the sub group
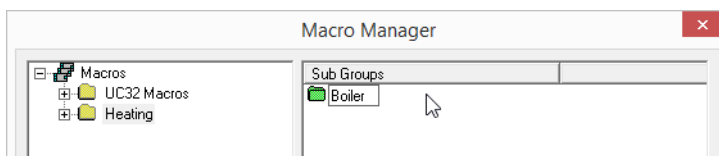
You can view the subgroups under a group by clicking on the " + " sign to the left of the group in the left-hand explorer pane .
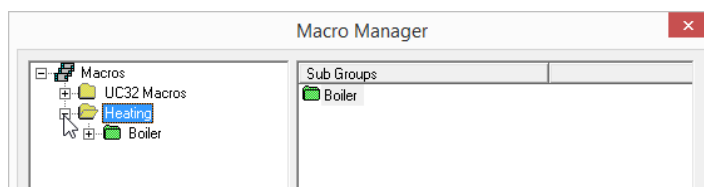
To close the Macro Manager , click Exit .

When a new **Macro** group is created, it will be listed under Macros in the View menu. When a new sub-group is created, an icon is also created for that sub-group and displayed in the **Macro** sub-group bar.

HOW TO RENAME POINTS IN A MACRO TEMPLATE

Points can be renamed from the Macro Manager interface.

To open the Macro Manager dialog, press the Macro Manager button in the Create Macro dialog.

Alternatively, if the Create Macro dialog is not opened, select Manager from the Macro menu.
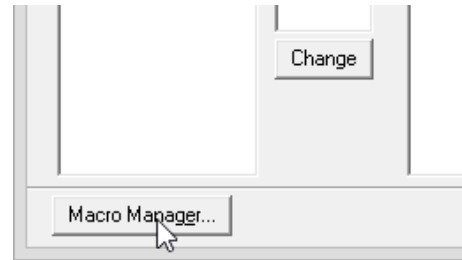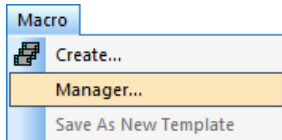
Clicking on a **Macro Template** in the left-hand-side 'Tree view' pane of the Macro Manager displays properties of the **Macro Template** in the right-hand pane.

The Macro Name , Macro ID , User Created flag, and the list of point names are displayed.

If there is no point names list, then a Create Point Names button will be displayed below the right-hand pane as shown above.
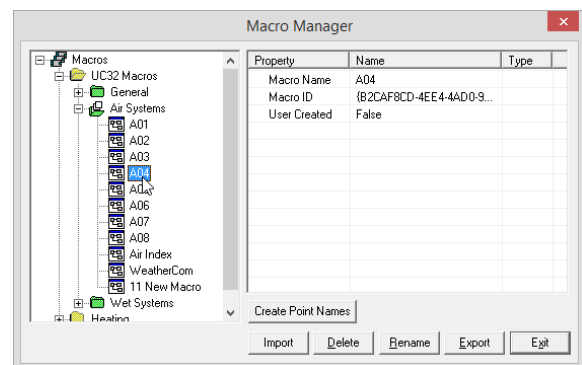
If point names have already been defined, then an Edit Point Names button will be displayed instead:
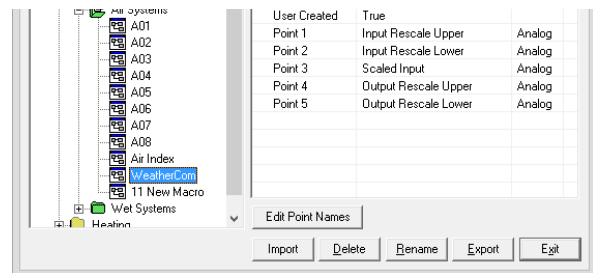
Clicking either button will open the Macro Point Name Prefix dialog as described in *How to View Macro details* on page 256.

However, if this dialog is opened from the Macro Manager as shown here instead of from the Create Macro dialog, then when OK is clicked the **Macro Template** is changed and any **Macro** instances created afterwards will use the updated pointnames list.
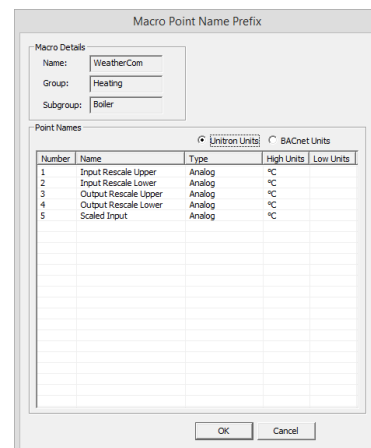
HOW TO SET MACRO SETPOINT UNIT LABELS

In the Macro Point Configuration dialog, it is possible to set labels for specific setpoint values, so that a user can for example select "Night" and "Day" for a digital setpoint, or "off", "on,", "trip" and "switch" for an analog point, without the need to know which numerical value matches each function.

To set an enumerated list for a setpoint, right-click on the setpoint in the Macro Point Configuration dialog, and select Add/Edit Enumerates .

> **Note**: This option is only available for setpoints.
>
> **Note**: This option will not be available when a Macro is being added to a strategy, or when a Macro instance is being edited within a strategy – in those cases, when the Macro Point Configuration dialog opens the user will be allowed only to select from an existing enumerated list, or to type a value.
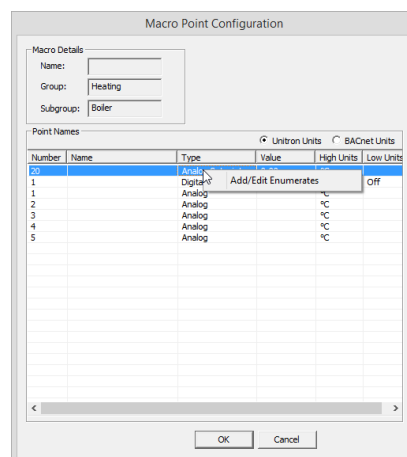
This will open the Setpoint Enumerates dialog.
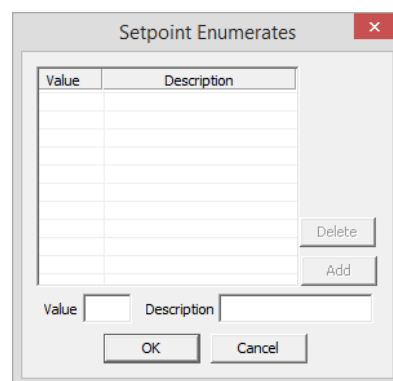
Enter a Value and Description pair, and click the Add button.
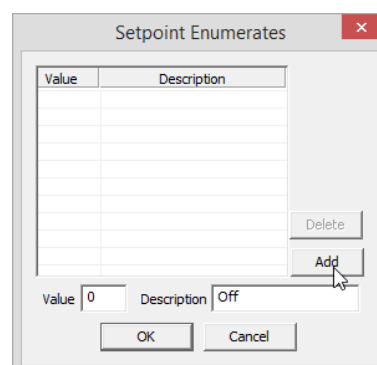
The Value/Description pair will be added to the list
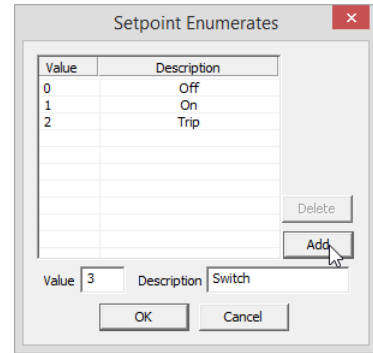
If an entry is made in error it can be removed from the list by selecting it and clicking the Delete button.
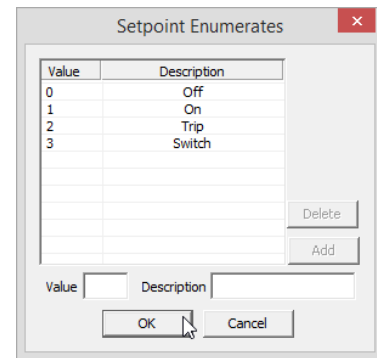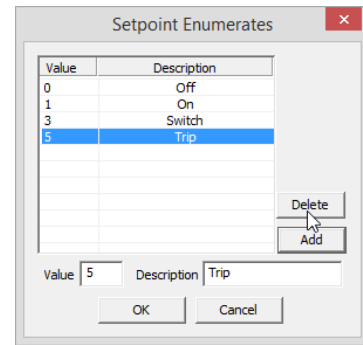
Now, when editing the setpoint, the user can select the required value from a drop-down list.
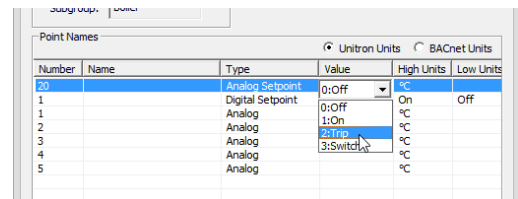
The setpoint value is displayed in the list with the text description.
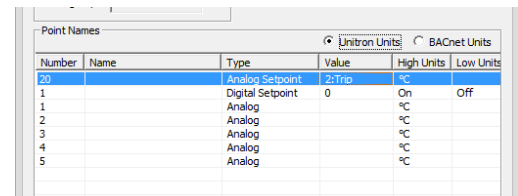
The enumerated list is saved with the Macro template, and will be available in all instances of the Macro created afterwards.

HOW TO TRANSFER MACROS FROM ONE COMPUTER TO ANOTHER

It is possible to use Macro Templates created on one PC on a different PC. They must be exported from the PC on which they are created, and added to the 'host' PC system (i.e. the PC on which they will be used) as follows:

Export macros from the PC on which they were created

Exporting Macro Templates as follows puts each Macro Template in a separate file with a user-identifiable name, so that they can be easily identified and moved to the 'host' PC system.

Click on Manager in the Macro menu.
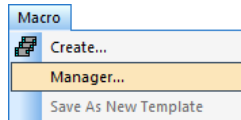
Select the Macro group that contains the Macro Templates you wish to export,
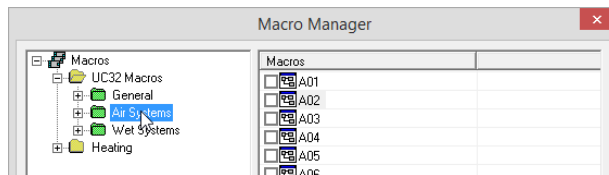
Select all of the Macro Templates within that group that you wish to export,

and click the Export button.
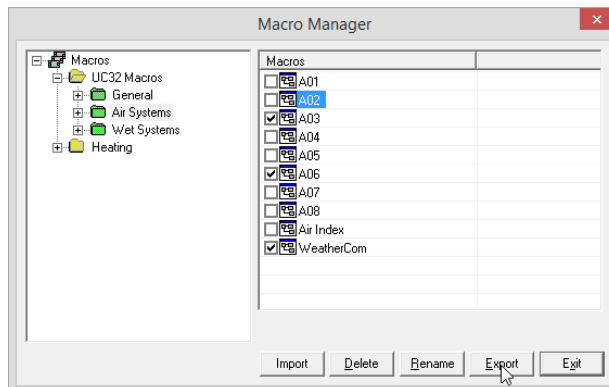
A Select Folder dialog will open. Select the location into which the selected Macros will be saved.
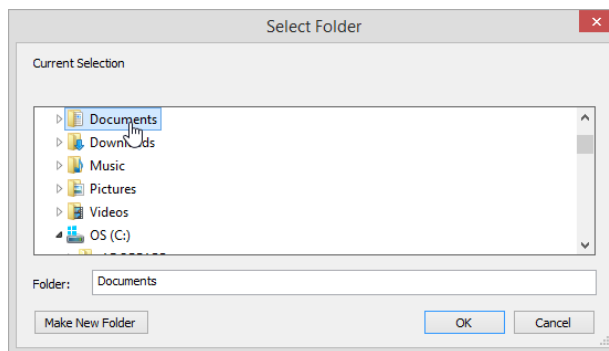
Add exported Macros to the host PC system

Once all required Macros have been exported, copy them onto the PC on which they will be used.

Click on Manager in the Macro menu.
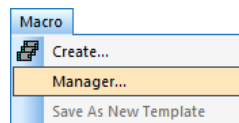
Select the group and subgroup **into** which you wish to import **Macro Template**s,

and click on the `Import` button.

In the standard **Windows** `Open` dialog. Multiple files can be selected by holding the [CTRL] key while clicking on each file.

Select the **Macro Template**s you wish to add, and click the `Open` button.

The selected **Macro Template**s will be imported into the selected group.

If the Macro Template already exists on the host PC, an alert box will be displayed identifying the group and subgroup of any duplicates.

If you wish to import any of the listed **Macro Template**s, tick the box beside its name before clicking the `OK` button. This will create a new Macro Template on the host PC, in addition to the existing duplicate.
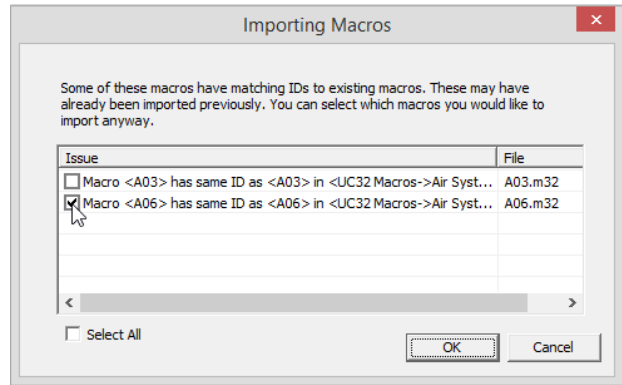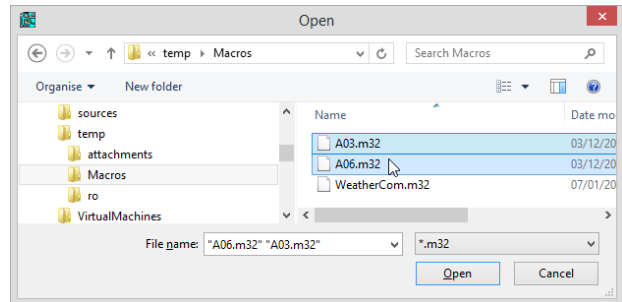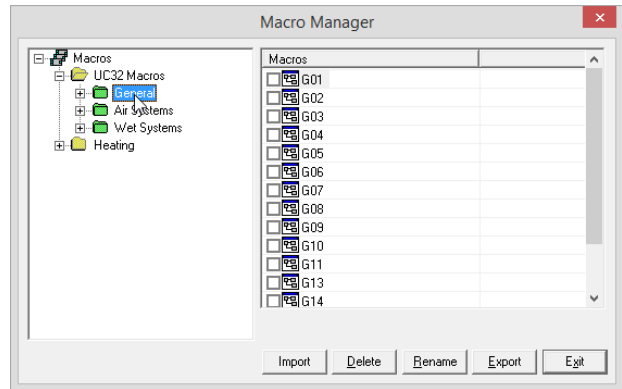
> **Note:** Each newly imported Macro Template will be named "*x* `New Macro`", where *x* is the index of the Macro Template in the list.
>
> To change this name, select it in the `Macro Manager` dialog, and click the `Rename` button.
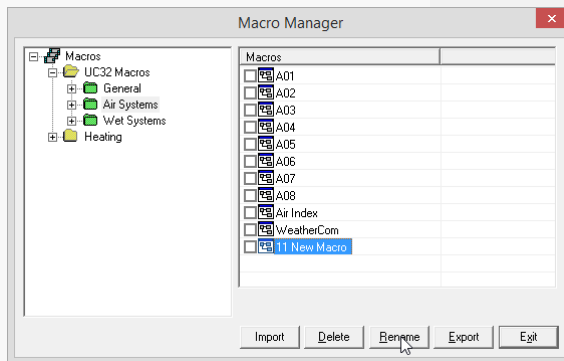
Once all **Macro Template**s have been added, they are available for use in the 'host' PC.

WORKING WITH MACROS

To access the **Macro** groups and sub groups that exist in a site, click on `Macro bar` in the `View` menu.

The `Macro bar` will be displayed under the `Toolbars`

How to insert a macro into a strategy

To insert a **Macro** in a strategy, select the strategy's group on the `Macro bar` ...
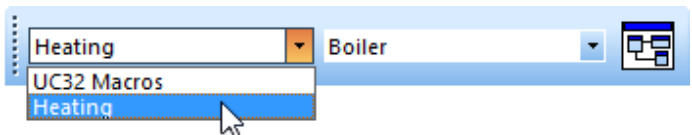
...and its `Macro Subgroup` .
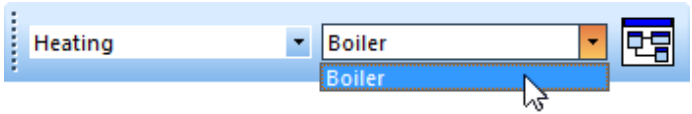
If the `floating Macro button bar` is not already open, open it by pressing the `Macros` button on the `Macro bar` .
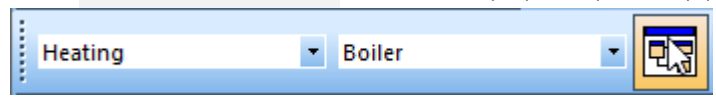
This opens the `floating Macro Buttons bar:`
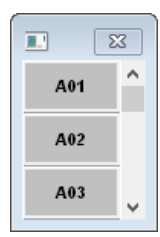
Click the **Macro** button. It will depress to show that it is selected.
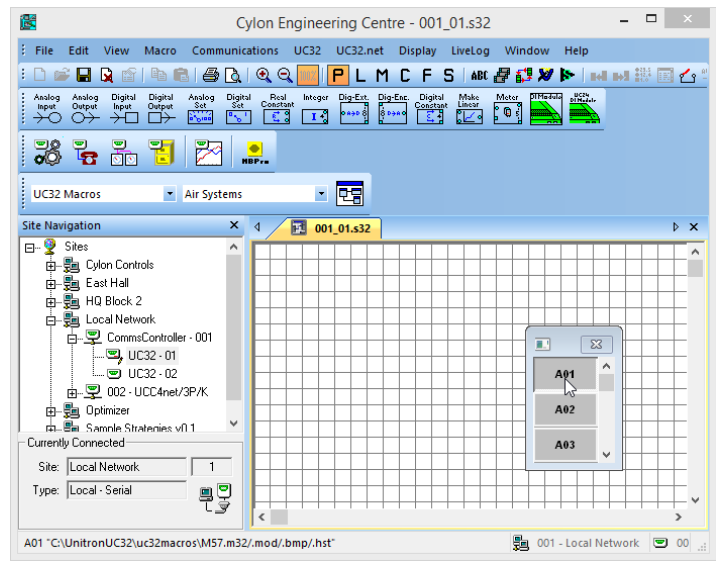
To place the **Macro** on the drawing area, click the drawing area with the mouse.
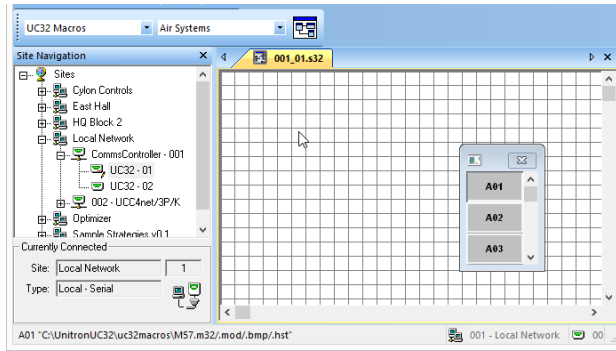
The **Macro** symbol will be positioned with its top left-hand corner on the point where the mouse was clicked.
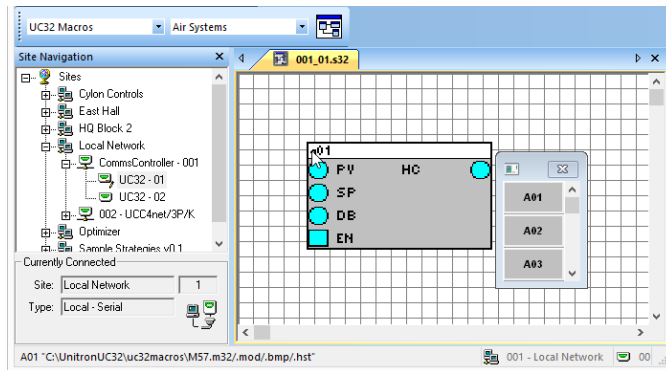
The **Macro** symbol can be renamed through the Macro Details dialog box.

How to View Macro details

To view details of the **Macro**, right click the **Macro** symbol.

This will display the Macro Details dialog box.
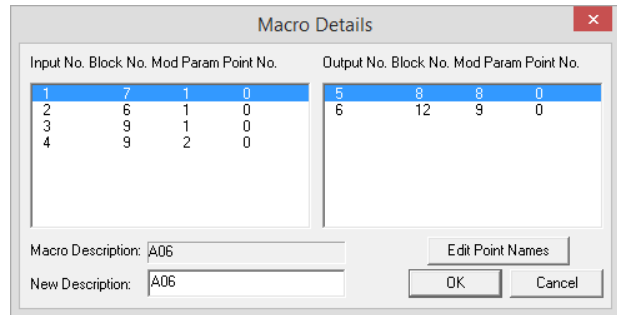
If required, enter a name for this instance of the **Macro** (displayed in the Macro symbol on the drawing area) by entering a name of 10 alphanumeric characters or less in the New   Description box.

Click OK to confirm the new name or click Cancel to close the dialog box without implementing any changes.
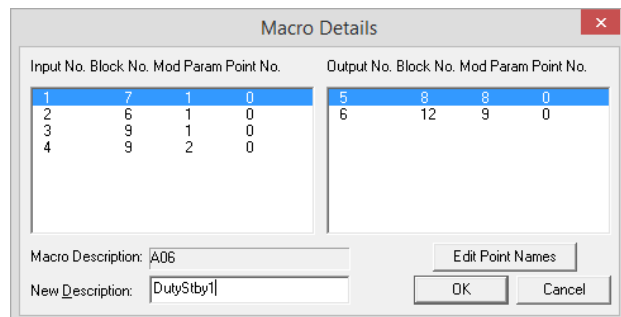
If required, you can edit point names in this instance of the **Macro** (but not in the Macro Template) by clicking on the Edit Point Names button on the Macro Details dialog box.

This opens the Macro Point Name Prefix dialog, allowing point names to be edited for the current instance.

> **Note**: If you would like to change the point names in the Macro Template, so that all future instances of this Macro will be affected, you must open the Macro Point Name Prefix dialog from the Macro Manager. See *How to rename points in a Macro Template* on page 250 for details.
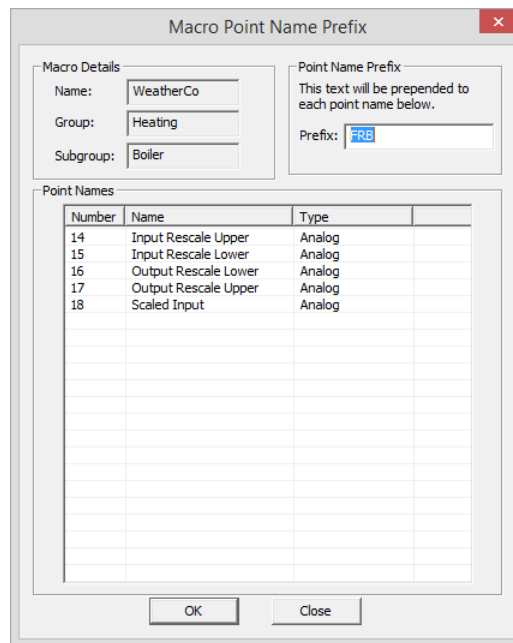
How to view the modules in a macro ("Expanding" a macro)

To expand a **Macro**, select the **Macro** symbol on the drawing area by double-clicking it.

Right click the selected **Macro** symbol.

The **Engineering Centre** will open a new **strategy** for the **Macro**'s constituent modules.
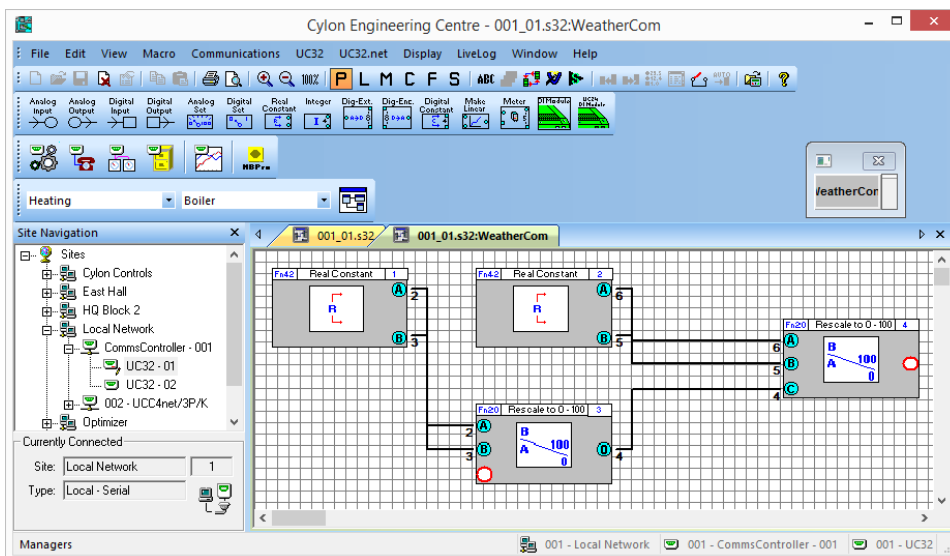
Note: The view settings for Lines and Point Numbers are saved with the Macro. They are not inherited from the parent strategy. For example, if lines are not visible when a Macro is expanded , simply right-click on the strategy drawing, select Display Options , and specify that lines are to be shown.

Note: To distinguish between the inputs and outputs of individual modules and the inputs and outputs of the overall Macro module red highlighting is used to mark the connection points of the Macro module. It also provides the full path of the strategy file that it just created when expanding the Macro in the **Window** menu.

Use the list of open files in the Window menu to jump between the strategy and the expanded Macro. Alternatively, choose Cascade , Tile Horizontal or Tile Vertical to view both the strategy and the expanded Macro simultaneously.

Note: Any changes made to a macro within a strategy will only affect the current strategy. The macro and all of its module blocks are saved within the active strategy. To edit the macro strategy itself you must open the `*.etm` file.

How to Edit a Macro

It is not possible to edit an existing Macro Template, but it is possible re-save a modified Macro as a new Macro Template.

To do this, double-click the Macro symbol on the drawing area to select it.
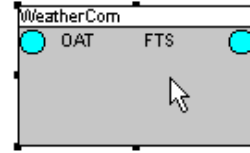
Click on the Macro symbol with the right mouse button to view the constituent modules of the Macro:
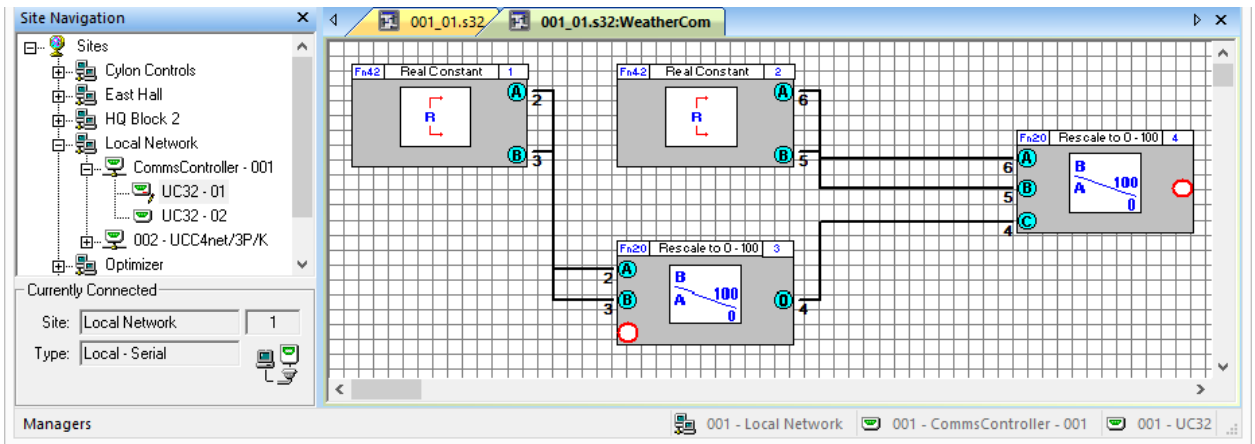
Click each individual module with the right mouse button to call its dialog box.
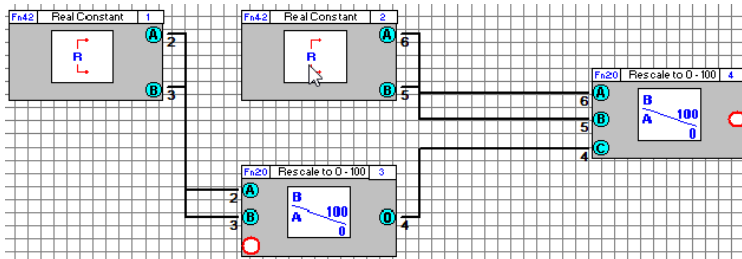
The variables associated with each module can be edited in its dialog box.
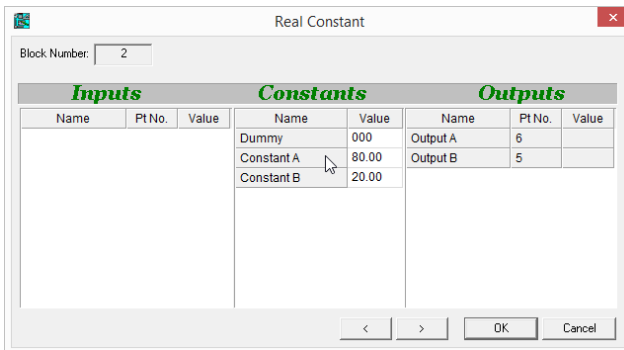
To save the changes select Save As New Template from the Macro menu.
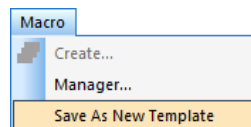
This opens the Create Macro dialog, but in this case Macro Inputs and Macro Outputs cannot be added or deleted.

The input and output point names can be changed, as can the Macro Name , Group and Sub Group .
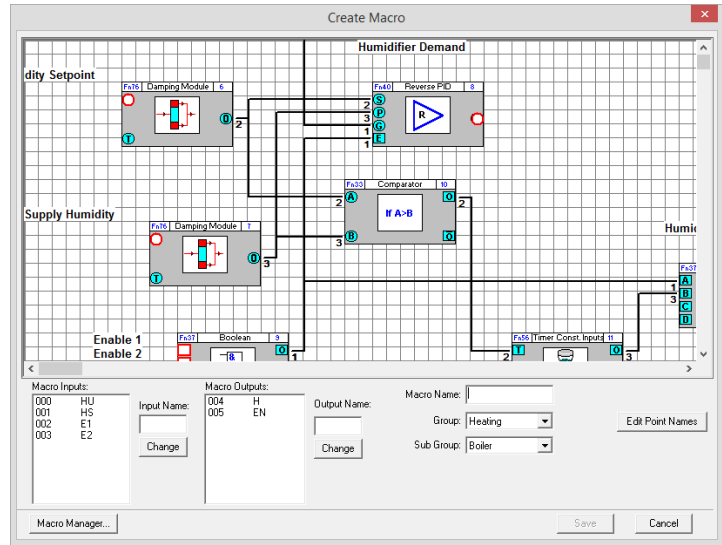
How to customize macro buttons

When you create a **Macro**, the **Engineering Centre** automatically creates a bitmap file with the same file name as the **Macro** with the extension `.bmp` (e.g. `M1.bmp`).

This file is stored in one of 2 subdirectories of the **CEC** install directory, depending on whether the controller on which it was created was a **UC32/CBM/CBT** type controller or a legacy **UC** type controller:

- [**UC32/CBM/CBT**] the `UC32Macros` subdirectory (e.g. `UnitronUC32\UC32Macros`)
- [**UC**] the `Macros` subdirectory (e.g. `UnitronUC32\Macros`).

In a bitmap editor (e.g **Microsoft Paint**), open the `.bmp` file that has the same name as the **Macro** you wish to customize.

The **Macro** button will be displayed on the drawing area of the bitmap editor, e.g.

You can now edit the bitmap to include a customized image and/or text, e.g.
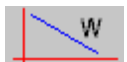
Save the modified bitmap. When the **Engineering Centre** is restarted, the bitmap will be displyed on the floating **Macro** bar.

SECTION 9 : COMMUNICATING WITH CONTROLLERS

COMMUNICATING WITH CYLON CONTROLLERS

When you are using the **Cylon Engineering Centre**, you will need to communicate with the Cylon controllers on the site.

There are two main types of controller: the Communications Controller and the Field Input/Output controller.

- You may need to **send** information **to** a controller such as a control strategy, a command to erase its memory, details of its set-up, etc.

- You may need to **get** information **from** a controller such as its version, current set-up and details of any strategies it may contain.

- You may wish to view events **within** a controller, such as changes in values when a strategy is being serviced. This can be done in **Scan** mode or by using the **LiveLog** menu option.

Note: If you have **CCView** open on the same PC that is running the Cylon Engineering Centre, make sure that 'realtime' mode is turned OFF, as it will inhibit communication with Cylon controllers.

SENDING INFORMATION TO A COMMUNICATIONS CONTROLLER

When implementing controls on your site, you may need to send the following information to its Communications Controllers:

- Details of the number of Communications Controllers on the Ethernet or ARCnet;
- Details of the number of Field Controllers on the Fieldbus;
- The number of local and wide globals in a Communications Controller.

All three can be sent to the Communications Controller by sending **Set-up** (see *Sending set-up to a Communications Controller* on page 265)

Wiping a Communications Controller's memory

If you are using **Automatic Download** (see page 190), it is not necessary to wipe a Communications Controller's memory before downloading. If you are not using Automatic Download or if you are using the controller for the first time, its memory must be wiped manually as described below.

You may wish to erase only some of the information in the Communications Controller. For example, you may wish to wipe all information from its memory except for that which refers to globals and time schedules. The Engineering Centre allows you to select the type of information to be erased from the Communications Controller.

Note: When you wipe a Communications Controller's memory, you also wipe Alarm Strings, Modem Strings, and the Site ID.

How to wipe the memory of a Communications Controller:

- Target the controller to be wiped by selecting the correct Communications Controller from the Site List.

Log in by clicking the login/logout button on the toolbar so that the gate is closed as shown below:

or by choosing **Login** from the **File** menu
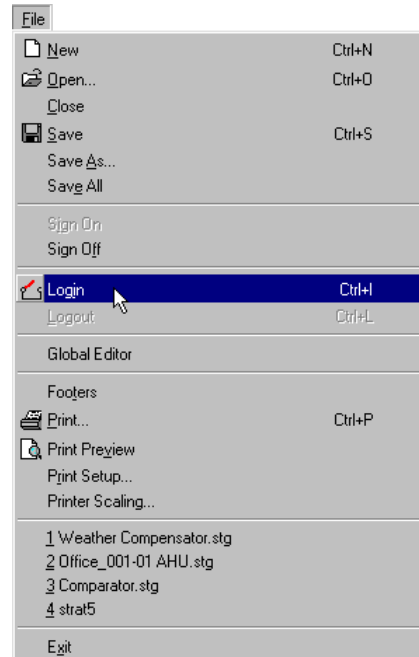
- Choose **Wipe Memory** from the **UC32.net** or **UCC4** menu. A dialog box appears prompting you to select the information that is to be wiped from the controller.

- Click the checkbox beside each type of information you would like to erase from the controller's memory. In the following example, all information in the Communications Controller, except for that relating to globals and time schedules, will be erased:
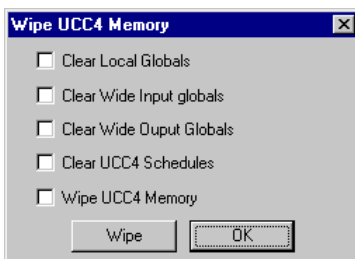
- Click Wipe to wipe the controller of the options chosen

or

- Click **OK** to close the dialog box without wiping the controller's memory.

Note: On a UCC4-type Communications Controller, to show that the memory has been wiped the green LED on will pulse rapidly. If the memory has not been wiped, the green LED will light continuously without pulsing

---

Sending set-up to a Communications Controller

Sending set-up to a Communications Controller means informing the Comms Controller of the number of Field Controllers on its Fieldbus, the number of Comms Controllers on its Ethernet or ARCnet and the number of local and wide globals it contains. If you are using **Automatic Download** (see page 190), you no longer need to send set-up to a Communications Controller after information is downloaded. However, if you are not using Automatic Download, you must send set-up to the Communications Controller in order for the strategy to be serviced. It is also necessary to send set-up to a Communications Controller before it is first used.

How to send set-up to a Communications Controller:
- Target the controller to which you wish to send set-up by selecting it in the Site List.

- Log in by clicking the login/logout button on the toolbar so that the gate is closed: or by choosing **Login** from the **File** menu

- Choose Setup from the **UC32.net** or **UCC4** menu. This calls the **Setup** dialog box. Complete the **Setup** dialog box by entering in the boxes provided the number of Comms Controllers on its Unet/ARCnet, the number of local and wide globals in the Comms Controller and the number of UCs on its Fieldbus.

- Click the **Send** button to send the set-up to the Comms Controller. A message stating "Setup sent successfully" appears in the Current Status section of the **Setup** dialog box when the set-up has been sent. In addition, the green LED on the targeted Communications Controller no longer pulses. Instead, it lights continuously.

Downloading globals to a Communications Controller

Globals (see page 304) are created like modules as parts of strategies and are downloaded to the targeted Communications Controller when the strategies in which they are contained are downloaded to their targeted UCs.

SENDING INFORMATION TO A FIELD CONTROLLER

In the Engineering Centre, downloading a strategy can be completed in a single step, when you use **Automatic Download** (see page 190). When the strategy is ready to be downloaded, simply click the download button on the toolbar or choose `Download` from the `Communications` menu and the **Engineering Centre** will download the strategy and send the set-up automatically. Alternatively, you can use **Automatic On-line Download** (see page 193), where the **Engineering Centre** automatically downloads a module as soon as it is placed on the drawing area. Or finally, if you are already familiar with the **Engineering Centre**, you can download manually.

Automatic download

For details of how to enable **Automatic Download**, refer to *Downloading a strategy using Automatic Download* on page 190.

Automatic on-line download

If you use **Automatic on-line download**, the **Engineering Centre** will download to the controller the contents of the drawing area as soon as each module is placed on the drawing area. In other words, you do not have to press the download button on the toolbar or choose `Download` from the `Communications` menu. The Engineering Centre will download automatically. For more detail see *Downloading a strategy using Automatic Online Downloading* on page 193.

The following criteria must be met for automatic on-line download to function:

- You must wipe the controller's memory before beginning the strategy.
- You must be working on-line, i.e. you must be logged in to the controller.
- You must enable automatic on-line download.
- When the strategy is completed, you must send details of the number of blocks to service to the controller, i.e. send the set-up.

Downloading tip

If you enable both options (`Automatic download` and `Automatic online downloading`) on the `Download setup` tab, the **Engineering Centre** will automatically wipe the controller's memory, download the modules as soon as they are placed on the drawing area and then automatically send the set-up. For example, supposing that you want to design a basic **Strategy**, download it and then download any changes that you make. In that case, you would enable the first option, i.e. `Automatic Download` , create the basic **Strategy** and download it by clicking the `download` button on the toolbar. The **Engineering Centre** will send the set-up automatically. Then you would enable the second option on the `Download Setup` tab, `Automatic on-line downloading` , so that each time you make a change to the original strategy or add another module, the changes are downloaded and the set-up is sent automatically.

Wiping a Field Controller's memory

Although it is no longer necessary to wipe the Field Controller's memory before downloading if automatic download is enabled, it is still necessary to wipe the controller's memory before using it for the first time. If you are not using automatic download, you must manually wipe the controller's memory before downloading.

The effect of wiping a Field Controller's memory

Wiping **Field Controller** memory has the following effect:

- All blocks are deleted (the strategy is deleted).
- The functions of the site (valves, pumps, dampers, etc. controlled by this **Field Controller**, are no longer available.)
- The number of serviced blocks will be set to zero. **Field Controller** Set-up has to be sent again.
- All virtual points are assigned the value zero.
- All hardware points are assigned the value zero.
- All outputs go to zero volts.
- Inputs do not read any signals from connected devices. This is true for manually overridden points too.
- The green LED on the **Field Controller** flashes rapidly. If the **Field Controller** is running without a network (standalone), the flashes are regular. If the **Field Controller** is running on a network (connected to a **Communications Controller**), the flashes are irregular.
- If the alarm feature is active, an alarm appears on the monitor of the connected PC.
- If a keypad program for that **Field Controller** exists, it will be deleted.
- Target points of globals are no longer updated by the **Communications Controller**.

Sending set-up to a Field Controller

If you are using **Automatic Download**, it is not necessary to send set-up to the controller after downloading. Otherwise, set-up must be sent manually as described below:

How to send set-up to a Field Controller:
- Target the controller to which you wish to send set-up by selecting the controller from the Site List (see *Targeting a controller* on page 48).
- Choose UC Setup from the UC menu. This produces the UC Setup dialog box (see *How to start a strategy (send set-up)* on page 205).

> **Note**:   When directly connected to a Field Controller that has either been 'hardware wiped' or is in its factory state, if you send a setup or wipe the UC's memory you may see a message "Checksum error in UC16 Modem RAM". This can be solved by downloading a valid set of Modem settings to the controller.

GETTING THE COMMUNICATIONS CONTROLLER VERSION

<u>How to get the version of a Communications Controller:</u>

- Target the Communications Controller whose version you want to upload by selecting it from the Site List (see *Targeting a controller* on page 48).

- Log in to the controller by choosing **Login** from the **File** menu, or clicking the **Login/Logout** button on the Toolbar. Communication is not possible unless you are logged in.

- Choose **Version** from the **UC32.net** or **UCC4** menu.

- The Engineering Centre will get the version number from the controller and display it in a dialog box.

- Click **OK** to close the Version dialog box.

GETTING THE COMMUNICATIONS CONTROLLER SETUP

The Setup of a Communications Controller includes details of the number of Comms Controllers on its Ethernet or ARCnet, the number of Field Controllers on its Fieldbus and the number of wide and local globals it may contain.

<u>How to get the set-up of a Communications Controller:</u>

- Target the Communications Controller whose set-up you want to upload by selecting it from the Site List (see *Targeting a controller* on page 48).

- Log in to the controller by choosing **Login** from the **File** menu, or clicking the **Login/Logout** button on the Toolbar. Communication is not possible unless you are logged in.

- Choose **Setup** from the **UC32.net** or **UCC4** menu.

- The Engineering Centre will get the set-up from the controller and display it in a dialog box.

- Click **OK** to close the Setup dialog box.

CONFIGURING UC32.NET-TYPE COMMUNICATIONS CONTROLLERS

Configuring the UC32.net Ports

The communications ports on a UC32.net-type communications controller can be configured directly from the **Cylon Engineering Centre** as detailed below. The ports on a **UCC4** must be configured using the **UCC4 Configuration** program.

How to configure UC32.net ports:

Click on `Port Setup` in the `UC32.net` menu. This opens the `UC32.net Port Setup` dialog. In this dialog there are up to 4 tabs:

- `Subnet port`
- `Port 1`
- `Port 2 (USB)`
- `Port 3`
- `Port 4 (Modbus)`

> **Note**: The `Port 4 (Modbus)` tab is only visible if the targeted Comms Controller is a modbus type

Each tab shows the possible configurations allowed for the related port, and has a `Send` button and a `Receive` button.

- Click on the `Receive` button to display the current settings for that port. Click on the `Send` button to change the port on the targeted **Comms Controller** to match the settings in the dialog box.

At the bottom of the dialog there is a `Send All` button and a `Close` button.

- Click the `Send All` button to immediately change all of the ports on the UC32.net to match the settings in the dialog box.
- Click on `Close` to close the dialog box without applying changes.

The parameters for each port are explained below:

Port	Function	Parameter	Purpose	Possible values
Subnet (Fieldbus) Port	Fieldbus communications	Baud Rate	Sets the speed of communication with other controllers on the Fieldbus. This value must match the baud settings in all other controllers.	1200 9600 19200 38400 76800
Port 1	Service Port Printer	Port Use	Defines what the port will be connected to.	PC Printer
		Baud	Sets the speed of communication with the equipment connected to the port. This value must match the setting in the connected equipment	300 600 1200 2400 4800 9600 14400 19200 38400 57600 115200
		Data size	Data is usually sent in 8-bit packets. However in some circumstances this can be changed. This value must match the setting in the connected equipment	5 6 7 8
		Stop bits	Sets the number of bits added to the end of a packet of data. This value must match the setting in the connected equipment	1 2
		Parity	This is used for checking the integrity of transmitted data. This value must match the setting in the connected equipment	None Even Odd Mark Space

Port	Function	Parameter		Possible values
Port 2 (USB)	Service port	Baud	Sets the speed of communication with the PC connected to the port. This value must match the setting in the connected PC for the 'COM' port representing the USB connection.	300 600 1200 2400 4800 9600 14400 19200 38400 57600 115200
Port 3	Modem with Cylon Software Printer Service port	Port Use	Defines what the port will be connected to.	PC Printer Modem Modem PPP Connection
		Baud	Sets the speed of communication with the equipment connected to the port. This value must match the setting in the connected equipment	300 600 1200 2400 4800 9600 14400 19200 38400 57600 115200
		Data size	Data is usually sent in 8-bit packets. However in some circumstances this can be changed. This value must match the setting in the connected equipment	5 6 7 8
		Stop bits	Sets the number of bits added to the end of a packet of data. This value must match the setting in the connected equipment	1 2
		Parity	This is used for checking the integrity of transmitted data. This value must match the setting in the connected equipment	None Even Odd Mark Space
		Flow Control	This value must match the setting in the connected equipment	None CTS / RTS

Port	Function	Parameter		Possible values
Port 4 (Modbus)	RS232 Modbus-Master RS232 Modbus-Slave RS485 Modbus Master	Port Use	Defines how the controller will behave towards connected Modbus equipment.	Modbus Master Single Modbus Master Multiple Modbus Slave Modbus Slave Swapped Jbus Slave Jbus Slave Swapped
		Baud	Sets the speed of communication with the equipment connected to the port. This value must match the setting in the connected equipment	300 600 1200 2400 4800 9600 14400 19200 38400 57600 115200
		Data size	Data is usually sent in 8-bit packets. However in some circumstances this can be changed. This value must match the setting in the connected equipment	5 6 7 8
		Stop bits	Sets the number of bits added to the end of a packet of data. This value must match the setting in the connected equipment	1 2
		Parity	This is used for checking the integrity of transmitted data. This value must match the setting in the connected equipment	None Even Odd Mark Space
		Drive	This is the transmission protocol used for modbus communication. This value must match the setting in the connected equipment	RS232 RS485

Configuring UC32.net Web Server Access

The configuration of a UC32.net-type communications controller can be viewed and edited with a web browser, using the UC32.net's embedded web server. In order to configure a UC32.net in this way, Web Access must be specifically enabled, and a username/password combination should be defined.

How to configure UC32.net Web Server Access

Click on **Web Server Access...** in the **UC32.net** menu. This opens the **UC32.net Web Server Access** dialog, which allows the following parameters to be set:

- Enable Web Access

If this box is ticked, then the web server will respond to configuration requests from a web browser.

- Enter a Username and Password

In this section you should enter a unique username to identify anyone who wishes to configure the controller from a web browser. A password must be entered for that user, and then must also be re-entered in the **Confirm Password** box to ensure that the correct password has been set.

- Apply to all UC32.nets on Site

Tick this box if each UC32.net on the site is to use the same Web Access settings.

Configuring UC32.net Strings

Communications controllers hold several sets of text or "string" data in memory. These include:

- **Alarm strings**, which are pieces of text that will be displayed when particular alarms arise
- **Modem Strings**, which are configuration instructions sent to modems to facilitate communication
- **Print strings**, which represent text that is to be printed alongside specified parts of an alarm message.

Each of these strings types is explained in the following sections.

- Uploading Strings from the Controller

To view the strings already set in the Comms Controller:

- Select a string type (tab)
- Specify the range of strings you want to view in the **Upload - Start Num** and **End Num** boxes
- Click on **Upload.**
- Adding a new String

To define an new string in the Comms Controller,

- click the **Add** button in the relevant tab of the **UC32.net Strings Setup dialog**.
- Enter the text of the string, and click **OK**. The string number will be assigned automatically.
- Changing a string value

To change the text of a string,

- select the string in the relevant tab, and click on **Change**.
- Enter the new text for the string, and click **OK**.

Saving the String values

To save all of the string values to disc, click the **Save Strings** button.

Downloading Strings to the controller

To download all string settings to the controller, click the **Download All** button.

To download specific strings, click on them in the strings list, and then click the **Download Selection** button.

Alarm String Values

It is possible to have alarms displayed on the supervisory PC with a message, for instance "The boiler in building 3 has overheated". These messages are defined by strings that are stored in the Comms Controller. Each alarm in a strategy can have two alarm strings associated with it – a string associated with the alarm becoming active, and a string associated with the end of the alarm.

When an alarm is triggered on a field controller, information about the alarm is sent to the Communications Controller. If the Communications Controller contains an alarm string associated with that alarm, the string will sent from the Communications Controller to the queue to which the alarm is assigned.

The association between Field Controller alarms and Comms Controller strings is made in the Strategy (see *Start Alarm and End Alarm* on 402).

Modem String Values

In order for a UC32.net to communicate with a US Robotics 56K Fax Modem, five specific strings are required:

String Number	Description	Value
1	UC ID code This is the ID string for the site.	This must identical to the UC ID code that is entered in the Site Configuration dialog in the Configuration program.
2	Initialisation string This is used to initialise the modem	~~~+++~~~ATH@~~~AT&F0&D0&K0&M0S0=2S19=5&W0@
3	Dial out string This is the command to dial the supervisory PC when an alarm occurs. It should contain the modem command to dial and the telephone number of the central PC and the @ which indicates a carriage return.	ATDT [the phone number to which alarms are to be dialled out] @
4	Hang up string This hangs up the modem.	~~~+++~~~ATH@
5	Connect string This is a piece of text that should be in the message sent back by the modem when a connection has been made.	CONNECT

Note: These strings are normally assigned using the **Cylon Dialout Program** (**CCDial**). Configuring these strings in the **UC32.net Strings Setup** dialog should only be carried out by experienced users.

Print String Values

When a printer is directly connected to the Comms Controller, the controller will send specific strings with specific parts of the Alarm in order to make the printout more readable. These strings can be defined in the **UC32.net Strings Setup** dialog. The strings numbers must match the table below:

String No.	String Function	Purpose	Example values
1	Printer Reset	This is sent to reset the printer.	
2	Alarm Date	Precedes the date and time of the alarm.	Date and Time:
3	Active Alarm	Indicates that the Alarm is still active.	This Alarm is Current
4	Non Active Alarm	Indicates that the alarm has ended.	This Alarm has ended
5	Point	Indicates the number of the point from which the alarm is coming.	Point causing the alarm:
6	Priority	Indicates the priority of the alarm.	Priority Number:
7	Field Controller System Alarm	Identifies a Field Controller system alarm.	This is a system alarm from a Field I/O Controller
8	Comms Controller System Alarm	Identifies a Comms Controller system alarm.	This is a system alarm from a Communications Controller
9	Subnet alarm	Identifies a sub-network alarm.	Sub-Network Alarm
10	ARCnet Alarm	Identifies an ARCnet alarm.	ARCnet Alarm
11	Field Controller Alarm	Identifies a control alarm.	Control Alarm
12	Net Empty	This is sent if the Ethernet or ARCnet has no Comms Controller on it, or that the Fieldbus has no Field Controllers on it.	No Controllers Present
13	Net Complete	This is sent if the Ethernet or ARCnet contains the number of Comms Controllers specified in the setup and that the fieldbus has the number of Field Controllers specified in the setup.	All Controllers present

Sending the Site Number to a Comms Controller

In order to respond properly to the Supervising PC and Cylon Engineering Centre software, and also so that UC32.netK Comms Controllers can 'see' each other on the Ethernet, the Comms Controller must be registered as being part of the correct site. The site number in the controller can be viewed or set as follows:

To View the site number currently set in the controller,

- Select Send Site Number from the UC32.net menu. This opens the UC32.net **Send Site Number** dialog.
- Click on the **Receive** button (this is not strictly necessary, as when the dialog opens Site number is automatically received. However, clicking the button will re-confirm this information if required).
- The current site number setting will be displayed in the **Current Site Number** box.

To change the site number in the controller:

> **Note**: The site number in the **Send Site Number** dialog cannot be edited directly. If the number is to be changed, it must be changed in the site definition in the Cylon Configuration utility (CCConfig).

- If this number is to be sent to all Comms Controllers at once, tick the **Apply to all UC32.nets on site** box.
- Click on the **Send** button.
- The new site number will be set in the controller

GETTING COMMUNICATIONS CONTROLLER STATISTICS

When you are logged in, you can upload statistical information from the Communications Controller by simply selecting **Statistics** from the **UCC4** menu, or **Generate Report** from the **UC32.net** menu.

UCC4 Statistics

Selecting **Statistics** from the **UCC4** menu will open the **Statistics** dialog box. The **Statistics** dialog box contains information that comes directly from the controller – this information allows you to check the status of the UCC4 and the ARCnet network

The Statistics dialog box has three tabs – System Statistics, Engineering Statistics and ARCnet Statistics.

System Statistics tab

The System Statistics tab provides the following information:

To find out	Look at
The time and date of the last time the UCC4 was reset	Last Reset
How many alarms are present in the UCC4	Number of alarms
The time and date of the last time the UCC4 was powered down	Last power down
The time and date the last time power was restored to the UCC4	Last power up

Engineering Statistics.

The Engineering Statistics tab provides the following information:

Note: A check beside each item indicates that it is functioning correctly.

To find out	Look at
How many times the system has been powered up and down	Number of resets
How many Fieldbus communications errors have been detected	Number of Fieldbus errors
If the UCC4 is correctly servicing	UCC4 servicing
If the communication ports are working correctly	Ports set-up
If the set-up information, the number of UCC4s on ARCnet, UCs on Fieldbus, etc., stored in the UCC4 is identical to the set-up information received (Each item is individually checksummed, i.e., the data received from the controller is checked against the stored value for that item)	Set-up checksum OK
If local globals are functioning correctly	Local globals checksum OK
If wide input globals are functioning correctly	Wide input globals checksum OK
If wide output globals are functioning correctly	Wide output globals checksum OK
If the UCC4 time schedules are functioning correctly	Schedules checksum OK
If daylight saving is operating	Daylight saving checksum OK
If alarms are being processed correctly	Alarm level checksum OK

ARCnet Statistics

The ARCnet Statistics tab provides the following information:

To find out	Look at
How many times the ARCnet has reconfigured itself. (If this happens regularly, the ARCnet is unstable and should be tested.)	Number of reconfigurations
How many times the targeted UCC4 has reconfigured itself.	Reconfigurations for this UCC4
How many requests to the UCC4 were not responded to.	Excessive Nacks
If there is an ARCnet board present in the UCC4.	No ARCnet board
If the ARCnet board is present and working.	ARCnet OK
To find out	Look at
If there is another UCC4 with the same address as the targeted UCC4.	Clash – other node with same address
If there are other UCC4s on the ARCnet.	Empty – no other nodes
If all 255 addresses on the ARCnet have been used.	Full – all addresses used

UC32.net Statistics Report

Selecting **Generate Report** from the **UC32.net** menu opens a dialog box in which you can select the items of information about the controller that you want to examine.

When you click on the **Generate** button, a HTML page will be displayed, which contains details of all of the selected items. The report can include:

Version & Identification	**Site number, address, identification and version of the targeted Communications Controller.**
Setup Block	Details of Fieldbus and Unet nodes relating to the targeted Communications Controller, and numbers of globals in the Controller's fieldbus.
Time & Date	The time and date stored in the controller, and the Daylight Saving setting.
Ports Setup	The configuration of each of the controller's ports.
TCP/IP Settings	The controller's IP address, port, subnet mask and gateway.
Subnet Termination Status	Whether or not the Fieldbus is terminated at the targeted controller.
Battery Status	Battery level and voltage
Hardware Platform Status	Version of the controller's hardware
Bootloader version	Version of the controller's bootloader
Keypad Configuration Settings	Whether or not the keypad configuration program is enabled in the controller, and the password required to access it.
Keypad information	Keypad type and firmware version
Alarm Strings	Number and contents of each alarm string in the controller.
Modem Strings	Number and contents of each Modem string in the controller.
Printer Strings	Number and contents of each Printer string in the controller.
Subnet Map	The address and operation status of each field controller on the fieldbus.
Unet Statistics	Packet information for traffic over Ethernet between the controller and other UnitronUC32 equipment
Ethernet Statistics	Information about overall Ethernet traffic detected by the controller
Ports Statistics	Information on traffic through each of the controller's ports.
Engineering Statistics	Diagnostic information about the operation of the controller.

SETTING THE COMMUNICATIONS CONTROLLER TIME AND DATE

When you are logged in, you can check and set the time and date in the targeted Communications Controller, and also select the Daylight Saving time scheme for it, by selecting **Time and Date** in the **UC32**.**net** or **UCC4** menu.

In the **Time and Date** dialog, you can receive the time and date set in the targeted controller, by clicking on the **Receive** button (time and date are automatically received when you first open the dialog).

The Time and Date can be changed by typing a new date,

by scrolling,

or by pressing the **System Time and Date** button, which sets the time and date to match the settings in the PC on which the Engineering Centre is running.

The daylight saving time scheme can be selected in the **Time based on** box on the Time and Date dialog:

If the **'None'** option is selected for Daylight Savings, then the controller will not automatically adjust its time to match conventional Summer and Winter time.

If the **'EU'** option is selected for Daylight Savings, then the controller will automatically adjust its time according to the standard European rules for Summer and Winter time.

If the **'US'** option is selected for Daylight Savings, then the controller will automatically adjust its time according to the standard United States rules for Summer and Winter time.

If the time and date settings have been changed in the dialog box, they must be sent to the Communications Controller before they will take effect. This is done by clicking the **Send** button:
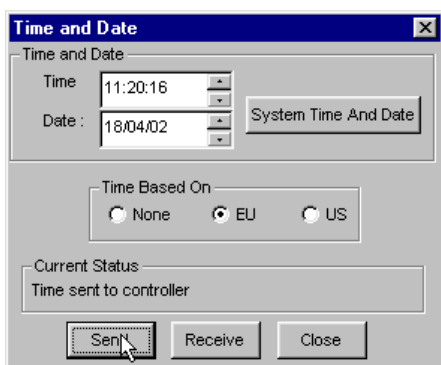
Clicking the **Close** button closes the dialog box without sending or receiving further information.

UPLOADING FROM A COMMUNICATIONS CONTROLLER - GLOBALS

If you have created local or wide globals, you can upload them as follows:

- Open a new strategy file by choosing **New** from the **File** menu or clicking the **New** button on the Toolbar.

- Select the controller from which you wish to upload information when prompted by the Engineering Centre (see *Targeting a controller* on page 48).

- Log in to the controller by choosing **Login** from the **File** menu, or clicking the Login/Logout button in the Toolbar. Communication is not possible unless you are logged in.

Select **Upload** from the **Communications** menu or click the

button on the toolbar.
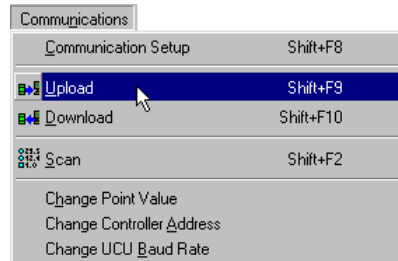
When you have clicked **Upload** on the **Communications** menu, the Engineering Centre displays the **Select Items to Upload** dialog box.

Use this box to specify which items, strategy blocks, analog or digital points and local or wide globals you wish to upload.

To upload local globals, check the **Local Globals** checkbox.
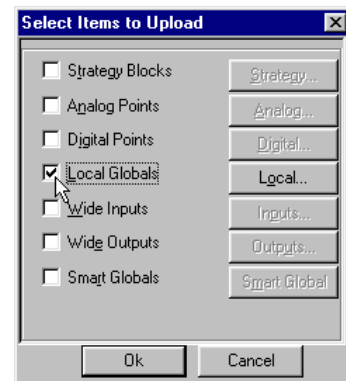
To upload Wide Input, Wide Output, or Smart globals, check the corresponding checkbox:
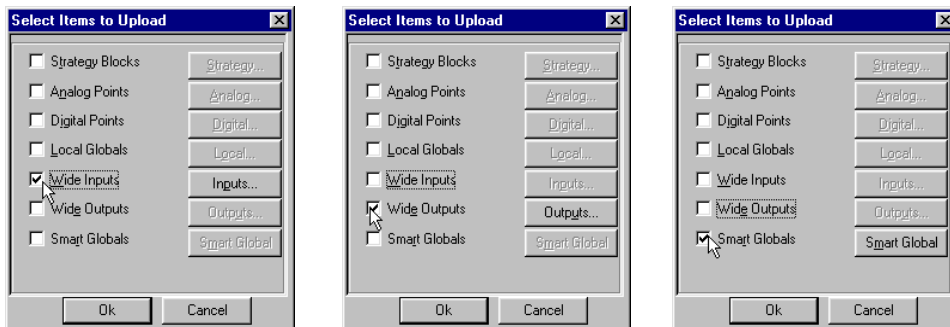
If you wish to upload a particular range of globals, instead of all available globals, click the **Locals …** button or **Wide …** button to the right of the check-boxes.

The **Globals** dialog box now appears:
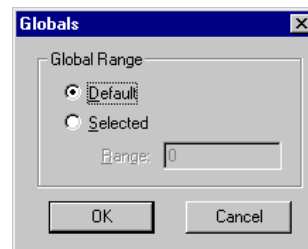
You can specify which globals are to be uploaded by clicking the Selected radio button, and entering values.

Local globals are in the range 1 to 255. Wide globals are in the range 1 to 64.
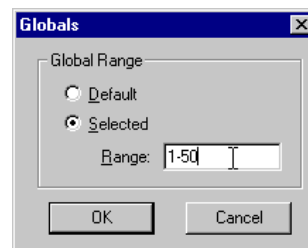
Click **OK** to close the **Globals** dialog box.
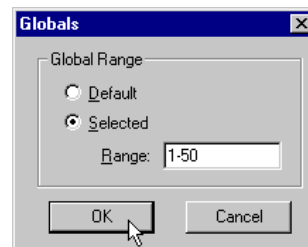
Click **OK** to close the **Select Items to Upload** dialog box.
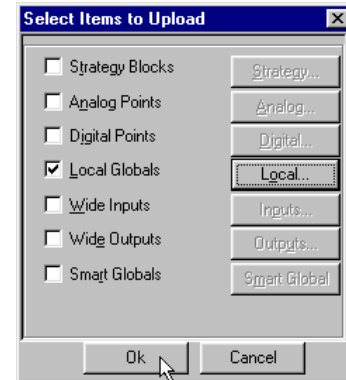
The **Uploading** window appears to show the progress of the upload.
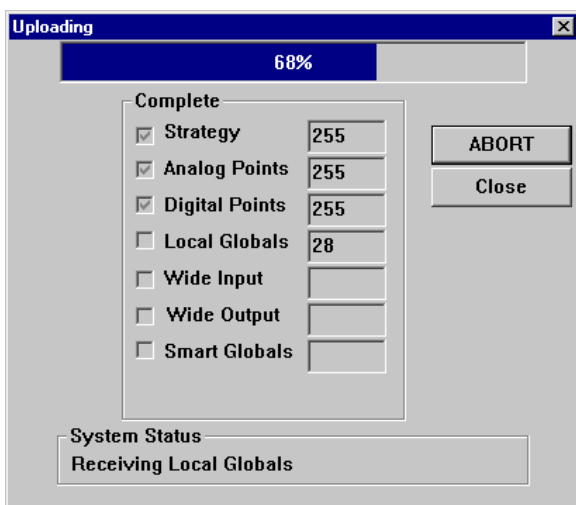
When the upload is complete, click the **Close** button to close the Uploading window.

GETTING THE UC32/UC VERSION

How to get the version of a UC32, UC or UCU:

- Target the controller whose version you want to upload by selecting the controller from the Site List (see *Targeting a controller* on page 48).

- Log in to the controller by choosing **Login** from the **File** menu, or by clicking the Login/Logout button on the toolbar. Communication is not possible unless you are logged in.

- Choose **Version** from the **UC32** or **UC** menu. The Engineering Centre will get the version from the controller and display it as follows:
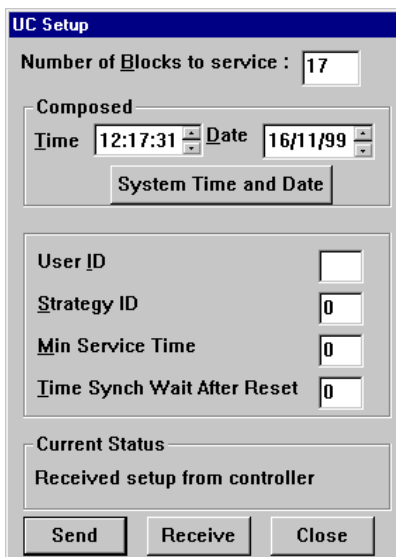
- Click **OK** to close the version window.

GETTING THE CONTROLLER SET-UP

How to get the set-up of a UC32, UC or UCU controller:

- Target the controller whose set-up you want to upload by selecting the controller from the Site List (see *Targeting a controller* on page 48).

- Log in to the controller by choosing **Login** from the **File** menu, or by clicking the Login/Logout button on the toolbar. Communication is not possible unless you are logged in.

- Choose **Setup** from the **UC32** or **UC** menu.

- The Engineering Centre will display the UC Setup dialog::

- Click **Close** to close the UC set-up window.

GETTING CONTROLLER STATISTICS

When you are logged in you can upload statistical information from the UC32, UC or UCU by clicking **Statistics** on the **UC or UC32** menu. The **Statistics** dialog box, shown below, appears. The Statistics dialog box contains information that comes directly from the controller – this information allows you to check the status of the controller:
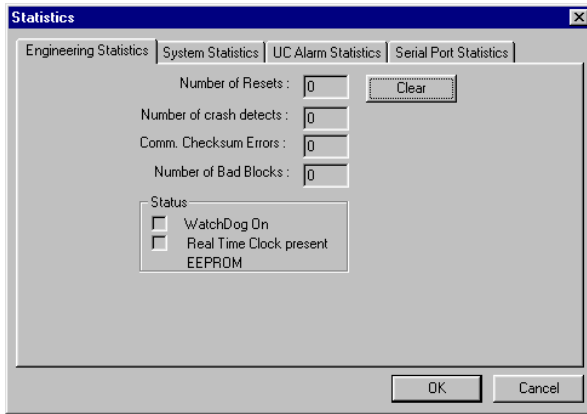
The UC Statistics dialog box has four tabs – Engineering Statistics, System Statistics, UC Alarm Statistics and Serial Port Statistics.

Note: When UC or UCU controllers are targeted, the **Serial Port Statistics** tab is not available

Engineering statistics tab

To view the information in the **Engineering Statistics** tab of the UC **Statistics** dialog box, simply click the Engineering Statistics tab:
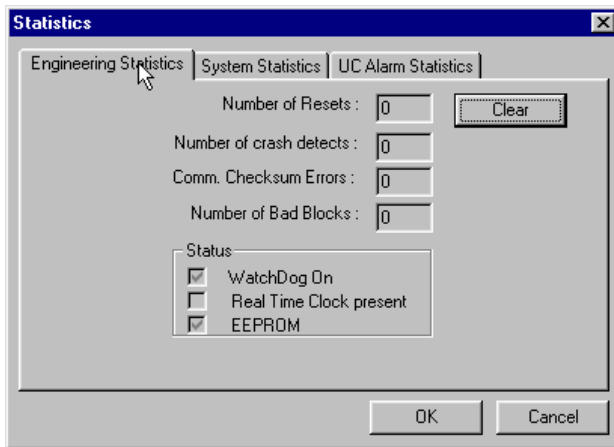
The information provided in the Engineering Statistics tab is outlined in following the table.

To find out	Look at
How many times the UC has been powered up and down	Number of resets
How many crashes in the UC have been detected	Number of crash detects
How many data errors have occurred in communications	Comm. Checksum errors
How many bad or corrupted blocks have been in the strategy	Number of bad blocks
If the watchdog is switched on (a watchdog is a hardware component in the controller that checks if the controller is serviceable. When the watchdog is off, the controller is not operating)	Watchdog on
If a real time clock is present in the UC	Real time clock present
If a controller's inputs have been calibrated (Testing of UCs includes calibration of input points. Calibration details are stored in the UC's EEPROM. If a controller's inputs have been calibrated, the EEPROM checkbox will be checked.)	EEPROM

System statistics tab

To view the information in the **System Statistics** tab of the UC **Statistics** dialog box, simply click the System Statistics tab. This tab provides information on any problems the controller may have in servicing the strategy.
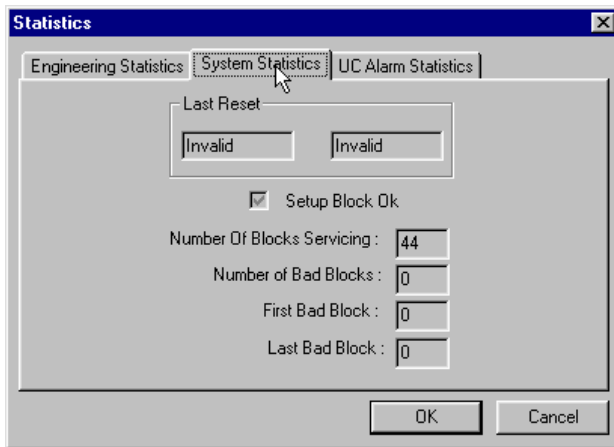
The information provided in the System Statistics tab is outlined in the following table:

To find out	Look at
The date and time that the UC was last reset	Last reset
If the Set-up block (the block in the controller that stores details of the number of blocks in the strategy) is functioning	Set-up block OK
How many blocks are servicing in the UC	Number of blocks servicing
To find out	Look at
How many bad or corrupted blocks are in the UC	Number of bad blocks
The number of the first of the bad blocks	First bad block
The number of the last of the bad blocks	Last bad block

Controller alarm statistics

To view the information in the **UC alarm statistics** tab of the UC **Statistics** dialog box, simply click the UC alarm statistics tab:
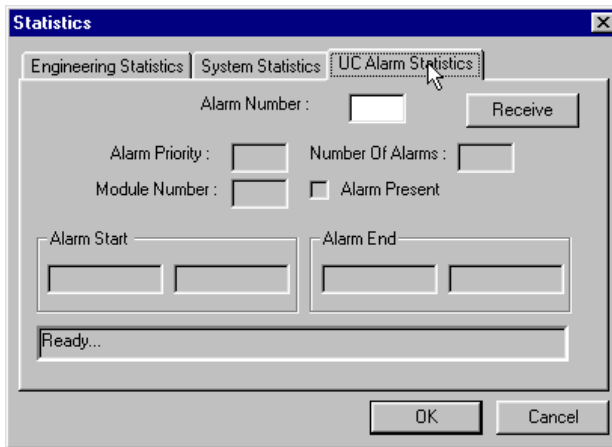
Enter an alarm number and click on **Receive**. The details of the alarm will be shown as outlined in following the table.

To find out	Look at
The number of the alarm that is reported in the UC alarm statistics tab	Alarm number
The priority of the reported alarm	Alarm priority
The number of the strategy block (module) defining the alarm	Module number
How many of alarms have been reported in the UC	Number of alarms
If an alarm is currently active	Alarm present
When the alarm first occurred	Alarm start
When the alarm ended	Alarm end

Serial Port Statistics

The **Cylon Engineering Centre** can display information about messages passing through the UC32 controller's serial ports as follows:

Clicking on the 'Serial Port Statistics' tab displays details about the numbers of each of the different types of messages that pass through any one of the serial ports on the targeted UC32 controller.
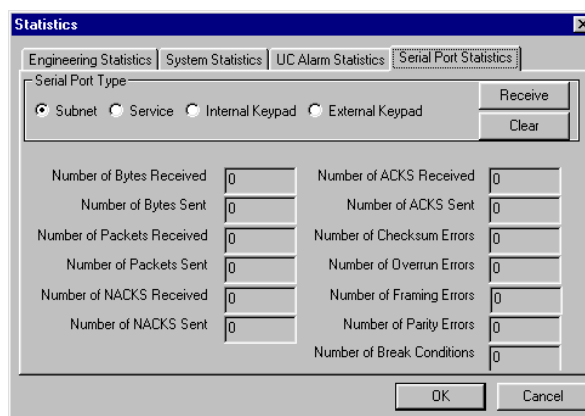
The first section of this panel, Serial Port Type allows you to select which of the four possible serial ports the displayed information refers to.
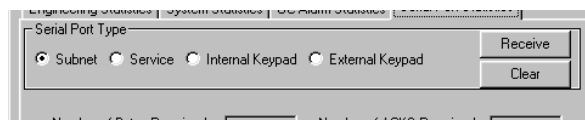
Pressing the **Receive** button causes the **Cylon Engineering Centre** to upload information about the selected port from the UC32 controller.

Clicking on **Clear** causes the UC32 controller to clear its memory of port statistics referring to the selected port.

The information displayed is the number of each of the following messages that passed through the selected serial port since the controller's memory was last cleared:

- Number of Bytes received
- Number of Bytes Sent
- Number of Packets received
- Number of Packets Sent
- Number of NACKs received
- Number of NACKs sent
- Number of ACKs received
- Number of ACKs sent
- Number of Checksum errors
- Number of Overrun errors
- Number of Framing errors
- Number of Parity errors
- Number of break conditions

This information can be used to diagnose low-level problems with the UC32's serial-port communications, and this is usually done in consultation with Cylon Technical Support.

VIEWING UC32 DIAGNOSTIC INFORMATION

The **Cylon Engineering Centre** has a facility to display information about the operation of the UC32 controller's hardware system. This information, referred to as 'board diagnostics' can be of use in troubleshooting unusual and low-level problems on a Cylon site, and is intended for use primarily when communicating with Cylon technical support.

Board Diagnostic information may be viewed by selecting **Diagnostics** from the UC32 menu in the **Cylon Engineering Centre**.
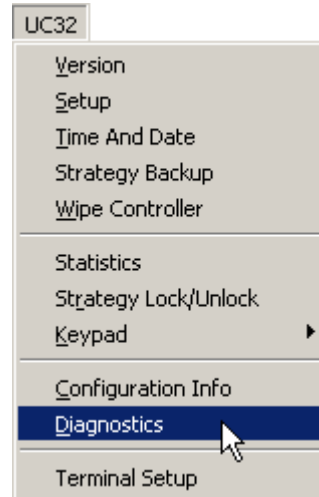
This opens a display panel showing categories of information about the UC32 controller's hardware.

Clicking on the **Receive** button causes the **Cylon Engineering Centre** to upload the relevant information from the targeted UC32 controller.
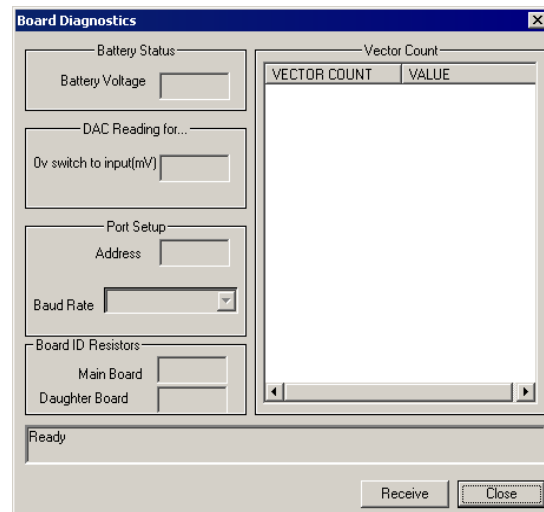
VIEWING UC32 CONFIGURATION INFORMATION

The **Cylon Engineering Centre** has a facility to display the configuration of the UC32 controller. This information, can be of use in troubleshooting unusual and low-level problems on a Cylon site, and is intended for use primarily when communicating with Cylon technical support.

Controller Configuration information may be viewed by selecting **Configuration Info** from the UC32 menu in the **Cylon Engineering Centre**.
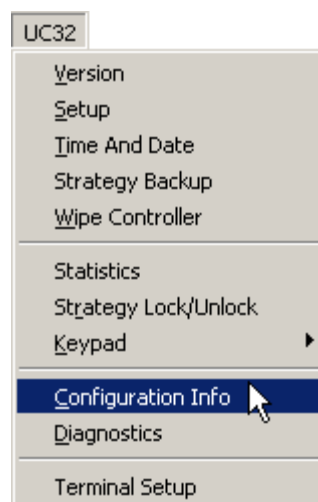
This opens a display panel showing the configuration of the UC32 controller's hardware.
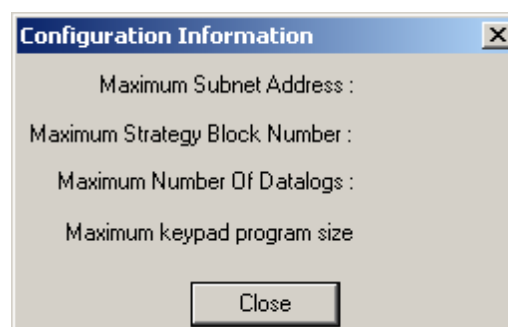
SETTING THE CONTROLLER TIME AND DATE

When you are logged in, you can check and set the time and date in the targeted controller, and also select the Daylight Saving time scheme for it, by clicking on Time and Date in the **UC32** or **UC** menu:
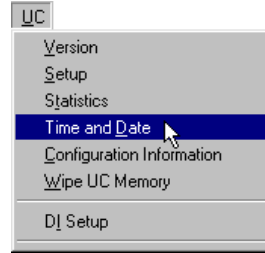
This opens the Time and Date dialog:
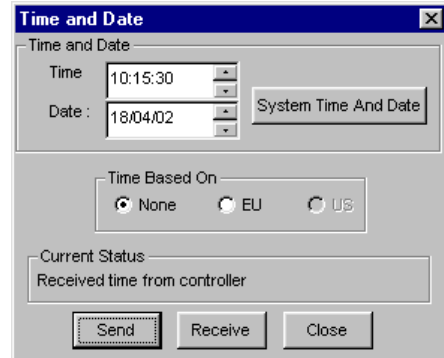
In this dialog, you can receive the time and date set in the targeted controller, by clicking on the **Receive** button (time and date are automatically received when you first open the dialog).

The Time and Date can be changed by typing a new date,

by scrolling,

or by pressing the **System Time and Date** button, which sets the time and date to match the settings in the PC on which the Engineering Centre is running.

The daylight saving time scheme can be selected in the **Time based on** box on the Time and Date dialog:

If the **'None'** option is selected for Daylight Savings, then the controller will not automatically adjust its time to match conventional Summer and Winter time.

If the **'EU'** option is selected for Daylight Savings, then the controller will automatically adjust its time according to the standard European rules for Summer and Winter time.

> **Note**:   US daylight saving time on a Fieldbus is governed by the Fieldbus's Communications Controller
> - see *Setting the Communications Controller Time and* Date on page 282)

If the time and date settings have been changed in the dialog box, they must be sent to the controller before they will take effect. This is done by clicking the **Send** button:
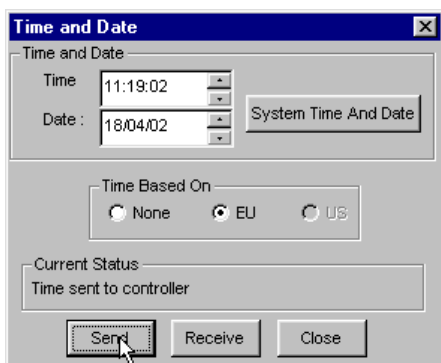
Clicking the **Close** button closes the dialog box without sending or receiving further information.

UPLOADING POINTS FROM A CONTROLLER

For detailed information on uploading points from a UC32, UC or UC32 controller, see *Uploading strategies from a Field Controller* on page 119.

UPLOADING STRATEGIES FROM A CONTROLLER

For a detailed step-by-step guide to uploading strategies from a UC32, UC or UC32 controller, see *How to upload a strategy* on page 213.

VIEWING INFORMATION UPLOADED FROM A CONTROLLER

For a note on viewing information uploaded from a UC32, UC or UC32 controller, refer to *Uploading a strategy* on page 212.

CHANGING THE ADDRESS OF A CONTROLLER (UC32 AND UCU ONLY)

UC32 and UCU controller addresses must be set from software, because there are no Controller Address DIP switches on this type of controller.

To set a controller's address from the Engineering Centre:

- Make sure that the PC, running the Engineering Centre, is directly connected to the Field Controller's service port.

- Make sure that there is a site set up in the Engineering Centre with the PC connected to Com port:
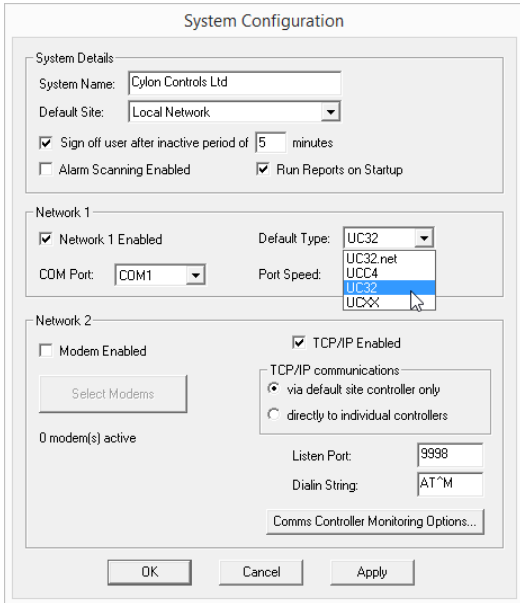
Make sure that the directly connected controller is targeted in the Engineering Centre's Site List:
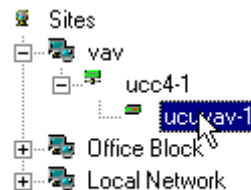
Make sure that the Engineering Centre is Logged In to the controller.

Select **Change Controller Address** from the Communications menu.
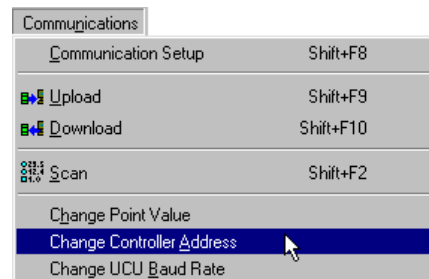
The **Change Address** dialog opens, and the address of the targeted controller is read:
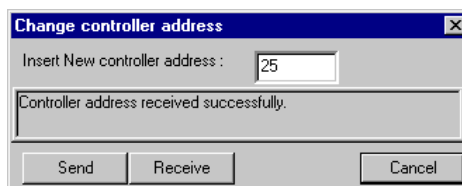
Enter the new address for the controller:
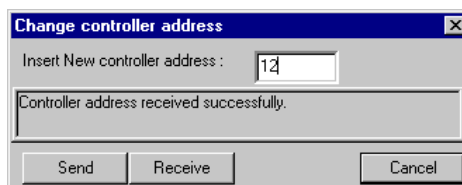
And press the **send** button
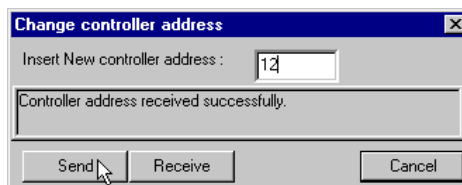
When the controller address is changed, it reports back to the Engineering Centre:
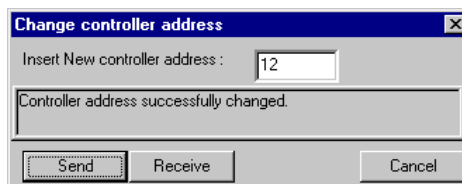
Press **Cancel** to close the Change controller address dialog

CONFIGURING THE INPUTS ON A UC16DI CONTROLLER

The UC16DI controller is a dedicated input device. It has 16 digital inputs and no outputs, and is designed specifically to global the values of those inputs to other controllers.

The UC16DI's inputs can also be inverted or manually overridden. The Engineering Centre has a facility for configuring these 'states' for each of the inputs.

To configure UC16DI controller inputs, select **DI Setup** from the **UC** menu.
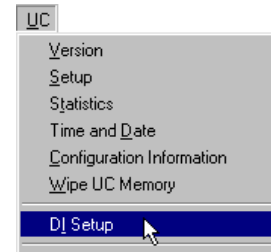
This opens the **DI Setup** dialog box.
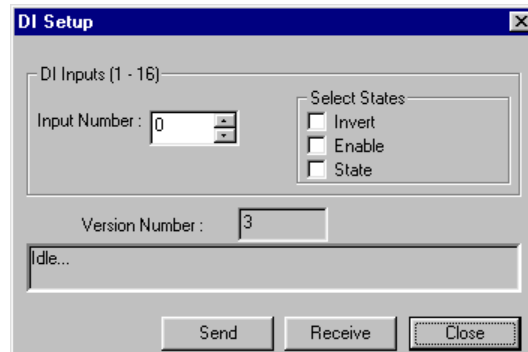
Select the input that you would like to configure.
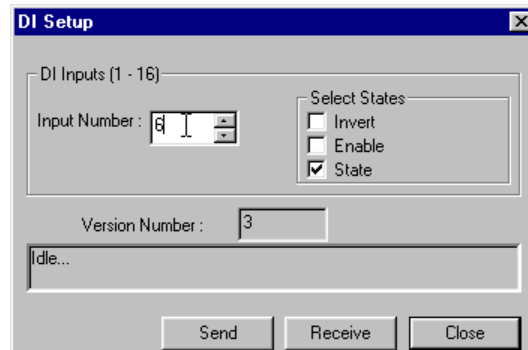
Select whether the input should be <u>overridden</u> (by ticking the override '**Enable**' box)

or <u>active</u> (by clearing the override '**Enable**' box)

If the input is active (override '**Enable**' box is cleared) then its value can be inverted if required - so that the value globalled out to other controllers is the logical complement of the value at the controllers physical input.

If the input is overridden (override '**Enable**' box is checked) then the value that will be globalled out to other controllers will be determined by the 'State' checkbox. If this is checked, then the value sent to other controllers will be logical '1'. If it is cleared, the value sent out will be '0'

When all of the required inputs have been configured, click on 'send' to download the information to the controller.
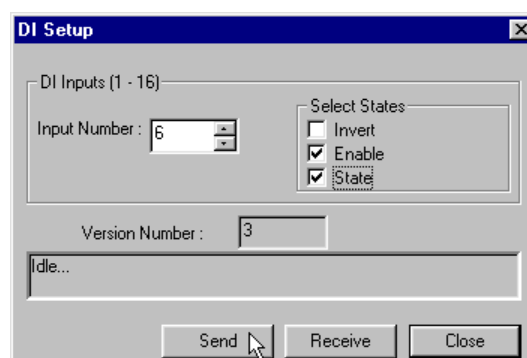
SECTION 10 : GLOBALS

GLOBALS - AN OVERVIEW

What is a global?

A global is a way of passing a value from one controller to another. It is an important means of communication within the **Cylon** Building Management System, as it allows the output of one strategy on one controller to be passed on to another strategy on another controller.

A global can pass a point or time schedule value from:

- one Field Controller to another on the same Fieldbus (a **local global**);
- one Field Controller to all other Field Controllers on the same Fieldbus (a **broadcast local global**);
- a Field Controller on one Fieldbus to a Field Controller on another Fieldbus (a **wide global**);
- one Field Controller on one Fieldbus to all Field Controllers on any or all Fieldbusses (a **broadcast wide global**).

If the global is used to transmit a point value, it can be either analog or digital depending on whether the point whose value is being transmitted is analog or digital. A global can also be used to pass a time schedule value from one controller to another.

There is also a special type of local global that combines the values of one point in several different controllers and places a calculation (maximum, minimum, average or sum) of the values into a different point in one controller. These are called "**Smart**" **global**s, and they can simplify actions such as reporting the total airflow in many VAV units, registering the maximum temperature in a complete floor of a building, etc.

Each type of global, with the exception of the broadcast globals, is presented on a floating globals bar (see page 308). Broadcast globals are created by checking the **Broadcast** checkbox that exists in each global's dialog box.

How do globals work?

To pass a point value (or time schedule) from one controller to another, you need:

- A strategy – also called the **source strategy**. This is where the point whose value is being transmitted originates. This point is called the **source** point;
- An **output global**, which you join to the output of the source strategy;
- Another strategy – called the **target strategy**. This is where the point that is receiving the value is found. This point is called the **target point** or **destination**;
- An **input global**, which you must join to the target point.

How Local Globals operate

Temperature Sensor

1 A Sensor measures the room temperature

UCC4 communications controller

3 The UCC4 extracts the temperature from the strategy.

The UCC4 transmits the temperature to one or all of the UC controllers on the sub-network.

4

2 The Strategy in the controller interprets the sensor signal, and converts it to a temperature reading.

UC Controllers
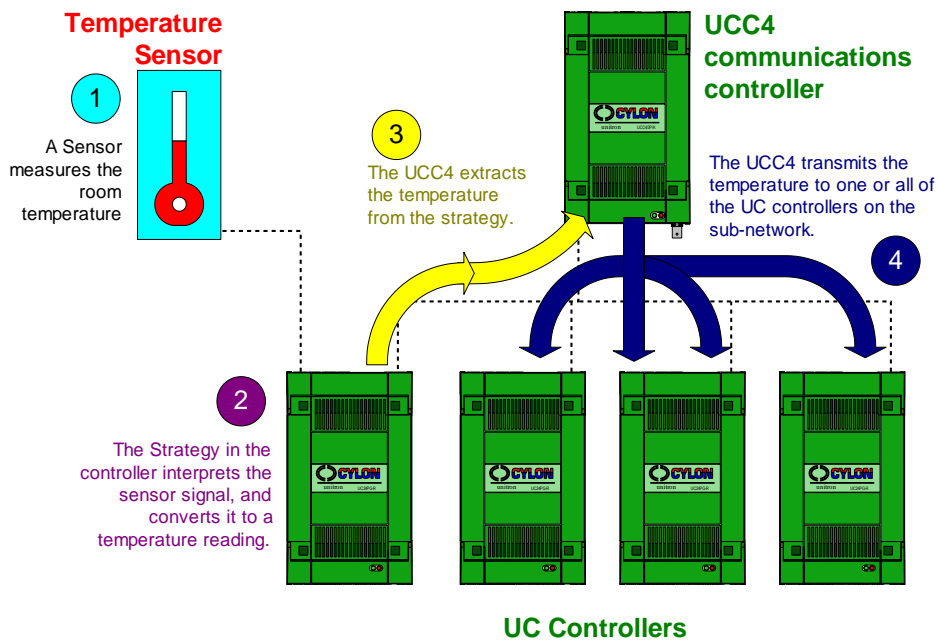
You could say that a global is made up of two halves – firstly, a source strategy with a source point and an output global and secondly, a target strategy with an input global and a target point.

Both local and wide globals work in essentially the same way. Wide globals, however, are slightly more complex. A wide global needs one more constituent part other than the source and target strategies and that is a **Unet** or **ARCnet global**. This is needed to pass the value across the Unet or ARCnet from the Communications Controller of the source strategy to the Communications Controller of the target strategy.

How Wide Globals operate

ARCnet
Terminator

**UCC4
communications
controller**

4

The UCC4 sends the information in a
Wide Output Global message to all
other UCC4s on the ARCnet network

**Temperature
Sensor**

3

The UCC4 extracts
the temperature
from the strategy.

1

A Sensor
measures the
room
temperature

2

The Strategy in the controller
interprets the sensor signal, and
converts it to a temperature reading.

UC Controllers

ARCnet Bus

**UCC4
communications
controller**

5

Each UCC4 on the ARCnet Receives the
temperature using a Wide Input Global
and transmits it one or all of the UC
controllers on its own sub-network

To more UCC4

UC Controllers

ARCnet
Terminator

The illustration below shows the source and target strategies of a local global, as they would be shown in the Engineering Centre. Both strategies can easily be viewed at the same time, using one of the **Tile** options on the Window menu.
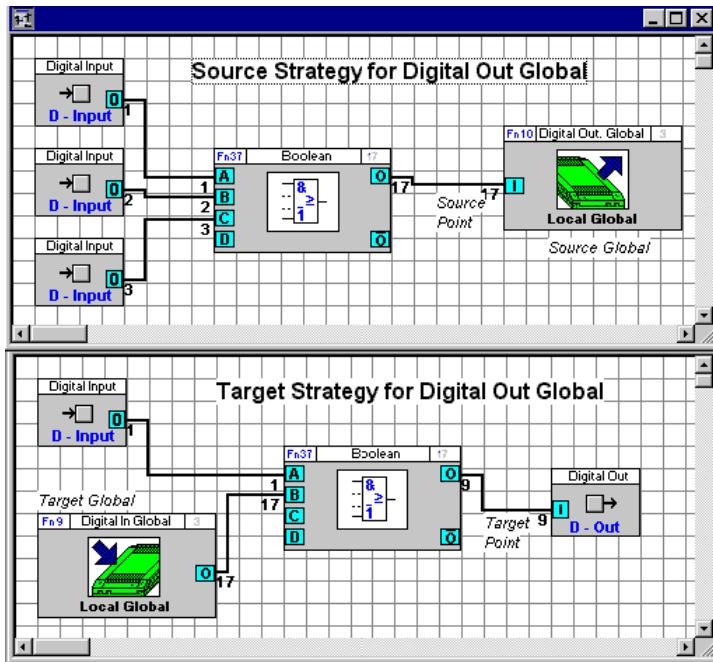
Arrangement of globals in the Engineering Centre

Like modules, globals are represented by buttons in a globals bar.

This is viewed either by clicking on the button in the toolbar, or by selecting Globals from the View menu.

The globals bar is by default docked underneath the Toolbar and Modules bar , but can be resized and moved to any part of the screen.
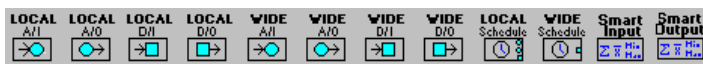
The globals bar

The table below describes the buttons that are available on the floating globals bar.

To	Click
Place an analog input local global on the drawing area (in other words to place on the drawing area a symbol that represents an analog local global passing a value to a point on the target Field Controller.	LOCAL A/I
Place an analog output local global on the drawing area (in other words to place on the drawing area a symbol that represents an analog local global receiving a value from a point on the source Field Controller.	LOCAL A/O
Place a digital input local global on the drawing area (in other words to place on the drawing area a symbol that represents a digital local global passing a value to a point on the target Field Controller	LOCAL D/I
Place a digital output local global on the drawing area (in other words to place on the drawing area a symbol to represent a digital local global receiving a value from a point on the source Field Controller.	LOCAL D/O
Place an analog input wide global on the drawing area (in other words to place on the drawing area a symbol to represent an analog wide global passing a value from the ARCnet to a point on the target Field Controller.	WIDE A/I
Place an analog output wide global on the drawing area (in other words to place on the drawing area a symbol to represent an analog wide global passing a value from a point on the source Field Controller to the Cylon Network (UNet).	WIDE A/O
Place a digital input wide global on the drawing area (in other words to place on the drawing area a symbol to represent a digital wide input global passing a value from the ARCnet to a point on the target Field Controller.	WIDE D/I
Place a digital output wide global on the drawing area (in other words to place on the drawing area a symbol to represent a digital wide global passing a value from a point on the source Field Controller to the Cylon Network (UNet).	WIDE D/O
Place a local time schedule global on the drawing area (in other words to place on the drawing area a symbol to represent a local global passing a value from a Communications Controller time schedule to a point on a target UC on the Fieldbus of that Communications Controller.	LOCAL Schedule
Place a wide time schedule global on the drawing area (in other words to place on the drawing area a symbol to represent a wide time schedule global passing a value from the ARCnet to a point on the target Field Controller.	WIDE Schedule
Place a Smart input local global on the drawing area (in other words to place on the drawing area a symbol that represents a Smart global passing a value to the Communications Controller for processing.	Smart Input
Place a Smart output local global on the drawing area (in other words to place on the drawing area a symbol that represents a Smart global receiving results from the Communications Controller.	Smart Output

LOCAL GLOBALS

Local globals

Local globals are used to transfer point values between UCs, which are connected together on the same Fieldbus of a Communications Controller. They are also used to transfer Time Schedule results (on or off) from a Communications Controller to the Field Controllers connected to the Fieldbus of this Communications Controller. There can be up to 255 local globals on a Fieldbus. Details of all of the globals on a Fieldbus are maintained by the Communications Controller.

> **Note:** Any of the points on a UC32 may be globalled, but only 255 local globals are available in total.

Types of local global

A local global can be one of three types:

- **An analog local global** *(point to point transmission)*: Source and target points are analog.
- **A digital local global** *(point to point transmission)*: Source and target points are digital.
- **A local time schedule global** *(time schedule to point transmission)*: The source is a Communications Controller Time Schedule and the target point can be analog or digital.

How local globals transmit point and time schedule values

The value contained by a local global may be passed in the Fieldbus in the following ways:

One-to-one connection

A source value (time schedule, point value) is transferred to a point in **one target UC only**. This is the common way of using local globals:

Transmitting a point value using a Local Global

UCC4 communications controller

The UCC4 extracts the point value from the strategy.

The UCC4 transmits the point value on the sub-network

The Source point is in the strategy of this controller

UC Controllers

The Target point is in the strategy of this controller
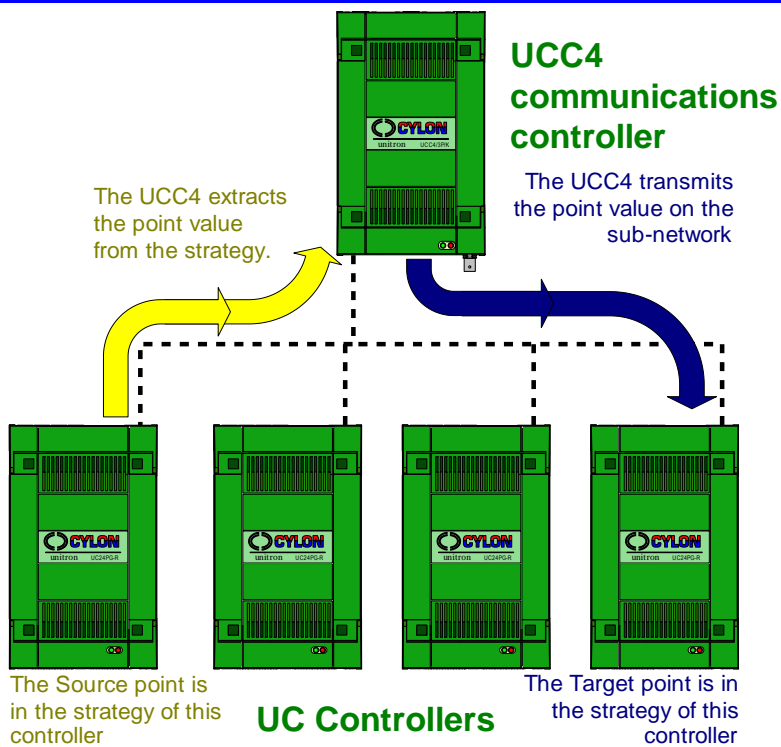
<u>One-to-N connection (Broadcast global)</u>

A source value (time schedule, point value) will be transferred to a point in **all connected UCs** on the Fieldbus ("N" represents the number of UCs on the Fieldbus). All strategies of the connected UCs must use the same point number for the shared information. This way of using local globals is effective only if the same or standardised strategies are used in all connected UCs on the Fieldbus. Globals that pass values in this way are called **broadcast globals**, as the point value is "broadcast" to the same point on every UC on the Fieldbus.

Transmitting a point value using a Local Broadcast global
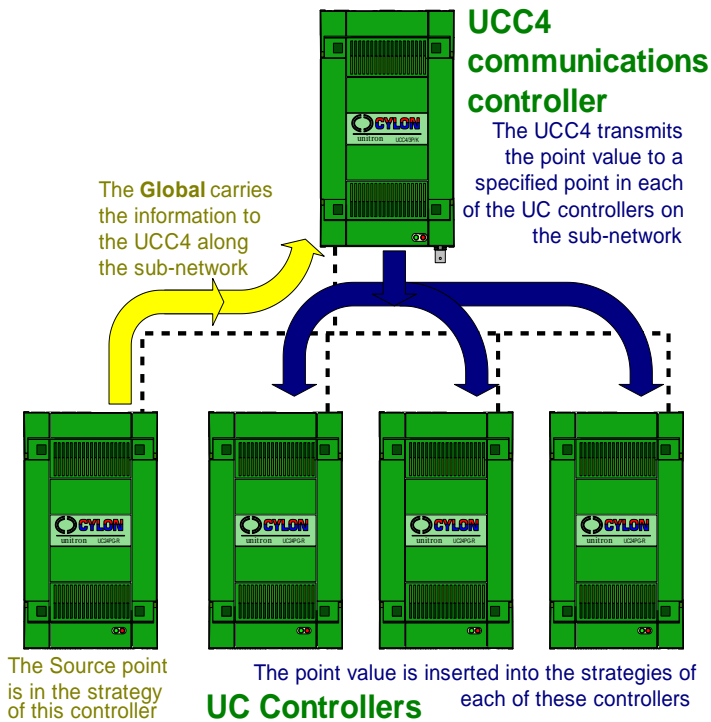
UCC4 communications controller

The UCC4 transmits the point value to a specified point in each of the UC controllers on the sub-network

The **Global** carries the information to the UCC4 along the sub-network

The Source point is in the strategy of this controller

UC Controllers

The point value is inserted into the strategies of each of these controllers

---

Note: Points numbered 1 to 16 cannot be transferred using a broadcast global, even from a UC32 controller.

Note: Points numbered above 255 can be transmitted by Broadcast global, but will be ignored by any UCxx controllers on the Fieldbus.

WIDE GLOBALS

Wide globals are used to transfer point values between UCs which are connected on different Fieldbusses in the Unet or ARCnet network. A Unet or ARCnet network can have up to 255 wide globals.

Wide globals are also used to transfer time schedule results (on or off) from a Comms Controller to the Field Controllers connected to the Fieldbus of another Comms Controller.

A Comms Controller can have up to 64 Wide Globals.

A wide global is made up of three constituent parts;

- a wide output global;
- an ARCnet global;
- a wide input global.

The wide output global takes the value from the output of the source strategy, the Unet or ARCnet global passes the value on to the wide input global which then passes the value on to the input of the target strategy.

Types of wide global

A wide global can be one of three types:

- **An analog wide global** *(point to point transmission)*: Source and target points are analog.
- **A digital wide global** *(point to point transmission)*: Source and target points are digital.
- **A wide time schedule global***(time schedule to point transmission)*: The source is a Comms Controller Time Schedule and the target point can be analog or digital.

Wide globals and the Unet / ARCnet

A wide global is made up of three constituent parts:

- **A wide output global**: A wide output global is joined to the source point in the source strategy. It takes the value of source point and sends it to the Unet or ARCnet. Each Comms Controller can send a maximum of 64 wide output globals to the Unet or ARCnet.

- **A Unet/ARCnet global**: A Unet/ARCnet global takes the value from the wide output global and passes it on to the Comms Controller at the destination. The Unet or ARCnet can accommodate a maximum of 255 such globals.

- **A wide input globals**: A wide input global is joined to the target strategy. It takes the point value from the Comms Controller and passes it on the target strategy. Each Comms Controller can receive a maximum of 64 wide input globals.

Note:	When a Unet or ARCnet global is specified as the destination of a wide output global, it can only receive values from that wide output global. No other wide output global defined in the network can pass a value to such a Unet / ARCnet global. That is, the relationship between a wide output global and the Unet / ARCnet global which has been specified as its destination is unique. This means that although each Comms Controller in the network can have as many as 64 wide output globals, the total possible number of wide output globals on a network is 255, since that is the maximum number of Unet / ARCnet globals available.

The relationship between a wide input global and the Unet / ARCnet global which is specified as its source does not have to be unique. Several wide input globals can have the same Unet / ARCnet global as their source.

How wide globals transmit point and time schedule values

The value contained by a wide global may be passed across the network in the following ways:

One-to-one connection

A source value (time schedule, point value) can be transferred to a point in **one target UC only** on any Fieldbus that has an input global to receive it. This is the most common way of using wide globals.
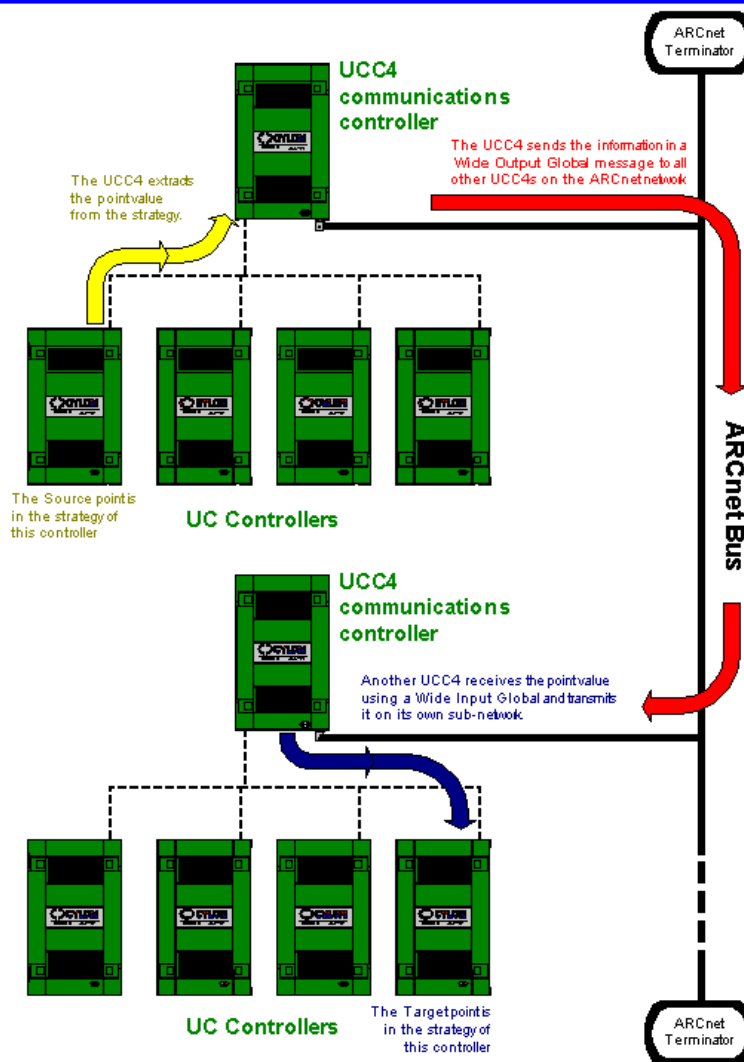
One-to-N connection

A source value (time schedule, point value) will be available to a point in **all connected Field Controllers** on any Fieldbus that has a **wide input global** set up to receive it ("N" represents the number of Field Controllers on the target Fieldbus). All **Strategies** of the connected Field Controllers must use the same point number for the shared information. This way of using local globals is effective only if the same or standardized strategies are used in all connected Field Controllers on the target Fieldbus.

Transmitting a point value using a Wide Broadcast Global
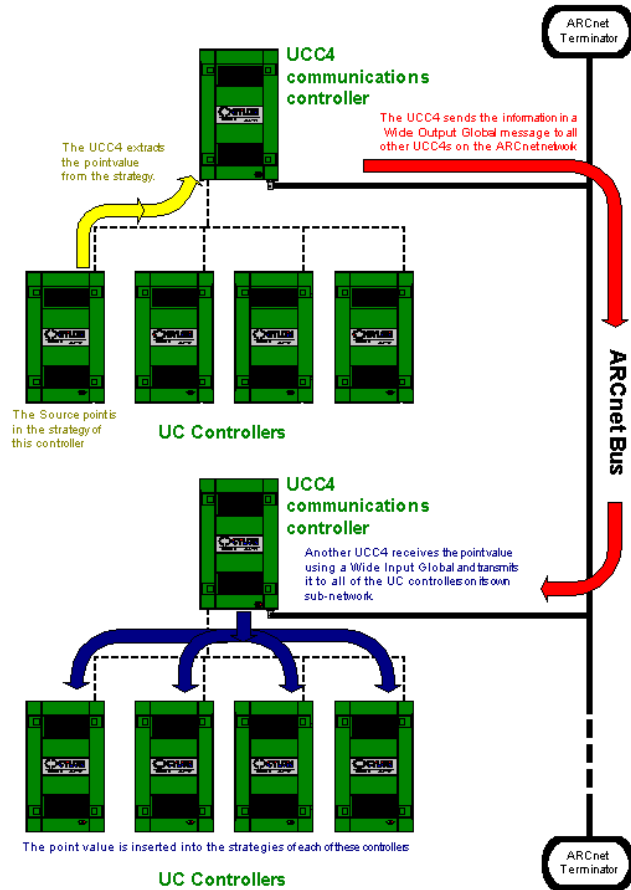
Note: Points numbered 1 to 16 cannot be transferred using a broadcast global, even from a UC32 controller.

Note: Wide Globals cannot connect directly to hardware output points.

Note: Points numbered above 255 can be transmitted by Wide Broadcast global, but will be ignored by any UCxx controllers on the receiving Fieldbus.

SMART GLOBALS

Smart Globals are a special type of Local global, in that they operate within the Fieldbus of a single Comms Controller. The difference between a "Smart" global and a "Local" globals is that the Local global takes a single point value from one controller, and assigns its value to a single point in another controller. A Smart global, on the other hand, takes the values of one point number in several controllers and places the maximum, minimum, sum, and average of those values into 4 points in one controller.

Transmitting a point value using a 'Smart' Global

UCC4 communications controller

The UCC4 combines all of the received values, and places the results in the values of 4 points in one controller.

maximum
sum
average
minimum

The UCC4 extracts the value of the same point in a number of strategies.

UC Controllers
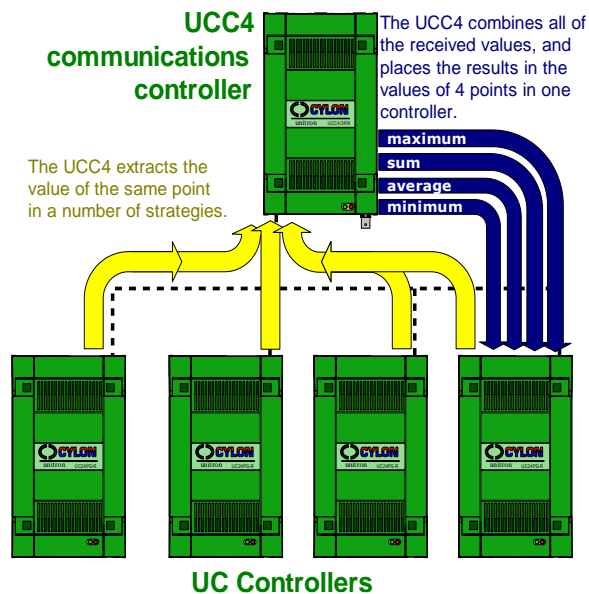
The purpose of Smart globals is to simplify tasks such as

- calculating the total airflow through a set of VAV boxes,
- determining the total power usage in a number of meters,
- switching on a boiler when heating demand in any Fancoil exceeds a set amount,
- switching on all lights on a floor if any light switch is pressed

etc.

In the Engineering Centre, a Smart global is set up by first placing a **Smart Output global module** in a single strategy, and connecting it to a point. The point number of that connected point is the number of the point that will be read in each of a number of controllers, which are identified in the **Smart output global module**'s dialog box.

When the **Smart input global module** is set up, a **Smart input global module** can be added to any strategy on the Fieldbus, and connected to points within that strategy. Those points are where the results of the Smart global will be placed.

An example of this procedure is illustrated in *Using Smart Globals in strategies* on page 350.

INCLUDING GLOBALS IN STRATEGIES

Placing a global on the drawing area

Like modules, to place a global on the drawing area proceed as follows:

- Click a global button from the floating globals bar.
- Click the drawing area.
- In the global dialog box enter the required parameters for the global. (For a guide to defining globals, see *Defining Globals* on page 376).
- Click **OK**.

Like modules, each global is represented graphically by a symbol, which is positioned on the drawing area with its top left hand corner on the point where the mouse was clicked. The example shown is an analog input local global symbol.

Joining globals to other modules

To create a global, open the source and target strategies. Place the required global in the source strategy and join it to the source point in the same way as you would join two modules (see *Joining modules in a strategy* on page 84). Similarly, in the target strategy, insert the required global and join it to the target point.

Using local globals in strategies

A global consists essentially of two halves:

- the source strategy, which includes the source point and the local output global that transmits the source point's value to the Comms Controller
- the target strategy, which includes the local input global that transmits the source point's value to the target strategy and ultimately, the target point.

To include a local global in a strategy, you must

1. Create or open the source strategy (see page 318)
2. Open the globals bar (see page 319)
3. Choose a local output global from the floating globals bar (see page 319)
4. Place the local output global on the drawing area (see page 319)
5. Complete the local output global's dialog box (see page 320)
6. Join the local output global symbol to the module (see page 324)
7. Create or open the target strategy (see page 325)
8. Select the target (see page 325)
9. Choose a local input global from the floating globals bar (see page 325)
10. Place the local input symbol on the drawing area (see page 326)
11. Complete the local input global's dialog box (see page 327)
12. Connect the local input global to other modules/points in the strategy (see page 328)

When the steps above have been completed, the global is set up. Save both the source and the target strategies by clicking **Save All** from the **File** menu.

Once saved, the global can then be downloaded and tested in the same way as you would any strategy. (See *Downloading a strategy* on page 189 and *Testing a strategy with Scan Mode* on page 207).

Local Global setup - Create or open the source strategy

The first step is to create or open the strategy which will generate the value that is to be transmitted by the local global.

If you are using an existing strategy to generate the source point, click the open button on the toolbar or click Open on the File menu. Then, in the Open dialog box, choose the file that you want to use as the source strategy

If you do not have an existing file to work from, you must create the source strategy now (see How to Create a Strategy on page 159).

To illustrate the use of a local global in a strategy, an example is shown below of a simple Boolean strategy. The output of the Boolean module is to be transmitted, via a local global, to another UC on the same Fieldbus. Since the point that is to be transmitted is a digital output point, a digital output local global is needed.
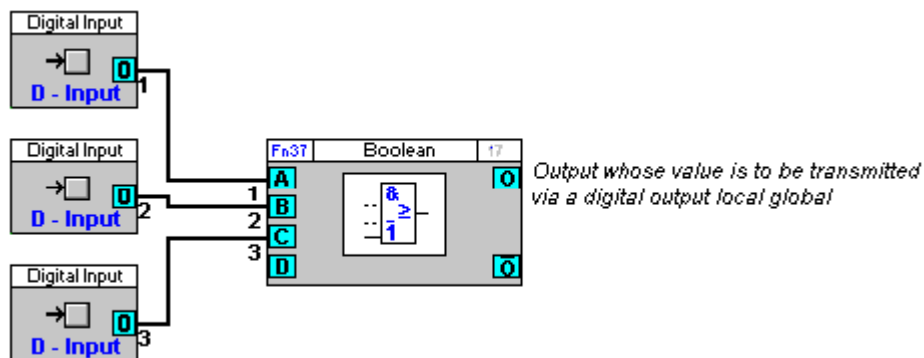
Local Global setup - Open the globals bar

Click on the

button in the toolbar, or select Globals from the view menu
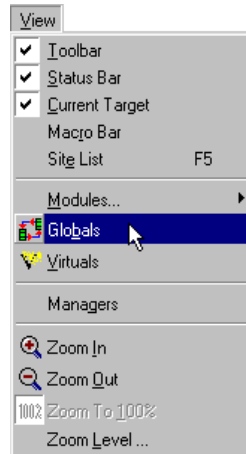
This opens the globals bar:

Local Global setup - Choose a local output global from the floating globals bar.

Choose a local global, either analog or digital depending on whether the point whose value being transmitted is analog or digital (in this example, a Digital Output is required) from the globals bar, as you would choose any module.

Local Global setup - Place the local output global on the drawing area

Place the local output global on the drawing area by clicking the drawing area once.
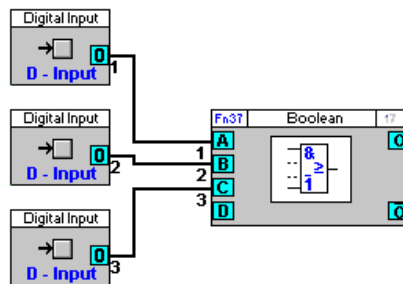
The local output **Global**'s dialog box will open:

> **Note:** As there are two parts to every global (an output and an input global), there will also be two dialog boxes (one for the output and one for the input global). Both are identical except for the sections that list the **Available Source Globals** and **Available Destination Globals**.

Local Global setup - Complete the local output global's dialog box

Much of the information in the global's dialog box is entered automatically by the Engineering Centre. Each section of the dialog box is described below, including those that are completed automatically by the Engineering Centre and those that you must complete yourself.

- UCC4

The Engineering Centre automatically enters in the UCC4 edit box the name and number of the targeted Comms Controller. In the example above, the Engineering Centre has entered the name of the Comms Controller – it is called 001-Rooftop.

- Global number

Each Comms Controller has a capacity to store 255 globals and each of those globals is given a unique number between 1 and 255. This number is assigned automatically by the Engineering Centre, starting at 1, and cannot be edited. In the example above, the global being created is the third global in the Comms Controller, so it is given the global number 3.

- Global description

The Engineering Centre automatically enters a name for each global – it includes the type of global and its number, e.g. the first local global would be called LocalGlobal_001, the first wide global would be called Global_001, etc. If you would prefer to use a name other than the one entered automatically by the Engineering Centre, simply select the text in the Global Description edit box and type in the name that you want to use. The example above shows the default name for the third local global in a Comms Controller, i.e. LocalGlobal_003.

- Service period

The Service Period (secs) is a time constant (measured in seconds) which determines how often the value of the local global is transmitted across the Fieldbus. The system guarantees that the global is updated no more frequently than this period, but it may be slower if there are many globals. Enter in the Service period (secs) edit box a value between 1 and 60. The service period in the example above is set at 5 seconds.

If the Service period is set to 0, the global is updated as fast as possible by the Comms Controller, which is usually less than 1 second.

- Default global value

The **default global value** is the value which the global will transmit to the target point if the source UC goes off-line, e.g. if there is a power cut or a break in the Fieldbus cable. You can specify a default global value by simply typing a value in the default global value edit box. This field is unavailable if the point whose value is being transmitted is a time schedule point. In this example, the default global value is *OFF*.

- Current value

When you are logged in, the **Current value** section displays the value of the source point (also the value of the target point). This value is entered automatically by the Engineering Centre and cannot be edited. In this example, the current global value is *OFF*.

- Local Input details

The **Source details** section displays the name and address of the UC that is the source of the global. It also displays the name and number of the source point. In this example, the source of the global is a UC called *001-02 AHU2*, and its address on the Fieldbus is *2.* The source point is called *global target point* and it is point number *17* on the UC*.*

- Local Output details

The **Destination details** section displays the name and address of the UC that is the destination of the global. It also displays the name and number of the destination point. In this example, the destination of the global is a UC called *001-01 AHU1*, and its address on the Fieldbus is *1.* The source point is called *global source point* and it is point number *17* on the UC*.*

- Available destination globals

When you are creating a source global, you can choose from the list of **Available destination globals** an existing target strategy and make it the target of the global you are creating. This will only be the case if you began by creating the target global and then went on to create the source global (in this example the Global was not begun in that way, so the **Available destination globals** box is empty). Remember that one source global can be used for several target globals but each target global can have only one source global.

The first time you create a local global on a particular Fieldbus, there will be no existing destination globals, so the **Available destination globals** list box will be empty. As you create more and more globals, any available destination globals will be listed here.

When the global dialog box is complete, click **OK**.
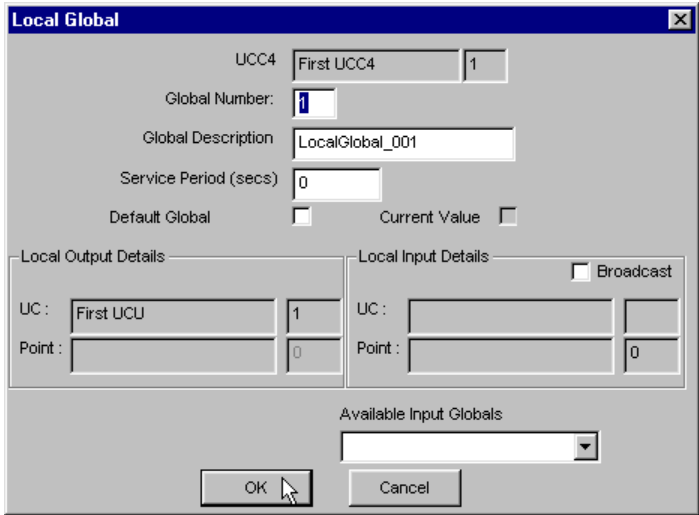
The output global's symbol will be placed with its top-left hand corner on the point where the mouse was clicked.
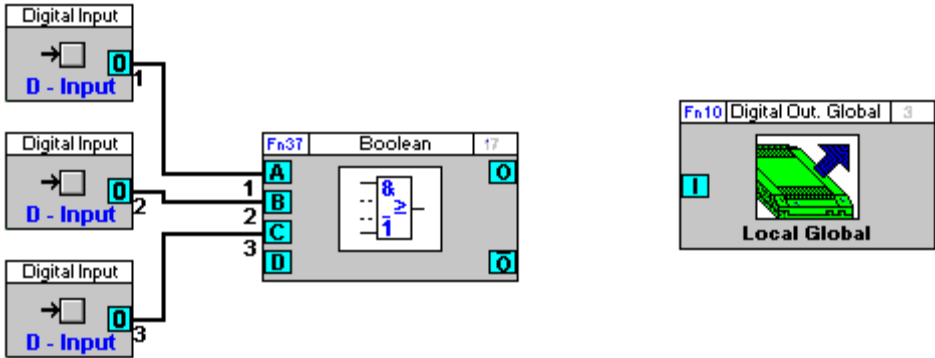
Local Global setup - Join the local output global symbol to the module

Join the local output global symbol to the output whose value the global will be transmitting. A global symbol is joined to a module in the same way that any 2 modules are joined (see *Joining modules in a strategy* on page 84).
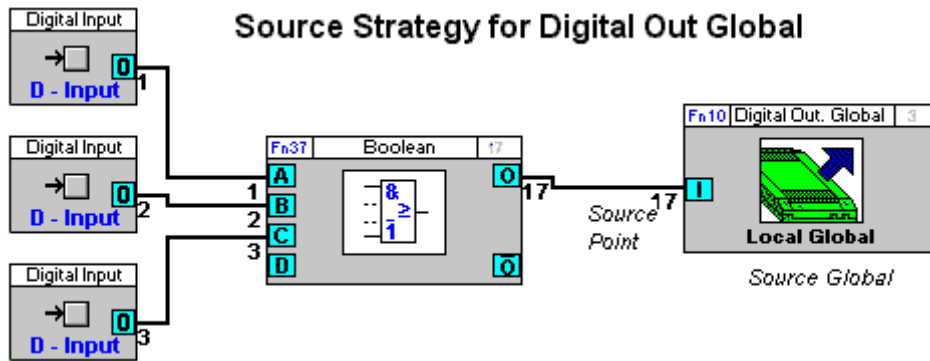
Local Global setup - Create or open the target strategy

The next step is to create or open the strategy that will receive the value transmitted by the local global.

If you are using an existing strategy as the destination, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the target strategy.

If you do not have an existing file to work from, you must create the target strategy now. To create a new strategy, click the new button on the toolbar or click **New** from the **File** menu.

Local Global setup – Select the target

Select on the Site List the UC which is to be the destination of the global. As you are using a local global, the UC that you target will be on the same Fieldbus, i.e. it will be connected to the same Comms Controller as the source strategy.
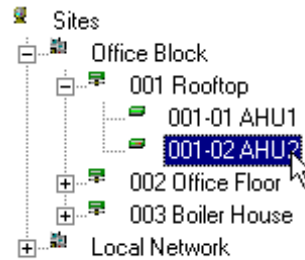
Local Global setup – Choose a local input global from the floating globals bar

From the globals bar, choose a local global, analog or digital depending on whether the point whose value is being transmitted is analog or digital In this example a Digital input is required) by clicking its button with the mouse. In this example, you need a digital input local global.

Local Global setup - Place the local input symbol on the drawing area

Place the local input global on the drawing area by clicking the drawing area.
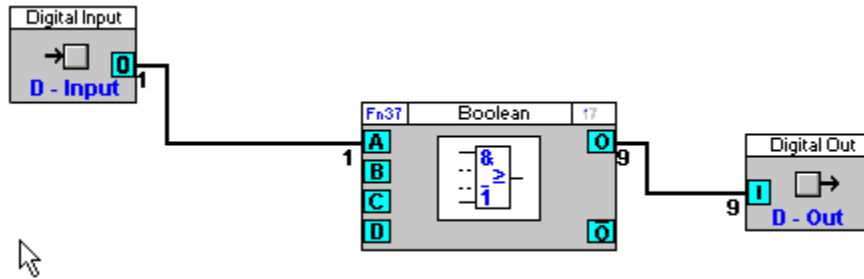
As it did when you created the source strategy, the Engineering Centre will open the local input global's dialog box.
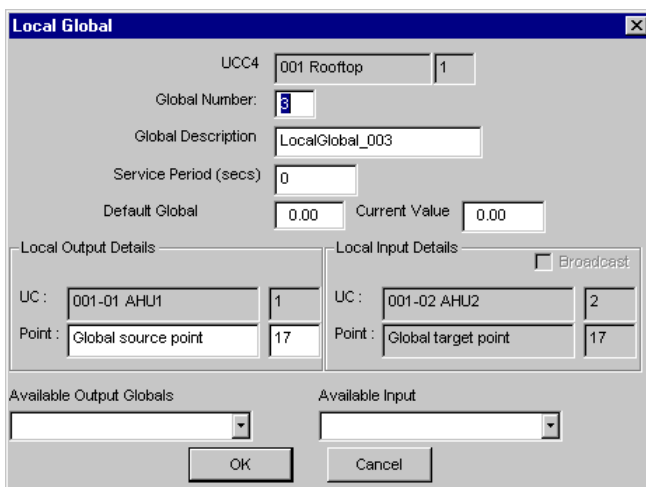
Local Global setup - Complete the local input global's dialog box

Complete the local input global's dialog box, as outlined in step 5.

The **Available source globals box** lists any source globals you have created. This means that the same source global can be used repeatedly. Simply create a target strategy, and choose the existing source strategy from the list of available source globals. One source global can be used for several target globals but each target global can have only one source global.
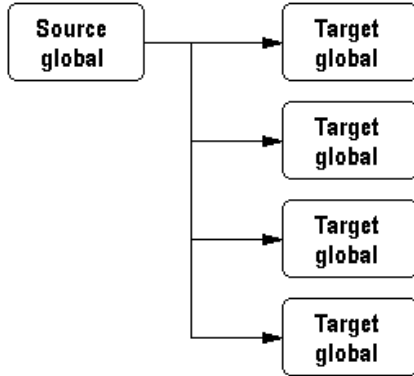
When the dialog box is complete, click **OK**.
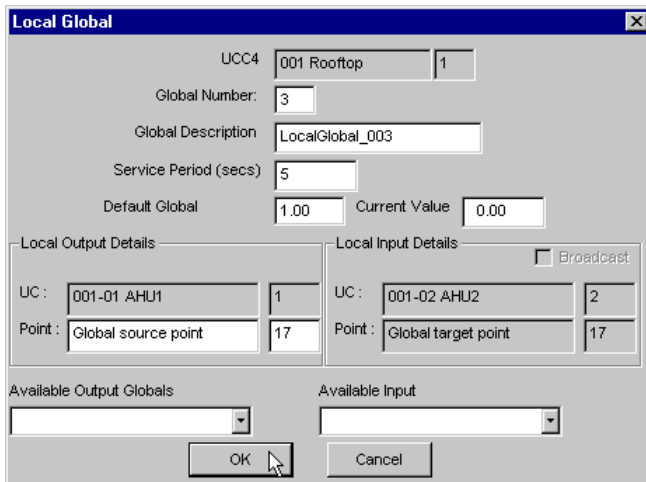
The local input global's symbol will be placed with its top left-hand corner on the point where the mouse was clicked.
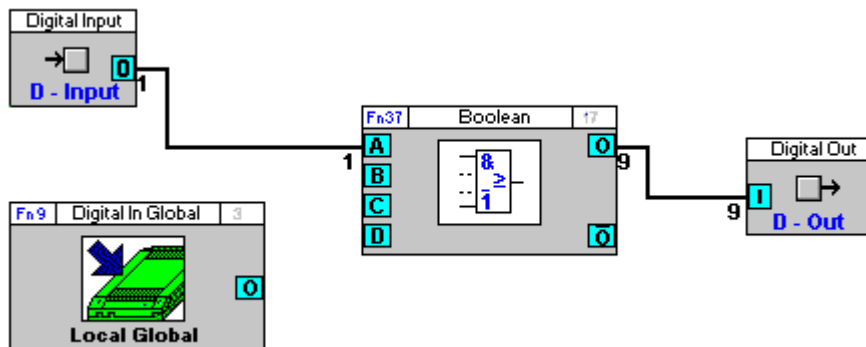
Local Global setup - Connect the local input global to other modules/points in the strategy

If your target strategy is based on an existing strategy, there will already be modules on the drawing area. Place the global in a position on the drawing area where it can easily be joined to the other modules and points in the strategy.

If the target strategy is not based on an existing strategy, i.e. it is a new strategy, you must create the target strategy by placing the required modules and input/output points on the drawing area and connecting them (see *How to Create a Strategy* on page 159).

Join the local input global symbol to the point whose value the global will be setting.

A global symbol is joined to a module in the same way that any 2 modules are joined (see *Joining modules in a strategy* on page 84).
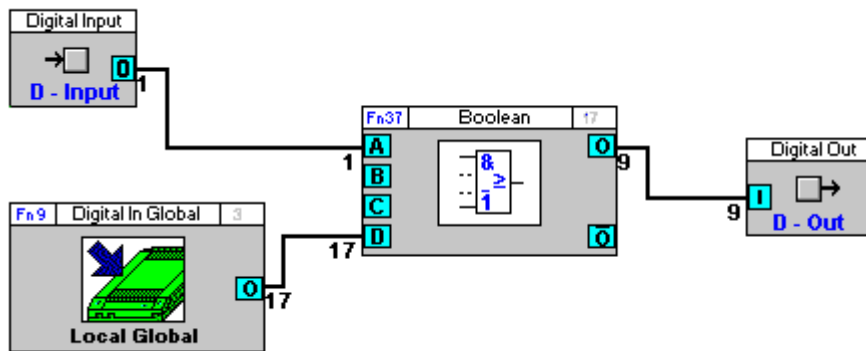
Add explanatory text if required:
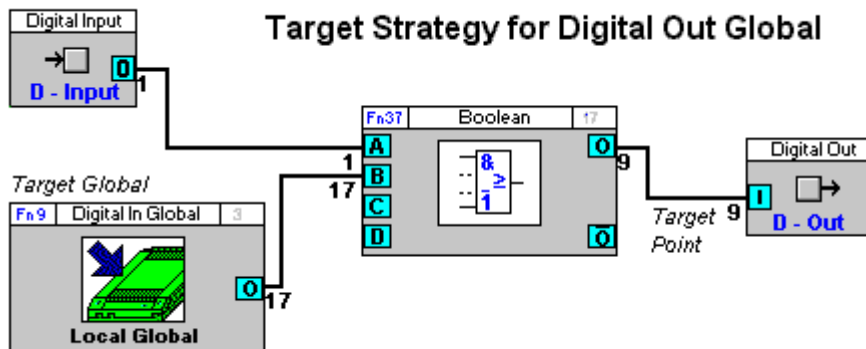
Using Wide Globals in strategies

A wide global is made up of three constituent parts:

- A **source strategy**, which includes the **source point** (or time schedule) and a **wide output global**;
- A **Unet / ARCnet global**, which passes the value of the wide output global across the Unet or ARCnet to the Comms Controller of the target Fieldbus;
- A **target strategy**, which includes a **wide input** global, that passes the value from the Unet / ARCnet global to the **target point**.

The procedure for including a wide global is the same as that for a local global. The difference lies in the completion of the wide output and wide input global dialog boxes.

To include a wide global in a strategy, you must

1. Create or open the source strategy (see page 330)
2. Open the globals bar (see page 330)
3. Choose a wide output global from the floating globals bar (see page 331)
4. Place the wide output global on the drawing area (see page 331)
5. Complete the wide output global's dialog box (see page 331)
6. Join the Wide output global symbol to the module (see page 333)
7. Create or open the target strategy (see page 334)
8. Select the target (see page 334)
9. Choose a wide input global from the floating globals bar (see page 334)
10. Place the wide input symbol on the drawing area (see page 335)
11. Complete the wide input global's dialog box (see page 336)
12. Connect the wide input global to other modules/points in the strategy (see page 337)

When the steps above have been completed, the global is set up. Save both the source and the target strategies by clicking **Save All** from the **File** menu.

Once saved, the global can then be downloaded and tested in the same way as you would any strategy. (See *Downloading a strategy* on page 189 and *Testing a strategy with Scan Mode* on page 207)

Wide Global Setup - Create or open the source strategy

The first step is to create or open the strategy which will generate the value that is to be transmitted by the local global.

If you are using an existing strategy to generate the source point, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the source strategy.

If you do not have an existing file to work from, you must create the source strategy now.

To illustrate the use of a local global in a strategy, this guide takes as an example a very simple Boolean strategy (shown below). The output of the Boolean module is to be transmitted, via a local global, to another UC on the same Fieldbus. Since the point that is to be transmitted is a digital output point, a digital output local global is needed.
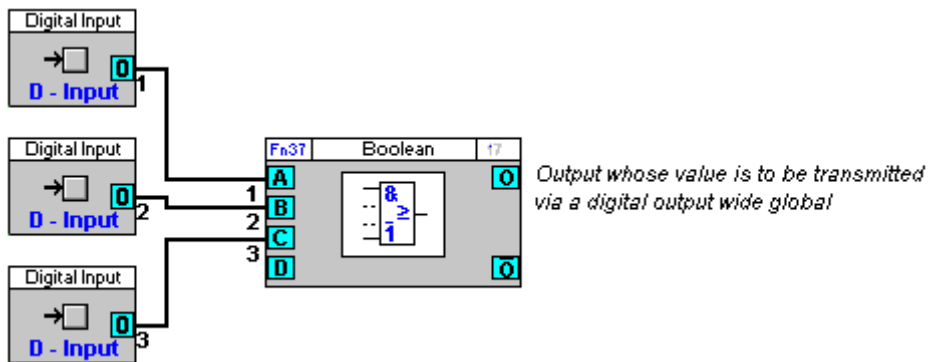
Wide Global Setup - Open the globals bar

Click on the

button in the toolbar, or select Globals from the view menu
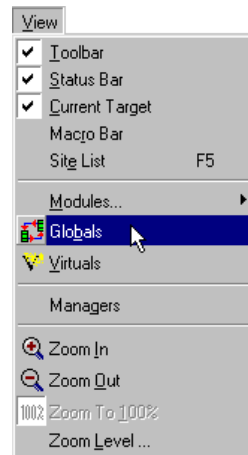
This opens the globals bar:

Wide Global Setup - Choose a Wide output global from the floating globals bar.

Choose a Wide output global, either analog or digital depending on whether the point whose value being transmitted is analog or digital (in this example, a Digital Output is required) from the floating globals bar, as you would choose any module.

Wide Global Setup - Place the Wide output global on the drawing area

Place the Wide output global on the drawing area by clicking the drawing area once.
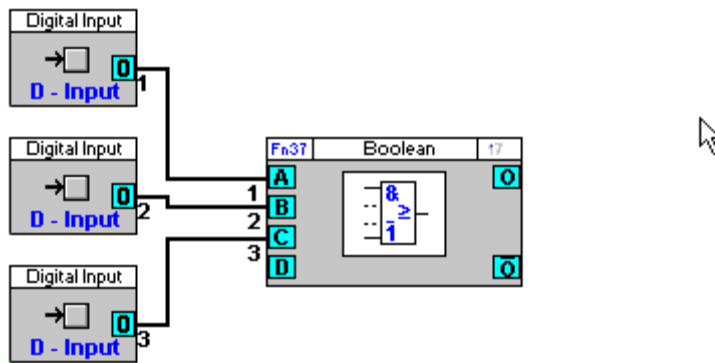
The Engineering Centre will open the wide output global's dialog box.

> **Note:** As there are two parts to every global (an output and an input global), there will also be two dialog boxes (one for the output and one for the input global). Both are identical for the very last section – **Connect To...**.

Wide Global Setup - Complete the Wide output global's dialog box

Much of the information in the wide global's dialog box is entered automatically by the Engineering Centre. Each section of the dialog box is described below, including those that are completed automatically by the Engineering Centre and those that you must complete yourself.

- Comms Controller Details

Global number

Each Comms Controller has a capacity to store 64 wide output and 64 wide input globals and each of those globals is given a unique number between 1 and 64. This number is assigned automatically by the Engineering Centre, starting at 1, and cannot be edited. In the example above, the global being created is the first global in the Comms Controller, so it is given the global number *001*.

Global type

The Engineering Centre automatically enters the type of global that is being created.

Comms Controller

The Engineering Centre automatically enters in the Comms Controller box the name and number of the targeted Comms Controller.

UC

The Engineering Centre automatically enters the name and number of the targeted UC in the UC box.

Point

The Engineering Centre automatically enters in the Point box the name and number of the source point.

- ARCnet Details

Number

The ARCnet network has the capacity to store 255 globals. This number is assigned automatically by the Engineering Centre, starting at 1, and cannot be edited.

Description

The Engineering Centre automatically enters a name for each Unet/ARCnet global – it includes the type of global and its number, e.g. the first local global would be called LocalGlobal_001, the first wide global would be called Global_001, etc. If you would prefer to use a name other than the one entered automatically by the Engineering Centre, simply select the text in the Description edit box and type in the name that you want to use.

Default value

The **default value** is the value the ARCnet global will transfer to the target point if the source is unavailable, e.g. if there is a power cut or a break in the network cable. You can specify a default global value by ticking or clearing the default value check box. This field is unavailable if the point whose value is being transmitted is a time schedule point.

Current value

When you are logged in, the **Current value** section displays the value of the source point (also the value of the target point). This value is entered automatically by the Engineering Centre and cannot be edited

Connect To...

The **Connect To...** section shows all wide input globals, i.e., target globals, that have and have not been associated with a wide output global. If you want one of the available destinations to be the destination of the global that you are creating, click the **Show Free Globals** radio button to display the available Wide Input globals and click the required global so that it is highlighted in blue. If you do not want a highlighted destination to be the destination of the global that you are creating, click the **Show Current Connections** radio button and click the global in the **Connect To**... box to disconnect it.

> **Note**: Clicking the **Show all Wide Inputs (Connected and Free)** radio button will display all globals, whether connected or not.

When the global dialog box is complete, click **OK**.

The output global's symbol will be placed with its top-left hand corner on the point where the mouse was clicked.
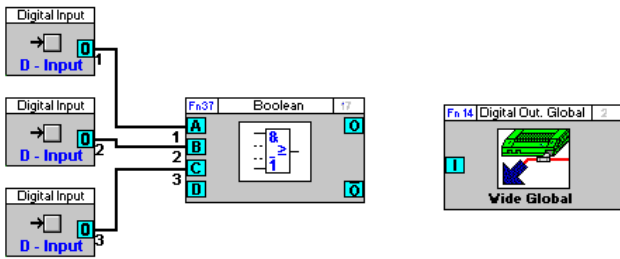
Wide Global Setup - Join the wide output global symbol to the module

Join the wide output global symbol to the output whose value the global will be transmitting. A global symbol is joined to a module in the same way that any 2 modules are joined (see *Joining modules in a strategy* on page 84).
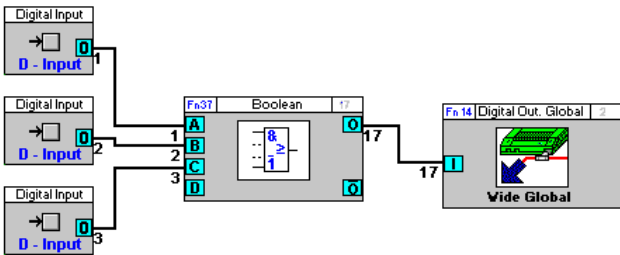
Wide Global Setup - Create or open the target strategy

The next step is to create or open the strategy which will receive the value that is to be transmitted by the local global.

If you are using an existing strategy as the destination, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the target strategy.

If you do not have an existing file to work from, you must create the target strategy now. To create a new strategy, click the new button on the toolbar or click **New** from the **File** menu.

Wide Global Setup - Select the target

Select on the Site List the UC which is to be the destination of the global. As you are using a local global, the UC that you target will be on the same Fieldbus, i.e. it will be connected to the same Comms Controller as the source strategy.
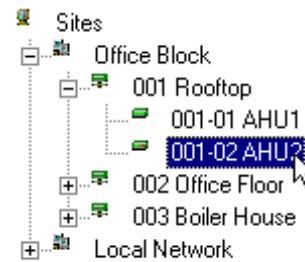
Wide Global Setup - Choose a Wide Input Global from the floating globals bar

From the globals bar, choose a wide global, analog or digital depending on whether the point whose value is being transmitted is analog or digital (in this example a Digital input is required) by clicking its button with the mouse.

Wide Global Setup - Place the Wide Input Global symbol on the drawing area

Place the wide input global on the drawing area by positioning the pointer at the part of the strategy drawing where the Wide Input global symbol is to be inserted:
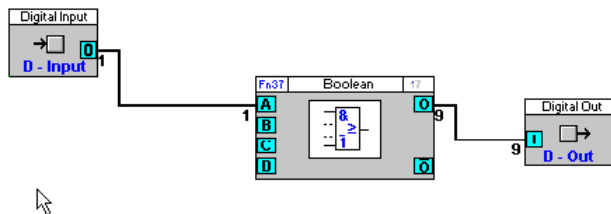
And clicking the mouse button.

As it did when you created the source strategy, the Engineering Centre will open the wide input global's dialog box.
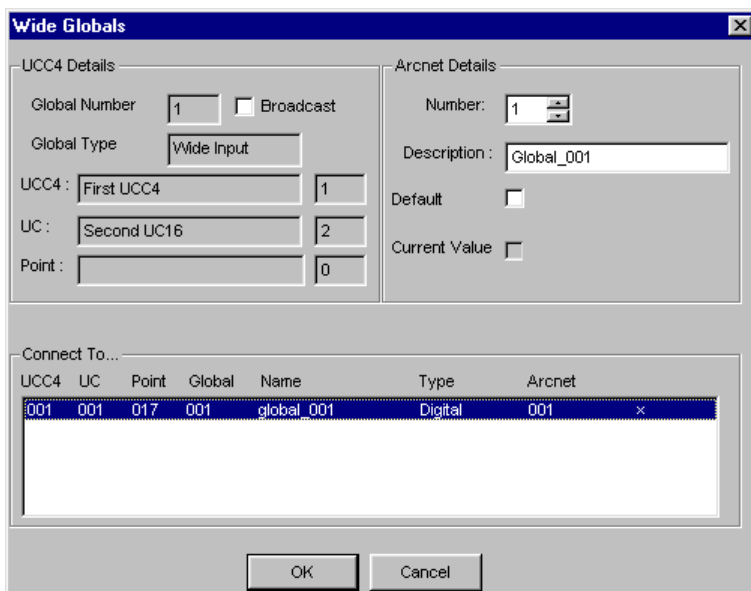
Wide Global Setup - Complete the Wide Input Global's dialog box

The dialog box for a wide input global is the same as that for a wide output global, with the exception of the last section **Connect To...**. Complete the wide input global's dialog box, as outlined in step 5, and follow the instructions below for completing the Connect To... section.

- Connect To...

The **Connect To...** section lists any wide output global, i.e., a source strategy, that has not been associated with a wide input global, i.e., a target strategy. If you want one of the available sources to be the source of the global that you are creating, click it so that it is highlighted in blue. If you do not want a highlighted source to be the source of the global that you are creating, click it again.

When the dialog box is complete, click **OK**.
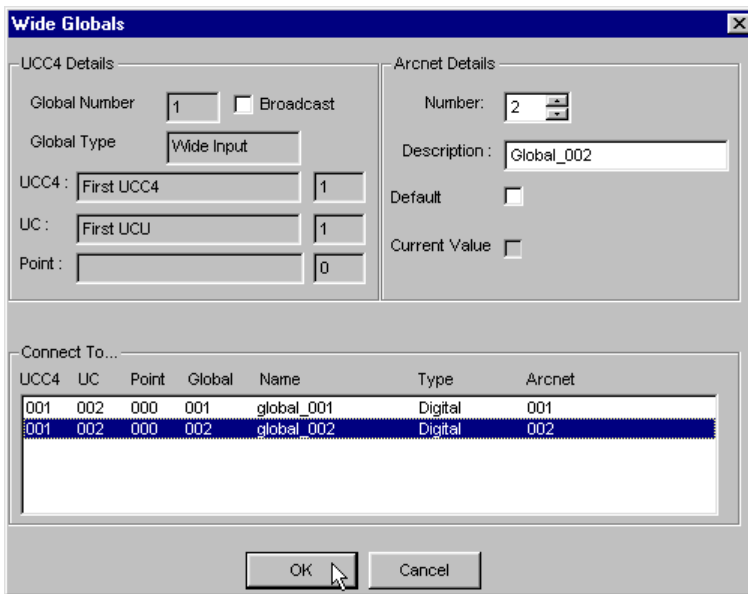
The local input global's symbol will be placed with its top left-hand corner on the point where the mouse was clicked.
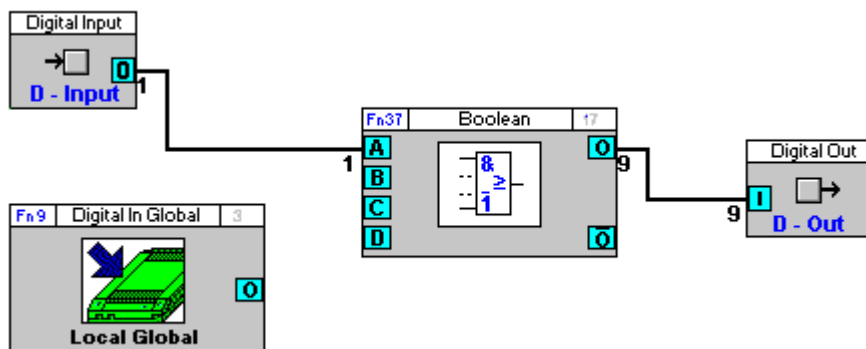
Wide Global Setup - Join the Wide Input Global to other modules/points in the strategy

If your target strategy is based on an existing strategy, there will already be modules on the drawing area. Place the global in a position on the drawing area where it can easily be joined to the other modules and points in the strategy.

If the target strategy is not based on an existing strategy, i.e. it is a new strategy, you must create the target strategy by placing the required modules and input/output points on the drawing area and connecting them (see *How to Create a Strategy* on page 159).

Join the local input global symbol to the output whose value the global will be transmitting.

A global symbol is joined to a module in the same way that any 2 modules are joined (see *Joining modules in a strategy* on page 84).

Using Time Schedule globals in strategies

In order to use a Comms Controller time schedule to send values to controllers on the Comms Controller's Fieldbus, you must set up a Local Time Schedule Global in the strategies of relevant controllers in that Fieldbus.

To broadcast the time schedule on the Comms Controller's own Fieldbus, only local globals are needed.

To Broadcast the time schedule to controllers on the Fieldbus of a different Comms Controller, Wide Time Schedule Globals are needed.

To include a local time schedule global in a strategy, the following steps are required:

- Create or open the source strategy (see page 338)
- Open the target Strategy (see page 339)
- Open the Globals bar (see page 339)
- Choose a global from the Globals bar (see page 340)
- Place the Local Time Schedule on the drawing area (see page 340)
- Connect the local time schedule (see page 343)

Local Time Schedule Globals - Create or open the source strategy

The first step is to create or open the time schedule's strategy. This is the strategy that will generate the value that is to be transmitted by the local time schedule global, i.e. the source strategy.

If you are using an existing strategy to generate the source point, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the source strategy.

If you do not have an existing file to work from, you must create the source strategy now (see *How to Create a Strategy* on page 159).

Local Time Schedule Globals - Open the target strategy

Open the strategy of the controller to which the values of the Comms Controller time schedule will be passed. (If the values are to be broadcast to all the controllers on the Fieldbus, open any one of the strategies – all procedures performed here will apply to all the other controllers).

Open the strategy by clicking the

button on the toolbar,

or by selecting **Open** from the **File** menu.

Either of these options will produce the generic Windows **Open** dialog box.

```
File
  New                    Ctrl+N
  Open...                Ctrl+O
  Close
  Save                   Ctrl+S
  Save As...
  Save All

  Sign On
  Sign Off

  Login                  Ctrl+I
  Logout                 Ctrl+L

  Global Editor

  Footers
  Print...               Ctrl+P
  Print Preview
  Print Setup...
  Printer Scaling...

  1 Weather Compensator.stg
  2 Office_001-01 AHU.stg
  3 Comparator.stg
  4 strat5

  Exit
```

Local Time Schedule Globals - Open the Globals Bar

Click on the

button in the toolbar, or select Globals from the view menu.

```
View
  ✔ Toolbar
  ✔ Status Bar
  ✔ Current Target
    Macro Bar
    Site List            F5

    Modules...           ►

    Globals
    Virtuals

    Managers

  ⊕ Zoom In
  ⊖ Zoom Out
  100% Zoom To 100%
    Zoom Level ...
```
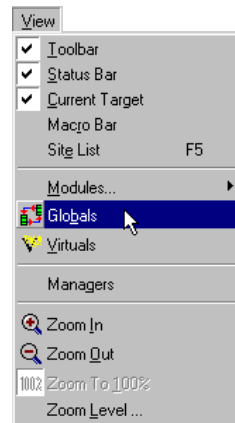
This opens the globals bar:
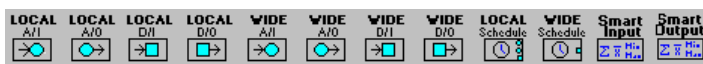
Local Time Schedule Globals - Choose a global from the floating globals bar.

Choose a local time schedule global from the floating globals bar. In this example, a local time schedule global is needed to transmit the time schedule to a controller on the same Fieldbus. When the global button is clicked, it will depress, as shown below:

Local Time Schedule Globals - Place the global on the drawing area

Choose the local time schedule global button from the globals bar and place the pointer at the place in the drawing area where the local time schedule global symbol is to be placed.
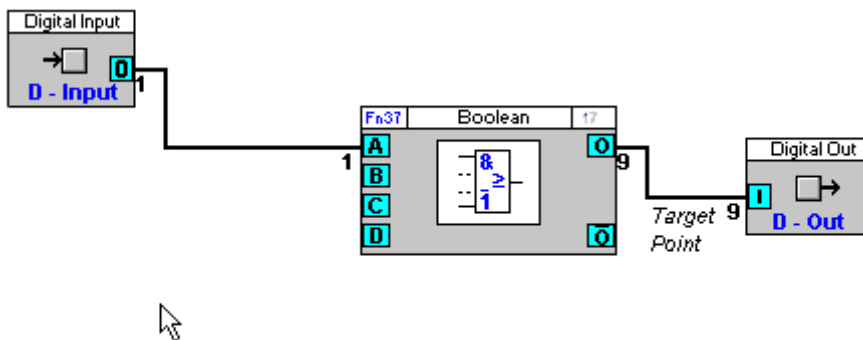
Press the mouse button.

This calls the **Local Time Schedule** dialog box:
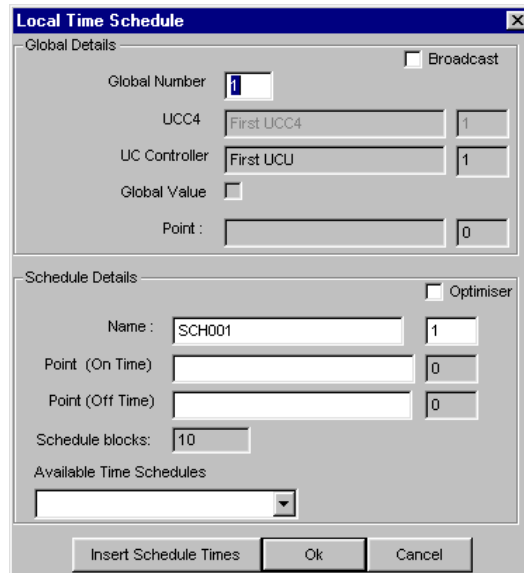
Under **Global Details**, you can give the time schedule global a number and a value. You can also specify whether the global is to be **broadcast** (see page 349) to the same point on all UCs on the same Fieldbus by checking or unchecking the **Broadcast** checkbox.
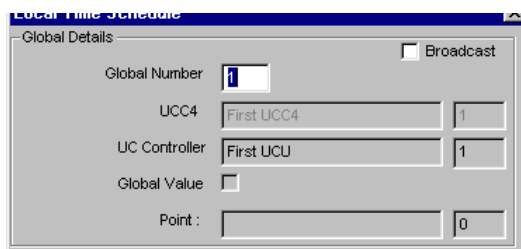
Under **Schedule Details**, you can enter a name for the Comms Controller Time Schedule, as well as specifying the numbers of the points that will contain the on and off times for the schedule.
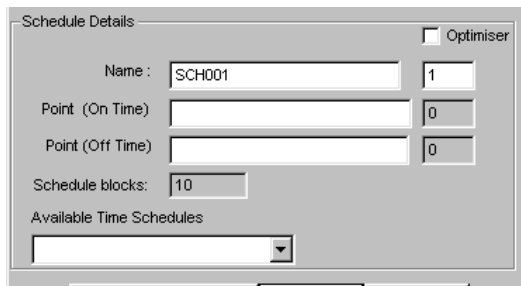
Note: The "On time" and "Off time" points are two analog outputs on the Time Schedule module. Their values are numbers in 'Decimal Time' format representing the time that the Time Schedule will next change from off to on ("On time"), and the time when it will next change from on to off ("Off time").

For example, if the time schedule will next change to 'off' at 15 minutes past 6pm, the value of the 'Off Time' point will be 18.25.

The Engineering Centre automatically calculates and inserts the number of **schedule blocks**.

Click the **Insert Time Schedule** button to call the **Schedule Planner** program,
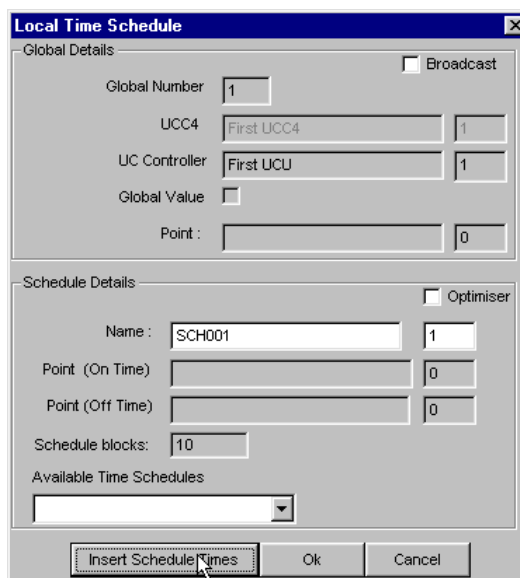
which allows you to enter on/off times and details of standard weeks and exceptions.

Enter details of the on/off times and exception weeks for the Comms Controller time schedule. For details of how to enter on/off times and exception weeks, see *MAN-0054 Schedule Planner User Manual*.

When you have completed the entry of on/off times and exceptions, choose **Exit** from the **File** menu to close the **Schedule** window. You have now set-up the Comms Controller time schedule.

Click **OK** to close the **Insert Schedule Times** window. The **Local Time Schedule** dialog box closes and the local time schedule global symbol appears on the drawing area.
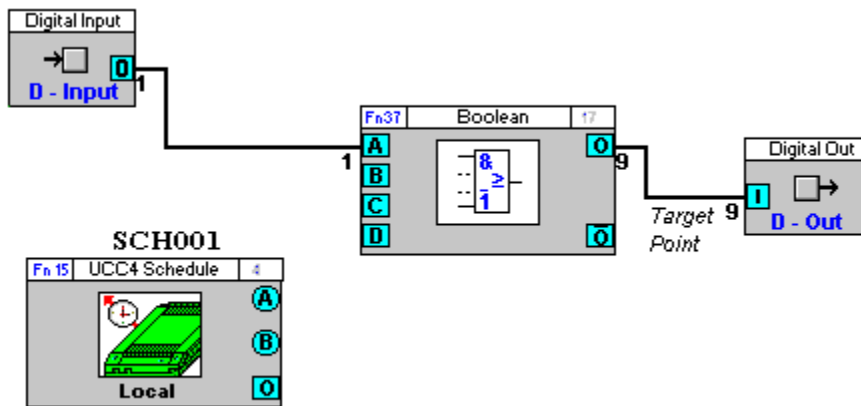
Local Time Schedule Global - Connect the Local Time Schedule

Connect the local time schedule global symbol to the point to which on/off values are to be passed.
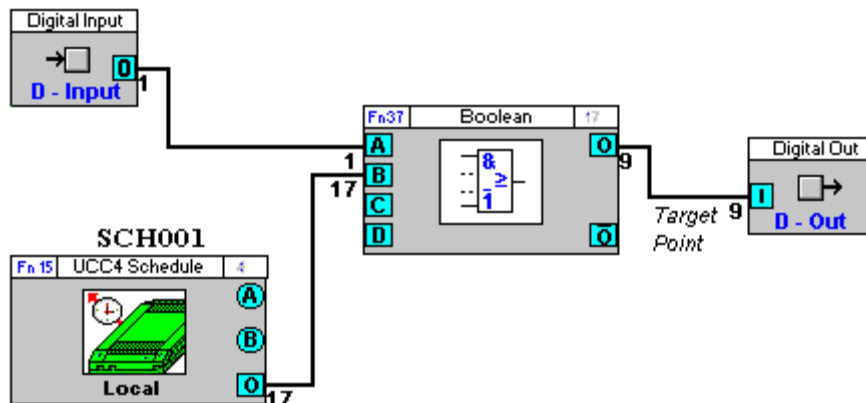
The global which will pass values from the Comms Controller time schedule to one or all of the controllers on the Fieldbus has now been set-up.

The same procedure is used for setting up a Comms Controller time schedule and associated wide global.

Wide Time Schedule Globals

In most cases, time scheduling information that affects Field Controllers on a Fieldbus is held in that Fieldbus's Comms Controller. This gives a Cylon site great flexibility in terms of scheduling – for instance different floors of an office block can operate to different time schedules.

However, there are times when controllers on one Fieldbus may need to follow the time schedules in the Comms Controller of another Fieldbus – for instance, the AHU controllers on the roof of a building might need to operate to the same schedule as the Boiler Room in the basement.

In such cases, Wide Time Schedule globals are used.

A **Wide Time Schedule Global**, like any other global, is a facility to pass information between controllers. It is "Wide" because the information it transmits can be received by any controller on any Fieldbus on the Cylon site's ARCnet.

A **Wide Time Schedule Global** (contained in the strategy) makes a local time schedule (contained in the same strategy) available to Field Controllers on other Fieldbusses.

To set up a **Wide Time Schedule global**, proceed as follows:

- Open or Create the Source strategy (see page 344)
- Open the globals bar (see page 345)
- Choose Wide Schedule from the Globals bar (see page 345)
- Insert a Wide Time Schedule Global into the strategy (see page 345)
- Complete the Wide Time Schedule dialog box (see page 346)
- Open or Create the target strategy (see page 346)
- Insert and connect a Wide Digital Input Global into the target strategy (see page 347)

There can be more than one target strategy – any strategy containing a Wide Digital Input Global can be set up to receive the information transmitted by the Wide Time Schedule Global. Alternatively, on any Fieldbus a single Wide Digital Input Global can be used to receive the information from the time schedule, and then send it as a Broadcast Global to the same point every controller on that Fieldbus.

Wide Time Schedule global - Open or Create the Source strategy

The first step is to create or open the strategy which will generate the value that is to be transmitted by the local global.

If you are using an existing strategy to generate the source point, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the source strategy

If you do not have an existing file to work from, you must create the source strategy now (see *How to Create a Strategy* on page 159).

Wide Time Schedule global - Open the globals bar

Click on the

button in the toolbar, or select Globals from the view menu
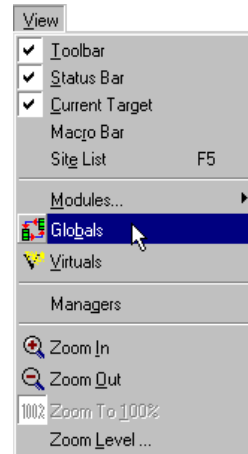
This opens the globals bar:

Wide Time Schedule global - Choose Wide Schedule from the Globals bar

Choose a **Wide Schedule global** from the globals bar, as you would choose any module.

Wide Time Schedule global - Insert a Wide Time Schedule Global into the strategy

Place the local output global on the drawing area by clicking the drawing area once.
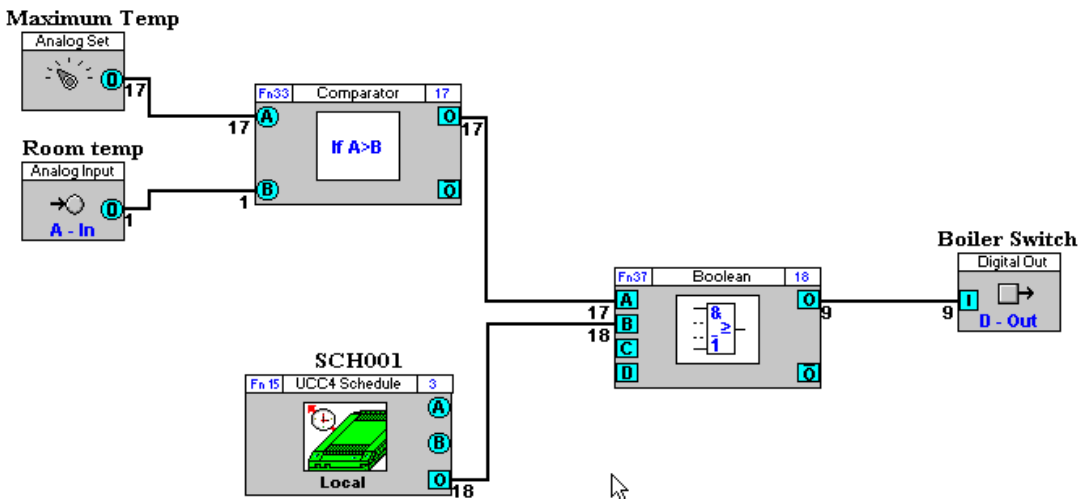
The Engineering Centre will open the Wide Time Schedule global's dialog box:

Wide Time Schedule global - Complete the Wide Time Schedule dialog box

The Wide Time Schedule dialog box allows you to set up a global to make information from a local time schedule available to all Fieldbusses in the Cylon site.

- Comms Controller details

The wide time schedule global is first stored in the local Comms Controller to allow it access to the ARCnet for transmission to other Fieldbusses.

The **Comms Controller details** section of the dialog lists information about how the Wide time schedule is stored.

- ARCnet Details

This section shows information about Wide Time schedule as it is broadcast on the ARCnet.

- Connect to destination

In this section, the Engineering Centre lists all the controllers containing strategies that are set up to receive information from the **Wide Time Schedule**. Engineering Centre gets this information from the site's database, stored on the supervisory PC.

From this section of the dialog box, it is possible to stop controllers from receiving **the Wide Time Schedule**'s information, by selecting the controller from the list and clicking the **Disconnect** button

- Schedule details

This section of the Wide Time Schedule dialog box shows details of the local time schedule that is to be transmitted by the Wide global.

Wide Time Schedule global - Open or Create the target strategy

Open the strategy of the controller to which the values of the **Wide Time Schedule** will be passed. This controller will be on a separate Fieldbus on the Cylon site. (If the values are to be broadcast to all the controllers on a Fieldbus, open any one of the strategies).

Wide Time Schedule global - Insert and connect a Wide Digital Input Global into the target strategy

Select Wide Digital Input from the modules bar

In the Target strategy (the strategy of the controller to which the values of the Wide Time Schedule will be passed), click at the position where the Input global is to be inserted:
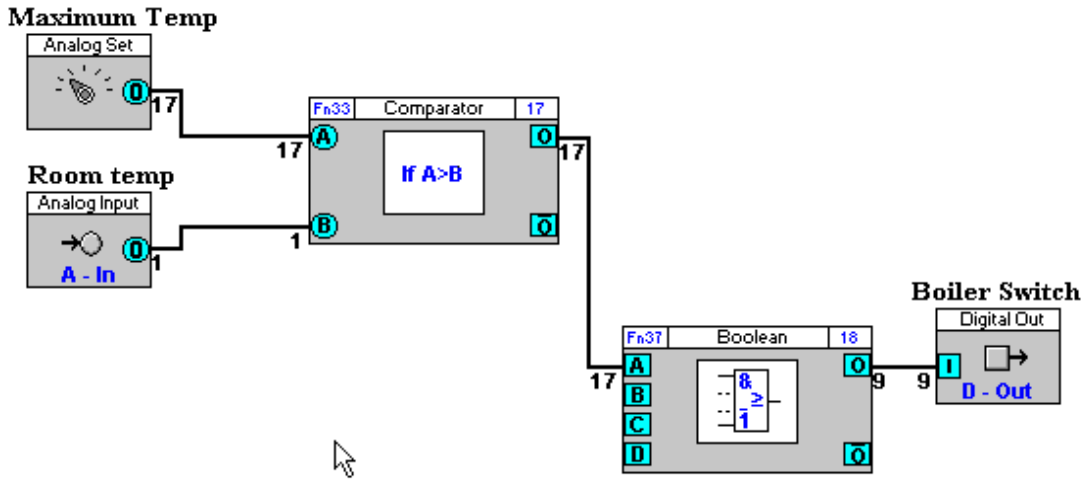
This opens the **Wide Globals** dialog box.

Complete the Wide Input Globals dialog (see *Wide Global Setup - Complete the Wide Input Global's dialog box* on page 336), ensuring that the Unet/ARCnet details match the definition of the Wide Time Schedule that is to be received, and press OK.

The Wide Digital Input global module appears in the drawing area:
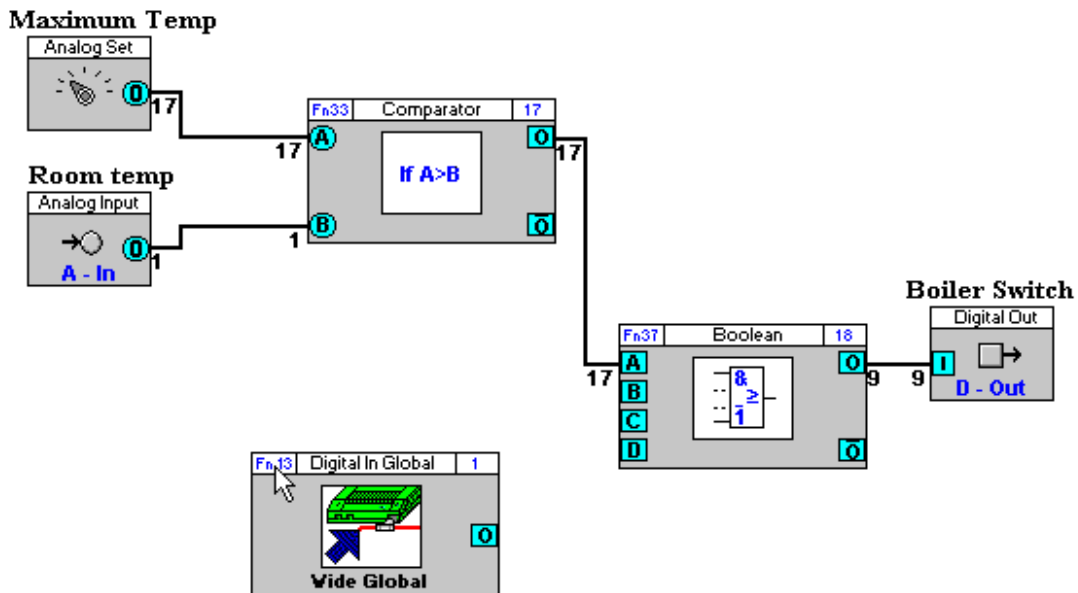
Join the Wide Digital Input global to the relevant point(s) in the strategy:
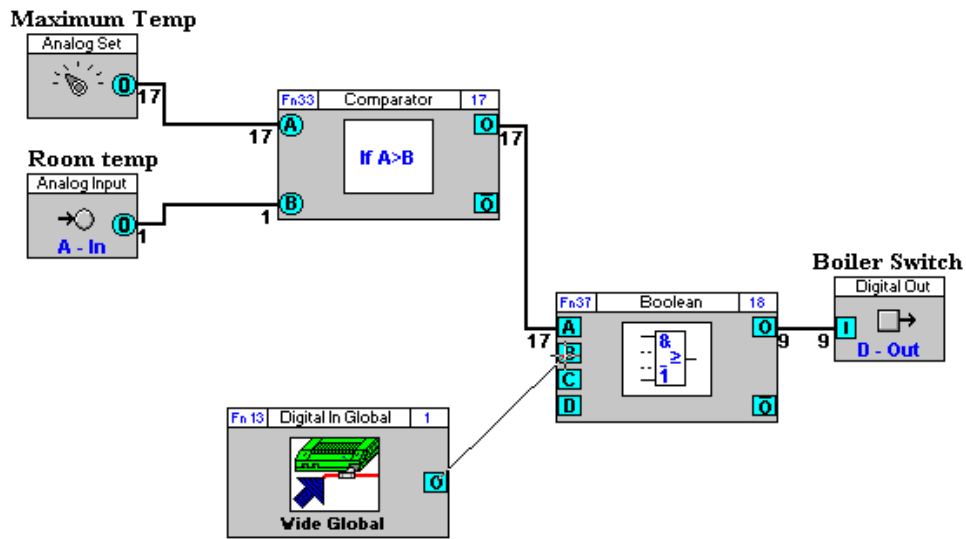
The target schedule is now ready to receive data from the Wide Time Schedule global:
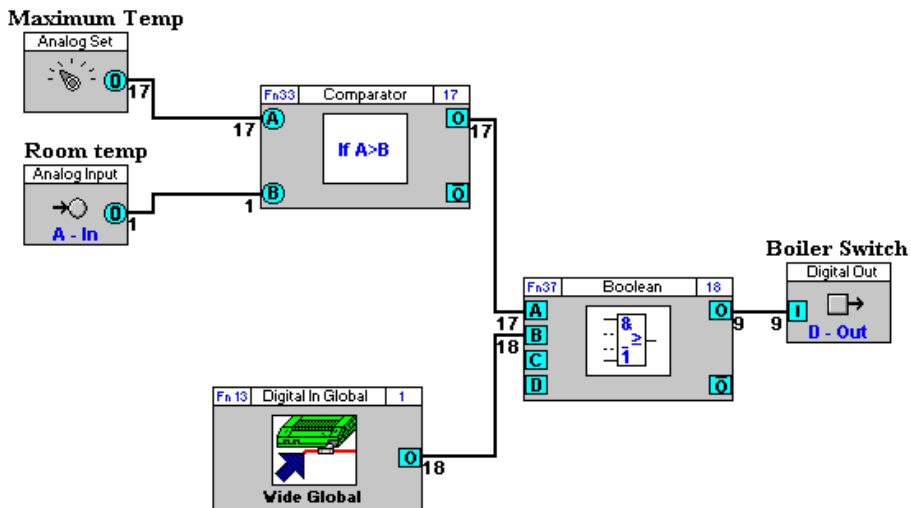
Broadcast Globals

In order to reduce the number of globals used on a Fieldbus, and to reduce the number of modules used in several controllers, it is possible to send information from a global to the same point in all controllers on the Fieldbus at once. This is referred to as a 'Broadcast Global'

The main application for this is distributing Time Schedule information among a large number of controllers that have identical strategies – such as the controllers in VAV or Fan-Coil units.

To set a global as a Broadcast global, tick the broadcast box.

For **Local Globals**, this is found in the Local input Details part of the global's dialog:

When the broadcast box is ticked, the UC: box disappears.

Enter the Point description and number in the remaining boxes.

For **Wide input Globals**, this is found in the Local input Details part of the global's dialog:

When the broadcast box is ticked, the UC: box disappears.

Enter the Point description and number in the remaining boxes.

Information from the global will be written to every strategy on the Fieldbus, at the specified point.

Note: The first time **Broadcast** is selected, Engineering Centre will enter 199 as the point number. Subsequent Broadcast Global point numbers decrement from this number. These point numbers become reserved for this global in all other controllers along the Fieldbus, and cannot be used in the strategies of those controllers. It is possible to manually select the Broadcast Global point number, but remember that the selected point number will then be inactive in all other controllers on the Fieldbus.

Using Smart Globals in strategies

To use a Smart Global you must

1. Create or open the source strategy (see page 350)

2. Open the globals bar (see page 351)

3. Choose a Smart output global from the floating globals bar (see page 351)

4. Place the Smart output global on the drawing area (see page 351)

5. Complete the Smart output global's dialog box (see page 352)

6. Join the Smart output global module to a point in the strategy (see page 354)

7. Create or open the target strategy (see page 355)

8. Select the target (see page 355)

9. Choose a Smart input global from the floating globals bar (see page 355)

10. Place the Smart input symbol on the drawing area (see page 355)

11. Complete the Smart input global's dialog box (see page 356)

12. Connect the Smart input global module to other modules/points in the strategy (see page 357)

When the steps above have been completed, the global is set up. Save both the source and the target strategies by clicking **Save All** from the **File** menu.

Once saved, the global can then be downloaded and tested in the same way as you would any strategy. (See *Downloading a strategy* on page 189 and *Testing a strategy with Scan Mode* on page 207).

Smart Global - Create or open the source strategy

The first step is to create or open the strategy which will generate the value that is to be transmitted by the smart global.

If you are using an existing strategy to generate the source point, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the source strategy

If you do not have an existing file to work from, you must create the source strategy now (see *How to Create a Strategy* on page 159).

Smart Global - Open the globals bar

Click on the

button in the toolbar, or select Globals from the view menu
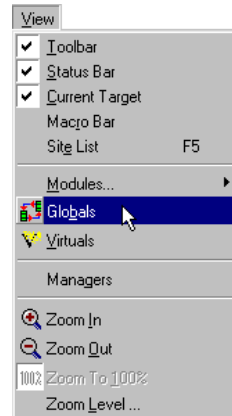
Smart Global - Choose a Smart output global from the floating globals bar

Smart Global - Place the Smart output global on the drawing area

Place the wide input global on the drawing area by positioning the pointer at the part of the strategy drawing where the Wide Input global symbol is to be inserted:
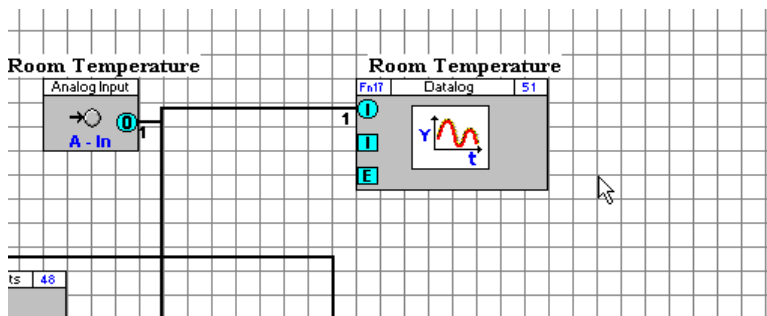
And clicking the mouse button.

The Engineering Centre will open the Smart output global module's dialog box (the "Smart Source Global" dialog).
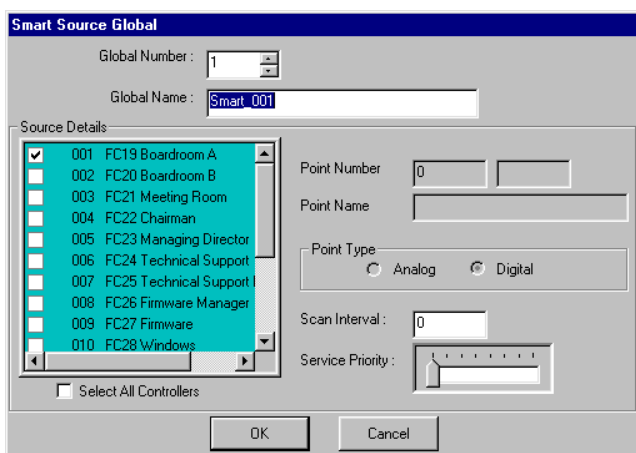
<u>Smart Global - Complete the Smart output global's dialog box</u>

Some of the information in the global's dialog box is entered automatically by the Engineering Centre. Each section of the dialog box is described below, including those that are completed automatically by the Engineering Centre and those that you must complete yourself.

Choose the number of the global will collect the required values. This can be between 1 and 255.
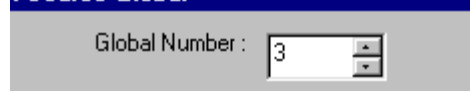
Set a name to be associated with that global number - this will help identifying the correct global number in the target strategy.
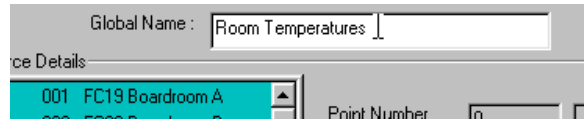
The number, name and type of the source point whose value will be transmitted cannot be edited. It will be set when the Smart global module is graphically connected to a point in the strategy drawing.
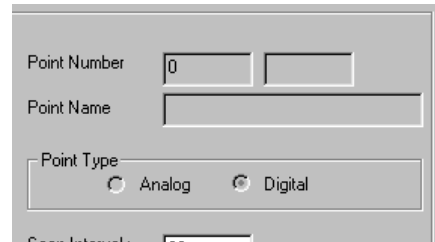
In the Source Details box, all of the controllers on the Comms Controller's Fieldbus are listed. Select those controllers whose points are to be used in calculating the output of the smart global.
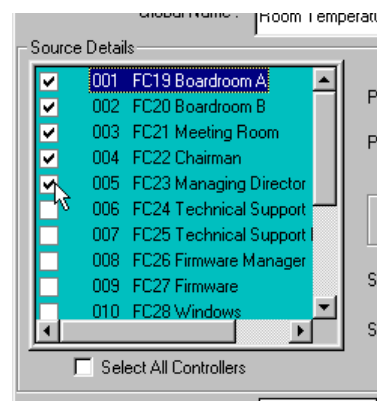
The values of the points in the selected controllers whose point numbers match the source point in the current strategy will be used.

If the matching point in ALL controllers on the Fieldbus are to be used, then all of the controllers can be quickly selected by checking the **select all controllers** box beneath the controllers list.
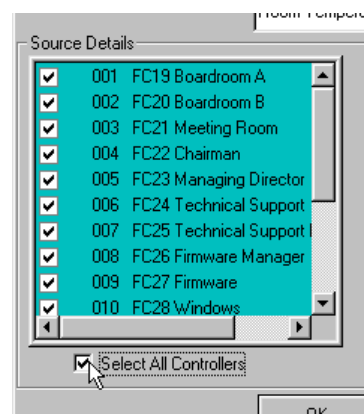
Set a **Scan Interval** for the smart global. This determines how often the Comms Controller will read the source point in each of the selected controllers, and is measured in seconds.
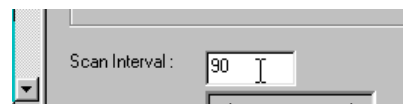
Smart globals can generate a lot of network activity. The **Service Priority** setting determines how that activity
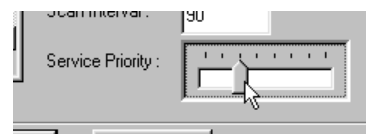
interrupts other network activity governed by the Comms Controller.

A low setting for the **Service Priority** (slider towards the left side of its range) means that the Smart Global will be slowed if necessary to allow for other network activity. A high setting (slider towards the right side of its range) means that other network activity will be postponed until the smart global has completed its service procedure.

When the Smart Output Global module's dialog (the "Smart Source Global" dialog) is complete, click on **OK** to save the settings and close the dialog.
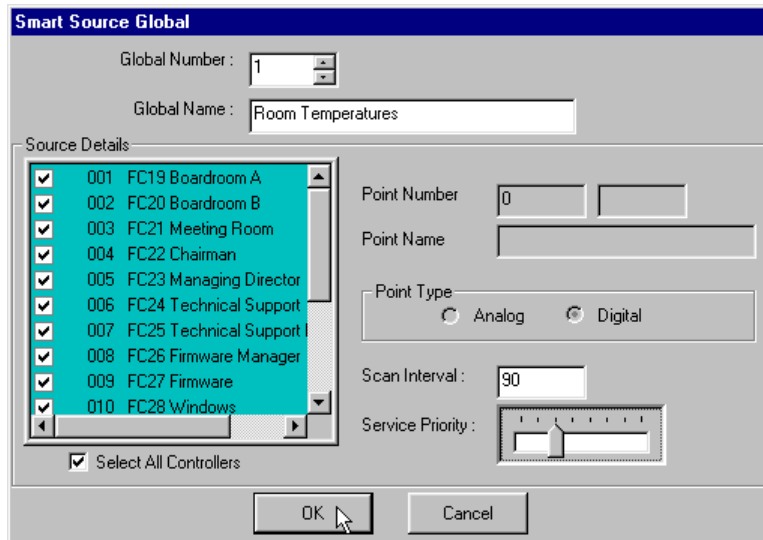
If you do not want to save the settings when the dialog closes, click **Cancel**.

Smart Global - Join the Smart output global module to a point in the strategy

When the dialog is closed, the Smart Global module will be visible on the strategy drawing:
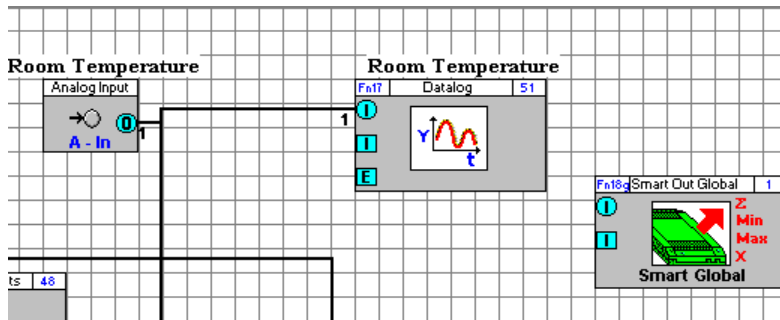
Connect one of the module's inputs (analog or digital) to the required point in the strategy. A global symbol is joined to a module in the same way that any 2 modules are joined (see *Joining modules in a strategy* on page 84).
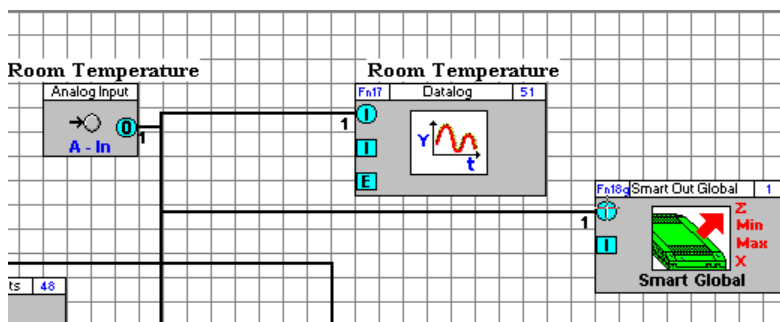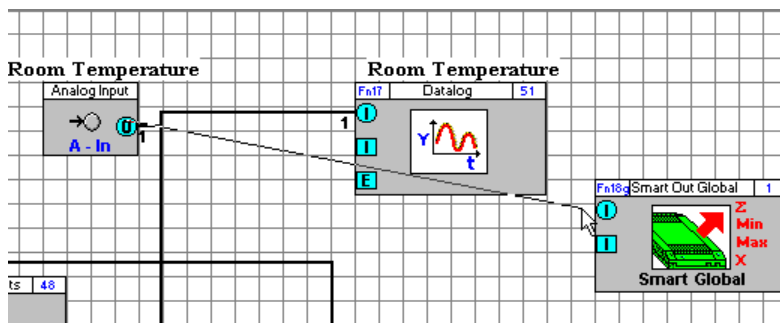
When the module is joined to a point, that point will be visible in the dialog's source point settings if the dialog is opened by right-clicking on the module:
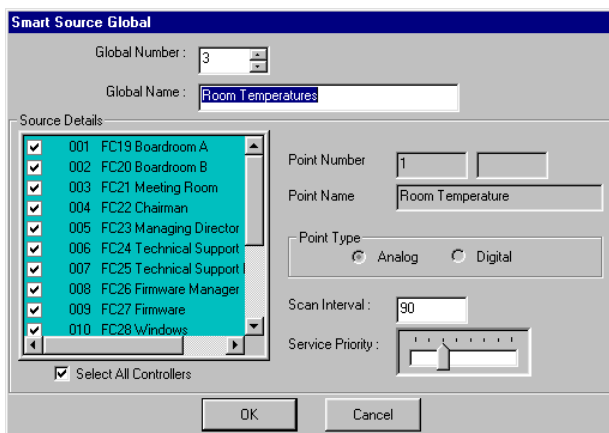
The source part of the Smart Global is now set up.

Smart Global - Create or open the target strategy

The next step is to create or open the strategy that will receive the calculated result of the smart global.

If you are using an existing strategy as the destination, click the open button on the toolbar or click **Open** on the **File** menu. Then, in the **Open** dialog box, choose the file that you want to use as the target strategy.

If you do not have an existing file to work from, you must create the target strategy now. To create a new strategy, click the new button on the toolbar or click **New** from the **File** menu.

Smart Global - Select the target

Select on the Site List the UC which is to be the destination of the smart global. As a smart global is a type of a local global, the UC that you target will be on the same Fieldbus, i.e. it will be connected to the same Comms Controller as the source strategy.

Smart Global - Choose a Smart input global from the floating globals bar

Smart Global - Place the Smart input symbol on the drawing area

Place the local input global on the drawing area by clicking the drawing area.

As it did when you created the source strategy, the Engineering Centre will open the smart input global's dialog box.

Smart Global - Complete the Smart input global's dialog box

Select the number of the smart output global whose values are to be used.
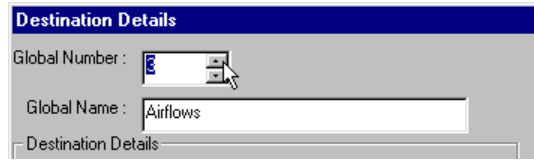
When you click in the name box, the name corresponding to the selected global number will appear. This shows that the correct global number has been selected.
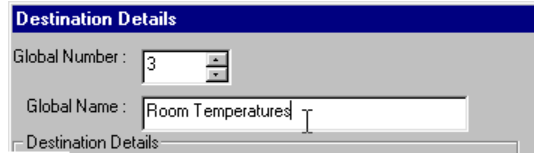
Select the controller into which the results of the smart global will be inserted.
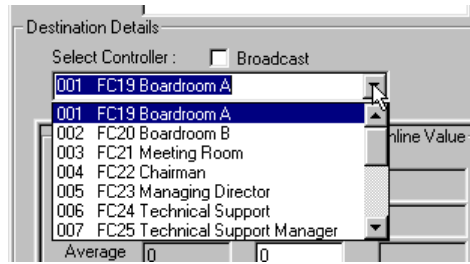
> **Note:** If you would like the results of the smart global to be available in all of the controllers on the Fieldbus, tick the '**Broadcast**' box instead of selecting a controller name.

Set default values for each of the smart global output points. These will be used if the smart global becomes unavailable for any reason.
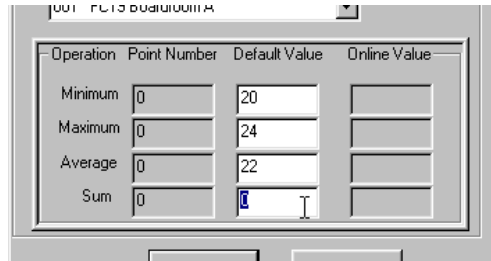
When the Smart Input global module's dialog box (the "Destination Details" dialog), click on **OK** to save the settings and close the dialog.

If you do not want to save the settings when the dialog closes, click on **Cancel**.
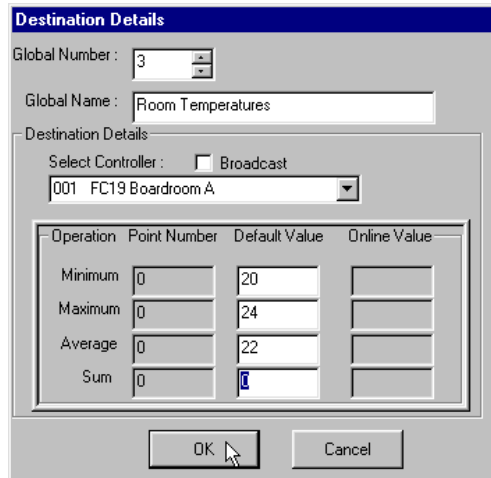
Smart Global - Connect the Smart input global module to other modules/points in the strategy

When the dialog is closed, the Smart Global module will be visible on the strategy drawing:

If your target strategy is based on an existing strategy, there will already be modules on the drawing area. Place the global in a position on the drawing area where it can easily be joined to the other modules and points in the strategy.

If the target strategy is not based on an existing strategy, i.e. it is a new strategy, you must create the target strategy by placing the required modules and input/output points on the drawing area and connecting them (see *How to Create a Strategy* on page 159).

Join the required output of the Smart input global module (maximum, minimum, sum, or average) to the point where that value is required.

A global symbol is joined to a module in the same way that any 2 modules are joined (see *Joining modules in a strategy* on page 84).
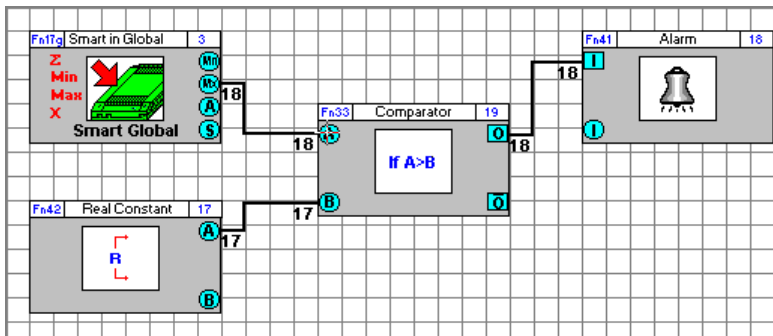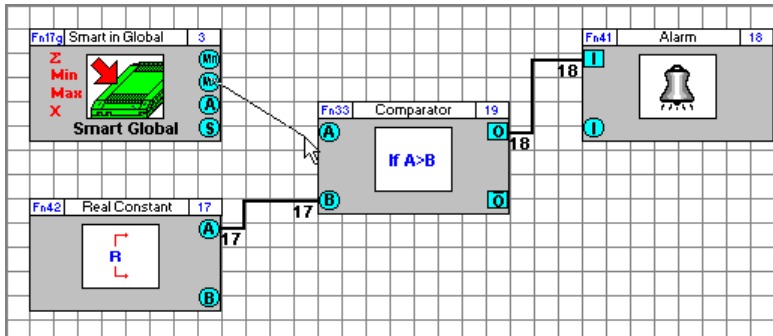
When the module is joined to a point, that point will be visible in the dialog's output point settings if the dialog is opened by right-clicking on the module.

BACnet Globals

Overview

Global messages in the **Cylon Unitron** system, commonly called "**Globals**", are a way of passing a value from one controller to another. A global allows a value from a **Strategy** on one controller to be passed on to another strategy on another controller.

Cylon BACnet controllers implement **Global**s over BACnet for backward compatibility. However, this concept is not native to **BACnet**, and so it is recommended that where possible **Strategies** should be Engineered to use `3rd-party Blocks` instead (see *3rd Party point blocks – [Analog 3rd Party Analog] and [Binary 3rd Party]* on page 686)

> **Note**: Use of Global messages on BACnet Sites should be avoided. As a result, when BACnet Globals are added to a BACnet Strategy, the following warning will be displayed:
>
> WARNING!
>
> Globals will be deprecated in an upcoming version for BACnet strategies.
>
> We advise that you use Third Party Blocks instead to communicate between controllers.

There are two main types of globals used in the **Cylon BACnet** system:

- Local Globals

This type of global allows points to be passed between controllers on the same **MS/TP** bus.

- Site Wide Globals

This type of global allows points to be passed between controllers on different **MS/TP** bus via Ethernet connections between the BACnet routers above each **MS/TP** bus.

Global Ranges

- 64 Local BACnet globals.
- 255 Fieldbus Local Globals
- 255 Site Wide Globals

BACnet Global Types

	Analog Destination
	Analog Source
	Digital Destination
	Digital Source
	Not Supported in Cylon BACnet system
	Not Supported in Cylon BACnet system
	Not Supported in Cylon BACnet system
	Analog Wide Broadcast Receiving
	Digital Wide Broadcast Receiving

How to add Globals to Strategies

- Step 1: Add a BACnet Source Global

To create a source BACnet Global, right-click the point that is to be transmitted, and select Create New Global .
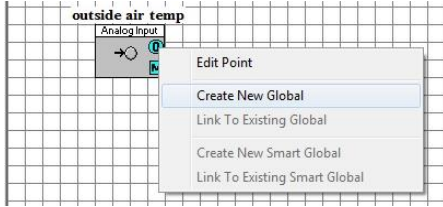
This will attach a source Global block to the point. Depending on the type of point, a corresponding analog or digital type global will be assigned. In this example an analog BACnet Global block has been added:
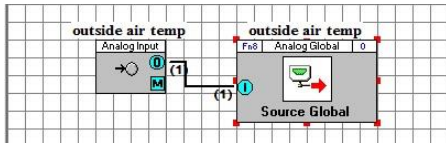
> **Note**:   A "0" is displayed in the right top corner of the Global block. This is the Global number, and until the Source Global is linked to a destination a place holder value of 0 is assigned.
>
> **Note**:   The point itself must be exposed on BACnet or the Global will not function. By default the point will be exposed, but this can be disabled manually causing the Global to fail. To fix this, open Configure BACnet Points from the UC32 menu.

- Step 2: Open Strategy of Destination Controller

Open the **Strategy** into which the **Global** is to be received. Right-click on an input point of a block and select Link to Existing Point Global .
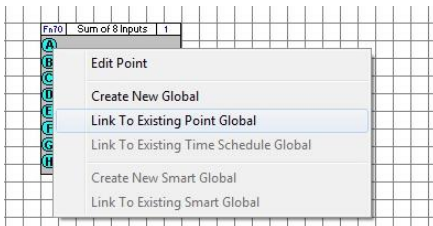
This will open the Source Globals dialog:
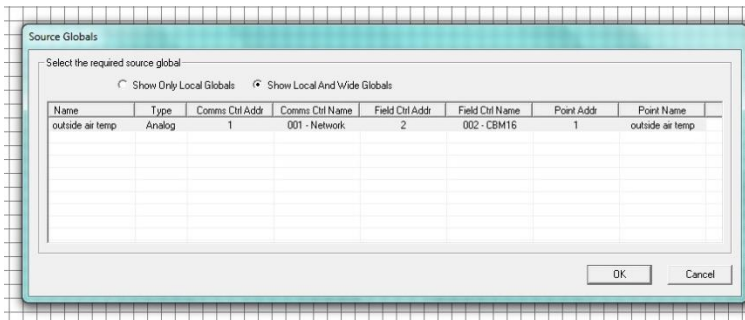
- Step 3: Link the Source and Destination Globals

In the Source Globals dialog you can choose to link the current destination to any Source Global that is present on the **BACnet** network. In the above example, the Source Global created in steps 1 and 2 is listed. Select this **Global** and click OK .

A Destination BACnet Global block will be connected to the point:
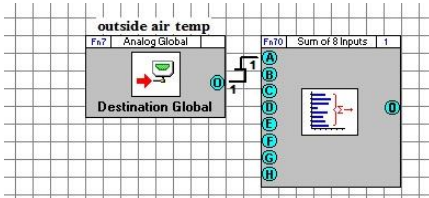
Editing the Properties of BACnet Globals

In order to see the properties of a **BACnet Global,** select the BACnet Global block with a left-click and then right-click the block. This will open the relevant **Global** properties dialog:
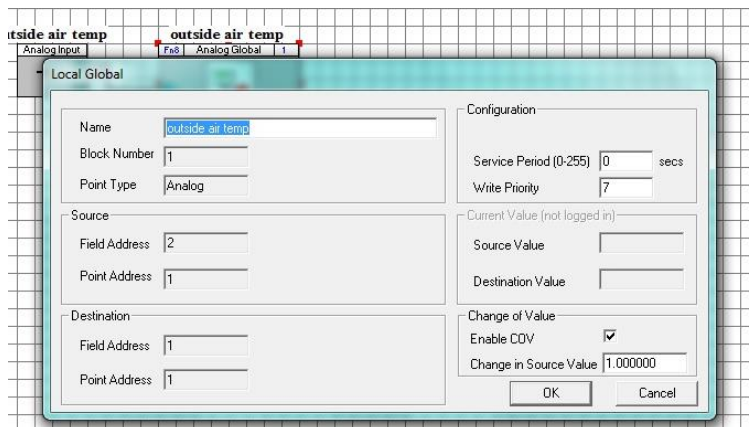
- Service Period

The Service Period is the rate at which the **Global** is serviced. For example if the **Global** is has a service period of 10, the Destination Global will change to the source value every 10 seconds. If the service period is set to 0 the destination value will change to the source values as quickly as the controller can process this action.

- Enable COV

The Change of Value parameter allows the Destination Global to be updated only when the value at the source changes by a certain value. By default the Change in Source Value attribute is set to 1, therefore if the Enable COV checkbox is checked then the destination value will only change when the source changes by 1 unit.

- Write Priority

The Write Priority parameter can also be changed. By default it is set to 7.

> **Note**: On Wide Globals, this parameter does not affect the priority at which the value is written. All Wide Globals are written at priority 16.

<u>Adding a Global between Different Subnets</u>

You can also add **Globals between** controllers on different subnets. However, the process is slightly different. After the `Source Global` has been added, instead of adding a `Destination Global` in the standard way a `Wide Broadcast Receiving Global` must be added to the **Strategy** on the target subnet.

When the `Wide Broadcast Receiving Global` is added to the destination **Strategy**, a prompt requiring a name will be displayed. Enter an informative name here and click `OK`.

A new block is added to the **Strategy**:

Right-click on the block and select `link`. A dialog box will appear with a list of source **Global**s from different subnets. Select the required `Source Global` and click `OK`.
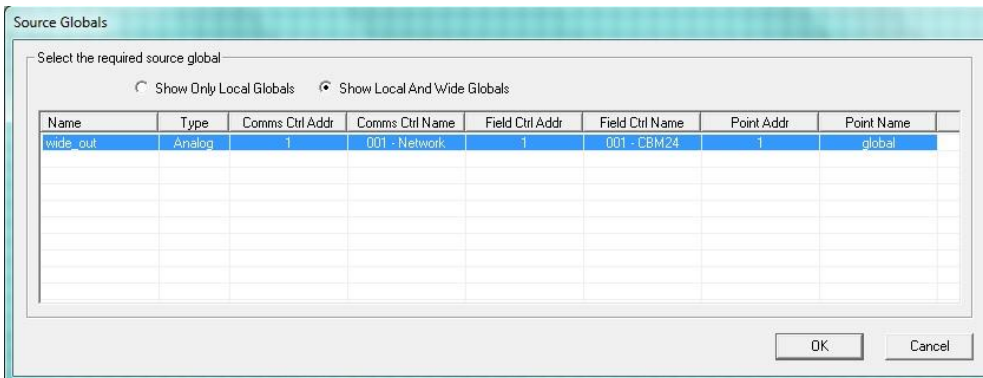
The **Global** is now linked, and will start operating.

To view details of the Global, right-click on the `Destination Global` block, and select `Properties`. The relevant Properties dialog will appear:
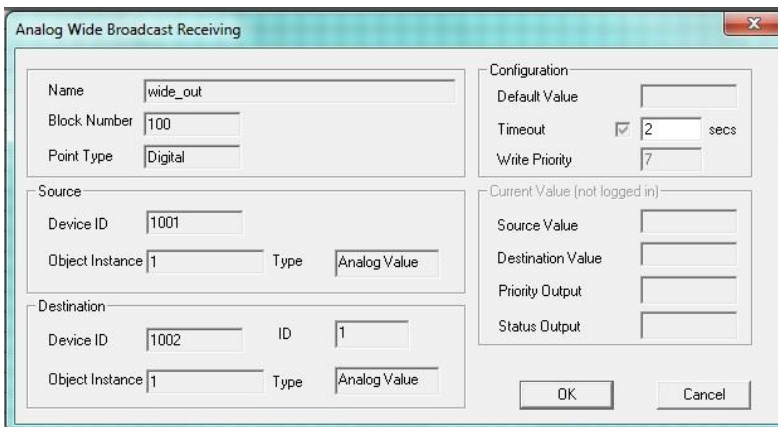
Note: All Wide Globals are written at priority 16. For Wide Globals, the `Write Priority` parameter does not affect the priority at which the value is written, and is merely reflected in the Strategy module's Pr output.

To avoid this issue, it is recommended that 3rd-party Blocks should be used instead of Globals on BACnet Sites

Testing globals

To test a global means to check that it is passing the values it was defined to pass. This can be done by observing the operation of the global in scan mode, which allows you to observe the changing values in a strategy in real-time. See *How to test a global:* on page 364.

How to test a global:

Log in by choosing Login from the File menu

or by clicking the login / logout button on the toolbar so that the gate is closed as shown below:
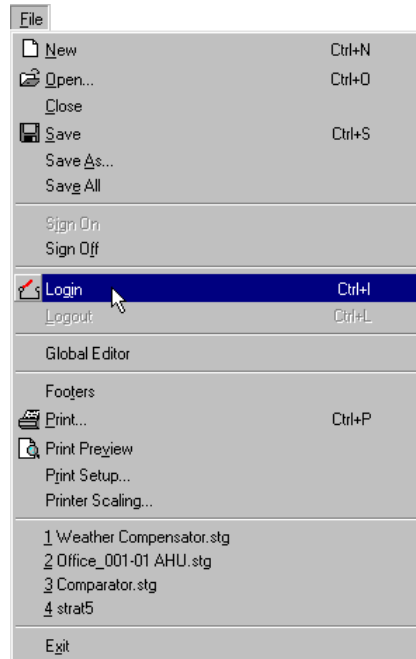
Download the strategy by choosing Download from the Communications menu :

or by clicking the download button on the toolbar:
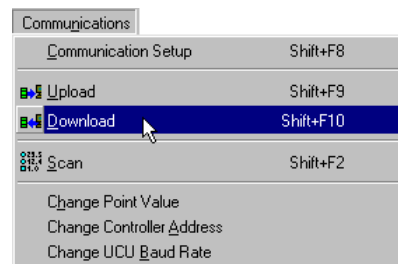
For further details of **automatic download** and **automatic on-line download,** see *Downloading a strategy* on page 189 and *Testing a strategy with Scan Mode* on page 207.

Select the Module Setup menu item from the Display menu
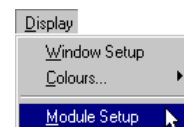
and ensure that the Display Point Values and the **Display Constant Values** check-boxes are checked.
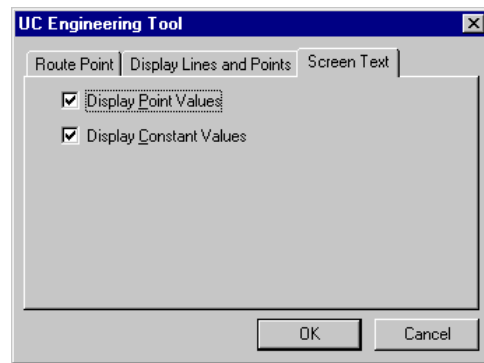
Activate scan mode by choosing Scan from the Communications menu :

or by clicking the scan button on the toolbar.
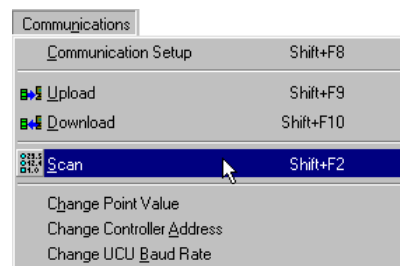
For more information on scan mode, see *Testing a strategy with Scan Mode* on page 207.

Viewing the strategy in scan mode, you will be able to see whether the global is passing the correct value to the correct point(s).
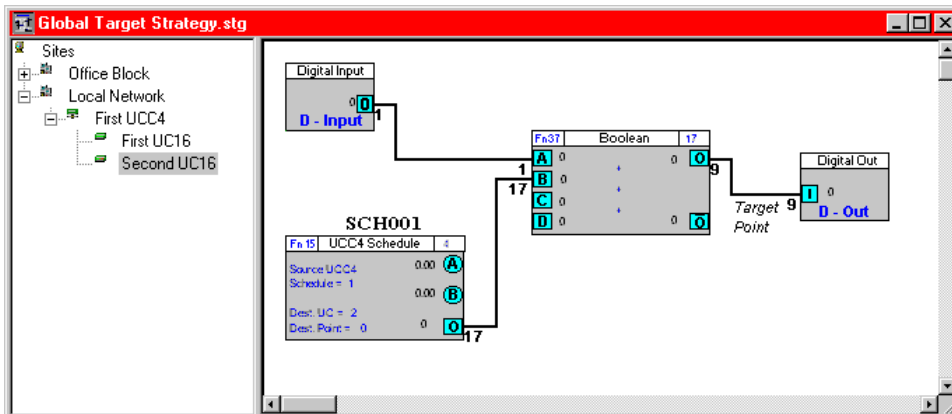
An example of testing the operation of a local global in scan mode

In the following example, an analog local global is set-up to pass values from point 1 on UC number 1 on the Fieldbus:
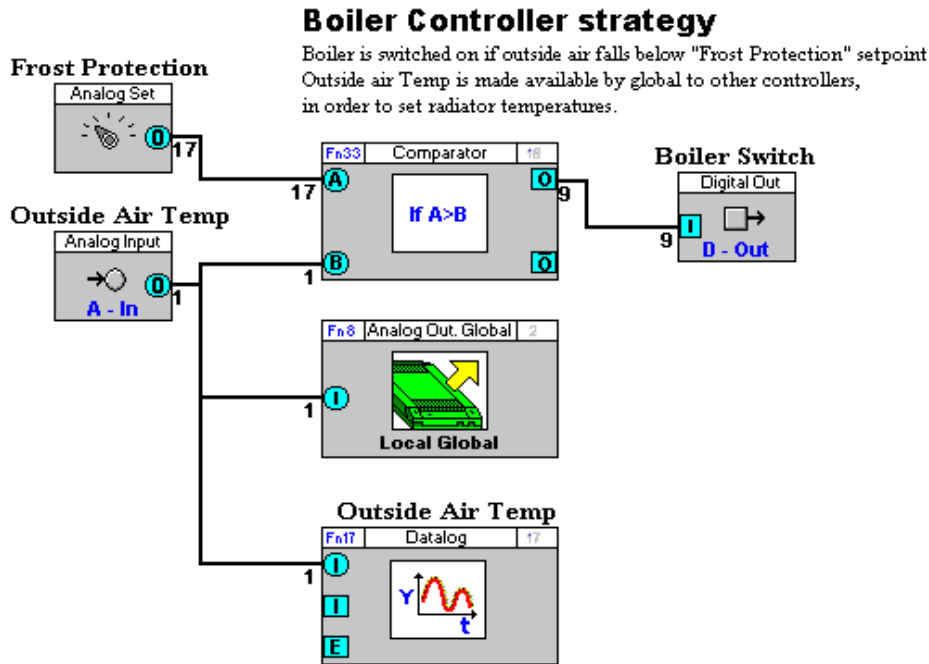
to point 22 on UC number 4 on the same Fieldbus:
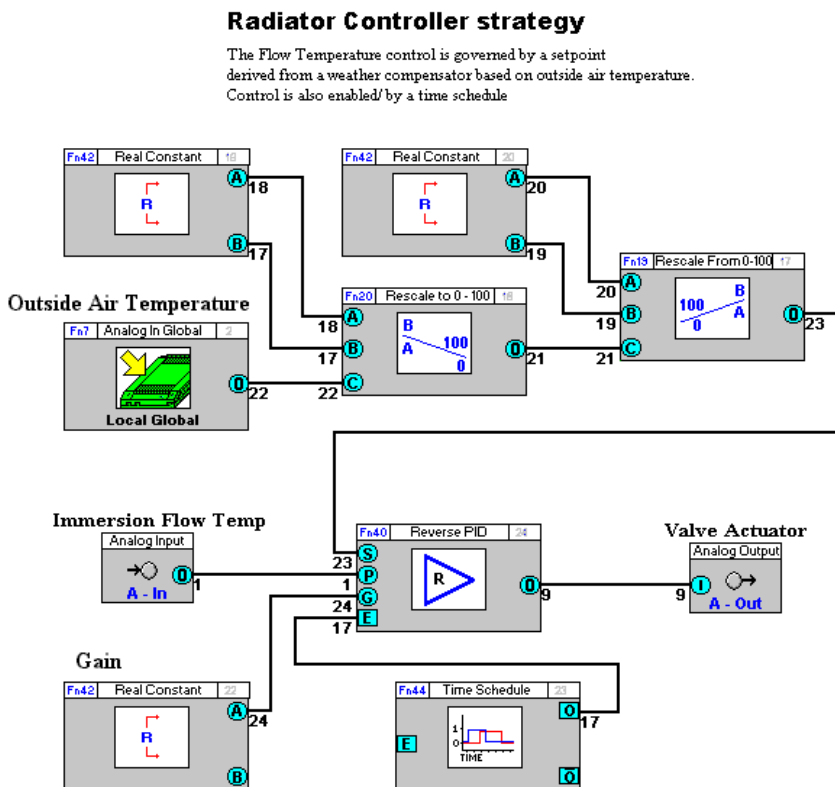
These **strategies** have been downloaded to their respective controllers.

How to test the operation of this global using scan mode:

Log in by choosing **Login** from the **File** menu

or by clicking the login/logout button on the toolbar so that the gate is closed as shown below:
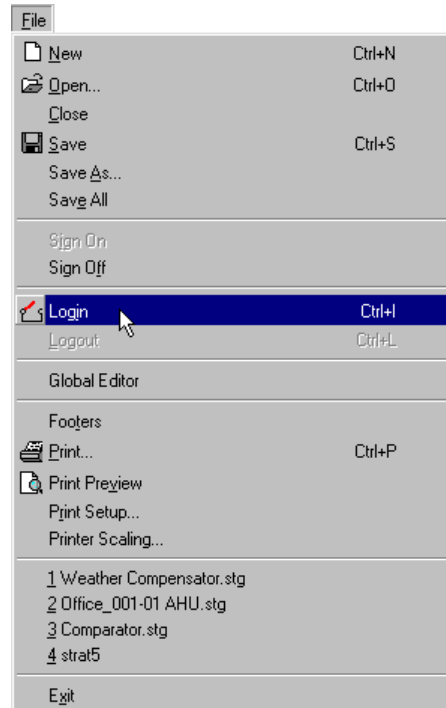
Open the strategy for the source controller.
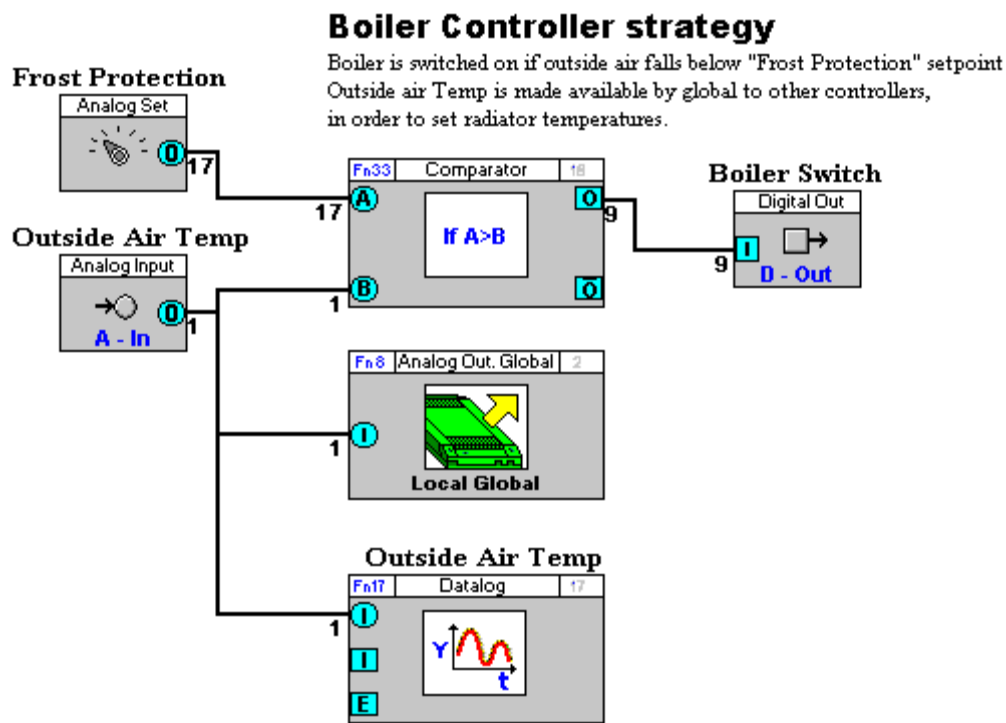
Ensure that variable and constant values are shown on the modules, by choosing **Module Setup** from the **Display** menu ….
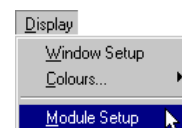
... and checking Display Point Values in the Screen Text tab.
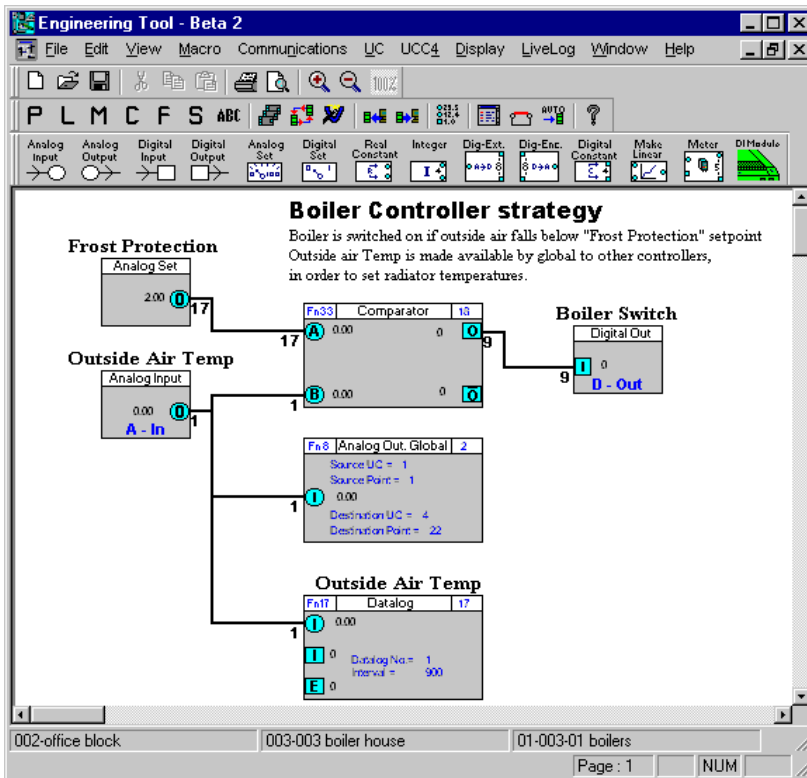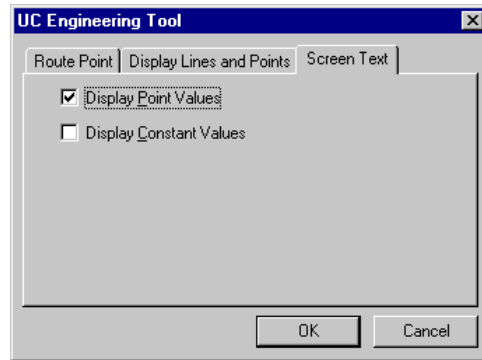
Activate scan mode by choosing **Scan** from the **Communications** menu....

...or by clicking the scan button on the toolbar.
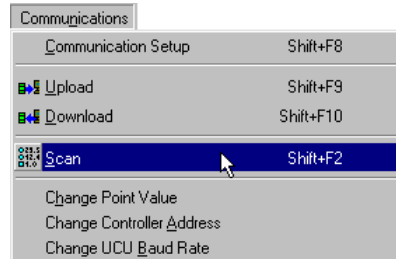
The title bar colour changes to red, and the menus are reduced to **Stop Scan** and **Window**.

You will see the values on screen being updated as each block in the strategy is serviced. The status bar tells you which block is currently being serviced.

When all the blocks have been serviced, check that the analog output local global contains the value you wish to pass, which in this example is 18.00.

Boiler Controller strategy
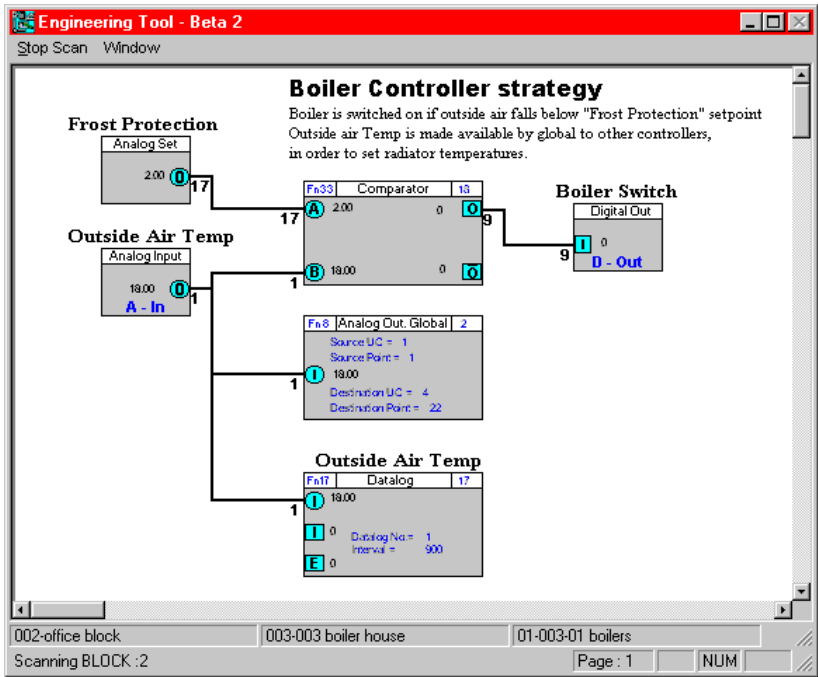
When you are certain that the analog output local global is functioning correctly, click **Stop scan** to deactivate scan mode.

Open the strategy for the target controller.

Radiator Controller strategy

The Flow Temperature control is governed by a setpoint
derived from a weather compensator based on outside air temperature.
Control is also enabled/ by a time schedule
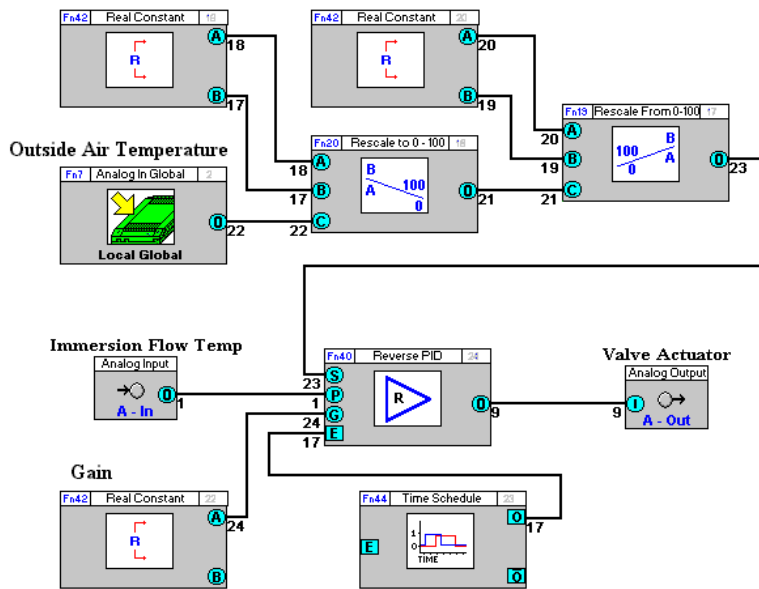
Ensure that variable and constant values are shown on the modules, by choosing **Module Setup** from the **Display** menu ....

... and checking Display Point Values in the Screen Text tab.
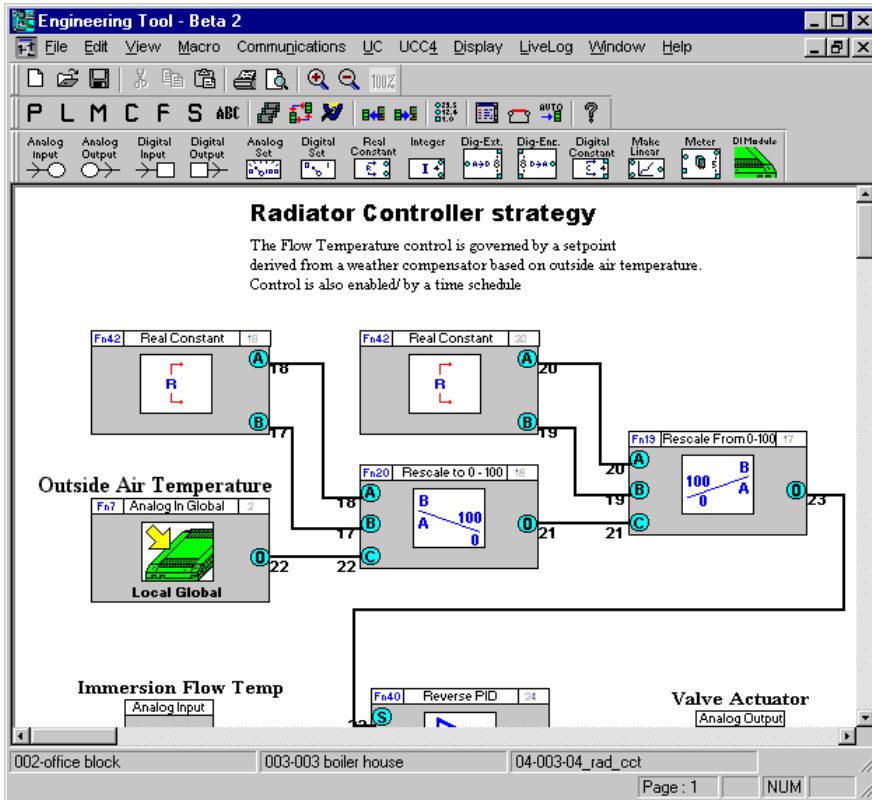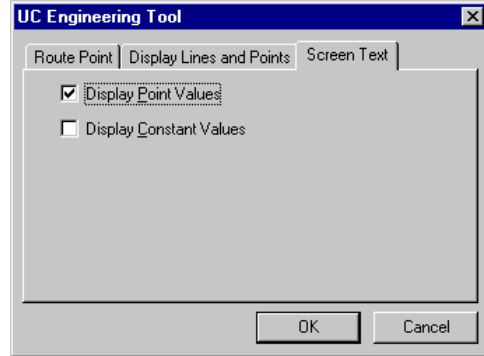
Reactivate scan mode by choosing **Scan** from the **Communications** menu....

...or by clicking the scan button on the toolbar.
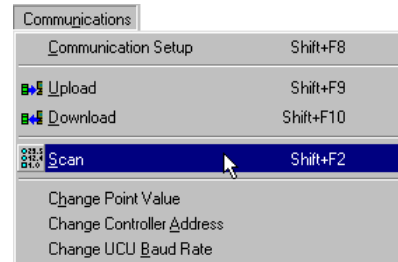
You will see the values on screen being updated as each block in the strategy is serviced. The status bar tells you which block is currently being serviced.

When all the blocks have been serviced, check that the analog output local global contains the value you wish to pass, which in this example is 18.00.
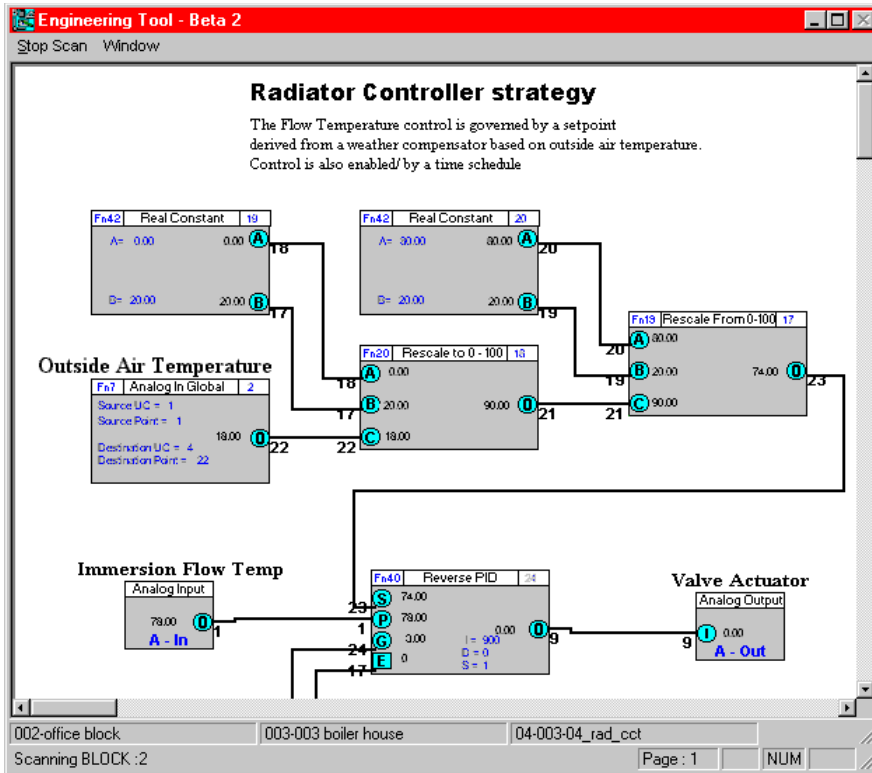
When you are certain that the analog input local global is functioning correctly, click **Stop scan** to cancel scan mode and to return to the Engineering Centre standard window.

Starting globals (sending set-up)

Starting globals means configuring the Comms Controller to service the already downloaded globals. The Comms Controller reads the values of source points and/or source schedules and sends them to the configured target points.

How to start globals

To start a global operating, so that it passes information between controllers, you must:

1. Start the strategy in the target Field Controller (see page 372)

2. Call the Comms Controller setup dialog box (see page 372)

3. Complete the Comms Controller setup dialog box (see page 373)

4. Confirm the settings in the Comms Controller dialog box

Starting globals - Starting the strategy in the target UC

Log in to the **Engineering Centre** and start the strategy in the target UC by selecting **UC Setup** from the **UC** menu. At least one module in the target UC must be serviced for point values to be changed via globals in this UC.

Starting globals - Calling the Comms Controller Setup dialog box

Select **Setup** from the **UC32.net** or **UCC4** menu to call the Comms Controller Setup dialog box.

<u>Starting globals - Completing the Comms Controller Setup dialog box</u>

The following points should be remembered when completing the Comms Controller Setup dialog box:

- All Field Controlles which are involved in the global transmission must be entered in the Comms Controller Setup. If a Unet or ARCnet is used for transmitting wide globals, the Comms Controllers involved must be entered in the Comms Controller Setup too.

- The globals must be entered in the Comms Controller Setup to be activated.

The Comms Controller Setup dialog box has the following sections:

- Composed

The current time and date from the PC will automatically be placed in the **Composed** section to indicate at any subsequent uploading when the strategy was started.

- User ID

In the User ID section the application engineer can enter a special character to indicate at any subsequent uploading who has started the strategy.

- Network Details

The Network Details section has subsections which must be completed to activate the globals:

- UCs on Sub-net

Enter the number of UCs on the Fieldbus in the UCs on Sub-net field. This will enable communication with all UCs connected to the Fieldbus. For example, entering "6" in the UCs on Fieldbus field enables communication with the UCs with IDs in the range 1 to 6.

- Local Globals

Enter the number of configured local globals in the Local Globals field. For example, entering "23" in the Local Globals field activates the local globals numbered 1 to 23.

- Wide Input Globals

Enter the number of configured wide input globals in the Wide Input Globals field. For example, entering "5" in the Wide Input Globals field activates the wide input globals numbered 1 to 5.

- Wide Output Globals

Enter the number configured wide output globals in the Wide Output Globals field. For example, entering "6" activates the wide output globals numbered 1 to 6.

- Nodes on Unet / UCC4s on ARCnet

Enter the highest Comms Controller ID number of the Comms Controllers connected to the Unet or ARCnet in this field. This will tell the target Comms Controller the maximum address of controllers on the Unet or ARCnet. For example, entering "3" configures it to communicate with Comms Controllers with IDs in the range 1 to 3.

- Current Status

This section keeps you updated about the progress of the uploading or downloading procedure.

- Send

Click to download set-up to the Comms Controller.

- Receive

Click to upload the most recently sent set-up from the Comms Controller.

- Cancel

Click to close the dialog box.

<u>Starting globals - Confirming the settings in the Comms Controller Set-up dialog box</u>

Click on **Send** to confirm the settings which have been entered in the Comms Controller Set-up dialog box. A message appears in the Current Status box to indicate whether the transmission of the Comms Controller set-up block was successful. The following message indicates that transmission was successful: *Setup sent successfully.*

The possibility of errors when starting globals

The following possible sources of error exist:

- Wrong numbers for points, UCs, Comms Controller and Unet/ARCnet globals.
- Globals not being activated, caused by incorrect or insufficient Comms Controller set-up.
- Strategy not being activated in the target Comms Controller, caused by incorrect or insufficient UC Set-up.

MANAGING GLOBAL FILES

Saving globals

Globals are saved when the strategies that contain them are saved. To save a strategy, click the save button on the toolbar or choose **Save** from the **File** menu. For further details on saving a strategy, see *Saving Files* on page 64.

Deleting globals

To delete a global select it on the drawing area, in the same way that you would select a module, and press the Delete key on the keyboard.

Downloading globals

Globals are downloaded by downloading the strategies that contain them. If automatic download (see page 190) has been not been enabled, then the controller's memory must be wiped before downloading, and set-up must be sent to the controller after downloading, so that the downloaded blocks will be serviced. See *Sending information to a Field Controller* on page 266 and *Sending information to a Communications* Controller on page 263 for further details of memory wipes and sending set-up.

Uploading globals

Globals are saved and implemented as parts of strategies. They can be uploaded by uploading the **Strategies** in which they are implemented, as long as they are connected to other modules in the strategy.

For details of how to upload a global, refer to *Uploading from a Communications Controller - globals* on page 284.

Defining globals

Globals are defined by entering the required parameters either

- in their individual dialog boxes (see below) or
- in the Globals editor (see *Defining Globals in the Global Editor* on page 377).

When a global is placed on the drawing area, the **Engineering Centre** automatically displays the dialog box for that global. Alternatively, right click in the global symbol on the drawing area to view its dialog box.

If you require a broadcast global is required, that is, a global that passes a value to the same point on all UCs on a target Fieldbus, you can specify this in the global dialog box by checking the **Broadcast** checkbox. This will then reserve that point for receipt of values from the global on all UCs on that Fieldbus.

> **Note:** When you are setting up a global broadcast you must ensure that the point on each of the target Fieldbus UCs to which the value will be passed is available. In other words, you must ensure that they are not already being used by another strategy. If any of the points to which the broadcast global value will be passed is already in use in a strategy, then there may be a conflict between the value of the point in its existing strategy and the value being passed to it by the broadcast global. One option is to create a strategy for each of the UCs on the target Fieldbus, place in each strategy an input global, check the Broadcast checkbox in the global dialog box and, by dragging the mouse, join each global symbol to the same target point in each strategy.

How to define local output globals

To define a local output global, you must

- Place the local output global on the drawing area (see page 319)
- Complete the local output global's dialog box (see page 320)

How to define local input globals

To define a local input global, you must

- Place the local input symbol on the drawing area (see page 326)
- Complete the local input global's dialog box (see page 327)

How to define Wide Output globals

To define a wide output global, you must

- Place the Wide output global on the drawing area (see page 331)
- Complete the Wide output global's dialog box (see page 331)

How to define Wide Input globals

To define a wide input global, you must

- Place the Wide Input Global symbol on the drawing area (see page 335)
- Complete the Wide Input Global's dialog box (see page 336)

DEFINING GLOBALS IN THE GLOBAL EDITOR

The Global Editor

The **Global Editor** is a tool for managing all of the globals in a Comms Controller at once. It displays all of the globals in a single Comms Controller, allows them to be edited, and allows new globals to be defined.
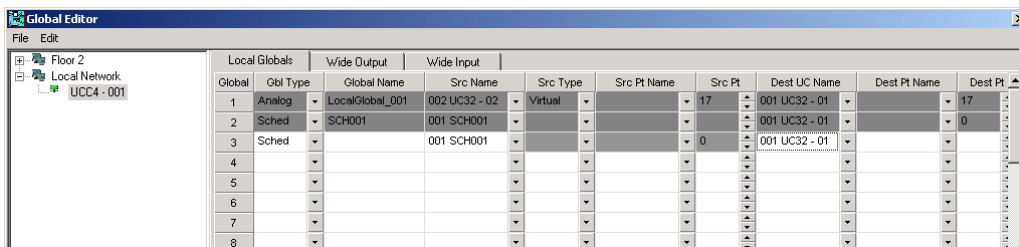
The **Global Editor** is displayed when 'Global Editor' is selected on the Engineering Centre's **File** menu.
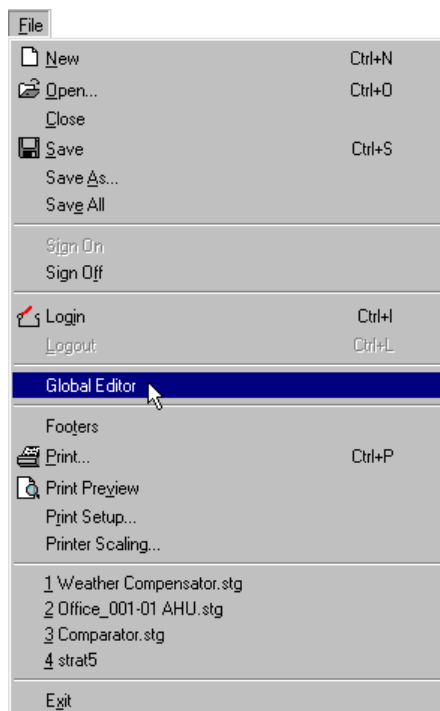
A 'site list' on the left-hand side of the editor allows you to target a Comms Controller...
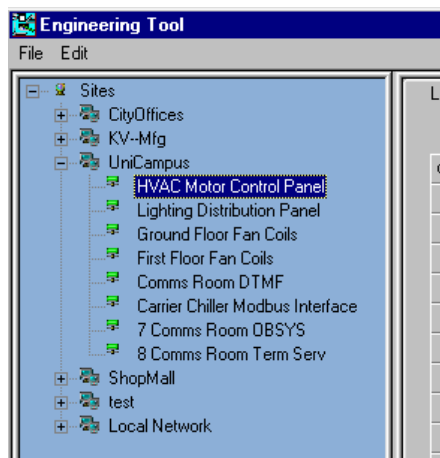
...and the globals in that Comms Controller will be listed on the right-hand side of the editor.

Global	Gbl Type		Global Name	Src Name		Src Type		Src Pt Name	
1	Analog	▾	LocalGlobal_001	002 UC32 - 02	▾	Virtual	▾		▾
2	Sched	▾	SCH001	001 SCH001	▾		▾		▾
3	Sched			001 SCH001			▾		▾
4	Analog	▾		001 UC32 - 01	▾	Hardware	▾	002 Temperature	▾
5	Digital	▾		001 UC32 - 01	▾	Virtual	▾	004 Digital_1_1_1	▾
6	Digital	▾		001 UC32 - 01	▾	Hardware	▾	006 Switch1	

Some of the entries in the globals list may be displayed with a white background,

4	Analog	▾		001 UC32 - 01	▾	Hardware	▾	002 Temperature	▾
5	Digital	▾		001 UC32 - 01	▾	Virtual	▾	004 Digital_1_1_1	▾

While others may have a shaded background.

1	Analog	▾	LocalGlobal_001	002 UC32 - 02	▾	Virtual	▾
2	Sched	▾	SCH001	001 SCH001	▾		▾

The shaded background indicates that the global was originally created in a strategy drawing. Shaded globals cannot be edited in the Global Editor, because if they change then the strategy drawings also have to change.

Defining Local Globals in the editor

To define a new global simply enter the following details in any blank line on the globals list:

> **Note:** These parameters are identical to those set in the Global dialog box (see pages 320, 327, 331, and 336)

Global **Type**:

A **Name** for this global:

If the global type is analog or digital, the **Src Name** field is used to select the UC containing the globals source point. If the schedule global type has been selected, this field is to select the schedule.

If the global type is analog or digital you must specify if the source type is a virtual or hardware point.

Source point Name and Number :

For convenience, a Src Pt Name column is provided. The source point for the global can be selected from a list of named globals, and its number will be entered in the Src No column.

If the point name has not been allocated a name then the Src no must be entered manually.

Note: The source number is the most important information in the definition of the Global's source point. The point name is not stored in the Comms Controller, it is cross-referenced from the Cylon database.

The Field Controller containing the global's destination point

Destination point Name and Number:

For convenience, a Dest Pt Name column is provided. The destination point for the global can be selected from a list of named globals, and its number will be entered in the Dest Point No column.

If the point has not been allocated a name then the Dest Point no must be entered manually.

> **Note**: The source number is the most important information in the definition of the Global's source point. The point name is not stored in the Comms Controller, it is cross-referenced from the Cylon database.

The **Default Value** for the global

How often the value of the global should be transmitted across the sub network:

If the global is a Time Schedule, the time of day that the schedule will next be activated (go "**On**"),

and the time of day at which it will next be deactivated (go "**Off**") are sent as decimal analog values.

The points to which those values will be sent can be set in the global editor.

Defining Wide Globals in the editor

Clicking on the **Wide Input** and **Wide Output** tabs at the top of the **Global Editor** allow you to define or set up Wide globals in a similar manner to the Local Globals described in *Defining Local Globals in the editor* on page 379.
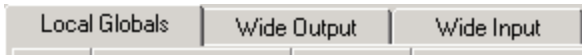
The Global type, number, and name, and the source point parameters are set as in the local global list, but there are no destination or time schedule point parameters.

Global	Glbl Type	Arc Num	Global Name	Src Name	Src Pt Type	Src Pt Name	Src Pt No	Def. Value.
1								
2								
3								

Editing globals in the editor

Globals can be edited in the same way that they are defined in the editor (see *Defining Local Globals in the* editor on page 379), as long as they were not originally created as part of a strategy drawing (i.e. they must not be 'shaded' in the global list).

Saving changes made in the editor

To save the changes made in the Global Editor, select **Save** from the **File** menu.

If you try to close the editor while there are unsaved changes the **Save Globals** dialog will open.

This dialog gives you the option of saving some or all of the unsaved changes in the editor.

Select the items in the field in the middle of the dialog and click the **Yes** button to save the information.
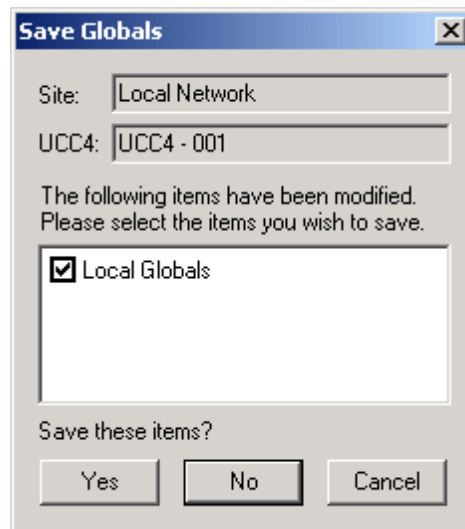
SECTION 11 : TIME SCHEDULES

TIME SCHEDULES - OVERVIEW

Comms Controller time schedules contain on/off times for each day in a week as well as for exception periods. They are saved and serviced in Comms Controllers.

Details of on/off times and exception periods for a Comms Controller time schedule are entered in the **Schedule Planner** program. For further information on the Schedule Planner program, see MAN-0054 Schedule Planner User Manual.

Before on/off times can be entered into the Comms Controller time schedule, the time schedule must first be defined. This is done in the Engineering Centre.

Comms Controller time schedules must pass on/off times to the controllers connected to the equipment to which they apply, so a global must be set-up to pass the time schedules values to the correct controller. In the Engineering Centre, the global is set-up at the same time as the time schedule.

> **Note**: Time schedules operate according to the time in the controller (UC32/UCU/UC or UC32.net /UCC4) clock, not the clock of the Supervisory PC .

SETTING UP A COMMS CONTROLLER TIME SCHEDULE

Before you define a Comms Controller time schedule, you must first decide if it will be used to pass on/off times to one or all controllers on its own Fieldbus, or to one or all controllers on a different Fieldbus.

- If the values are to be passed to one or all controllers on the Fieldbus of the Comms Controller in which the time schedule is being set-up, you must set-up a local time schedule global (see *Using Time Schedule globals in strategies* on page 338) to pass the values.

- If the values are to be passed to one or all controllers on the Fieldbus of a different Comms Controller to the one in which the time schedule is being set-up, you must set-up a **wide time schedule global** to pass the values.

The procedure for setting up either of these types of time schedule global and associated time schedule is the same.

HOW TO SET UP A COMMS CONTROLLER TIME SCHEDULE

For details of how to use time schedule globals in strategies, refer to *Using Time Schedule globals in strategies* on page 338.

DOWNLOADING COMMS CONTROLLER TIME SCHEDULES

The Comms Controller time schedule will be downloaded to the Comms Controller for which it was defined when the strategy in which the global is placed is downloaded to its controller. If automatic download has been enabled (see *Downloading a strategy using Automatic Download* on page 190), it is not necessary to wipe memory before downloading, nor to send set-up after downloading.

DELETING COMMS CONTROLLER TIME SCHEDULES

Comms Controller time schedules may be deleted by wiping the memory of the Comms Controller to which it has been downloaded. For information on wiping the memory of a Comms Controller, see *Wiping a Communications Controller's memory* on page 263.

For **UCC4**-type Comms Controllers, Time Schedules can be removed from the Cylon database by targeting a particular **UCC4**-type comms controller, and selecting Remove Time Schedules from the `UCC4` menu.

This opens a list of all the time schedules in the Comms Controller....
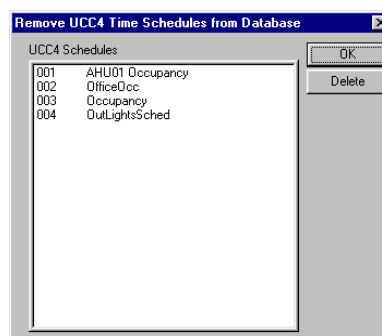
....from which you can select one of the files to be deleted.
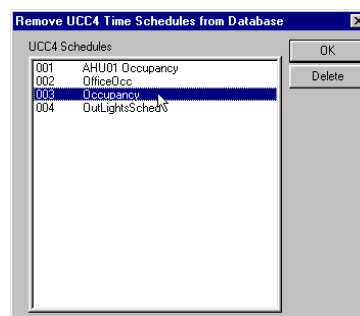
Pressing the delete button...
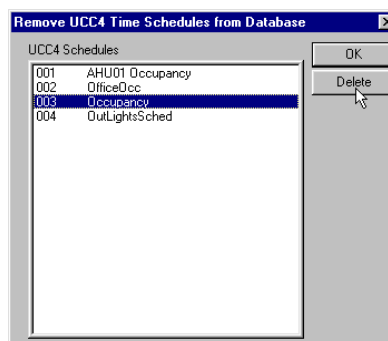
...removes the item from the list of Schedules.
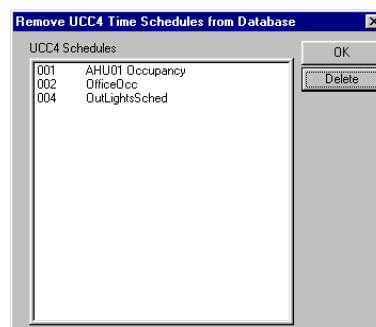
STARTING COMMS CONTROLLER TIME SCHEDULES

A Comms Controller time schedule will start to pass values to the target controller as soon as the target controller begins to service the strategy. If Automatic Download (see *Downloading a strategy using Automatic Download* on page 190) has been enabled, the strategy will be serviced immediately on being downloaded. For information on downloading strategies, see Downloading a strategy on page 189.

Adjusting time schedules

A Comms Controller time schedule may be edited by using the Schedule Planner program. See *MAN-0054 Schedule Planner User Manual* for details of how to use the Schedule Planner program.

HOW UC TIME SCHEDULES ARE UPDATED BY THE COMMS CONTROLLER TIME SCHEDULE

With the use of time schedule local globals is also possible to update UC time schedules on the Fieldbus from a Comms Controller time schedule. The update can either be sent to one time schedule on the Fieldbus or to all time schedules on the Fieldbus at the specified block number.

UC time schedules linked to a Comms Controller time schedule by a local global are updated by the Comms Controller time schedule in two ways:

- When changes made to the Comms Controller time schedule are downloaded, the UC time schedules linked to it are updated immediately.

- UC time schedules are updated by the Comms Controller time schedule to which they are linked on a daily basis.

Daily updating of UC time schedules

The daily update takes place as follows:

- At 00.01 each day, all local globals are examined to see if they have been defined as time schedule local globals and have 255 entered in both the On and Off Time fields of the Point Numbers for Next Schedule section of their definition.

- When such a local global is found, the list of Comms Controller time schedules is searched for the first exception block (if any), of the specified time schedule, which will be active on the current day -2+7 (that is, in five days' time).

- The first such exception block found is downloaded to the linked UC time schedule(s) as both the first and second set of on/off times for that day.

- If no exception block is found, the first standard week defined in the Comms Controller time schedule is searched for the settings for the current day -2 and these are downloaded to the corresponding day of the linked UC time schedule(s) as the first set of on/off times.

- If a second standard week has been defined in the Comms Controller time schedule, the settings for the current day -2 are downloaded to the corresponding day of the linked UC time schedule(s) as the second set of on/off times.

The two day time lag incorporated into the updating procedure ensures that this type of updating does not affect the performance of any Optimizers on the site.

SECTION 12 : DATALOGS

DATALOGS - OVERVIEW

Datalogs are a feature of Field Controllers, which allows point values in a controller to be recorded over a period of time. The recorded data can be later retrieved, displayed, and analyzed with the Datalog Manager module.

Analysis of logged data is often useful in optimizing the effectiveness of a Cylon site's controllers and strategies.

The datalog function module

The collection of point values in a datalog is implemented into a strategy by using the datalog function module.
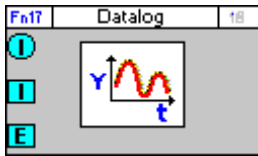
Restrictions on the use of datalogs

The number of datalogs permitted in a strategy depends on the type of controller in which the strategy will be used.

Some controllers, such as the **UC24PG-R** can have up to 16 datalogs, with a maximum of 192 entries per datalog. Other controllers, such as the UCU10VAV, have up to 4 datalogs, with a maximum of 102 entries in each. A **UC32.24** can store up to 1023 entries in a standard datalog, and 512 entries in a time stamped datalog. You can determine the number of datalogs that a particular controller can hold using the Managers dialog box, available from the View menu.

Standard Datalog sampling period

Each standard datalog module can be configured with an individual time constant for sampling data. To make the evaluation of datalogs easier it is advisable to use the same time period for sampling data in all datalog modules. A sampling period of 15 minutes is suggested.

The period of time over which the datalog samples is equal to the product of number of entries (104 or 192) and the sampling frequency. For example, a datalog module on a UC16PG with a sampling frequency of 15 minutes (900 seconds) will take samples for (192 X 15) minutes = 48 hours.

Time Stamped Datalogs

A time stamped datalog records the time and date at which a value was recorded, along with the value. A logging interval is not set - instead the value of the specified point is recorded:

- when the digital trigger point changes state
- when a logged digital point changes state
- or when a logged analog point changes state by more than a predefined amount from the last value that was logged for it.

There are several situations when such a datalog would be particularly useful. For instance, if you log the value of a point with a conventional datalog and set the logging interval to 10 minutes, the value of the point may change

significantly and return to its original value over a period of 3 minutes, and that change might occur during the 10 minutes when the datalog is not recording. If so, the event would not be logged at all. On the other hand, if the logging interval was 30 seconds, the event would be recorded - but the datalog could fill up and the event could be 'flushed' before it is viewed. If so, the event would also be lost. In both of these cases, a time stamped datalog could record data over the period of the event only, so that the necessary data is recorded without the datalog filling up.

The other primary use of a time stamped datalog is to log conditions that surround an event. For instance, when a window is opened, the temperature of the surrounding area could be logged to see how it reacts.

DATALOG SAMPLING OF DIGITAL AND ANALOG POINT VALUES

Both digital and analog point values can be sampled. The datalog module has a digital input and an analog input.
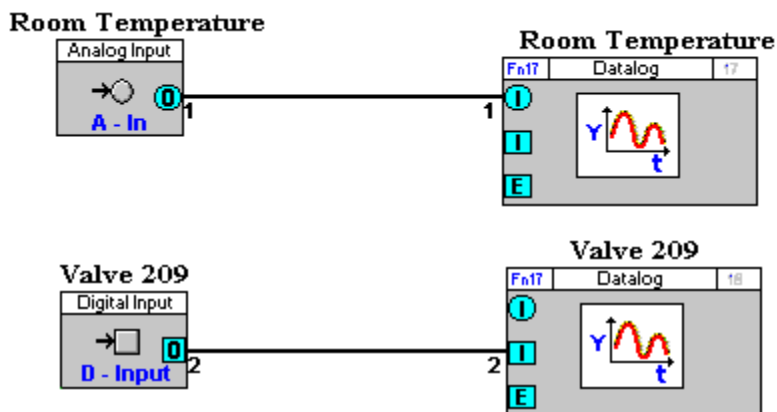
HOW TO DEFINE A DATALOG

To define a datalog, proceed as follows:

1. Place the datalog on the drawing area (see page 390)
2. Call the Datalog Definition dialog box (see page 390)
3. Complete the Datalog Definition dialog box (see page 391)
4. Confirm the datalog definition (see page 391)

Defining a datalog - Place the datalog on the drawing area

The datalog function module can be selected from the Statistic modules bar, pasted onto the drawing area, and joined to other modules in the strategy in the same way as any other function module. For further details of this procedure, see *Creating a strategy* in *Chapter 4 Strategies* in this manual.

Defining a datalog - Call the Datalog Definition dialog box

Once the Datalog module has been placed on the drawing area, the datalog can be defined. To define the datalog, call the **Datalog Definition dialog box** by clicking on the symbol with right mouse button. The dialog that will be displayed depends on whether a UC32 or UC/UCU controller is targeted.

UC32 Datalog Definition dialog:

UC or UCU Datalog Definition dialog:

Defining a datalog - Complete the Datalog Definition dialog box

The Datalog Definition dialog box has the following sections:

Block Number

This is the number of the block occupied by the Datalog module. This number is allocated automatically by the Engineering Centre.

Datalog Number

The Datalog Number field shows the number of the selected datalog module. Inside a UC datalogs are numbered 1 to 16. The datalog number is selected automatically by the Engineering Centre.

Datalog Description (UC32)/ Datalog Name (UC and UCU)

In Engineering Centre, a datalog is automatically given the same name as the point to which it is joined.

The name can be edited if required, by changing the text in the Datalog Description Datalog Name field of the **Datalog Definition** dialog box.

Log Point (UC32)/Point to Log (UC and UCU)

The Point to log field displays the number of the point to be logged. This can be a digital or analog point and is joined graphically to the datalog module.

Datalog Enable (UC32)/Enabling Point (UC and UCU)

The Enabling Point is a digital point, connected to input E of the datalog module, which restarts the sampling process if its value changes from 0 to 1. If this point is not connected the datalog samples continuously. In normal applications this input is not used.

Log Trigger Point (UC32)

In Time stamped datalogs, it is possible to record data when this trigger point changes. If the trigger point is not connected, logging occurs according to the '**Minimum Change**' parameter.

Datalog Point Type (UC32)/ Point Type (UC or UCU)

The type (analog or digital) of the point being sampled is shown in the Type of Point to Log. Once the Point to Log has been entered, this section is set automatically.

Update Interval

The frequency of sampling (in seconds) is entered in the Update Interval field.

Minimum Change for Analog Input (UC32 only)

If the datalog type is set to 'Time Stamped', and if the type of point being logged is analog, it is possible to trigger a sample whenever the point value changes by more than a particular amount. This field specifies that amount of change.

Advanced Options (UC32 only)

Clicking on this button opens the **Datalog Advanced Options** dialog. This allows you to set the datalog length, the number of decimal places that will be used when the datalog is displayed on a keypad and how the changing of a trigger point will affect the recording of time stamped datalogs.

Defining a datalog - Confirm the datalog definition

Click on OK to confirm the datalog definition as set out in the Datalog Definition dialog box. The strategy must now be downloaded to the controller for the datalog to take effect.

Steps 1 to 4 complete the procedure for defining a datalog.

STARTING A DATALOG

A datalog is part of a strategy and is saved with the strategy. The example below shows a datalog module linked to a strategy:
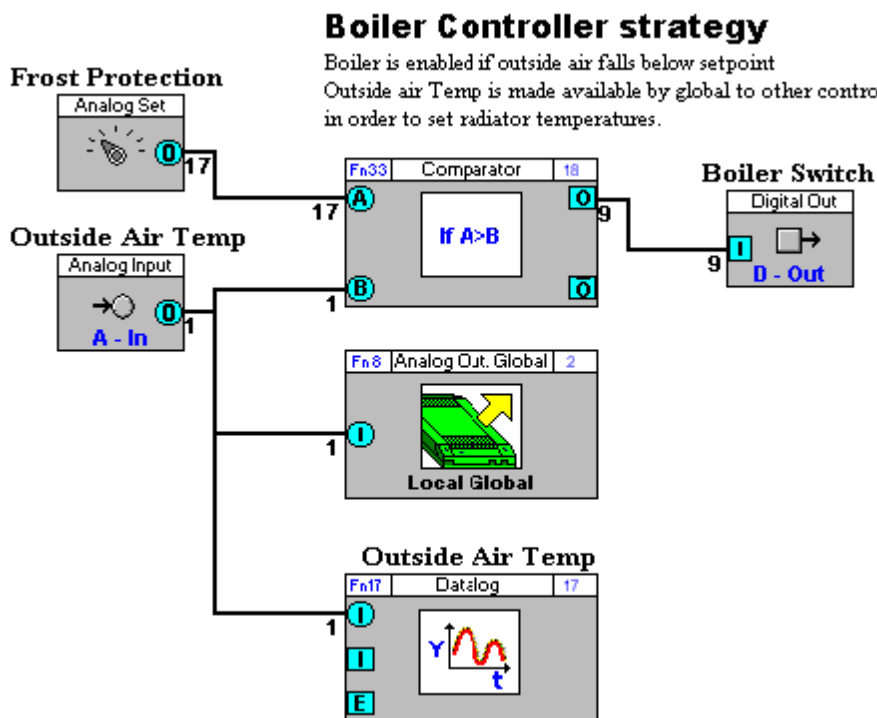
Datalogs are started along with the rest of the strategy in which they are contained, when the strategy has been saved (see page 177), downloaded (see page 189), started (see page 204) and tested (see page 207) .

> **Note:** If the block on which a datalog module is placed is downloaded again to the UC, the sampled data is deleted.

VIEWING THE CONTENTS OF A DATALOG

This is done on a PC running Cylon software.

The **Datalog Manager** program is used to view or print out datalogs, on screen or printer, as text or graphics. Clicking on the Datalog Manager icon in the Command Centre program group starts the program.
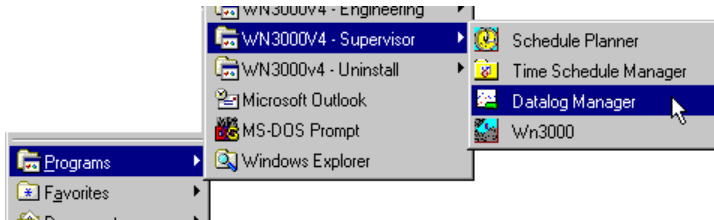
The Datalog Manager allows data from Field Controller datalogs to be viewed in a variety of ways:

- The data can be listed as text.
- A datalog can be viewed as a graph.
- Information from multiple datalogs can be superimposed on one graph.
- The status of data points can be viewed in real-time.
- 'Snapshots' can be made of data from any set of analog points in a controller strategy.

For further details on the display and printing of datalogs, see the *Datalog Manager* manual.

Archived datalogs can be statistically evaluated by using programs like Microsoft Excel. This provides valuable information about the operation of the site.

ARCHIVING DATALOGS

Archiving datalogs means storing them on the PC's hard disk. The **Reports** program can be used to do this automatically, when triggered either by time or by event.

For further details, see MAN-0044 - Reports Module User Manual.

SECTION 13 : ALARMS
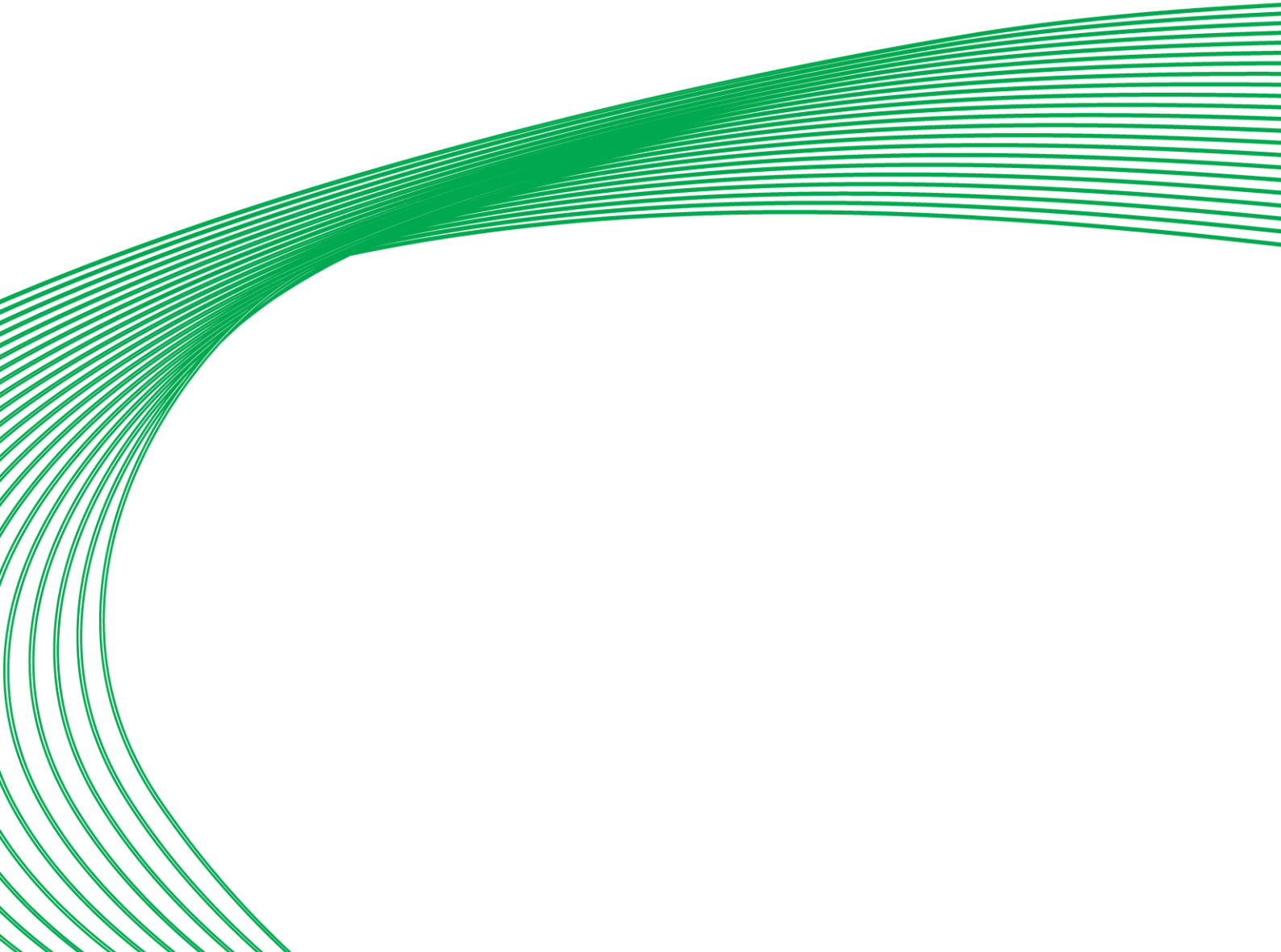
ALARMS - OVERVIEW

Alarms are used by the Cylon system to alert site supervisors/engineers to any difficulties that may occur in a site. The Cylon system uses the **Alarm Handler** program to send alarm messages.

An alarm message can be sent in a variety of ways – the most usual is to send the message to the supervisory PC, where it will appear on screen in a message window like the one below. Alarms can also be sent to printers, pagers, fax machines and via modems.

The example below shows that at 11:28 a.m. on the 26th January 1998, the Fieldbus of a Comms Controller called *cellar* went off-line. The message also shows that there is only 1 unacknowledged alarms, i.e. the Alarm handler program has sent just 1 alarm message to the supervisory PC which have not yet been read. To read any other alarms, click the **Acknowledge this alarm** button – this will close the active alarm message and display the previous unread alarm message. All UC alarms are assigned a priority, in the range 1 to 255. You can decide how alarms of different priorities are to be handled. For example, you may want the most important to be sent to an engineer via a pager, others to be sent to a printer, etc.

```
Subnet alarm from Local Network                    [X]
Priority:            1         UCC4: Cellar

Number of UC16s      1

Alarm occurred    11:28 26/01/98
The Subnet is down




Number of Unacknowledged Alarms:       1
        [ Acknowledge alarm ]   [ Acknowledge ALL alarms ]
```
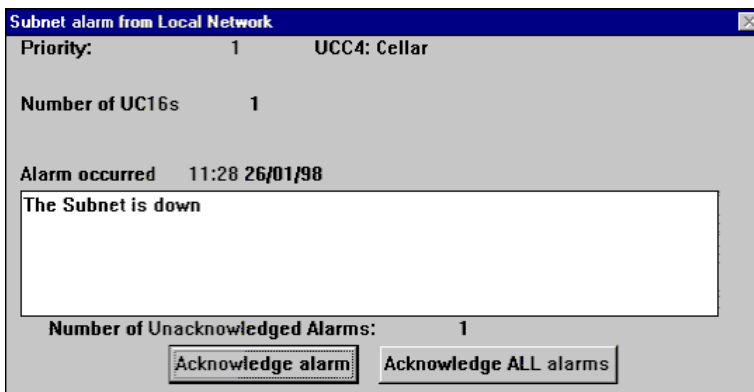
TYPES OF ALARMS

There are two main types of alarms:

- **System alarms:** If the problem originates in the Cylon system itself, e.g. a break may occur in the ARCnet network or a controller may go off-line, the alarm is said to be a system alarm. System alarms do not have to be set-up by the user, and always have priority 1. The example above is a system alarm, as it reports a controller going off-line.

- **Control alarms:** If there is a problem implementing a control, for example the temperature in a particular area of a site exceeds its predefined level, the alarm is said to be a control alarm. These alarms are set-up by the user and may be assigned a priority in the range 1 to 255.

All Comms Controller alarms are system alarms. UCs can send both system alarms and control alarms.

HOW TO ENABLE ALARMS:

For alarms to function, they must first be enabled in the **Configuration** module.

Run the **Cylon Configuration** utility (also called **CCConfig**) by choosing Configuration from the Cylon Engineering Centre group on the programs menu, or clicking the Configuration icon on the **Cylon Engineering Centre** toolbar
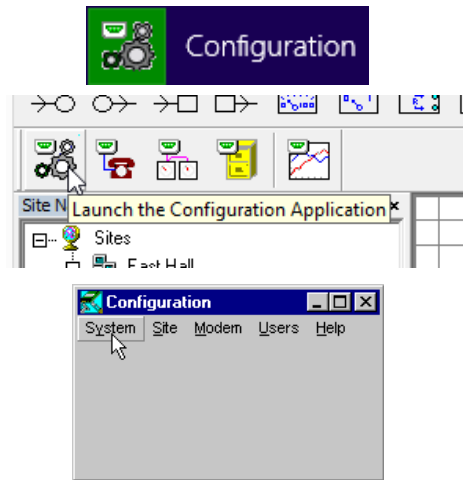
Click on the System menu

This will open the System Configuration dialog box.

To enable alarms, click the Alarm Scanning Enabled check box. Once checked, this option will ensure that the **Alarm Handler** will process any control and system alarms that occur on the site.

Click Save in the System Configuration box.

Close down and restart the **Engineering Centre**.

> **Note**: Alarm Scanning will not be enabled until the Cylon Engineering Centre or Unitron Command Centre is restarted.

SETTING UP ALARMS

To set-up a UC alarm, you must use the Engineering Centre to include an alarm module in the strategy that is downloaded to the particular UC. Details of how to do this are provided in the guide below.

Comms Controller alarms are system and not control alarms, i.e. do not relate to the implementation of controls. They are predefined, and so (unlike UC alarms) they do not need to be manually set up.

HOW TO SET UP A CONTROL ALARM

A **control alarm** is set-up by including the **alarm module** in a UC strategy. The alarm module is joined to a digital point. When the digital point has the value 1, an alarm present message is generated and sent to the **Alarm Handler** program. If the point value changes back to 0, an alarm end message is generated and sent to the Alarm Handler program. Along with the status of the digital alarm point and the alarm text, an analog point value can be displayed in the **Alarm Handler** program

An alarm event is always represented by a value of 1 in the digital point connected to the alarm module in the strategy.

To set up this strategy, proceed as follows:

(for illustration, this procedure uses a simple example of a pump trip switch – see page 403)

1. Create or open the strategy (see page 398)
2. Select a target (see page 398)
3. Choose the Alarm module from the statistics modules bar (see page 398)
4. Place the alarm module on the drawing area (see page 398)
5. Join the alarm module to the point it is monitoring (see page 399)
6. Complete the alarm record dialog box (see page 399)

Setting up alarms - Create or open the strategy

If you want to include an alarm in an existing strategy, open the strategy by clicking the open button on the toolbar or by clicking **Open** on the **File** menu and completing the **Open** dialog box.

If you are including an alarm in a new strategy, click the new button on the toolbar or click **New** on the **File** menu, and then add any required modules to which the alarm will be connected:
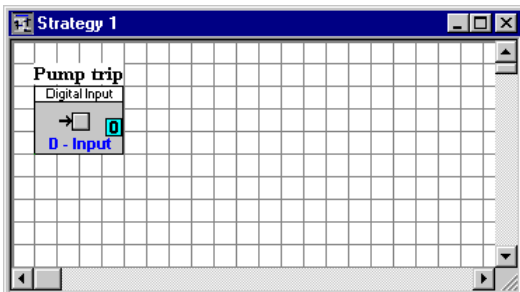
Setting up alarms - Select a target

To set a target for the alarm, select a controller from the Site List.

Setting up alarms - Choose the Alarm module from the statistics modules bar

Select the Alarm module from the statistics module bar by clicking it.

Setting up alarms - Place the alarm module on the drawing area

Click the drawing area to place the alarm module in the strategy.

If you are using an existing strategy, the strategy's modules will be on the drawing area. If you are creating the strategy from scratch, you must place and join the required modules on the drawing area.
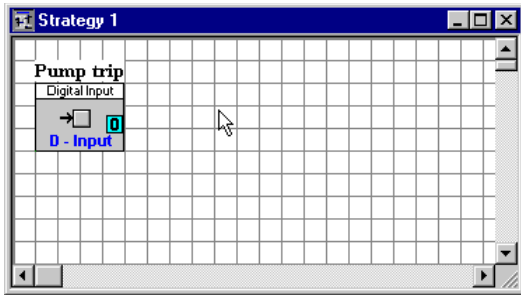
Position the alarm module in a place where it can easily be joined to the point that it is monitoring.
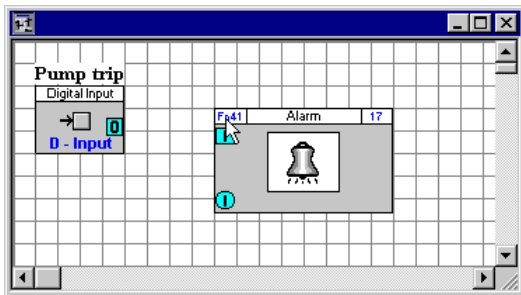
Setting up alarms - Join the alarm module to the point it is monitoring

Use the mouse to drag a connection line between the point that is to be monitored by the alarm and the alarm module. (See *Joining modules in a strategy* on page 84).
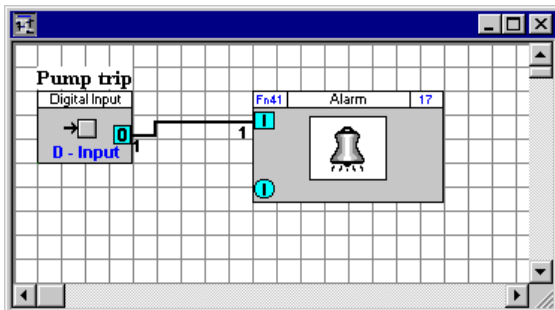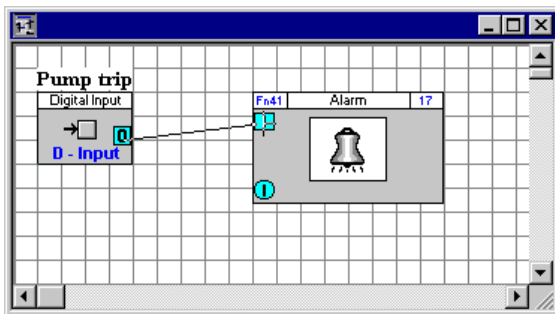
Setting up alarms - Complete the alarm record dialog box

Right click the Alarm module symbol on the drawing area to open its dialog box.
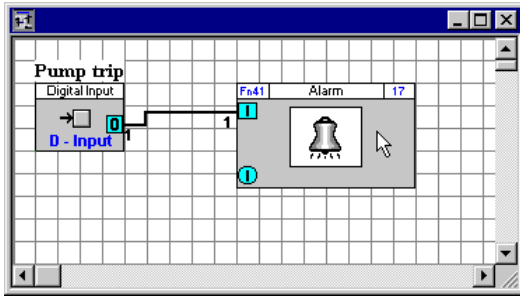
The Alarm Record dialog box has the following sections:

Block Number

This is the number of the block occupied by the module. It is entered automatically by the Engineering Centre and cannot be edited.

Input Point

The number of the joined digital point which represents the alarm event will be displayed in the Input point field. Again this is entered automatically when you join the trigger point and it cannot be edited.

Priority (1-255)

Alarms can be sorted into 255 priorities. Priorities are allocated to all alarms, and all alarms of the same priority are treated as having the same importance. You should stipulate what priority is to be given to which alarm. System Alarms are all priority 1. The priority allocated to the alarm being defined is entered in the Priority (1-255) field. The alarm will remain at this priority unless changed in this dialog box.

To save time, it is important to define the priorities before alarms are configured. Site-orientated alarm types should be grouped to be handled together by Comms Controllers and PCs.

Some possible ways of assigning priority to alarms are given below:

- Different priorities for different parts of buildings/sites
- Technical priorities assigned in order of importance:
  - o Alarm contacts of fire/security systems
  - o Disturbances, emergency contacts
  - o Switches for maintenance, automatic, manual
  - o Contacts for monitoring belts (ventilators)
  - o States (for example, "Temperature out of Acceptable Range")
  - o Sensor Broken
- Different priorities for repeated alarms and first alarms for any given event
- Different priorities for dial-out-alarms and local alarms
- Different priorities for alarms to be transferred by pager, fax, etc.

Alarm Number

A unique ID number is assigned to the alarm being configured in the Alarm Number field. This number must be unique in the UC. If the number is not entered, the alarm will not be seen by the Comms Controller. This means that the alarm will not work.

Alarm Point

The number of the analog point, which is joined to the alarm module, is displayed in the Alarm Point field. The value of this analog point will be displayed together with the text string in the alarm message. Whether or not this input of the module should be connected depends on the situation for which the alarm is being configured.

Text

In the Text field, a string of up to 9 characters can be entered. This will be displayed as the alarm message, if no alarm text has been configured in or downloaded to the Comms Controller. If the alarm is linked with existing alarm text strings in the Comms Controller, the string in the text field will be ignored.

> **Note:** This short text string is used for test reasons. In real applications on site, it should be ignored. Alarm messages should be defined in Comms Controllers in real applications.

Start Alarm and End Alarm

The **Start Alarm** and **End Alarm** drop-down lists show all of the Alarm text strings available in the Comms Controller to which the UC is connected. The text selected in **Start Alarm** is the text string in the Comms Controller that is sent to the Alarm Handler program when an alarm event occurs. The text selected in the **End Alarm** box is the text string in the Comms Controller that is sent to the Alarm Handler when the alarm event ends. These text strings are usually created and downloaded to the Comms Controller from the **UC32.net** menu or **UCC4** Configuration program, but can also be created by typing in the **Start Alarm** and **End Alarm** boxes in the **Alarm Record** dialog.

> **Note**: When setting up Alarm strings, it is necessary to send the Site ID to all Comms Controllers on the site, using the UC32.net menu Send Site option or the UCC4 Configuration program.

For time-saving reasons it is important to organise the relations between string numbers, text and alarms well. These relations should be clear before the alarms themselves are configured.

STARTING ALARMS

Alarms are parts of strategies and are saved with the strategies. Examples 1, 2 and 3 show how alarm modules can be linked to a strategy.

Alarms are started after the related strategies have been saved, downloaded, started and tested.

EXAMPLES OF STRATEGIES CONTAINING ALARMS

Alarms - Example 1: Pump Trip Switch

To illustrate the use of an alarm module in a strategy, this guide takes as an example a simple case where a digital hardware input represents a trip-switch contact of a pump. Joining the digital input to an alarm module means that an alarm will be generated if the pump goes off-line.
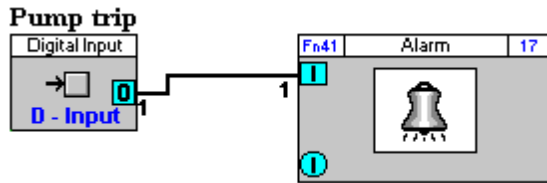
Alarms - Example 2: Pump Trip Switch with delay

This case joins a digital virtual point (a delay of 60 seconds on the digital hardware input) to the alarm record function module.
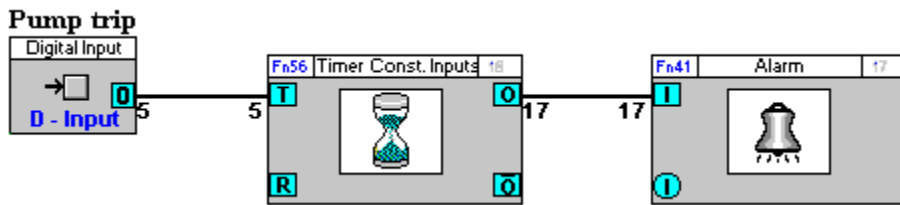
Alarms - Example 3: Room Temperature Input

In this case, an analog input (room temperature) is joined to the alarm record function module, and will cause an alarm to be sent to the Alarm Handler program if the input value is not within the range specified in the real constant module.
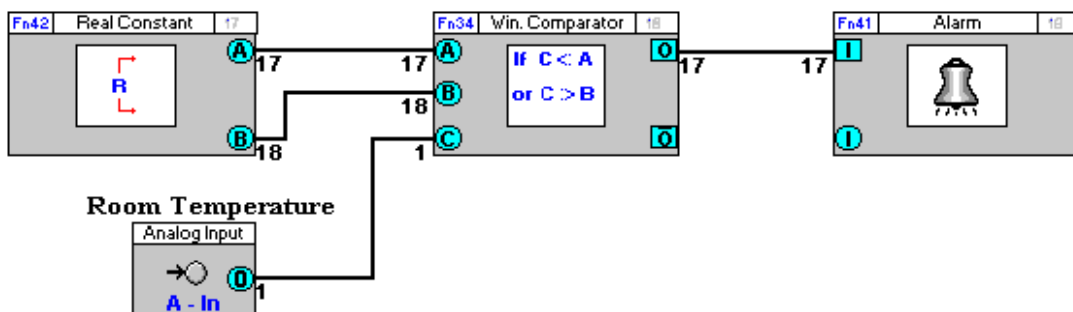
SECTION 14 : SIMULATION MODE

INTRODUCTION

A **Simulation Mode** is available within the **Cylon Engineering Centre**, which allows the operation of a strategy to be simulated without the requiring a controller to be connected. This is done, in most cases, by using actual Firmware code to ensure the simulation is as close as possible to real controllers.

To enable **Simulation Mode**, select **Controller Simulation** from the **View** menu:
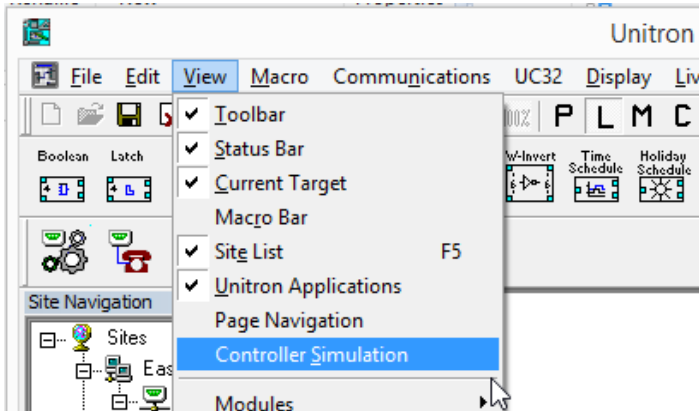
This will display the **Simulation Toolbar**:
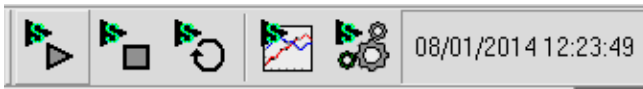
Clicking this button will start and pause the simulation for the current strategy. It is enabled only for CBM/CBT/UC32 strategies and if **Cylon Engineering Centre** is **not** logged into the site. When the strategy is paused, the current simulation state is still visible on the strategy.

Clicking this button will stop the simulation and clear the simulation information from the screen. However, the simulation state will still be preserved, and pressing the start button will restart from where it stopped.

Clicking this button will stop the simulation, clear the simulation information from the screen and clear any other simulation information for the strategy.

Clicking this button will enable or disable logging of data. When released, no point logging will happen. When pushed, any point that has logging information set will have its values logged accordingly.

Clicking this button opens the **Simulation Configuration** dialog.

CONFIGURING THE SIMULATION

Several aspects of the Simulation can be configured by pressing the [icon] button in the **Simulation Toolbar**. This opens the Simulation Configuration dialog:
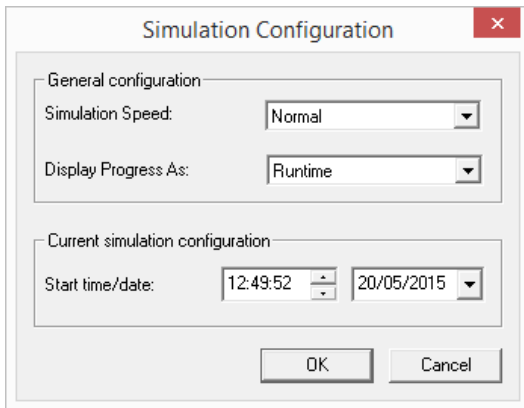
The Simulation Cycle

The basic unit for a simulation is a **Simulation Cycle**. This corresponds to approximately 1 second of runtime on a controller. Some modules (Hardware, Globals, time dependent modules) will be processed a fixed number of time during a cycle. Most of the other modules will be processed a number of times that depends on the size of the strategy. The bigger the strategy, the less the modules will be processed.

Simulation speed

The Simulation can be run manually ("Step by Step") where each click on the start button runs one Simulation Cycle, or automatically at one of 3 speeds: **Slow** (once cycle every 5 seconds), **Normal** (one cycle per second) or **Fast** (5 cycles per second).

Display Progress As:

The progress of the current simulation is displayed in the right-most section of the Simulation Toolbar. This progress can be displayed as **Runtime** (number of seconds since the simulation started) or **Date/Time** (current simulation date and time)

Current simulation configuration Start time/date:

When the Simulation Cycle is run, any time and date dependent modules – such as Time Schedules or Datalogs/Trendlogs - will use a simulated time. The value used will be the time and date set in the **Current simulation configuration Start time/date** field of the **Simulation Configuration** dialog, incremented by one second on each Simulation Cycle.

This allows a Strategy to be tested for unusual behaviours at specific times such as daylight savings time, year-end, leap years etc.

The value of this time and date will be displayed in the right-most section of the **Simulation Toolbar** if the **Display Progress As** field is set to **Date/Time**.

RUNNING A SIMULATION

When a Simulation runs, the labels at the end of lines will be updated to show the point values.
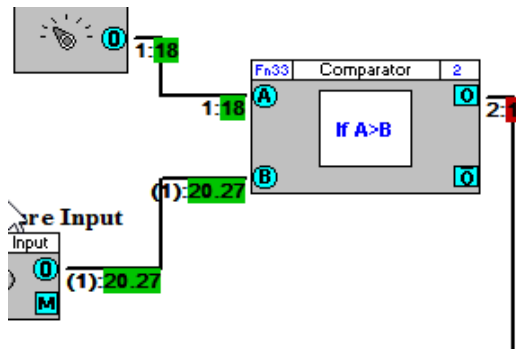
A green background means that the value is calculated by the simulation.

A red background indicates that the value has been overridden by the user.

> **Note**: It is possible to add, update and delete modules and lines while the simulation is running. The simulation will take it instantly into account in its calculations.

Livelog

During a simulation the livelog will display values from a simulation run so that it is possible to view point values from different parts of the strategy simultaneously.

POINT PROPERTIES

The Simulation mode has two sets of point properties:

- one for input points that feed into the Strategy (hardware inputs and Globals' destinations),

- one for all the other points whose values result from the Strategy's internal calculation.

Accessing the points properties

To open the Simulation Properties for a specific point right click on it and select **Simulation properties**:

Lines
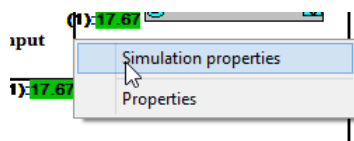
Hardware Inputs and Destination Globals
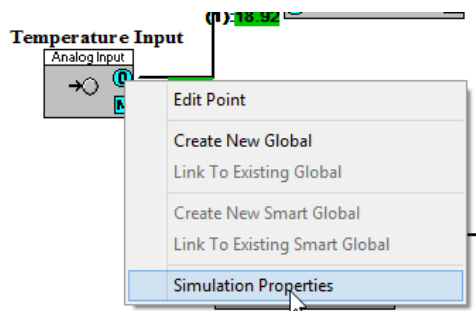
Connected nodes:
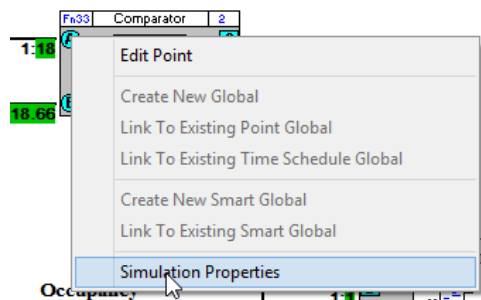
Point value override

In a point's Simulation properties dialog you can specify whether the value for the point will be calculated by the Simulation, or set to a fixed value:

<u>Analog points:</u>

Point calculated automatically:
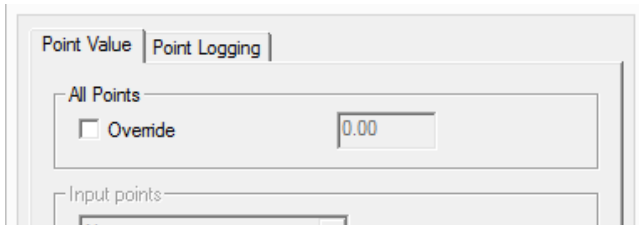
Point overridden and set to 18.5:
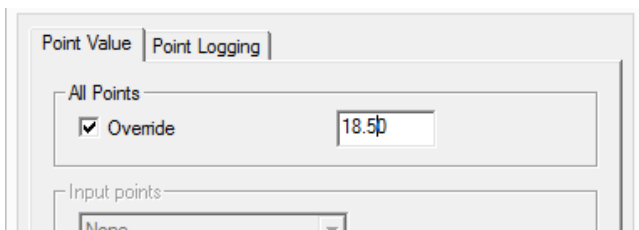
<u>Digital Points:</u>

Point calculated automatically:
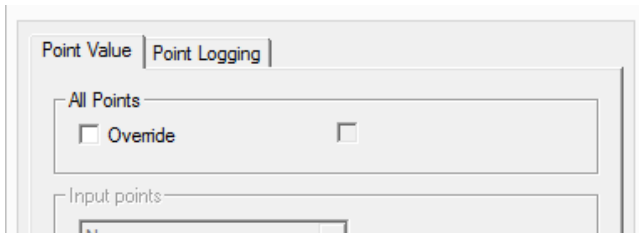
Point overridden, and set to "Off" (boolean 0)
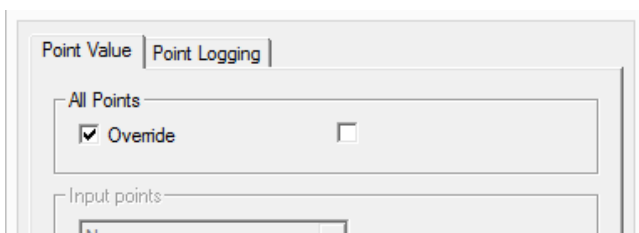
Point overridden, and set to "On" (boolean 1)
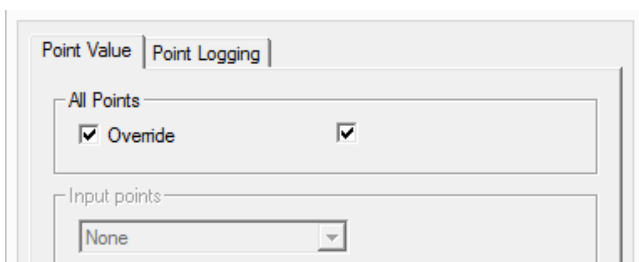
Input point options

For input point, a selection of options is available to simulate different types of inputs. For Digital points there are two options, for Analog points there are 7:

Digital Input point options
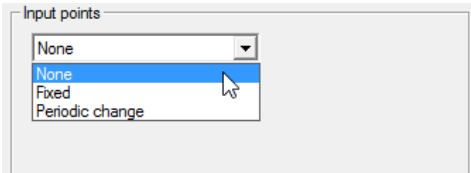
- Fixed value

The point will have a fixed value throughout the Simulation run.

Value is "Off" for the whole Simulation run:
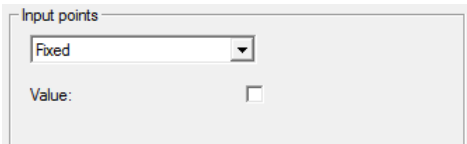
Value is "On" for the whole Simulation run:
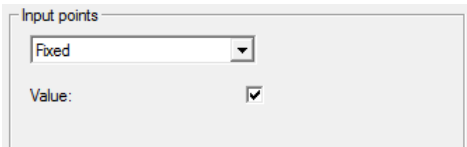
- Periodic change

This option will change the value of the digital point during the Simulation run.

If the **Random period** box is unchecked, the value will change after the **Basic Period** specified:
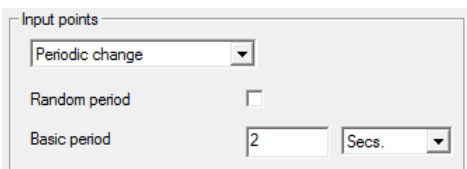
If the **Random period** box is checked, the value will change after a random period which is less than the specified **Basic Period**:
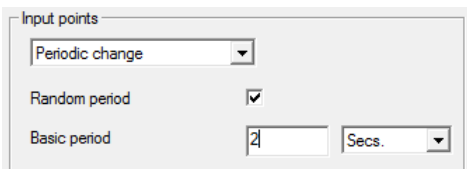
Analog Input point options:
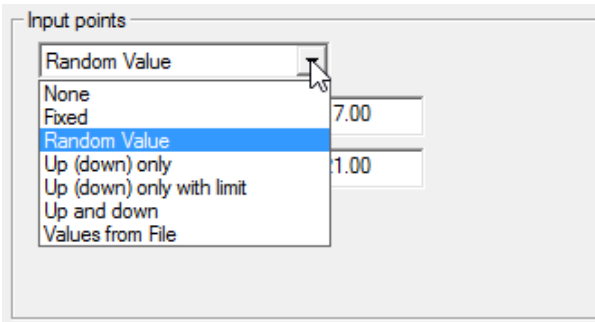
- None

The point is not assigned a value. The value will either be the last value that the point had, or zero if no previous value existed.
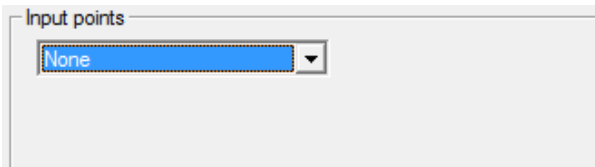
- Fixed

The point will have a fixed value throughout the Simulation run.
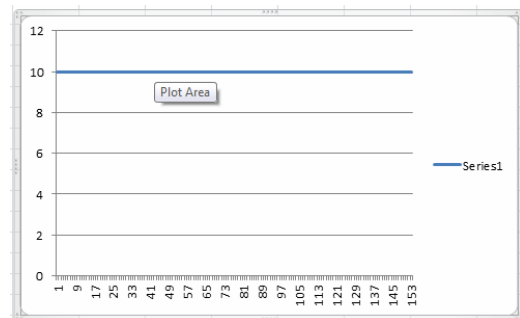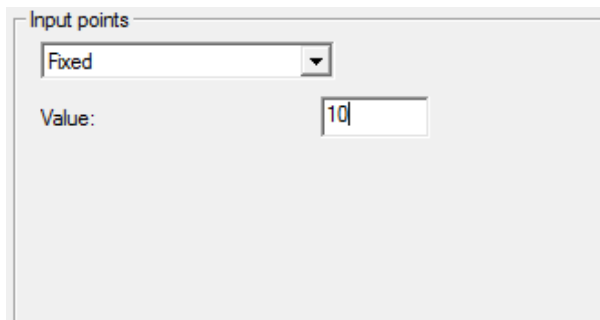
- Random value

During each simulation cycle, the point will be assigned a random value between a given minimum and maximum.
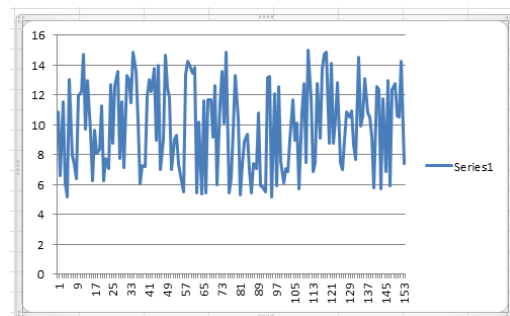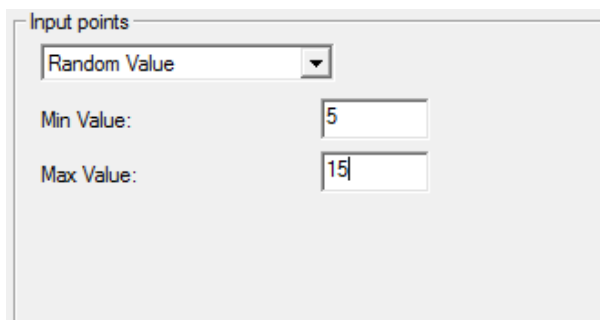
- Up (down) only

The value will change in only one direction (up or down). Use a negative step limit to go down.
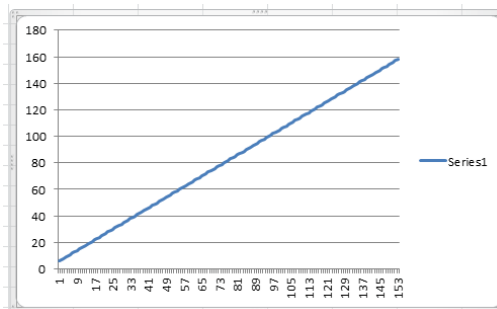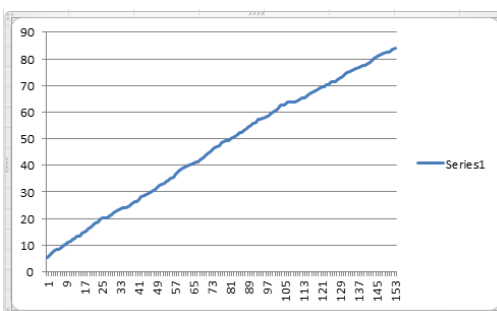
- Up (down) only with limit

The value will go from a Start value to a Stop value.
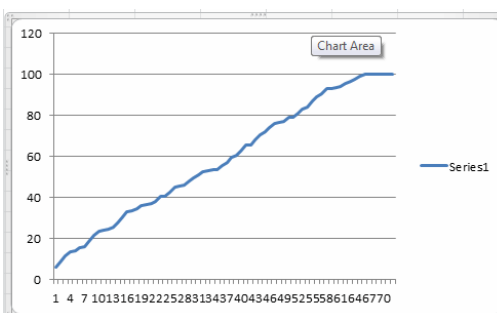
- Up and down

The value will go up and down continuously between two limits either by a specified step (fixed or random) with a specified period (specify the time to go from one limit to the other).
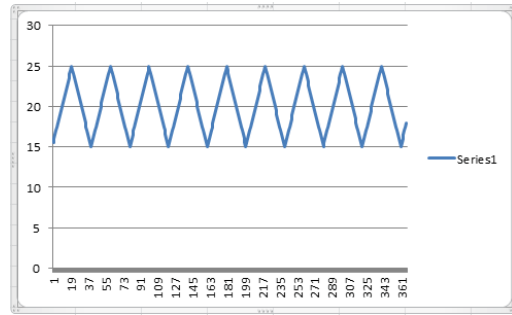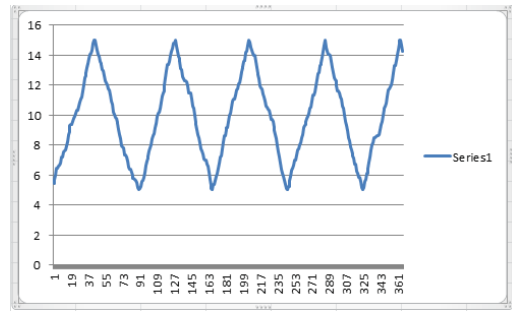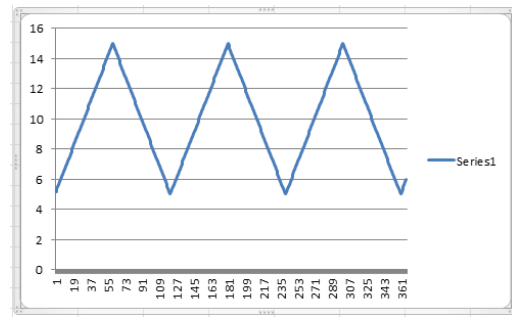
- Values from file

The point value will be taken from a datalog file – at each simulation cycle the next value will be read from the file.

This allows using real data such as a datalog of outside air temperature in the simulation. It also makes it possible to repeat a simulation exactly if the input points from the original simulation have been logged.
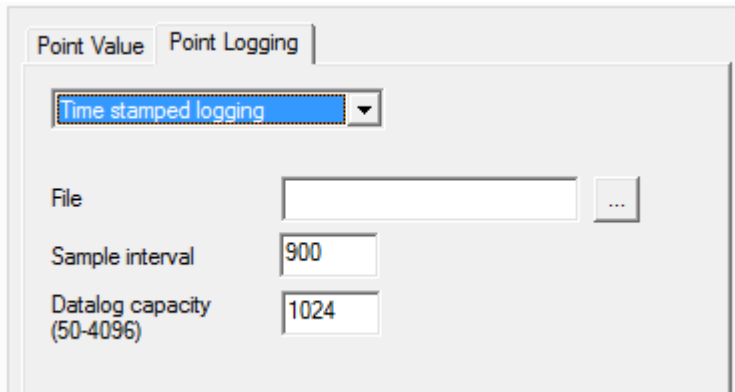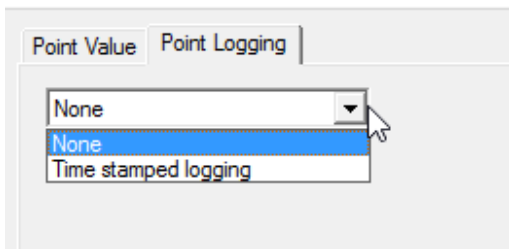
POINT LOGGING

Any point in the strategy can be logged to a file. This can be used to review values after the strategy has run, and analyse issues. It can also be used to feed back the value in another simulation (see "Input points options").

Note: Logging will occur only if both

1. the settings in the point Simulation properties dialog are set and

2. the logging button in the **Simulation Toolbar** is pressed.

This means that logging can be switched on or off during a simulation by clicking the logging button.

SECTION 15 : SITES

OVERVIEW

A **site** is the name given to one or more controllers, optionally connected to a PC. The following are examples of **sites**.

- A standalone **UC Field Controller**.
- One **Comms Controller** with a **Fieldbus** of one or more **Field Controllers**
- A network of **Comms Controllers**, each with a **Fieldbus** of one or more **Field Controllers**, connected to each other via TCP/IP.

Sites are configured in the **Configuration** program.

Some common procedures carried out on **sites** include:

- Installing a new **site** on the PC (see page 418)
- **Site** backup (see page 419)

INSTALLING A NEW SITE ON THE PC

To install a new site on a PC, the **Cylon Software Suite** must be installed already.

A new **site** is one which has not been installed on this PC before, and for which a backup from another PC does not exist.

WHAT HAPPENS WHEN A NEW SITE IS INSTALLED

Installing a new site involves the following events:

- Site-specific directories are created on the hard disk.
- Site-specific information (information about network ID, telephone number, ID code, etc.) is entered in the WN3000.ini file.
- The network size (number of Comms Controllers) is specified.
- The Comms Controllers and Field Controllers are named.

The **Configuration** program performs all these steps. For further details, see *MAN-0041 Configuration User Manual.*

> **Note:** Do not manually make entries to the WN3000.ini when installing a site on the PC. All necessary changes will be made to the WN3000. INI file by the Configuration program.

HOW A NEW SITE IS INSTALLED ON THE PC

Installing a new site on the PC involves the following procedures:

- Naming the new site in the Configuration program.
- Entering the size of the site (number of Comms Controllers) in the Configuration program.
- Naming the Comms Controllers and Field Controllers in the Configuration program.
- If the site is not a remote site, it can be configured as the default site (see *MAN-0041 Configuration User Manual*).
- Restarting Microsoft Windows and the Cylon Software Suite for the changes to take effect.

SITE BACKUP

Making a site backup means making a copy of all site-relevant data on the PC onto removable media such as diskettes or tape. A site can be recreated on another PC running Cylon Software using this site backup.

MAKING A SITE BACKUP

The following files and subdirectories must be backed up when making a site backup.

- All the files and subdirectories of the site (for example, the \UnitronUC32\LAN\ subdirectory and its contents for the Local Network site).
- All the files in the system directory (for example, \UnitronUC32\SYSTEM\).
- All the files in the macros directory, if macros are used in strategies on the site (for. \UnitronUC32\MACROS\).

To make a backup of the Local Network site, all files and subdirectories in the following directories must be backed up:

```
C:\UnitronUC32\LAN\
C:\UnitronUC32\MACROS\
C:\UnitronUC32\SYSTEM\
```

> **Note:** Cylon Software program files (__.EXE, ___.DLL etc.) are NOT part of the site backup.

This backing up procedure can be carried out using the **Site Backup** module (**CCBackup**).

SITE DISCOVERY AND UPLOAD

Strategy block data can now be uploaded from **Cylon** controllers and re-assembled into an easy-to-view layout. This is useful when you have a **Site** where you do not have existing **Strategy** drawings or other information.

The purpose of the discovery process is to determine all of the **Subnets** (i.e. a **Fieldbus** connected to a **Comms Controller**) on a **Site**.

> **Note**:   All Subnets are searched so that the integrity of the data passed between Subnets (e.g. wide globals) remains intact. This happens even if you are looking for information on a single Subnet.
>
> This process can be lengthy, so please ensure that sufficient time is allocated for it.
>
> However, you do not have to upload all Subnets at one time. If you specify a Subnet Range for a specific upload, you can retrieve the other Subnets at a later point in time.

The upload process is started from the Site Tree , either from the Sites Icon (if the Site is not already in the tree) or from the relevant Site node.

If the Site is not yet configured in the Site Tree

Click on the Sites icon in the Site Tree , and select Upload Unitron Site
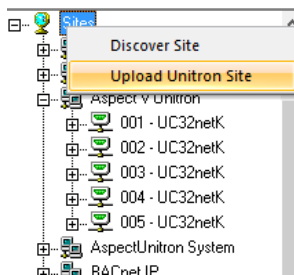
This opens the Upload Site Details dialog with all fields editable.

Enter the Site Name and Site Directory directory.

If you do not want to retrieve all **Fieldbusses** on the **Site**, specify a Subnet Range .

Sites can be uploaded either through **TCP/IP** or through a serial connection.   For **TCP/IP** connections, include the IP Address and verify the port. Port `4950` is the default.

When configured, click Discover .

If the Site is already configured in the Site Tree

If the Site is represented in the Site Tree – i.e. if it has been configured locally configured using the Configuration Utility (CCConfig), click on its node in the Site Tree and select Upload Site :
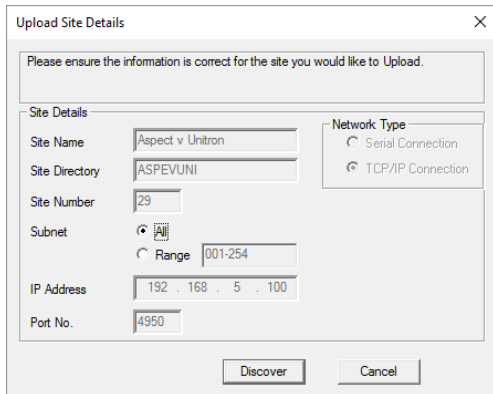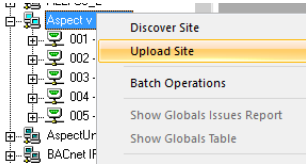
The Upload Site Details dialog will be displayed as before, but in this case the only parameter that can be edited is the Subnet   Range .

Use the **Configuration Utility** to edit any other **Site** information if required.

When configured, click Discover .

After the discovery process is started, the Upload Site Information dialog appears showing its progress:
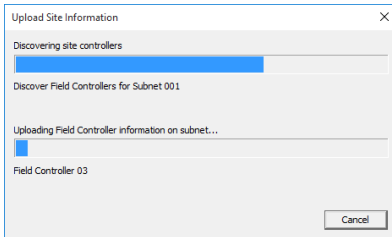
If you click Cancel to stop the process, any uploaded information is discarded and not applied to **Site** in the Engineering Center.

When the discovery has concluded, the discovered **Fieldbusses /Comms Controllers** are displayed in the Discovery Results dialog:
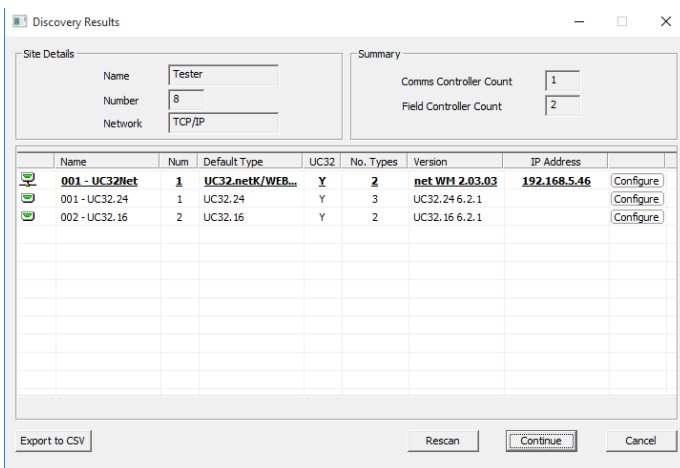
The `Export to CSV` feature provides a convenient way to get subnet information and firmware versions of controllers in the networks in CSV format that can be easily imported into Microsoft Excel.

If some discovered **Subnets** are offline, so that **Wide Global** information is incomplete, this is highlighted in the `Discovery Results` dialog:
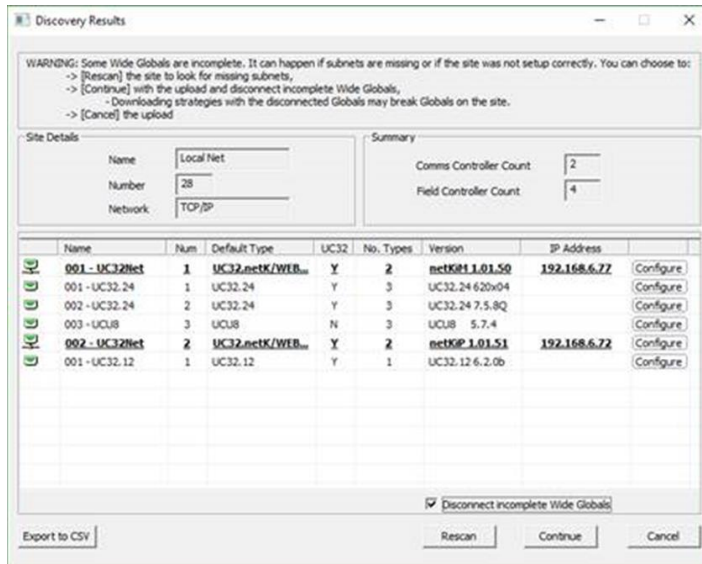
Correct any issues with wiring or power and attempt the discovery process again by clicking `Rescan` .

> **Note:** Clicking `Continue` when the `Disconnect incomplete Wide Globals` box is checked will allow the Discovery process to proceed <u>without</u> rectifying offline Subnet issues.

> **Note**: Failure to ensure that all Subnets are available may cause data integrity issues for cross-network information sharing.

If all known **Comms Controllers** are displayed and online in the `Discovery Results` dialog, click `Continue` to upload **Strategy** information.

Uploading Strategies

After **Discovery**, the upload process continues retrieving **Controller** information:
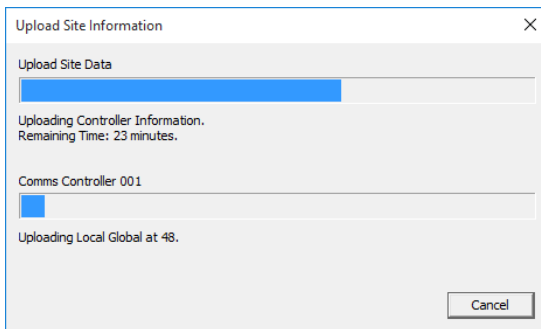
Strategy information from all selected **Fieldbusses** is uploaded into the **Engineering Center**.

If you click `Cancel` to stop the process, any uploaded information is discarded and not applied to **Site** in the **Engineering Center**.

If successful, the following is displayed.
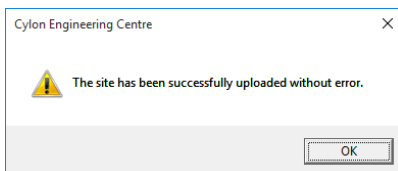
However, if **Controllers** or **Fieldbusses** become disconnected during the upload process, a `Site upload report` dialog is displayed:

This example shows a failure on the second **Field Controller** of the first **Fieldbus** followed by a failure of the entire second **Fieldbus**.

Click `Retry` to restart the upload for only those **Controllers** that were not completed. In this case:
1. The **Field Controller** at address 2 on the first subnet.
2. The entire second **Fieldbus**.

The **Controllers** that were completely uploaded will not be uploaded again.

Clicking `Validate` will validate the state of the site as it is, with missing data. To acquire the missing data, a full upload must be performed again, including the **Controllers** where the upload initially succeeded because their **Strategies** may have changed.

Restarting After an Interruption

If for some reason, the upload is interrupted, you may restart the upload process from the Site Tree as described earlier. In this case, only **Controllers** that have not yet been successfully read will be accessed.

If you do not realize that an upload has been interrupted and you open a **Strategy**, the following notification will appear:

Choosing Restart will restart the upload for the **Controllers** that are displayed.

Choosing Continue will accept the state of the **Site** as is. If the process has failed to access any specific **Controller**, the data from that **Controller** will not be uploaded. If uploading partially succeeded (i.e. upload failed while a **Strategy** was being uploaded), the data will be deleted to prevent data integrity issues.

The entire upload process must be performed again on the site to acquire missing data.

Strategy Layout

When you open a newly uploaded **Strategy**, the modules and blocks on the drawing are automatically positioned so that it is easy to identify the programming intent and operation of the **Strategy**. Configuration information about points, such as sensor types and output types, are included in the drawing.

The following describes the approach used to position blocks on a **Strategy** drawing:

1. **Blocks Modules** are clustered by functional section, and the cluster of modules has no connection to modules in other clusters. This clearly indicates **Strategies** where there is more than one application in a controller.

2. **Inputs** will appear on the left, **Outputs** will be shown on the right.

3. **Modules** will be placed such that the distances between modules are minimized.

4. Setpoints will be placed in their own column - between modules - for easy identification.

The following example shows the layout of the automatic Strategy drawing.
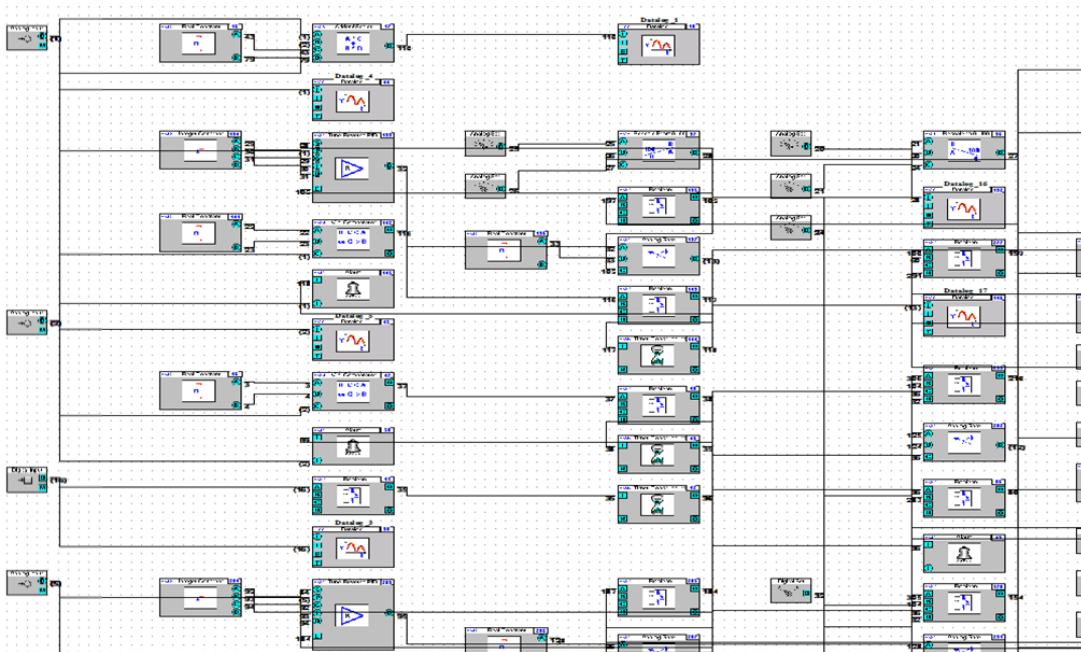
Configuration for Handling Errors

It is possible that errors can occur when uploading information from controllers. You can select the behavior for specific sorts of upload errors at the communication controller or field controller.

To change the configuration, click on View > Options and in the dialog box, choose Configure Failure Options . The Upload Failure Options dialog will appear.
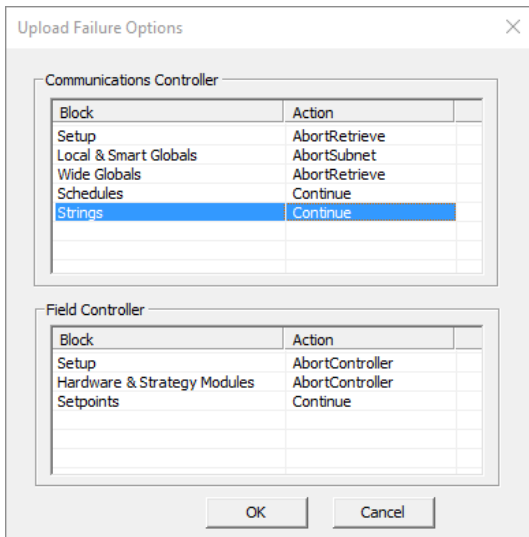
For each type of **Block** for **Communications Controllers**, the following behaviors are available:

`AbortRetrieve` – Stop the entire upload operation.

`AbortSubnet` – The upload process continues but this subnet is skipped.

`Continue` – Ignore the error and continue the upload process.

For each type of block for field controllers, the following behaviors are available:

`AbortRetrieve` – Stop the entire upload operation.

`AbortSubnet` – The upload process continues but this subnet is skipped.

`AbortController` – The remaining blocks in the controller are skipped and upload continues with the next controller.

`Continue` – Ignore the error and continue the upload process.

When finished with the configuration, click OK to save.

> **Note**: The following caveats must be taken into account when using Unitron Upload.
>
> 1. Previously unconnected setpoints will not appear in uploaded strategies for UC16 controllers due to the way the information is stored in these controllers.
> 2. Units are not stored on the Controllers so that if there is no prior information for the site, the units are likely to be incorrect. In this case, the units must be assigned manually.
> 3. Object names that were previously stored in the database will not be added to uploaded Strategies for *new* sites.
> 4. When uploading data for an existing Site, the database entries for the Site will be left in place. Verify that the database entries are aligned correctly with the uploaded data.

ASPECT EXPORT

This feature saves data for a **Controller**, **Fieldbus** (**Subnet**), or **Site** into a JSON-formatted text file for import into **Aspect**, allowing applications to be automatically configured in **Aspect Studio**. Exporting will work for both **Unitron** and **BACnet Sites** and networks (**Fieldbusses**).

Starting the Export

To export a **Field Controller**, **Communications Controller**, or **Site**, right-click on its note in the Site Tree and choose Export Aspect Data .
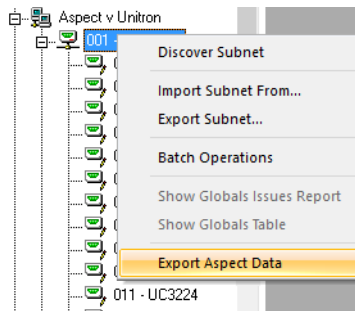
If a **Field Controller** is selected, that controller's information is exported to the **Aspect** .json file, along with the parent network and parent site information as required to correctly import into **Aspect**.

If a **Fieldbus** is selected, information for all controllers in that **Fieldbus** is exported along with the parent site information as required to correctly import into Aspect.

If a **Site** is selected, information for all **Controllers** on all **Fieldbusses** within that site will be exported.

After exporting, set a name for the export file that you want. By default it is set to the name of the **Site**. The filename extension must remain as `.json` for easy import into **Aspect**.
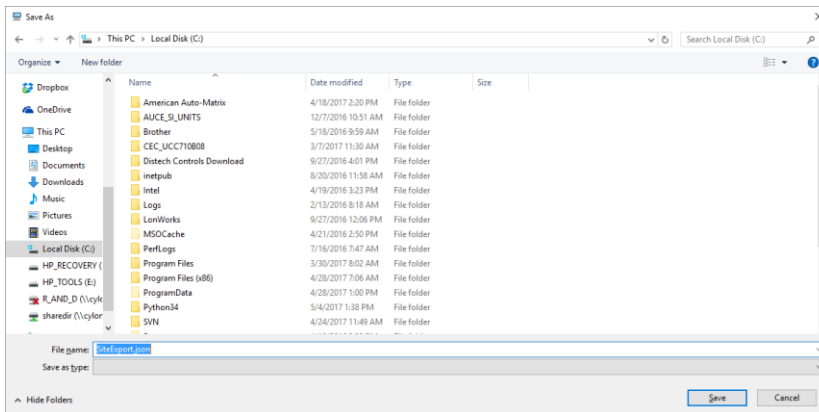
After setting the filename, click Save .

The process will begin to export information. The Creating Aspect Data... dialog will be displayed to show the progress of the export:
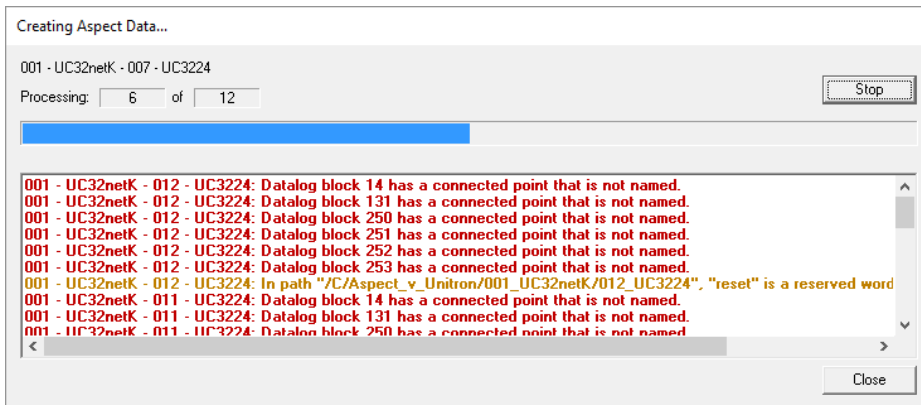
For any errors or warnings encountered, you will see the network (**Fieldbus**) name, the name of the**Controller** and the action that should be taken. Correct these errors in the appropriate **Strategy** or configuration and then start the Export process again.

You may stop the export process at any time and review the errors and warnings.

You may copy the errors and warnings from the dialog into a document or email.

When finished, click Close to complete the process.

Import into Aspect Studio

Refer to *MAN0129 Aspect Studio (Working with Unitron Devices > Importing Unitron Devices)* for details about importing the .json data into Aspect.

SECTION 16 : APPENDIX :: ADDING UNITS OF MEASUREMENT TO THE SYSTEM

ADDING UNITS OF MEASUREMENT

Additional units of measurement may be added to the existing list of units in a **site** to allow for a greater range of applications. Units must be added to the `site.ini` file in the `UnitronUC32\` *`(SITENAME)`* `\SYSTEM` directory

Note: Before changing the `site.ini` file, make a backup copy (for example, `site.ini.bak`).

The `site.ini` file can be edited in a word-processing program such as **Microsoft Windows Notepad**, or **Microsoft Word**. If you use Word to edit the file, make sure to save the file as a "Text Only" document.

HOW TO ADD UNITS OF MEASUREMENT TO THE SYSTEM

- Make a backup copy of `site.ini`.
- Open `site.ini`, using a word processing program.
- Search for the `[AnalogUnits]` section if adding analog units, and the `[DigitalUnits]` section if adding digital units.
- Either
  - edit one of the entries marked "spare"

    (e.g. change `UNITS61="Spare1"` to something like `UNITS61="m/s"`)

    <u>or</u>
  - append the new units to the list of units

    (for example, add something like `UNITS74="m/s"` to the end of the list of analog units).

    If you add to the list in this manner, be sure also to increment the `NumberUnits` parameter so that it matches the final number of units. Ensure the the number at the end of the units variable (e.g. `UNITS74`) has a number at the end that matches its place in the list of units.
- Save the amended `site.ini` file.
- Close and restart the **Engineering Centre**, to allow the changes to take effect. The new units can then be selected from list boxes for point configurations.

EXAMPLE OF ADDING UNITS TO ANALOG UNITS LIST

Old analog units list:	New list after changing:
[AnalogUnits]	[AnalogUnits]
NumberUnits=19	NumberUnits=21
Title="IU"	Title="Unit"
UNITS1=" "	UNITS1=" "
UNITS2=" %"	UNITS2=" %"
UNITS3=" %rH"	UNITS3=" %rH"
UNITS4=" °C"	UNITS4=" °C"
UNITS5=" Bits"	UNITS5=" Bits"
UNITS6=" g/kg"	UNITS6=" g/kg"
UNITS7=" Hz"	UNITS7=" Hz"
UNITS8=" kj/kg"	UNITS8=" kj/kg"
UNITS9=" kWh"	UNITS9=" kWh"
UNITS10=" L/s"	UNITS10=" L/s"
UNITS11=" Min"	UNITS11=" Min"
UNITS12=" mV"	UNITS12=" mV"
UNITS13=" Pa"	UNITS13=" Pa"
UNITS14=" Sek"	UNITS14=" Sek"
UNITS15=" Std"	UNITS15=" Std"
UNITS16=" Volt"	UNITS16=" Volt"
UNITS17=" bar"	UNITS17=" bar"
UNITS18=" K"	UNITS18=" K"
UNITS19=" Uhr"	UNITS19=" Uhr"
	UNITS20=" m/s"
	UNITS21=" kg/m3"

Note: Units are also listed in the `UnitronUC32\SYTEM\WN3000.ini`. However, this file is for legacy applications only and applies throughout the Cylon Software system, and so **must not be edited**.

Note: Take care when editing site.ini not to change the section headings [AnalogUnits], [DigitalUnits] etc. in any way, because this can cause errors in the Cylon Software system.

SECTION 17 : APPENDIX ::
CUSTOMIZING
MODULE GROUPS

CUSTOMISING MODULE GROUPS

In order to make it easier and faster to locate a module, modules are grouped together in six categories – points, logic, mathematical, control, function and statistic.

You can, however, customise the **grouping** of modules to suit your own preferences.

For example, you can **edit** the group definitions, to arrange the modules you use most often in one group.

GROUP DEFINITIONS

Module groups, and the modules they contain, are defined in a file called UC16INT.ini. This file is located in the C:\UnitronIUC32 folder. Two of the group definitions from UC16INT.ini are shown below:

```
[ETV51]
;***********Points group*****************
Total=13
Module0=1 ;Analog Input
Module1=2 ;Analog output
Module2=3 ;Digital input
Module3=4 ;digital output
Module4=5 ;Analog Set point
Module5=6 ;Digital Set point
Module6=42 ;Real Constant
Module7=43 ;Int Block
Module8=48 ;Digital Extract module
Module9=49 ;Digital Encode Module
Module10=54 ;Digital Constant
Module11=61 ;Make Linear Block
Module12=63 ;Meter Module
```

```
[ETV52]
;***********Logic group*****************
Total=13
Module0=37 ;Boolean Combination
Module1=38 ;Edge Triggered Latch
Module2=56 ;Timer With Constant Inputs
Module3=36 ;Timer with Variables
Module4=79 ;Timer with Min Off
Module5=57 ;Wide Or Gate
Module6=58 ;Wide And Gate
Module7=82 ;Wide Inverter Gate
Module8=44 ;UC Time Schedule
Module9=60 ;UC Holiday Schedule
Module10=55 ;Long Period Timer
Module11=83 ;Output Real Time
Module12=84 ; Adjust time schedule
```

The definition of each module within the group is of the form

```
Module X= Y ;Module Name,
```

where X = ((number of module's position in the group)-1);

and Y = module number.

For example, the definition: "Module0=1 ;Analog Input" from the Points group means that module number 1, called the Analog Input module, has position 1 in the Points module group.

EDITING THE GROUP DEFINITIONS

If you wish to change the modules contained in a group, it is possible to edit the **UC16INT.ini** file (see page 435), by opening it in a text editor such as MS Notepad or MS Word.

Using the Cut, Copy and Paste functions available in the text editor you are using, you can customise the modules groups. For example, you can group all the modules you use most frequently into one group.

Guidelines for editing group definitions

- Make a backup of the `UC16INT.ini` file before you start the editing process.

- Each module group can contain up to 100 modules (from Module0 to Module99). These module positions must be kept in numerical order when edited.

- Modules can appear in more than one module group. For example, function 82, the Wide Inverter Gate, is listed in both the Logic group and the Function group.

- It is not possible to create additional module groups. All editing must be done within the six existing groups.

SECTION 18 : APPENDIX :: FILE MANAGEMENT

FILE MANAGEMENT IN THE ENGINEERING CENTRE

On a large site with multiple Comms Controllers where more than one engineer will be commissioning software at any one-time file management becomes very important.

You must insure that no one modifies the same strategies / global files that an engineer is currently commissioning. To guard against this, we would recommend that all files are stored on a central computer and only the files required for commissioning are copied onto the engineer's laptop. We would also recommend that each engineer is allocated a single Comms Controller to work on at any one time. At the end of each day / commissioning period the data files for the Comms Controller are copied back onto the central computer.

Wide globals **must** be engineered from a single computer, possibly the central supervisor. This **cannot** be undertaken on several computers.

The data files required to commission a single LAN are as follows:

All files under	Where * is the address of the Comms Controller to be commissioned.
UnitronUC32 *[SiteName]*\dbase *	

All files under	Where *** is the address of the Comms Controller to be commissioned.
UnitronUC32 *[SiteName]*\strat5***	

The same files should be copied back to the central computer at the end of each day / commissioning period.

The Cylon Building Management System is made up of two main types of component:

- **Hardware** - the products that monitor and control a building's environment.
- **Software** - the interface which allows users to configure and monitor Cylon Hardware.

SECTION 19 : APPENDIX ::
BACNET
EXPLORERS

The **Cylon Engineering Centre** includes two utilities that facilitate the commissioning of BACnet Sites: the integrated **Discovery Tool**, accessible from the `Site Tree` , and the separate application **NB-Pro**.

NB-PRO

NB-Pro is a generic commissioning environment for BACnet controllers. Using **NB-Pro**, users can setup and configure devices to create control programs and strategies for building automation systems, including Cylon BACnet. For details see *MAN0122 NB-Link & NB-Pro*.

Note: For NB-Pro to work with Cylon Engineering Centre, you must open the `Settings` menu NB-Pro and select `Network Configuration` . In the `Network Configuration` dialog, select the `Remote IP` radio button in the `Communicate Via:` section so that NB-Pro does not attach to the BACnet UDP port of the PC as this would block the Engineering Centre. Also, register NB-Pro as a foreign device on a CBR on the network by entering the CBR's IP address in the `Network Configuration` dialog's `BBMD Device` field.

DISCOVERY TOOL

The purpose of the **Discovery Tool** is to allow users to see all live BACnet devices, objects and properties on the network via the Engineering Centre. It also allows some or all of the discovered objects to be added to an existing **Engineering Centre** Site or allow a new Site to be created with the discovered objects.

For existing sites, this tool is used to compare the site configuration with the devices that are live on the network. It is possible to change the `present_value` property of some objects.

BACnet Explorer

The Explorer is an extension of the Discovery Tool. It is available in the **Engineering Centre** by right-clicking on a BACnet Site in the `Site Tree` and selecting `Discover Site` .
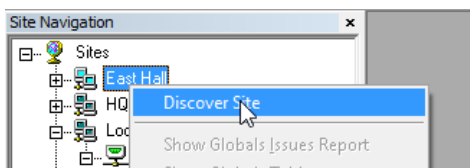
This opens the `Site Discovery` dialog, which is prefilled with the selected Site's information:
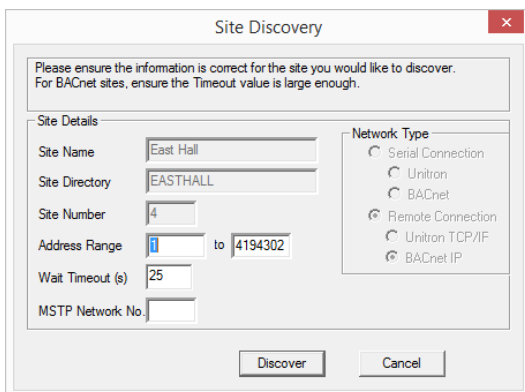
If the ⬛ Discover Site ⬛ option is selected from the context menu of the Site Tree's root node,
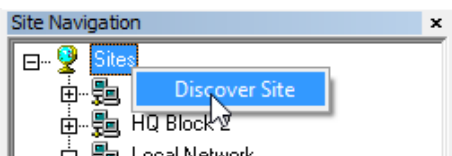
then the ⬛ Site Discovery ⬛ dialog will be blank, and can be used to create a new Site.

The Site Discovery dialog has the following fields:

Network Type

(If an existing Site is selected, this selection cannot be changed).

If a site is not selected, select a Network Type that will apply if you choose to create a site from the Explorer during the current exploration:

- Network 1 for Serial and Modem Sites
- Network 2 for TCP/IP or BACnet Sites

Site Name

(If an existing Site is selected, this field will not be editable).

If a site is not selected, enter a new Site Name here. If you choose to create a site from the Explorer during the current exploration, this is the name that will be used for it.

Site Directory

The ⬛ Site Directory ⬛ is automatically generated from the ⬛ Site Name ⬛ , but it can also be user defined. Do not use special characters in the ⬛ Site Directory ⬛ Name.

Site Number

(If an existing Site is selected, this field will not be editable).

If a site is not selected, specify a ⬛ Site Number ⬛ . If you choose to create a site from the Explorer during the current exploration, this is the Site Number that will be used for it.

Address Range

This can be used to limit the Discovery process. Only BACnet addresses within this range will be tested.

Wait Timeout (s)

This sets the length of time that the process will listen for I-Am responses during discovery.

Larger Sites require higher Wait Timeout(s) to explore the entire site (default 10 seconds)

Network

The user can choose a specific network to discover in this dialog box. If the user enters a network number, only devices on that network will be displayed. Leave this blank if you want to show devices on all networks.

The Discover button will launch the progress dialog.
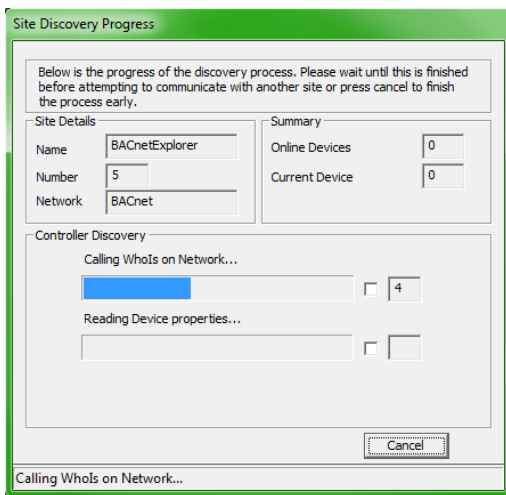
A WhoIs call is made, and then the system waits for the specified timeout (default is 10 seconds) after which it reads the BACnet information for each Device that responded with an I-Am message. When this is complete, the results dialog opens:
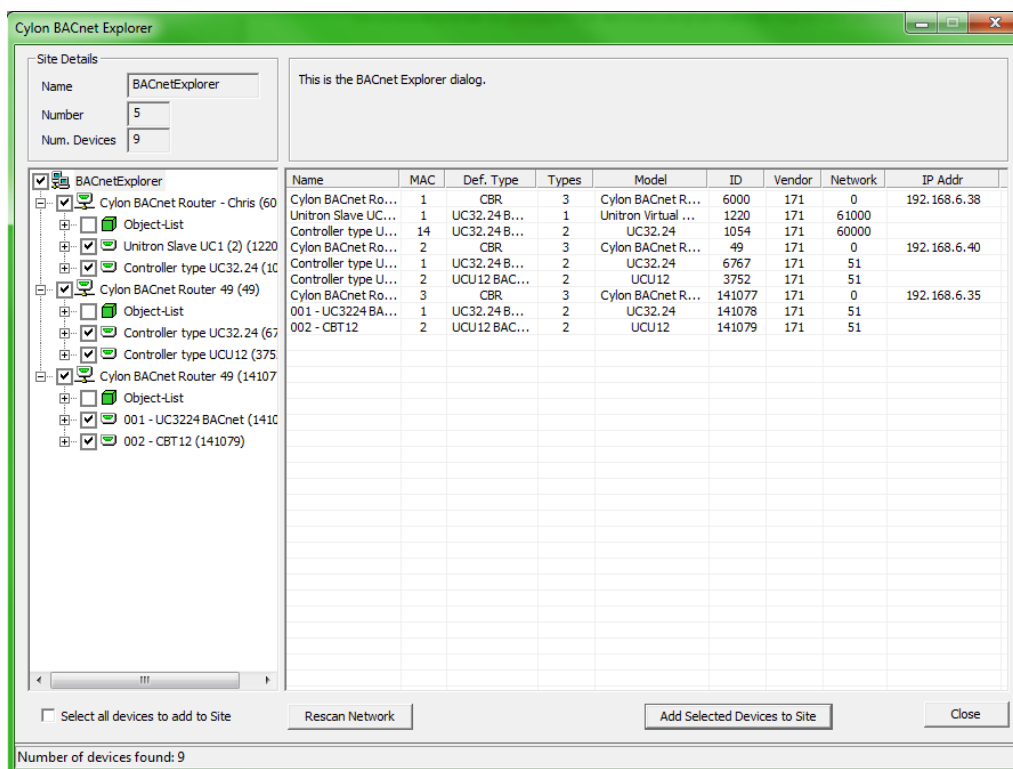
The results dialog contains two panels:

- The left panel contains a tree view list of the BACnet devices and objects discovered.

- The right contains information regarding the selected device or object.

It is possible that not all devices would be discovered during the specified Wait Timeout(s) ., so if necessary you can re-scan the network for further devices by clicking the Rescan Network button. The Site Details dialog will open again so that the settings for Address Range , Wait Timeout(s) and Network number can be adjusted. Devices that have already been discovered will be skipped, so that further devices may be discovered even if none of the settings are changed.

The tree view is similar to the existing site list in other applications. The site is the root node of the tree, followed by the routers and then devices under those. Under the device nodes there are other nodes in the Object List. Expanding this will show each object read in from the parent device.

As an extension of the **Site Discovery Tool**, the Explorer allows devices to be added to the Site specified in the top left corner of the Cylon BACnet Explorer dialog (which may be an existing site or a new site that will be created when devices are added).

To add devices to the selected site, check the box beside each required device in the Site Tree and click on the Add Selected Devices to Site button. To quickly select all of the discovered devices check the Select all devices to add to Site box beneath the Site Tree. Non-Cylon devices will be added as virtual controllers and have a Unitron address of 131 or above.

When the root of the tree view is selected, the right panel contains a list of the BACnet devices found, along with: device name , MAC address , vendor ID , model name , IP or MSTP Address , Network and estimated Controller Type .
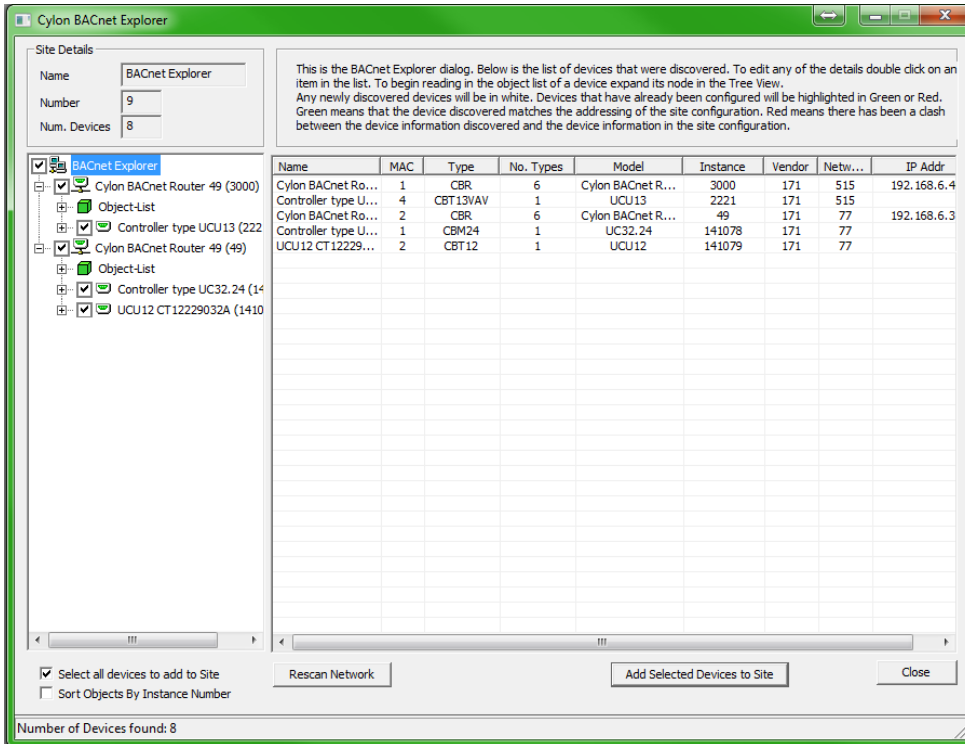
There is also a column (No. Types) which shows the number of possible Cylon controller types this device could be.

Cylon devices are initially set as a **CBM24** controller type, but this can be changed in the Controller Properties dialog.

The 'Type' of a non-Cylon device cannot be changed in the Controller Properties dialog, but if they are added to the Site, they will appear as **CBM24** in the **Engineering Centre**, and this can be changed in the **Configuration utility** (**CCConfig**).

To open the Controller Properties dialog, double-click on the device in the right-hand panel.
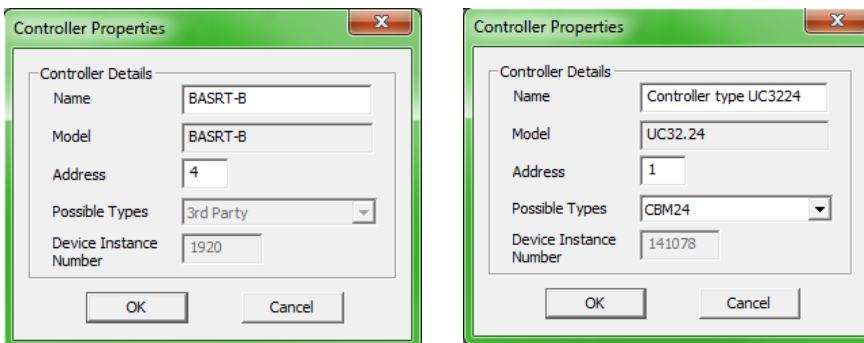
You can then change the Name , Type, Address, and Device Instance Number before adding them to the site.

Note: This will only change the name of the device in the database on the PC, it will not change the name on the device itself.

When the device node of the tree is expanded or double-clicked, the object list of that device will be read in. As each object is received from the device it will be added as a child to that device node. At this stage the right-hand

© Cylon Controls

panel will display the object list with a column for `object ID` , `object type` , `object name` , and `present value` and this list will be populated as objects are read in.
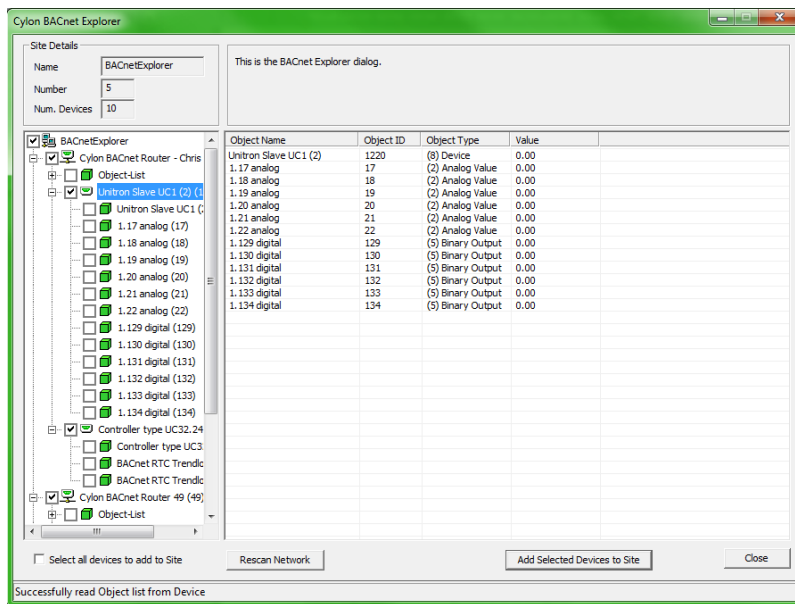
When an object is selected in the tree view, the properties of that object will be read from the device and the right-hand panel will contain the properties and values of that object.

From the results dialog, the user will be able to change the present value property for some of the objects.

Note: To refresh a specific object, right-click on that object.

Check Against Existing Devices

When using the BACnet Explorer on an existing site, any discovered devices must be checked against those that have already been configured. This is done by comparing the Device Instance Number of each discovered device against the Device Instance Number of any devices on the site configuration already.

For any discovered devices that have the same Device Instance Number as a device on the PC, there will be a comparison made between the MAC address discovered and the Unitron address.

- If these match, the device will be highlighted in the list in green to signify that the devices match. A matching device cannot be edited.

- If they do not match, then the device in the list control will be highlighted in red to alert the user to this mismatch. The user will be given a choice to resolve the mismatch

- If the Device Instance Number does not match any other ID on the PC, then this discovered device will not be highlighted and will be left white. Non-matching devices can be edited.

Changing the Present_Value Property

The present value can only be written to commandable BACnet objects. Commandable objects always have the 'present_value' property and two additional properties – `Priority_Array` and `Relinquish_Default`.

- Analog Output, Binary Output and Multi-State Output objects are always commandable.

- Analog Value, Binary Value and MultiState Value objects can be commandable, but this is decided by the vendor.

To change the present value of a commandable object, double-click on the present value property in the right panel. If the object has the required properties, this will open the Change Present Value Dialog :
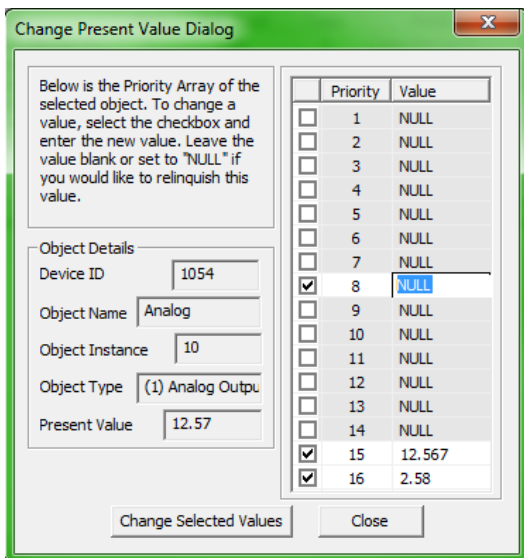
The table on the right-hand side of this dialog shows the current priority array of the object. To change or relinquish the value, you must select the checkbox beside the relevant priority index. By selecting the checkbox, you can edit the value at that array. To relinquish that value, clear the contents in the box or set it to "`NULL`".

When the Change Selected Values button is clicked, the value for any priorities whose checkbox is ticked will be sent to the BACnet object. This will update the priority array on the device and to show this, the list items, `present_value` and `priority_array`, in the Explorer dialog will be updated too.

SECTION 20 : BACKING UP A BACNET SITE

The **Cylon Engineering Centre** software uses data files organized on the PC in a directory structure representing the structure of the Site. This directory structure can be archived, and installed on another PC or restored to the original PC.

The Cylon Site Backup Utility, CCBackup, automates the archiving and the restoring process – see *MAN0072 Site Backup Utility*. However it does not include CBR configuration in those processes.

BACKING UP THE CBR ROUTERS

Each CBR on a Site must be individually backed up as follows:

Right-click on the CBR in the **Cylon Engineering Centre**'s Site Tree, and select Backup Router :
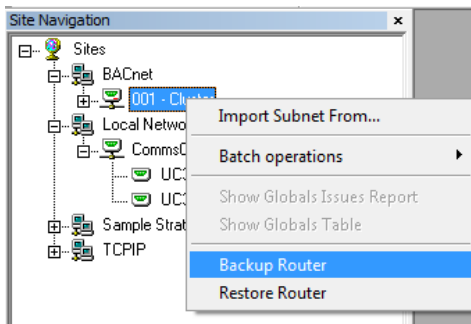
The Router Backup dialog will open:
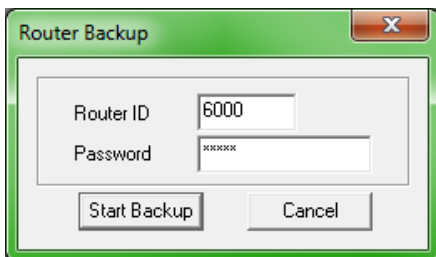
Enter a valid BACnet Device Instance Number and the router's password

> **Note**: The router's password is the one that is used to access the Configuration web interface of the router. It can be set or changed from the router's Configuration web interface.

Click the Site Backup button
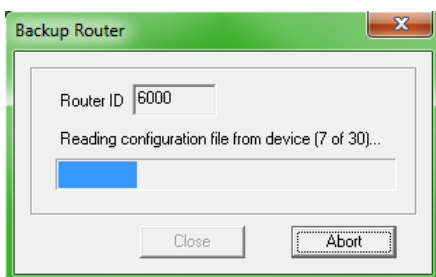
The backup file for this router will be stored in Site's RouterBackups directory:

Name	Date modified	Type	Size
1.d	17/06/2013 11:16	D File	2 KB
2.d	17/06/2013 11:16	D File	2 KB
3.d	17/06/2013 11:16	D File	1 KB
4.d	17/06/2013 11:16	D File	1 KB
5.d	17/06/2013 11:16	D File	6 KB
6.d	17/06/2013 11:16	D File	4 KB
7.d	17/06/2013 11:16	D File	27 KB
8.d	17/06/2013 11:16	D File	1 KB
9.d	17/06/2013 11:16	D File	65 KB
10.d	17/06/2013 11:17	D File	66 KB
11.d	17/06/2013 11:17	D File	66 KB
12.d	17/06/2013 11:17	D File	4 KB
13.d	17/06/2013 11:17	D File	2 KB
14.d	17/06/2013 11:17	D File	2 KB
15.d	17/06/2013 11:17	D File	3 KB

Tree (left pane):
- UnitronUC32 675
  - AlarmArchives
  - Animate
  - Archive
  - BACNET
    - ARCHIVE
    - BACnetEDE
    - dbase
    - DRAWINGS
    - Globals
    - KEYPAD
    - MACROS
    - RouterBackups
      - 6000_17062013_111617
      - 6000_17062013_125125
      - 6000_17062013_125156
      - 6000_17062013_124750

HOW TO RESTORE A CBR ROUTER

To restore a router from a backup,

Right-click on the CBR in the **Cylon Engineering Centre**'s Site Tree, and select Restore Router .
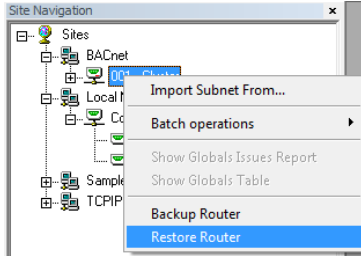
The Password dialog will open.

Enter the Device Instance Number of the router to be restored and the router's password

> **Note**: The router's password is the one that is used to access the Configuration web interface of the router. It can be set or changed from the router's Configuration web interface.

The Restore Router dialog will open:
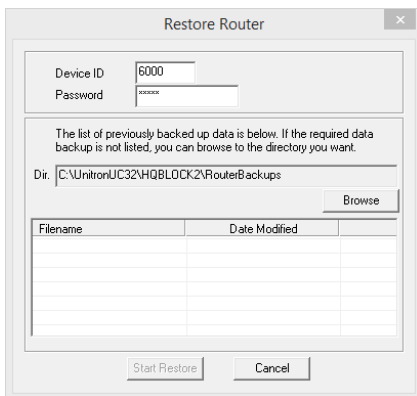
Click on the Browse button and select the location of the backup that is to be restored:
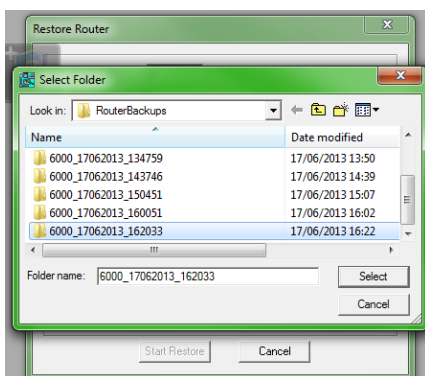
The files that comprise the backup will be displayed with their modified date:
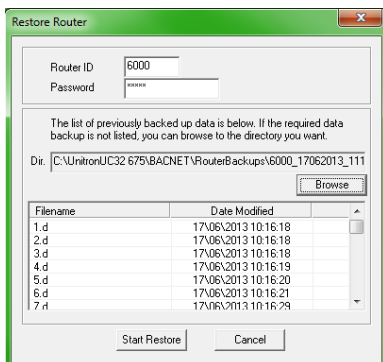
Click the Start Restore button.
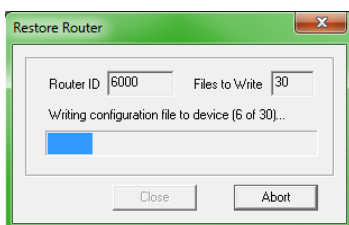
The restore process can be cancelled if required by clicking the Abort button.

When the process is complete, click the Close button.
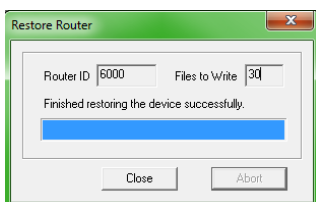
SECTION 21 : INTRODUCTION TO CYLON ENGINEERING CENTRE MODULES

WHAT IS A STRATEGY MODULE?

Modules are the building blocks from which **Strategies** are constructed. They are represented in a Strategy drawing as rectangular graphics with 'input' connections on the left-hand side and 'output' connections on the right.

When downloaded to a controller, each module uses a predefined algorithm to transform the values of the controller points that are associated with its inputs, and to place the resulting values in the points associated with the module's outputs.

The 'outputs' of one module can be connected to the 'inputs' of another, allowing modules to be joined together to form complex algorithms. When such a module or set of joined modules connect the hardware inputs of a controller to its hardware outputs, a "Strategy" is formed.

GRAPHICAL REPRESENTATION OF MODULES

Modules are represented graphically in 3 ways:

- As a **Module button** in the Engineering Centre's toolbar
- As a **Module symbol** on a Strategy drawing
- As a **Module dialog box** when the module is being configured.

MODULE BUTTON

Each module is represented by a button on the floating modules bar,
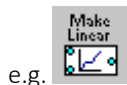
e.g.

MODULE SYMBOL

When a module has been placed on the drawing area, it is represented by a module symbol.

Most module symbols display

A module number,   a module name,   and a block number,

As shown in the example above.

The inputs to the module are represented by blue circles or squares on the left of the module symbol:

and the outputs by blue circles or squares on the right of the module symbol:

MODULE DIALOG BOX
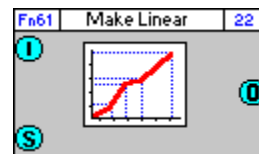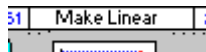
The **Module Dialog Box** is use to configure a Strategy Module. It allows the numbers and values of the points connected to the module's inputs and outputs to be examined, and allows any parameters the module may contain to be set.

Dialog Box features

When a UC32 controller is the target of the Strategy, the vast majority of Strategy Modules are represented in a standard format. This format is illustrated and explained in *Standard Format for Strategy Modules* on page 458.

13 of the strategy modules available in the **Cylon Engineering Centre** are not in the Standard Format. These are

- Analog Input
- Analog Output
- Digital Input
- Digital Output
- Analog Setpoint
- Digital Setpoint
- DI module
- Boolean Combination of Digital Inputs
- Time Schedule module
- Holiday Schedule module
- Long Period Timer
- Datalog module
- Alarm Record module

For details of these Module Dialog boxes, see the individual Module reference sheets

When a UC or UCU controller is the target of the Strategy, all of the Module Dialog boxes are non-standard. For details see the individual Module reference sheets.

Opening a Module's Dialog Box

To access the module dialog box, right-click on the module symbol in the Strategy drawing. The module's dialog box will open, allowing you examine the Module's state, and to adjust its parameters.

Standard Format for Strategy Modules

If the parameters of a Strategy module are to be adjusted, this is done through the modules 'dialog box', which is opened when you double-click on the module in the strategy drawing.

In the majority of cases, this dialog will be similar to that of the PID module, shown below:
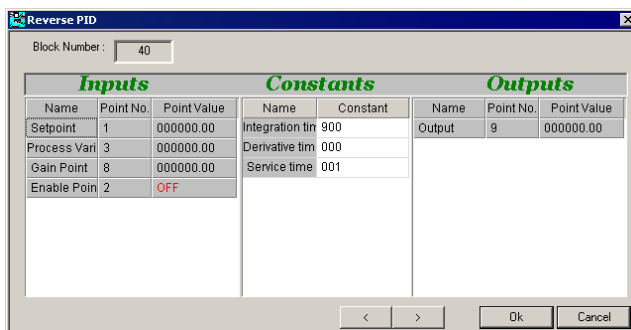
This is the 'Standard Format' used for most strategy modules in the **Cylon Engineering Centre**. The main elements of this format are:

- Inputs column

- Constants column

- Outputs column

- Block Number

- Next/previous module buttons

- OK and Cancel buttons.

Some of the fields within the dialog are editable - these are represented with a white background. The other fields display useful information about the points to which the module is connected.

Note: Some module dialogs contain a Keypad button that is used to add a module to a UC32 keypad program. For more information refer to MAN-0055 UC32 Keypad Manual.

When Scan Mode is active the Inputs and Outputs columns will display the current values of the listed points.

In the Constants column, the user can set the values of some of the Strategy Module's parameters. The exact number function of these constants depends on the nature of the module.

The functions of the module constants are explained in the individual module reference sheets.

The "Next module" and "Previous module" buttons allow you to move quickly between the dialog boxes of the modules that have already been added to the current Strategy drawing.

The **Block Number** box displays the number of the strategy block to which the current module is assigned.
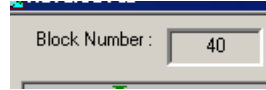
THE ARRANGEMENT OF MODULES IN THE ENGINEERING CENTRE

There are six categories of modules available in the Engineering Centre:

Points:
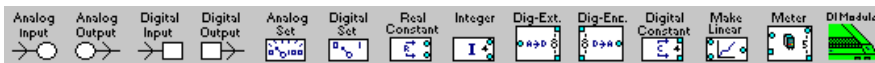
Logic:

Mathematical:

Control:

 Function:
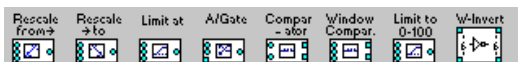
Statistical:

In the Engineering Centre, there are six module bars or groups available by default (as shown above), but the arrangement of modules within groups can be customised.

Each group is represented by a button on the toolbar,

and listed under the **Modules…** item in the View menu.
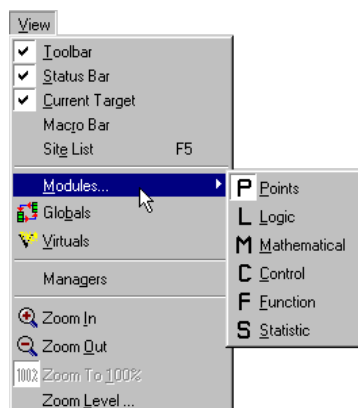
CONTROLLER TYPE AND AVAILABLE MODULES

Different modules are available for older Field Controllers than for the UC32 range. If a Field Controller is the target of a controller, the following module will not be available because Field Controllers did not have UniPuts:

- Uniput Extract (see page 499)
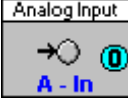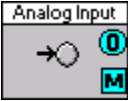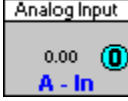
If a Field Controller is selected, the following extra modules are available, as they apply to specific custom Field Controllers:

- HOA Switch State (see 675)
- HOA Pot Value (see 673)
- Digital Extract DI (UC24PG Digital Input module (see page 492)

SECTION 22 : POINTS MODULES
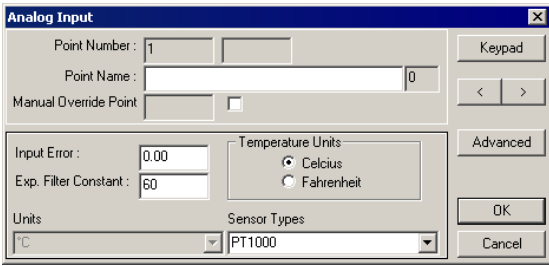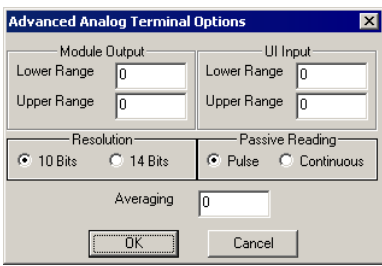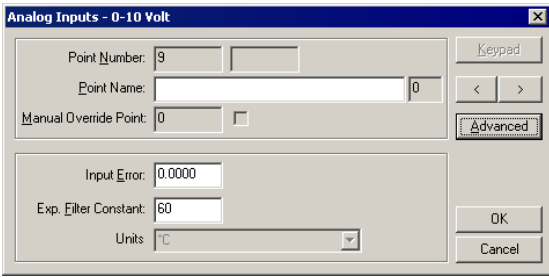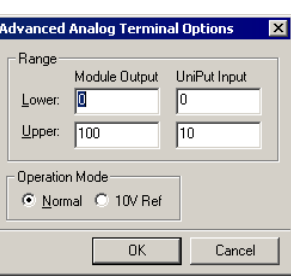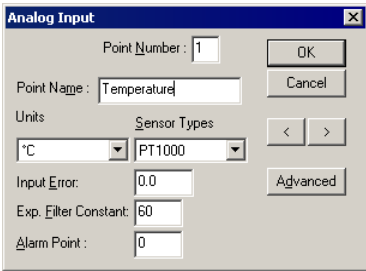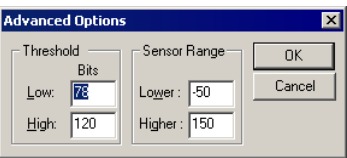
ANALOG INPUT

Button:	
Symbol:	
	UCxx/UCUxx UC32 Value shown
	Value not shown
Function of module:	The Analog Input dialog is used to define how a selected hardware terminal, configured as an analog input, will be identified within a controller strategy, and how it will behave.
	An analog input module in a strategy contains a value passed from a peripheral device, such as a temperature sensor, attached to the controller.
Note 1:	The number of analog inputs available depends on the type of controller you are using. For example, A UC32 controller allows 8 Universal (i.e., analog or digital) inputs, 8 UniPuts, and 8 UniPuts+Relays, a UC24PG-R controller allows 8 Universal Inputs, 8 digital-only inputs, and 8 universal outputs, a UCU10VAV has 3 universal inputs, 1 airflow input, and 6 outputs. To see how many and what type of inputs/outputs are available in the controller you are using, select the Managers dialog box from the **View** menu.
Note 2:	The 'Advanced' options are designed for use only when none of the predefined sensor types are suitable, and should be used in consultation with Cylon Technical Support.

Dialog box:

The dialog for an analog input changes significantly depending on whether the targeted controller is UC32 or UC/UCU, and also on the nature of the input terminal (if the targeted controller is UC32)

If UC32 is targeted AND point number is 1 - 8 (Universal Input terminal):	
If UC32 is targeted AND point number is 9 - 24 (UniPut terminal):	
If UC/UCU is targeted:	

Variables

Variable name	Description	Possible values
Point Number	This is the number of the hardware point to which this module refers	1-24 depending on controller type
(the box beside the point number-UC32 only)	The current value of the hardware point is displayed in a box beside the point number.	Real number
Point Name	An arbitrary name assigned by the user and stored in the Cylon databases to identify the point. If a point number is selected for which a name has already been assigned, that name is automatically displayed here.	Any combination of alphanumeric characters and spaces. Letters can be upper case or lower case. Maximum recommended length is 20 characters and spaces.
(the box beside the Point Name - UC32 only)	Beside the Point Name input box, there is a display that shows the number of characters in the Point Name. This is useful when the point name is to be displayed in a keypad program (see *MAN-0055 Keypad Wizard User Manual*)	Integer
Manual Override Point	This shows the number of the point to which the module's "Manual Override Point" is connected. The value of this point will be '0' when the Analog Input is active, and '1' when the point has been manually overridden. This allows the strategy to react to the fact that a point has been overridden.	1 or 0
(checkbox beside Manual Override Point - UC32 only)	Beside the Manual Override Point number display, there is a checkbox that indicates the value of the point. This is clear if the Manual Override Point is '0' and checked if the value is '1'.	Checked or cleared
Input Error	An optional constant with the same unit as the input value. It is added, if required, to the input value to calibrate for errors in input arising from, for example, resistance of long cables or the positioning of sensors.	Real number
Exp. Filter Constant	The **Exponential Filter Constant** is an individual time constant for the selected analog input. It acts like a damping filter, in that the measured input value will be averaged over the time specified in seconds by **the Exp. Filter Constant**. If the constant is greater than the response time of the sensor, transient variations of the measured value can be filtered out.	positive integer
Temperature Units (UniPut only)	If the selected sensor type is a temperature sensor, it is possible to adjust the value outputted by the module to the rest of the strategy, so that the value represents either Centigrade or Fahrenheit degrees. This is done by selecting one of the options in the 'Temperature Units' section of the Analog Input dialog.	Centigrade or Fahrenheit
Units	This field displays the units defined for the sensor selected in the '**Sensor Type**' field.	As associated with the selected **Sensor Type**
Sensor Types (UniPut only)	By setting this field to match the sensor connected to the input terminal, you are providing the strategy with all of the information it needs to interpret the input signal correctly.	A predefined list of sensors is provided with the Engineering Centre
Alarm Point (UC/UCU only)	This feature is not currently implemented.	

Advanced Options

Variable name	Description	Possible values
Module Output Lower Range & Upper Range	The Module Output settings specify the values that will be outputted by this module to represent 0% and 100% of the UI Input readings. This is part of the setup for the selected sensor. This is used in conjunction with the UI Input or UniPut Input ranges. For example, a 0 V - 10 V input can be represented within the strategy by point values of 0 - 100 by setting the UI/UniPut Input Lower range to 0, the UI/UniPut Input Upper range to 10, the Module Output Lower range to 0 and the Module Output Upper range to 100.	Any integer. Defaults to the setting in the sensor.ini file
UI Input Lower Range & Upper Range (available if the terminal associated with the module's point number is a Universal Input)	The UI Input settings specify the range of the input, after analog-to-digital conversion, that will be interpreted by the strategy as 0% and 100% of scale readings. This is part of the setup for the selected sensor. This is used in conjunction with the Module Output ranges. For example, a 0 V - 10 V input can be represented within the strategy by point values of 0 - 100 by setting the UI Input Lower range to 0, the UI Input Upper range to 10, the Module Output Lower range to 0 and the Module Output Upper range to 100.	Any integer. Defaults to the setting in the sensor.ini file
UniPut Input Lower Range & Upper Range (available if the terminal associated with the module's point number is a UniPut)	The UI Input settings specify the range of the input, after analog-to-digital conversion, that will be interpreted by the strategy as 0% and 100% of scale readings. This is part of the setup for the selected sensor. This is used in conjunction with the Module Output ranges. For example, a 0 V - 10 V input can be represented within the strategy by point values of 0 - 100 by setting the UniPut Input Lower range to 0, the UniPut Input Upper range to 10, the Module Output Lower range to 0 and the Module Output Upper range to 100.	Any integer. Defaults to the setting in the sensor.ini file
Resolution (UC32 only, Points 1 - 8 only)	This changes the effective input resolution of the Analog Input. 10bit resolution is a faster reading than 14 bit (by milliseconds) but for most BMS applications the difference is not significant.	14-bit or 10-bit resolution
Passive Reading (UC32 only, Points 1 - 8 only)	When measuring the value of a passive sensor, the controller outputs a reference voltage via a resistor. This voltage can be pulsed or continuous. A pulsed reference gives optimum accuracy by eliminating self-heating in the sensor, and this is the default setting.	Pulse or Continuous
Operation mode (UC32 only, Points 9 and 17 only)	This option appears on the 'advanced' dialog box for points 9 - 24, but is greyed out where it is unavailable If the operation mode of point 9 analog input is set to '**10V Ref**', then the associated terminal will provide a 10 volt reference. If the operation mode of point 17 analog input is set to '**13V Ref**', then the associated terminal will provide an unregulated 13 volt (at 150mA) power supply. This 13 volt supply is protected against short circuits and accidental 24Vac connection and is intended to supply active sensors. The specification of 20mA per each of 16 Analog outputs for a UC32 no longer applies when using the 13V psu feature.	Normal or 10 v PSU (point 9) Normal or 13 v PSU (point 17)

Application

A sensor reading the outside air temperature passes its current value to the system via an analog input every time the point defined as the analog input is serviced. It is set up as a PT1000 sensor, with an Exponential Filter constant of 60 seconds.

The Exponential Filter Constant smooths the effects of sudden changes in the input value. It is normally set to a value between 60 and 120 seconds. Using too low an Exponential Filter Constant will reduce the smoothing effect, while using an Exponential Filter Constant that is too high will slow down the input too much.

Analog Input: Using non-standard sensors

It is often necessary to use Universal Inputs with sensors that are not pre-defined in the **Cylon Engineering Centre**. This is easily done using the scaling options in the `Advanced` dialog of the `Analog Input` module. As an example, the procedures for using 4 - 20 mA and 1 KΩ - 11 KΩ sensors are illustrated below.

Setting a Universal Input to work with 4 - 20 mA sensor

In order to read a current-based sensor, you must first select a similar one from the preset list in the **Cylon Engineering Centre**. In this case a 0 - 20 mA sensor is selected as a basis for the custom sensor.
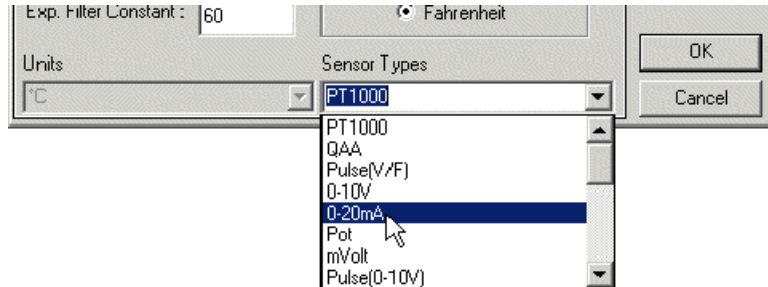
With 0-20 mA selected, click on the `Advanced` button
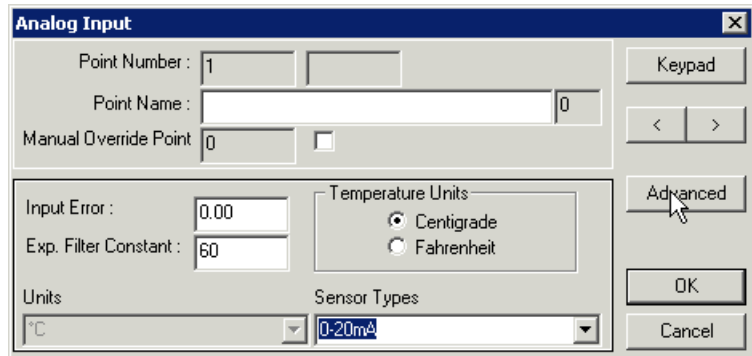
The `Advanced Analog Terminal Settings` dialog that opens has scaling parameters for the 0 - 20 mA sensor as shown. The `Module Output` is set to minimum value 0 (`Lower Range`) and maximum value 100 (`Upper Range`) which represent percentage of full-scale. The `UI Input` is shown as minimum 0 (`Lower Range`) and maximum 20 (`Upper Range`) which represent mA measured at the terminal.
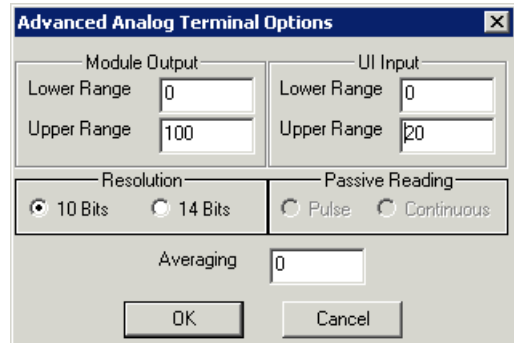
Change the `UI input` to 4 and 20 as shown, representing the 4 - 20 mA range required. The `Module Output` should be left as 0% - 100%.
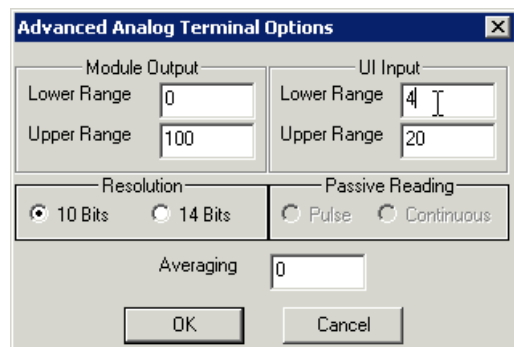
Click on `OK` . The `Analog Input` module will now output 0-100% to represent 4-20 mA

Setting a Universal Input to work with 1 KΩ- 11 KΩ sensor

In order to read a resistance-based sensor, you must first select a similar one from the preset list in the **Cylon Engineering Centre**. In this case a 0 KΩ - 10 KΩ ('POT') sensor is selected as a basis for the custom sensor.

With 'POT' selected, click on the '**Advanced**' button
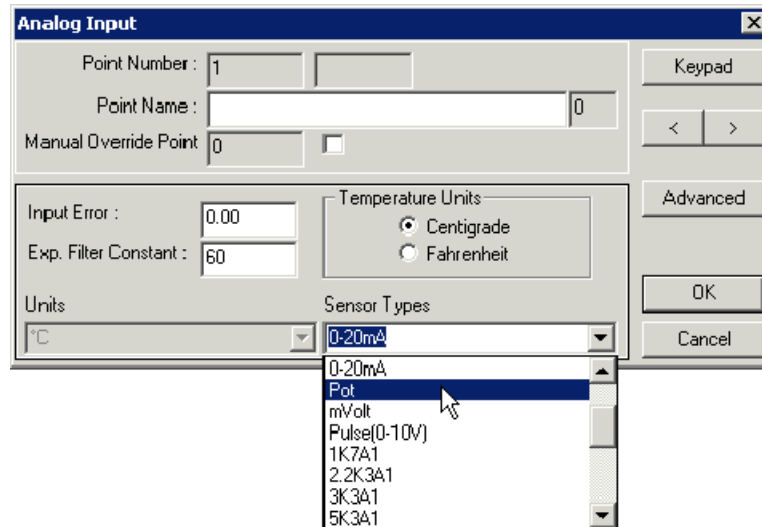
The **Advanced Analog Terminal Settings** dialog that opens has scaling parameters for the 0 - 10 KΩ sensor as shown. The **Module Output** is set to minimum value 0 ("**Lower Range**") and maximum value 100 ("**Upper Range**") which represent percentage of full-scale. The **UI Input** is shown as minimum 0 ("**Lower Range**") and maximum 10000 ("**Upper Range**") which represent resistance in Ohms measured at the terminal.
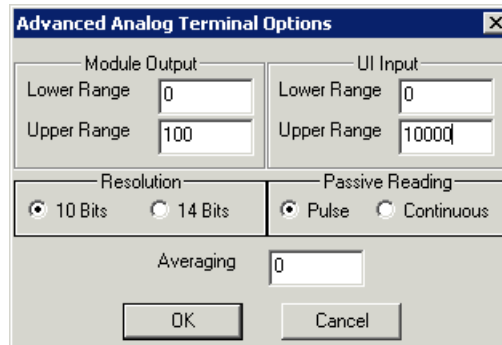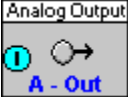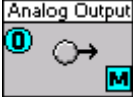
Change the **UI input** to 1000 and 11000 as shown, representing the 1 KΩ - 11 KΩ range required. The **Module Output** should be left as 0% - 100%.

Click on **OK**. The **Analog Input** module will now output of 0-100% to represent 1 KΩ - 11 KΩ.
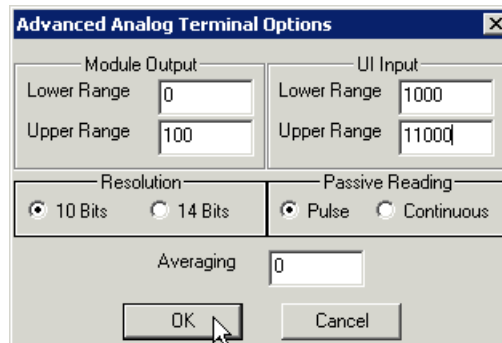
ANALOG OUTPUT

Button:

Symbol:

UCxx/UCUxx   UC32
Value not shown

Value shown

Function of module:
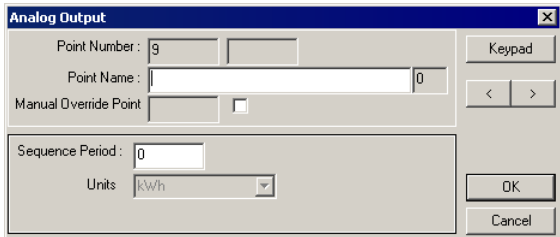
The Analog Output dialog is used to define how strategy information is represented on a controller hardware output terminal that is defined as an analog output.

An Analog Output module in a Strategy contains a value to be passed from the controller to a peripheral device such as a valve.
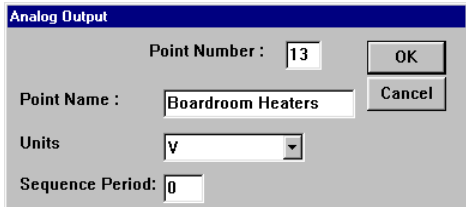
> **Note:** The number of analog outputs available depends on the type of controller you are using. A UC24PG-R controller allows 8 universal inputs, i.e., analog or digital, 8 digital-only inputs, and 8 universal outputs. A UCU10VAV has 3 universal inputs, 1 airflow input, and 6 outputs. To see how many and what type of inputs/outputs are available in the controller you are using, select the **Managers** dialog box from the **View** menu.

Dialog box:

If UC32 is targeted:

If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Point Number	This is the number of the hardware point to which this module refers	1-24 depending on controller type
(the box beside the point number-UC32 only)	The current value of the hardware point is displayed in a box beside the point number.	Real number
Point Name	An arbitrary name, assigned by the user and stored in the Cylon databases to identify the point. If a point number is selected for which a name has already been assigned, that name is automatically displayed here.	Any combination of alphanumeric characters and spaces. Letters can be upper case or lower case. Maximum recommended length is 20 characters and spaces.
(the box beside the Point Name - UC32 only)	Beside the Point Name input box, there is a display that shows the number of characters in the Point Name. This is useful when the point name is to be displayed in a keypad program (see *MAN-0055 Keypad Wizard User Manual*)	Integer
Manual Override Point	This shows the number of the point to which the module's "Manual Override Point" is connected. The value of this point will be '0' when the Analog Output is active, and '1' when the point has been manually overridden. This allows the strategy to react to the fact that a point has been overridden.	1 or 0
(checkbox beside Manual Override point)	Beside the Manual Override Point number display, there is a checkbox that indicates the value of the point. This is clear if the Manual Override Point is '0' and checked if the value is '1'.	Checked or cleared
Sequence Period	This is the number of 5-second periods that must elapse after a controller reset, before the selected output becomes active again.	0-255
Units	This field defines the units that correspond to the input to the analog output	Any of the strings in the drop-down list

Application:

In the dialog box above, the value (0-10V) for the Boardroom Heaters is connected to point number 9, terminal numbers 17 and 18, where 17 is the ground and 18 is the positive terminal.

Note: If a 4-20mA device is being used, a 0-10Vdc to 4-20mA converter can be bought off-the-shelf.

DIGITAL INPUT

Button:	
Symbol:	

UCxx/UCUxx   UC32   Value shown

Value not shown

Function of module:

A digital input contains a digital value passed from a peripheral device, such as a pressure switch, attached to the controller. Digital Inputs are used to monitor the status of such devices.

Note 1:

The number of digital inputs available depends on the type of controller you are using. A UC24PG-R controller allows 8 universal inputs, i.e., analog or digital, 8 digital-only inputs, and 8 universal outputs. A UCU10VAV has 3 universal inputs, 1 airflow input, and 6 outputs. To see how many and what type of inputs/outputs are available in the controller you are using, select the **Managers** dialog box from the View menu.

Note 2:

The 'Advanced' options are designed for use only when none of the predefined sensor types are suitable, and should be used in consultation with Cylon Technical Support.

Note 3:

When using a Digital Input module to monitor a UniPut terminal, it is possible to detect 24 V AC in addition to Active (0-10 V) and Passive (volt-free) conditions. The UniPut extract module is used to do this.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables

Variable name	Description	Possible values
Point Number	This is the number of the hardware point to which this module refers	1-24 depending on controller type
(the box beside the point number - UC32 only)	The current value of the hardware point is displayed in a box beside the point number.	Real number
Point Name	An arbitrary name assigned by the user and stored in the Cylon database to identify the point. If a point number is selected for which a name has already been assigned, that name is automatically displayed here.	Any combination of alphanumeric characters and spaces, upper case or lower case. Max recommended length is 20 characters and spaces.
(the box beside the Point Name - UC32 only	Beside the Point Name input box, there is a display that shows the number of characters in the Point Name. This is useful when the point name is to be displayed in a keypad program (see *MAN-0055 Keypad Wizard User Manual*)	Integer
Manual Override Point	This shows the number of the point to which the module's "Manual Override Point" is connected. The value of this point will be '0' when the Digital Input is active, and '1' when the point has been manually overridden. This allows the strategy to react to the fact that a point has been overridden.	1 or 0
(checkbox beside Manual Override Point - UC32 only)	Beside the Manual Override Point number display, there is a checkbox that indicates the value of the point. This is clear if the Manual Override Point is '0' and checked if the value is '1'.	Checked or cleared
Sensor Types	By setting this field to match the sensor connected to the input terminal, you are providing the strategy with all of the information it needs to interpret the input signal correctly.	Active or Passive
Short Circuit	This is a string that will be displayed by this module in the Unitron Command Centre when the input of this module is interpreted as a closed circuit.	Any of the strings in the drop-down list
Open Circuit	This is a string that will be displayed by this module in the Unitron Command Centre when the input of this module is interpreted as an open circuit.	Any of the strings in the drop-down list

Advanced options:

> Note 4:
>
> These options should NOT be changed unless a very specific and clearly identified reason makes it imperative to do so.
>
> Note 5:
>
> The threshold values for a digital input define the values of the signal at the controller terminal that will be interpreted as '1' and '0'.
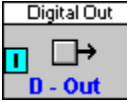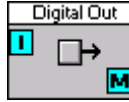
Variable name	Description	Possible values
Low Threshold	The Digital Input will be interpreted as "1" if the actual value of the signal at the controller terminal is above this value.	Integer - in units of the selected sensor type:, Passive type: Ohms Active type: milliVolts
High Threshold	The Digital Input will be interpreted as "0" if the actual value of the signal at the controller terminal is below this value.	Integer - in units of the selected sensor type:, Passive type: Ohms Active type: milliVolts

Application:
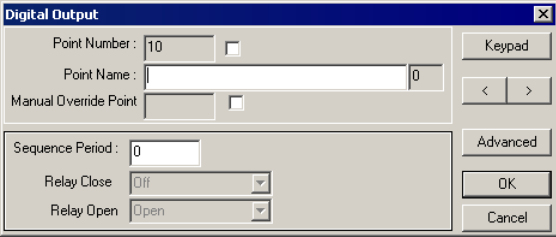
A digital input can carry a signal such as pump status; starter trip; boiler lockout or frost stat.

DIGITAL OUTPUT
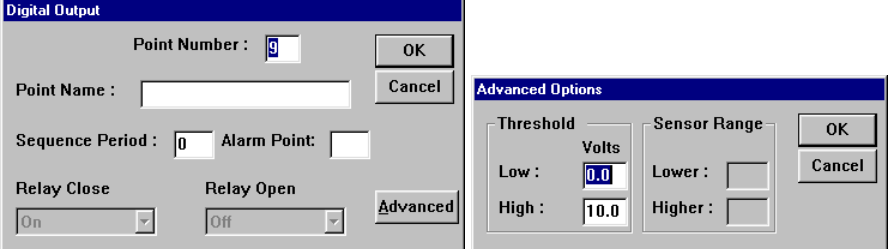
Button:			
Symbol:	UCxx/UCUxx	UC32	Value shown
	Value not shown		
Function of module:	A digital output passes a digital value from the controller to a peripheral device connected to that controller. Digital Outputs are used to provide on/off control for pumps, boilers etc.		
Note 1:	The number of digital outputs available depends on the type of controller you are using. A UC24PG-R controller allows 8 universal inputs, i.e., analog or digital, 8 digital-only inputs, and 8 universal outputs. A UCU10VAV has 3 universal inputs, 1 airflow input, and 6 outputs. To see how many and what type of inputs/outputs are available in the controller you are using, select the Managers dialog box from the **View** menu.		
Note 2:	The 'Advanced' options in the digital output dialog are for future use, and have not yet been implemented.		

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Point Number	This is the number of the hardware point to which this module refers	1-24 depending on controller type
(the box beside the point number - UC32 only)	The current value of the hardware point is displayed in a box beside the point number.	Real number
Point Name	An arbitrary name assigned by the user and stored in the Cylon databases to identify the point. If a point number is selected for which a name has already been assigned, that name is automatically displayed here.	Any combination of alphanumeric characters and spaces. Letters can be upper case or lower case. Maximum recommended length is 20 characters and spaces.
(the box beside the Point Name - UC32 only)	Beside the Point Name input box, there is a display that shows the number of characters in the Point Name. This is useful when the point name is to be displayed in a keypad program (see MAN-0055 Keypad Wizard User Manual)	Integer
Manual Override Point	This shows the number of the point to which the module's "Manual Override Point" is connected. The value of this point will be '0' when the Digital Output is active, and '1' when the point has been manually overridden. This allows the strategy to react to the fact that a point has been overridden.	1 or 0
(checkbox beside Manual Override point - UC32 only)	Beside the Manual Override Point number display, there is a checkbox that indicates the value of the point. This is clear if the Manual Override Point is '0' and checked if the value is '1'.	Checked or cleared
Sequence Period	This is the number of 5-second periods that must elapse after a controller reset, before the selected output becomes active again.	0-255
Relay Close	This defines the message that will be displayed in the strategy drawing when the digital output is in a high-voltage state.	On / Off / Open / Closed / Trip / Normal
Relay Open	This defines the message that will be displayed in the strategy drawing when the digital output is in a high-voltage state.	On / Off / Open / Closed / Trip / Normal

Advanced options:

Note 3: These options are for future use
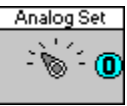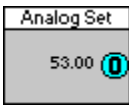
Variable name	Description	Possible values
Low Threshold	Not used	N/A
High Threshold	Not used	N/A

Application:
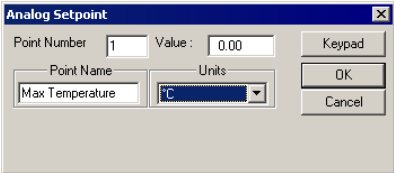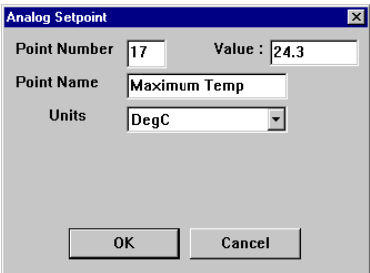
Digital Outputs are used to carry the following types of signal:

Lights ON/OFF commands, pump ON/OFF commands, boiler ON/OFF commands, S.A. Fan enable, R.A. Fan enable.

ANALOG SETPOINT

Button:		
Symbol:	 Value not shown	 Value shown
Function of module:	An analog setpoint can be assigned an analog value which will not be changed at any time by the operation of the strategy. However, analog setpoints can be changed by the user in CCView.	
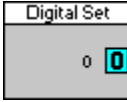
Dialog box:
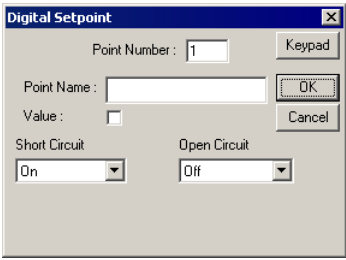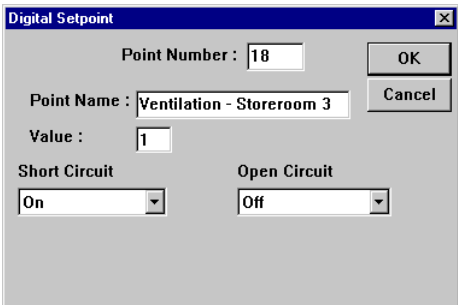
If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Point Number	This is the number of the point to be defined as an analog setpoint.	17 to 255
Point Name	Name assigned by the user.	Any combination of alphanumeric characters and spaces. Letters can be upper case or lower case. Maximum recommended length: 20 characters and spaces.
Units	Units of measurement which correspond to type of value contained in the analog setpoint.	A predefined selection of units is available. Additional units of measurement may be entered in the WN3000.ini file.
Value	Analog value assigned to analog setpoint. This value will be maintained as a constant.	Any floating point number.

Application: An analog setpoint is used when the programmer wants the user to be able to change the value. If the programmer does not wish to let the user change the value, a constant module should be used.

DIGITAL SETPOINT

Button:	
Symbol:	
	Value not shown Value shown
Function of module:	A digital setpoint can be assigned a digital value which will not be changed at any time by the operation of the strategy. However, digital setpoints can be changed by the end user in CCView.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Point Number	This is the number of the point to be defined as a digital setpoint.	17 to 255
Point Name	Name assigned by the user.	Any combination of alphanumeric characters and spaces. Letters can be upper case or lower case. Maximum recommended length: 20 characters and spaces.
Value	Digital value assigned to digital setpoint. This value will be maintained as a constant.	0 or 1
Open Circuit	Message to appear when the digital setpoint is in an open circuit state.	ON/OFF/Open/Closed/ Trip/Normal
Short Circuit	Message to appear when the digital setpoint is in a closed circuit state.	ON/OFF/Open/Closed/ Trip/Normal

Application: A digital setpoint is used when the programmer wants the end user to be able to set or unset a digital point in the strategy, e.g., to reset an alarm, to override main plant or to go into manual mode.

REAL CONSTANT
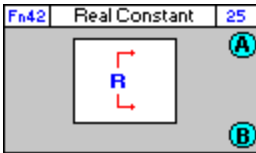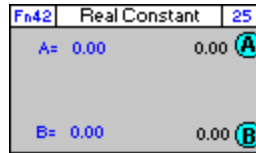
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Real Constant module allows the values assigned to two analog points to be specified as constant. The values assigned to these points can be any real number, up to two decimal places.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
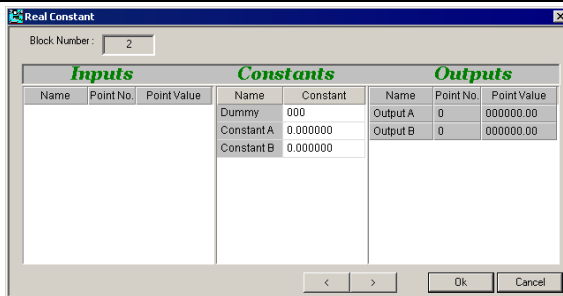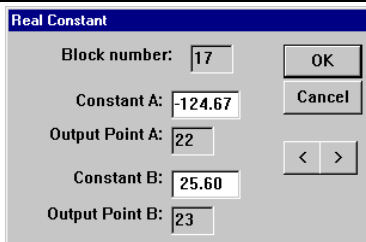
Variables:	*Variable name*	*Description*	*Possible values*
	Constants A and B	The values to be maintained as constants at output points A and B.	Any floating point number.
	Output Points A and B	The numbers of the points to which constants A and B are to be written.	17 to 255

Application: The Real Constant module is used to hold real constants with relation to another block, e.g., as the non-variable inputs to a Rescale to 0 and 100 module as shown:
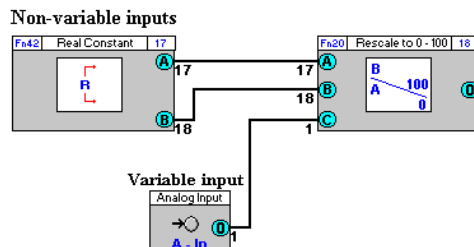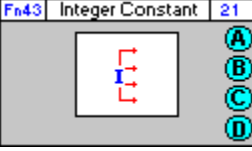
INTEGER CONSTANT
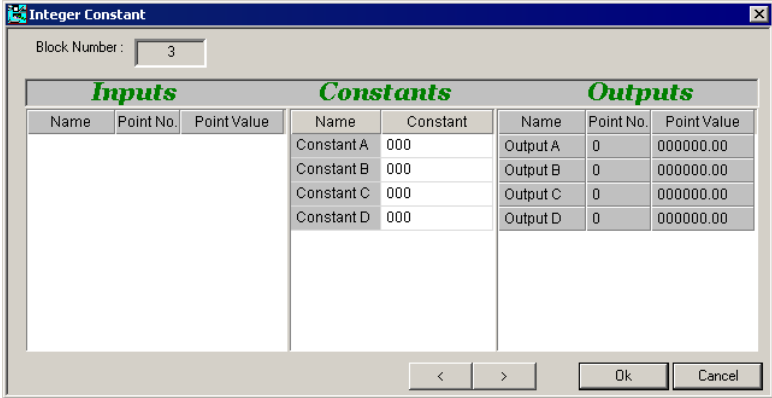
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Integer Constant module allows the values assigned to four analog points to be specified as constant. The values assigned to these points must be integers. Any non-integer value entered will result in an error message requesting that an integer value be input.
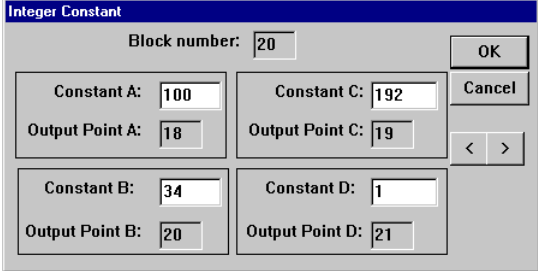
Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:	*Variable name*	*Description*	*Possible values*
	Constants A, B, C and D	The values to be maintained as constants in points A, B, C and D.	Integer (positive or negative) in the range -3.2768x104 to +3.2768x104
	Output Points A, B, C and D	The number of the analog points to which the constants A, B, C and D are to be written.	17 to 255

Application: The Integer Constant module is used to provide constant integer values to another block. In the example below, the integer constant module is used to provide non-variable inputs to two Rescale to 0 - 100 modules.

© Cylon Controls
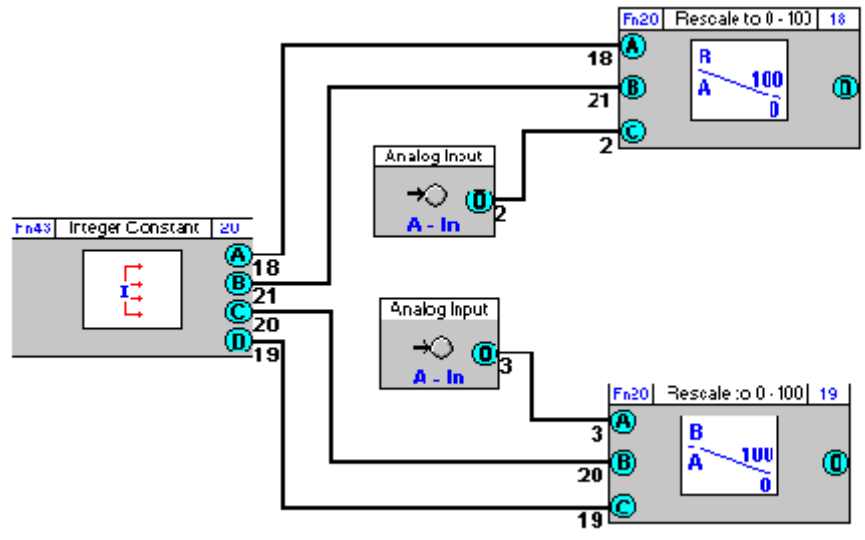
DIGITAL EXTRACT

Appearance

Group	Button	Symbol
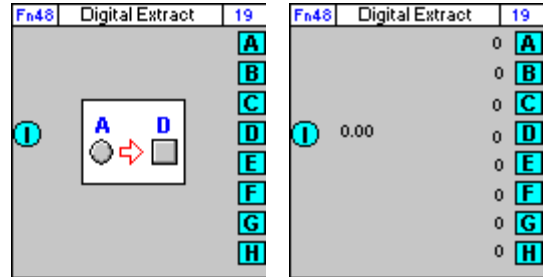
Group

P (Points)

Button

Dig-Ext.

Symbol

Dialog box

- If UC32/BACnet-type Controller is targeted:
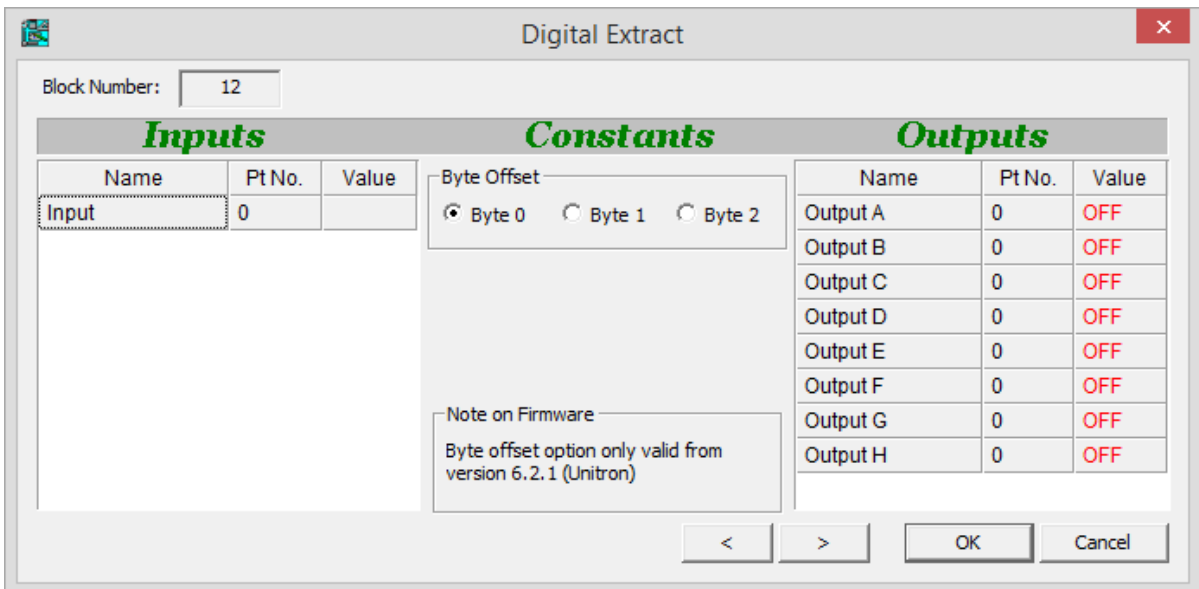
- If Legacy UC type Controller is targeted:
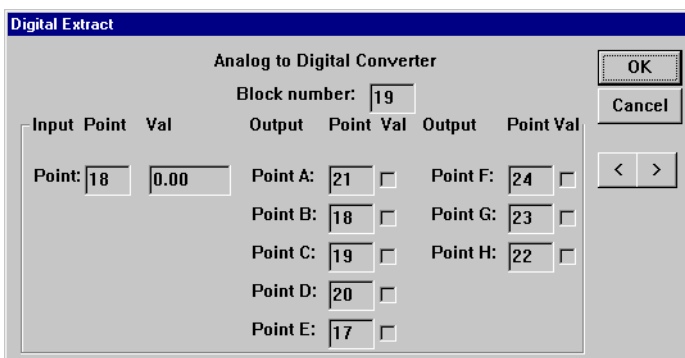
Function:

The Digital Extract module accepts an analog input and converts its integer component to an 8 bit digital expression, which is the binary value of the input.

Because the Digital Extract module converts the input value to an 8-bit digital expression, by default it outputs bits equivalent to analog values in the range 0 to 255. However, using the `Byte Offset` feature, the 8 bits that it outputs can represent one of 3 different ranges within larger (up to 24 bit) binary numbers.

The Digital Extract module is used with the DI hardware module to derive the state of each input on the DI from the single analog value outputted from the DI.

It can also be used in conjunction with the Digital Encode module to send eight digital globals as a single analog global which can then be converted back to eight digital globals on receipt.

Example:

Input value = 3652

Equates to a binary value of 000000000000111001000100

	Byte 0	Byte 1	Byte 2
Output A	0	0	0
Output B	0	1	0
Output C	1	1	0
Output D	0	1	0
Output E	0	0	0
Output F	0	0	0
Output G	1	0	0
Output H	0	0	0

Parameters

Inputs

Parameter Name	Description	Possible values
Input point	Analog value to be converted to 8 binary values.	Positive integer

Constants

- Only available If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Special	This should not be edited	
Byte Offset	The 8 bits reflected in the Digital Extract module outputs can represent the lowest, highest or middle byte within a 24-bit digital number. This parameter sets which byte will be reflected in the outputs. Byte 0 returns the lowest byte, Byte 1 returns the middle byte and Byte 2 returns the highest byte. **Note**: Byte Offset functionality is available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.	Byte 0, Byte 1, or Byte 2

Outputs

Parameter Name	Description	Possible values
Output points A-H	Point at which each component of the 8-bit digital expression is output. Significance of output bits increases from A to H (A is the least-significant bit) i.e., the 8-bit expression reads from H to A.	set or unset

DIGITAL ENCODE

Button:	Dig-Enc.
Symbol:	
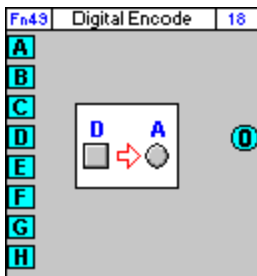
Values not shown   Values shown
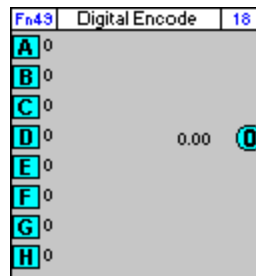
Function of module:	The digital encode module accepts eight digital inputs and converts them to an analog expression which equals the base 10 value of the binary expression represented by the inputs.

Dialog box:

If UC32 is targeted:	**Digital Encode** Block Number : 1

	Inputs			Constants		Outputs		
	Name	Point No.	Point Value	Name	Constant	Name	Point No.	Point Value
	Input A	0	OFF			Output	0	000000.00
	Input B	0	OFF					
	Input C	0	OFF					
	Input D	0	OFF					
	Input E	0	OFF					
	Input F	0	OFF					
	Input G	0	OFF					
	Input H	0	OFF					

If UC/UCU is targeted:	**Digital Encode**

Digital to Analog converter

Block number: 17

	Point	Value		Point	Value
Input Point A:	20	☐	Input Point E:	17	☐
Input Point B:	21	☐	Input Point F:	24	☐
Input Point C:	19	☐	Input Point G:	22	☐
Input Point D:	18	☐	Input Point H:	23	☐
Output Point:	19	0.00			

OK
Cancel

Variables:	Variable name	Point	Value
	Input points A to H	Points at which the digital values are input.	set or unset
	Output point	Point at which the resulting analog value is output.	0 to 255

Implementation of module:

Given inputs A, B, C, D, E, F, G, H:

Output = H*128 + G*64 + F*32 + E*16 + D*8 + C*4 + B*2 + A

Example: If A = 1; B = 1; C = 0; D = 1; E = 1; F = 0; G = 0; H = 0

Then Output = 0*128 + 0*64 + 0*32 + 1*16 + 1*8 + 0*4 + 1*2 + 1 = 27

Application:

The Digital Encode Module can be used in conjunction with the Digital Extract module to allow the programmer to send eight digital globals as one analog global which can then be converted back to eight digital globals on receipt.

DIGITAL CONSTANT
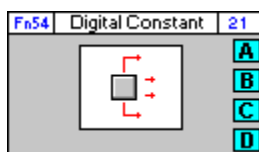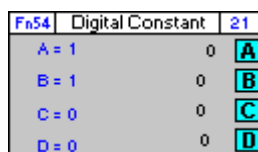
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Digital Constant module allows the values written to four digital points to be specified as constant.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
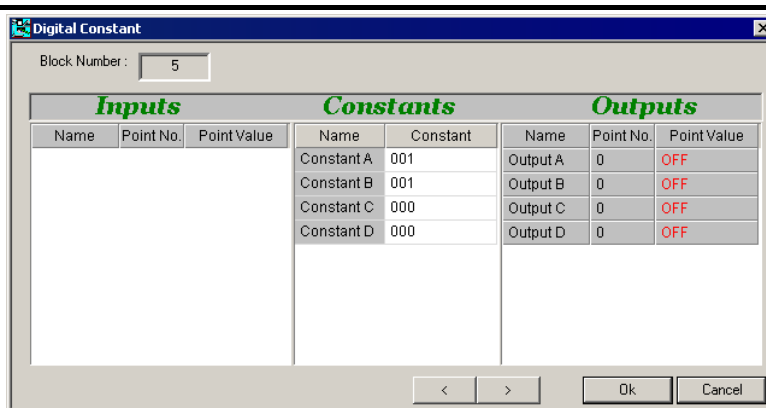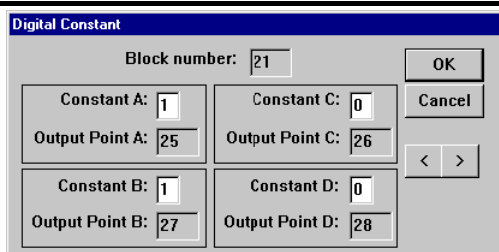
Variables:	*Variable Name*	*Description*	*Possible values*
	Constants A, B, C and D	The values to be maintained as constants in points A, B, C and D.	0 or 1
	Output Points A, B, C and D	The numbers of the digital points to which the Constants A, B, C and D are to be written.	17 to 255

Application: An example of the Digital Constant module in use is with a PID loop to continually enable a plant.

MAKE LINEAR
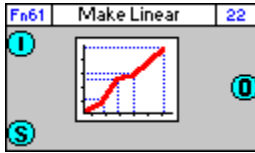
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Make Linear module allows a device with a non-linear characteristic to be used as an input. This is done by dividing the characteristic curve of the device into linear sections, which can be interpreted.

This is usually used with temperature-measuring devices. The hardware point attached to the device should be programmed to return values in millivolts (mV).

*Note: A lookup table that contains temperatures and corresponding voltage values must be made up. This table is made up from the values of a series of **consecutive** points in the strategy. These points can be the outputs of 'Analog setpoint', 'integer', or 'real constant' blocks, but it is important that the point numbers of these outputs of must be consecutive. For each of the linear sections into which the input characteristic is divided, there must be a start and end value. The total number of setpoints, integers, or constants required is therefore one more than the number of steps. The points are defined by specifying the **point number** of the first point, and the **total number of points** making up the table.* |

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable Name	Description	Possible values
Input Point	The number of the point containing the current value of the non-linear input.	1 to 8
Input Point Value	The current value of the non-linear input.	Any real number
Start of Table Point	The number of the point where the first value in the lookup 'table' is stored. *The 'table' is made up of the values of a set of consecutive points. For instance, these points can be the outputs from a number of Analog Setpoint blocks. The setpoints must be given values that match the expected input characteristic, and their point numbers can be set to any values within the strategy but **must** be consecutive. The "Start of Table' point on the Make Linear block must be connected to the first of those consecutive points.*	17 to 255
Start of Table Value	The first value in the lookup table.	Any real number
Output Point	The number of the point to contain the value of the linear output.	17 to 255
Output Point Value	The current value of the linear output.	Any real number
Number of Linear Steps	This must be set to the total number of POINTS that make up the in the conversion table.	Any integer
Start of Linear Range	Start of range of input.	Any real number
End of Linear Range	End of range of input.	Any real number
Negative Temp. Coeff.	Set if input has a negative coefficient of resistance (i.e. if resistance drops as temperature rises).	Set or unset

Implementation of module (example): A temperature sensor is connected to a controller as shown below. The resistances at a range of temperatures are given in the datasheet supplied with the sensor and are shown in the first two columns of the table below.
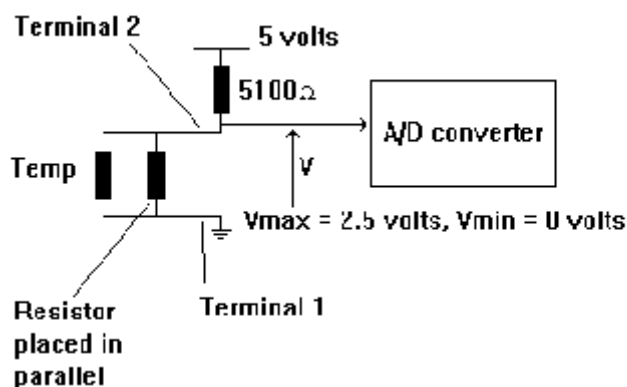
The Make Linear module requires that the input should be converted to mV and that all values of the input should fall in the range 0mV to 2500 mV. In order to constrain the mV values to this range, a resistor is placed in parallel as shown. The lookup table can be constructed as follows:

The final resistance is calculated by means of the equation for resistors in parallel:

R = (r1xr2)/(r1+r2).

For example, at a temperature of 5ºC, the final resistance = (4090x3300)/(4090+3300) = 1826.4
 I is constant, and can be calculated as I = V/R - 5/(5100+R), where R is the final resistance.

The value in mV for each temperature is given by V = IR, where I = 5/(5100+R) as shown above.
For example, at a temperature of 5oC, the value in mV = (5/(5100+1826.4) x 1826.4 = 1.3184 volts or 1318.4 mV.

Temperature	Initial Ohms	Resistor in parallel	Final resistance	mV
-5	6450	3300	2183.1	1498.7
0	**5120**	**3300**	**2006.7**	**1411.8**
5	4090	3300	1826.4	1318.4
10	**3290**	**3300**	**1647.5**	**1220.8**
15	2670	3300	1475.9	1122.2
20	**2180**	**3300**	**1312.8**	**1023.6**
25	1800	3300	1164.7	929.6
30	**1490**	**3300**	**1026.5**	**837.8**
35	1265	3300	914.5	760.2
40	**1040**	**3300**	**790.8**	**671.2**
45	890	3300	701.0	604.2
50	**740**	**3300**	**604.5**	**529.8**
55	640	3300	536.0	475.5
60	**540**	**3300**	**464.1**	**417.0**

The number of steps (points) in the lookup table is decided by the number of divisions required to preserve linearity. In this case, the figures in bold in the table indicate the divisions between which linearity is preserved, so the lookup table, which starts at point 17 will be as follows:

Point	Value
17	417.0
18	529.8
19	671.2
20	837.8
21	1023.6
22	1220.8
23	1411.8

Making a total of 7 points (which is entered in the "number of Linear Steps" section of the dialog box).

A strategy implementing this 'Make Linear' function might appear as shown:
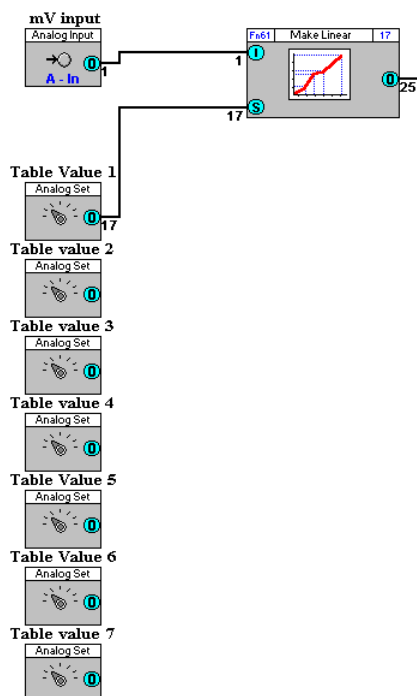
Note: the values of the setpoints **must** be consecutive. These can be edited by right-clicking on each of the setpoint modules, which opens the Make Linear dialog box.

The example shows Analog setpoints providing the lookup table values. It would also be possible to use Real Constant blocks (which would set two table values per block) or Integer blocks (which provide 4 table values per block)

DIGITAL EXTRACT DI (UC24PG DIGITAL INPUT MODULE)

Appearance

<u>Group</u>

P (Points)

<u>Button</u>

<u>Symbol</u>
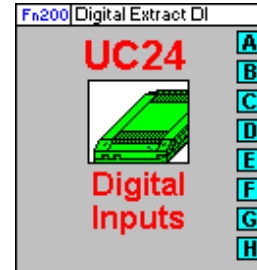
Dialog box
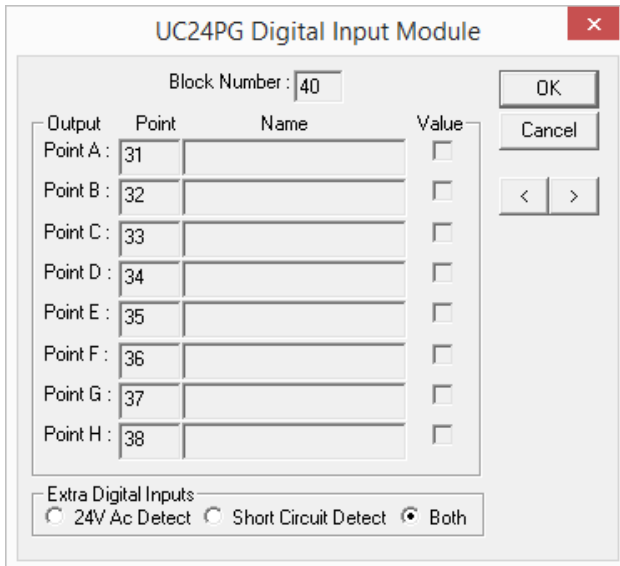
Function:

The UC24 Digital Input Module is used to access the **UC24PG-R**'s 8 digital-only inputs. In the PG-R range, 16 strategy points are allocated to inputs and outputs, but the **UC24PG-R**'s digital-only inputs do not lie in this range. As a result, the UC24 Digital Input Module must be used. It allows access to the digital inputs at the next available 8 consecutive points in the strategy.

The controller monitors the digital inputs at 35 ms intervals and performs a vote based on the last 3 readings to determine if the input is open, shorted or 24 V ac.

Note: This module can only be placed in a strategy that is running on a UC24PG-R controller.

Parameters

Parameter Name	Description	Possible values
Block Number	This shows the number of the block within the UC24PG-R controller occupied by this module.	any value between 17 and 255.
Output Point	This box shows the point number assigned to each output. These are automatically assigned, and cannot be changed.	17 to 255
Output Name	If a point to which an output is connected has been given a name, the name will be displayed here. The name cannot be changed in this dialog.	Text string
Extra Digital Inputs	This setting specifies the condition detected at each of the UC24PG-R digital-only inputs that will cause the module's outputs to be" True" : • if the input is shorted to common, or • if 24 V ac is detected. The module outputs can also be set if either condition is detected (this is the default condition). A typical use for this distinction is monitoring a 24 V ac output connected to a lamp. The lamp acts as a short circuit so that the 24 V ac status would not be detected if either 'Short Circuit Detect ' or 'Both' was selected.	24V Ac Detect Short Circuit Detect Both

DI MODULE (UC16DI DIGITAL INPUTS)
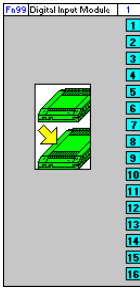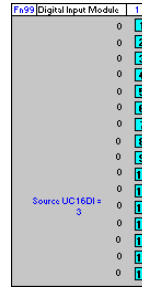
Button:	
Symbol:	
	Value not shown Value shown
Function of module:	This module brings the inputs from a UC16DI module into a strategy in a single block.
Note:	2 blocks and 2 local globals are used whenever this module is inserted in a strategy.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:	*Variable name*	*Description*	*Possible values*
	DI Source address	This drop-down list allows you to select one of the UC16DI modules available on the current Cylon Network.	1 to 16
	Global Details - Global number	The UC16DI module sends its inputs to a Field Controller strategy using two local globals. These are brought into the strategy by means of 2 analog set points. The two boxes marked "Global" show the numbers of the globals that are assigned to the selected UC16DI.	The next two available global numbers. (These will be in the range 1-255)
	Global Details - Point number	The box marked "Point" beneath each global number shows the number of the setpoint through which that global is brought into the strategy.	The next two point numbers available in the strategy. (These will be in the range 17-255)
	Global Details - Point value	This shows the value of the setpoint specified in the "Global Details - Point number" box.	This value should be "2000" if the module is functioning correctly.
	Module details – Digital extract 1	The information received by the globals is converted into digital signals by two digital extract modules. They are automatically assigned the next module numbers available in the strategy. The "Digital extract 1" and "Digital extract 2" boxes show the numbers that have been assigned.	The next available module numbers (These will be in the range 17-255)
	Input (1-16)	Each of the 16 input point number boxes shows the point number within the strategy to which that input has been connected.	17-255
	Value (for inputs 1-16)	The value box for each input shows the current value of that input.	0 or 1

METER

Appearance

<u>Group</u>
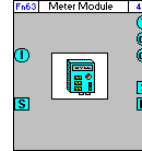
P (Points)

<u>Button</u>

<u>Symbol</u>

<u>Dialog box</u>

- If UC32/BACnet-type Controller is targeted:
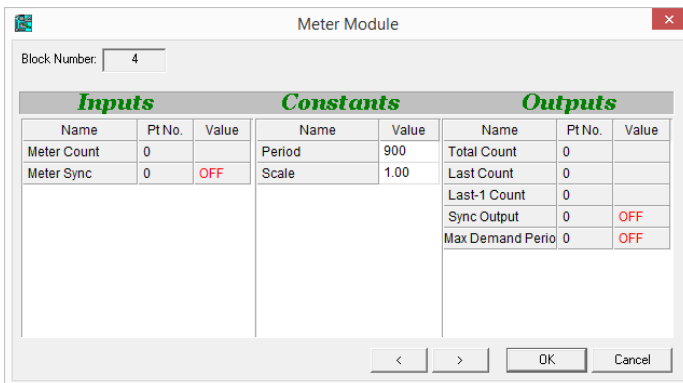
- If Legacy UC type Controller is targeted:
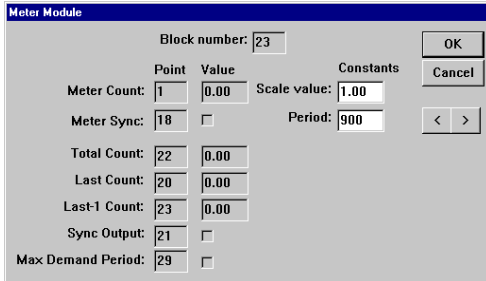
Function:

The Meter module records the "pulse count" reported by an external electricity meter (which is delivered to the module as an analog value). The value of the "pulse count" (which is constantly changing) is only recorded when a "synchronizing pulse" is received at the Meter module's digital input.

The Meter module is used for calculating electrical energy use over a specific period (e.g. daily or weekly)

This synchronizing pulse may be provided either by the external meter or by the module itself.

Note: Each pulsed input from an external meter can only be connected to a single Meter module in the strategy. If for example, power consumption is to be measured over two time periods (e.g. hourly and monthly) simultaneously from the same meter, this must be calculated elsewhere in the strategy.

> **Note**: The Meter Sync point overrides the Meter module's monitoring period, so that if a digital input is connected to the Meter Sync point, the Meter module will **not** update the 'total count', 'last count' or 'last count-1' values at the end of the monitoring period. The Meter Sync point is intended for use only in cases where Maximum Demand Tariff agreements are in place with a utility company, and the utility company provides a synchronizing pulse.

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
(I) **Meter Counter**	This reflects the "pulse count" at the external meter since the last 'synchronizing pulse'.	Real Number
[S] **Meter Sync**	When this is set, outputs are updated.	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
(I) **Meter Count Point**	Number of the controller's analog input point which reflects the analog value ("pulse count") reported by the external meter.	1 to 8 (must be controller analog input)
Meter Count Value	This is the current value of the input point specified above. It reflects the "pulse count" at the external meter since the last 'synchronizing pulse'.	
[S] **Meter Sync Point** (on input side)	Number of the controller's digital input point at which external meter's synchronizing pulse is received.	1 to 8
Meter Sync Value	This is the current value of the input point specified above. When this is set, outputs are updated.	Set or unset

Constants

Parameter Name	Description	Possible values
Scale Value	Factor for converting pulses to physical units. e.g. if 3 pulses = 1 kWh, then Scale Value = .333.	Positive integer (not 0)
Period	Length of time in seconds of the Monitoring Period. This value must be specified.	Any integer value

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
T Total Count	This is the current value of the strategy point specified above. This value reflects the cumulative total of the values recorded at the Meter Count Point (i.e. the total amount of energy units used) since the strategy started servicing.	Positive integer
c1 Last Count	This is the current value of the strategy point specified above, i.e. the value of the input point when the last synchronising pulse was received ("Last Count" value).	Positive integer
c2 Last-1 Count	This is the current value of the strategy point specified above, i.e. the value of the "Last Count" point (c1) before the last synchronising pulse was received.	Positive integer
S Sync Output	The value of this point is 'set' (on) for one scan cycle at the end of the Monitoring Period, then becomes unset again.	Set or unset
M Max Demand Period Value	(not operational)	Set or unset
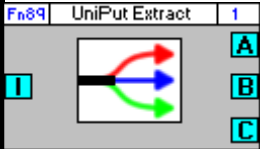
- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
T Total Count Point	Number of strategy point at which "Total Count" value is held.	9 to 255
Total Count Value	This is the current value of the strategy point specified above. This value reflects the cumulative total of the values recorded at the Meter Count Point (i.e. the total amount of energy units used) since the strategy started servicing.	Positive integer
c1 Last Count Point	Number of the strategy point at which "Last Count" value is held.	9 to 255
Last Count Value	This is the current value of the strategy point specified above, i.e. the value of the input point when the last synchronizing pulse was received ("Last Count" value).	Positive integer
c2 Last-1Count Point	Number of the strategy point at which "Last-1 Count" value is held.	9 to 255
Last-1 Count Value	This is the current value of the strategy point specified above, i.e. the value of the "Last Count" point (c1) before the last synchronizing pulse was received.	Positive integer
S Sync Output Point	Number of the strategy point at which Sync Output value is held.	9 to 255
Sync Output Value	The value of this point is 'set' (on) for one scan cycle at the end of the Monitoring Period, then becomes unset again.	Set or unset
M Max Demand Period Point	(not operational)	17 to 255
Max Demand Period Value	(not operational)	Set or unset
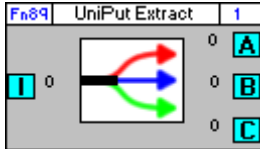
UNIPUT EXTRACT

Button:	

Symbol:

Values not shown   Values shown

Function of module:

When a UniPut is set as a 'Digital input' (see How to configure a UniPut), its value can be entered into a strategy using a Digital Input module. The Digital Input module can be set to read the UniPut as an Active (0-10 V) input or as a Passive (Volt Free) input, in exactly the same way as it would read a Universal Input.

However, Cylon's unique UniPut technology can also detect the presence or absence of 24 V AC in addition to 0-10 V, allowing even greater flexibility. The Digital Input module itself does not distinguish between these two active states, so that a 'true' ('On' or '1') signal from a Digital Input module may represent any one of the following three states:
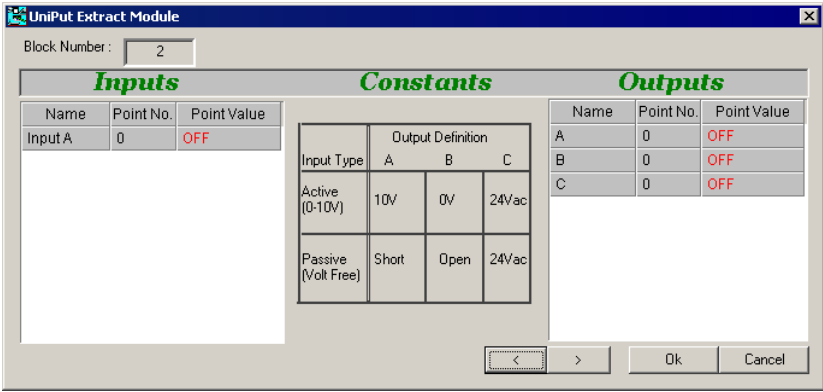
- 0 - 10 Volts is present at the terminal
- 24 Vac is present at the terminal
- There is a short circuit between the terminal and GND.

It is possible to determine which of the above is true by combining the Digital Input module with the 'UniPut Extract' module.

The UniPut Extract Module is accessed from the 'Points' toolbar - it is usually the rightmost icon on the toolbar.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	Not applicable

Variables:

Variable name	Description	Possible values
InputA	This point is connected to an input point representing a UniPut configured as a digital input.	1 or 0
A	Outputs '1' if either: Digital Input is set to 'active' and 10 V is present at the UniPut terminal Digital Input is set to 'passive' and the UniPut terminal is short-circuited to GND	1 or 0
B	Outputs '1' if either: Digital Input is set to 'active' and 0 V is present at the UniPut terminal Digital Input is set to 'passive' and the UniPut terminal is an open-circuit	1 or 0
C	Outputs '1' if either: Digital Input is set to 'active' and 24 Vac is present at the UniPut terminal Digital Input is set to 'passive' and 24 Vac is present at the UniPut terminal	1 or 0

Implementation of module:

The UniPut Extract module is used in conjunction with a digital input module:
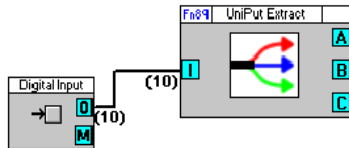
The setting of the Digital input module ("active" or "passive") and the values of the 3 output points will show the exact state of the UniPut input terminal.

Digital Input setting:	Input Terminal State	Module outputs	
Active (0-10V)	0 V present	A = 0 B = 1 C = 0	
	10 V present	A = 1 B = 0 C = 0	
	24 Vac present	A = 0 B = 0 C = 1	
Passive (Volt Free)	Shorted to GND	A = 1 B = 0 C = 0	
	Open Circuit	A = 0 B = 1 C = 0	
	24 Vac present	A = 0 B = 0 C = 1	

Application:

For determining the type of input being received at a Digital Input terminal.

SECTION 23 : LOGIC MODULES

EDGE TRIGGERED LATCH
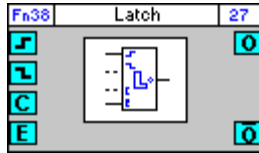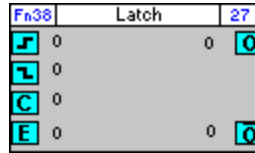
Button:	Latch
Symbol:	Fn38 Latch 27 ... Values not shown / Fn38 Latch 27 ... Values shown
Function of module:	The Edge Triggered Latch module is used to detect and record the change in state of a digital point. The term "edge triggered" means that the outputs contain a record of the input points' changes in state rather than their current states.

Dialog box:

If UC32 is targeted:

Edge Triggered Latch

Block Number : 2

Inputs

Name	Point No.	Point Value
Low to High I	0	OFF
High to Low I	0	OFF
Clear Input	0	OFF
Enable Input	0	OFF

Constants

Name	Constant

Outputs

Name	Point No.	Point Value
True Output	0	OFF
Complement	0	OFF

If UC/UCU is targeted:

Edge Triggered Latch

Block number: 18

	Point	Value
Low to High Input:	19	☐
High to Low Input:	20	☐
Clear Input:	22	☐
Enable Input:	0	☐
True Output:	24	☐
Complement Output:	23	☐

Variables:

Variable name	Description	Possible values
Low to High (LTH) Input Point	Number of point at which Low to High Input value is held. May be omitted.	17 to 255
Low to High (LTH) Input Value	If Low to High Input Point has been specified, each time this value changes from 0 to 1 the True Output value becomes set; otherwise ignored.	Set or unset
High to Low (HTL) Input Point	Number of point at which High to Low Input value is held. May be omitted.	17 to 255
High to Low (HTL) Input Value	If High to Low Input Point has been specified, each time this value changes from 1 to 0 the True Output value becomes set; otherwise ignored.	Set or unset
Clear Input Point	Number of point at which Clear Input value is held. May be omitted.	17 to 255
Variable name	Description	Possible values
Clear Input Value	If Clear Input Point is specified, the True Output will be unset if the value here is 1; otherwise ignored. Note: the effect of this value overrides the effect of the Enable Input value.	Set or unset
Enable Input (Point)	Number of point at which Enable Input Value is held. May be omitted.	17 to 255
Enable Input Value	If Enable Input Point is specified, this value must be set for the latch to function. If it is unset, the two data inputs will not be monitored and the outputs will remain in the states they were in before the Enable Input Value became unset; otherwise ignored.	Set or unset
True Output (Point)	Number of point at which True Output is held.	9 to 255
True Output Value	Value here is set if LTH Input Value goes from 0 to 1 or if HTL Input Value goes from 1 to 0, provided Enable Input Value is set and Clear Input Value is unset	Set or unset
Complement Output (Point)	Number of Point at which complement of True Output Value is held	9 to 255
Complement Output Value	Complement of True Output Value	Set or unset

Timing diagram:

Application: If an event happens, the plant must be held off until a manual reset button is pressed.

TIMER WITH CONSTANT INPUTS

Button:

Symbol:

Values not shown
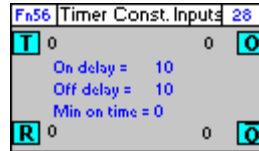
Values shown

Function of module:

The Timer with Constant Inputs module switches the state of a digital input point to a digital output taking into account up to three delay timers before the servicing of the output point. The module accepts two digital inputs - the point value being switched and a reset point value which can override the operation of the module - and produces two digital outputs which are complements of each other.

Dialog box:

If UC32 is targeted:

If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Trigger Point	Number of point at which Trigger Point Value is held.	1 to 255
Trigger Point Value	Value on which module will operate to produce output.	Set or unset
Reset Point	Number of point at which Reset Point Value is held.	1 to 255
Reset Point Value	When this is set, True Output is set until this becomes unset. Overrides operation of module.	Set or unset
ON Delay	Period in seconds for which the Trigger Point Value must be set before the True Output Point is serviced.	Positive integer
OFF Delay	Period in seconds for which the Trigger Point Value must be unset before the True Output Point is serviced.	Positive integer
Minimum ON Time	Minimum period in seconds for which the True Output must remain set once it has become set.	Positive integer
True Output Point	Number of point at which True Output Value is held.	9 to 255
True Output Value	Will be set after the period specified in the ON delay if the Trigger Point Value becomes set. Will be unset after the period of the OFF delay if the Trigger Point Value becomes unset	Set or unset
Complement Output Point	Number of point at which the complement of the True Output Value is held	9 to 255
Complement Output Value	Complement of True Output Value	Set or unset

Timing diagram:

Application: The Timer with Constant Inputs module is normally used when the time delay will never have to be changed by the end user.

TIMER
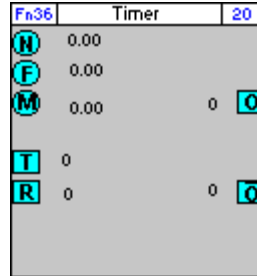
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Timer module enables the state of a digital input point to be switched to a digital output with up to three delay timers taken into account before the output point is serviced.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
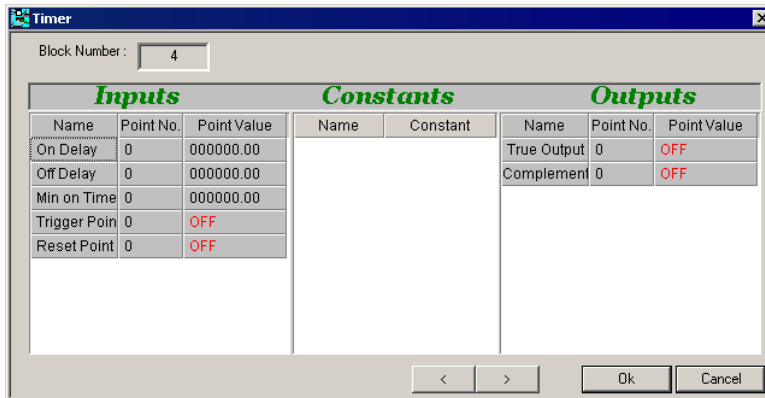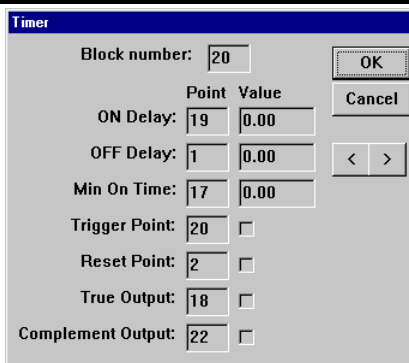
Variables:

Variable name	Description	Possible values
ON Delay Point	The point number at which the ON Delay value is held.	17 to 255
ON Delay Value	The period in seconds which must elapse after the trigger point is set before the true output point is set. The trigger point must be set for longer than the ON delay time in order to set the true output point.	Positive real number
OFF Delay Point	The point number at which the OFF Delay value is held.	17 to 255
OFF Delay Value	The period in seconds which must elapse after the trigger point is unset before the true output point becomes unset. The trigger point must be unset for longer than the OFF delay time in order to unset the true output point.	Positive real number
Min ON Time Point	Point number at which the Min ON Time value is held.	17 to 255
Min ON Time Value	Minimum period in seconds for which the true output point must be set.	Positive real number
Trigger Point	Point number at which the trigger point value is held.	17 to 255
Trigger Point Value	Value of digital input to the module.	Set or unset
Reset Point	Point number at which Reset Point value is held.	17 to 255
Reset Point Value	When this is set, true output point is unset and vice versa, and all the times are put back to zero.	Set or unset
True Output Point	Point number at which True Output Point value is held.	9 to 255
True Output Value	Set when trigger point is set, after any ON delays have expired. Unset when trigger point becomes unset if trigger point remains unset for longer than the specified OFF delay.	Set or unset
Complement Output Point	Point number at which complement of True Output Point value is held.	9 to 255
Complement Output Value	Complement of True Output Point value.	Set or unset

Timing diagram:
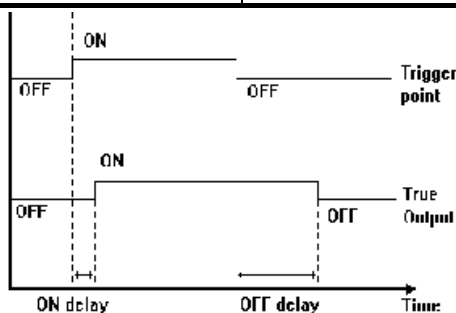
Application: If a boiler switches off at the end of occupancy, then the pump must remain on for one hour after that time. This is implemented as follows:
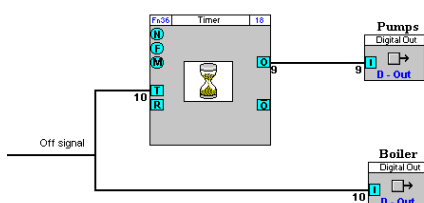
TIMER WITH MINIMUM OFF TIME

Appearance

<table>
<tr><td><u>Group</u></td><td><u>Button</u></td><td><u>Symbol</u></td></tr>
<tr><td>**L** (Logic)</td><td></td><td></td></tr>
</table>

<u>Dialog box</u>

- If UC32/BACnet-type Controller is targeted:
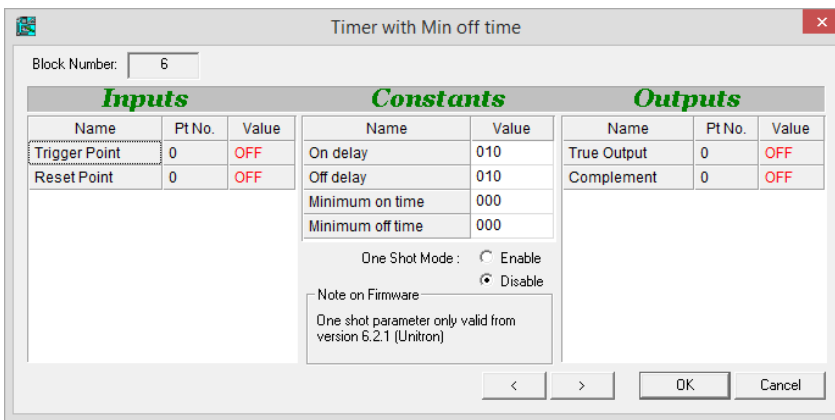
- If Legacy UC type Controller is targeted:
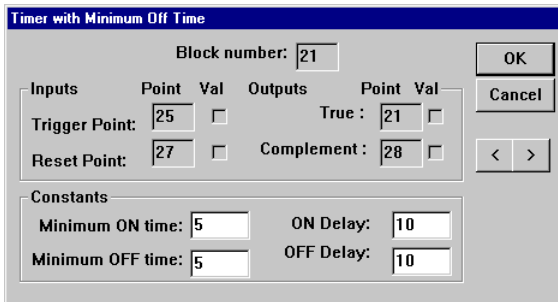
Function:

The **Timer with Minimum Off Time** module outputs a digital value based on an inputted digital value but taking into account up to four delay timers. The module accepts two digital inputs - the value being passed through and a reset point value which can override the operation of the module. It produces two digital outputs which are complements of each other.

This can be used, for example, to control fans which cannot be switched on for a certain period once they have been switched off.

It also includes "one-shot" functionality, in which the input point is automatically reset as soon as the output is triggered.

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Trigger Point	Value which module will operate on to produce output.	Set or unset
Reset Point	When this is set, True Output is set until this becomes unset. Overrides operation of module.	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Trigger Point	Number of point at which Trigger Point Value is held.	1 to 255
Trigger Point Value	Value which module will operate on to produce output.	Set or unset
Reset Point	Number of point at which Reset Point Value is held.	1 to 255
Reset Point Value	When this is set, True Output is set until this becomes unset. Overrides operation of module.	Set or unset

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
ON Delay	Period in seconds for which the Trigger Point Value must be set before the True Output Point is serviced.	Positive integer
OFF Delay	Period in seconds for which the Trigger Point Value must be unset before the True Output Point is serviced.	Positive integer
Minimum ON Time	Minimum period in seconds for which the True Output must remain set once it has become set.	Positive integer
Minimum OFF Time	Minimum period in seconds for which the True Output must remain unset once it has become unset.	Positive integer
One-Shot	If this is enabled then the Trigger point will be reset as soon as the True output becomes set – i.e. after the ON delay has expired. This means that the OFF delay and Minimum ON Time are triggered immediately. Note: One-shot functionality is available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.	Enable / Disable

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
ON Delay	Period in seconds for which the Trigger Point Value must be set before the True Output Point is serviced.	Positive integer
OFF Delay	Period in seconds for which the Trigger Point Value must be unset before the True Output Point is serviced.	Positive integer
Minimum ON Time	Minimum period in seconds for which the True Output must remain set once it has become set.	Positive integer
Minimum OFF Time	Minimum period in seconds for which the True Output must remain unset once it has become unset.	Positive integer

- Timing diagrams

UC32/CBM with one-shot parameter unset and Legacy controllers:
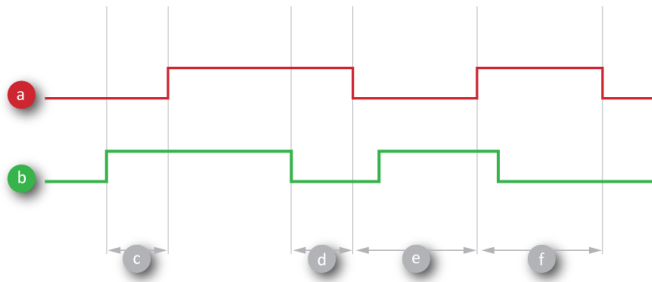
🔴 a Output   🟢 b Input   ⚪ c ON delay   ⚪ d OFF delay   ⚪ c Minimum OFF time   ⚪ d Minimum ON time

If the one-shot parameter is set (UC32/CBM only), then when the output goes ON, the input is reset to OFF
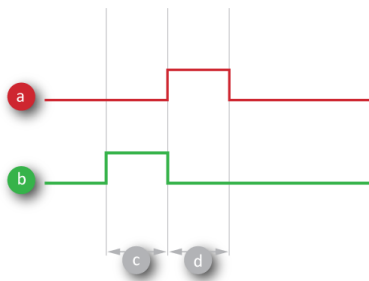
🔴 a Output   🟢 b Input   ⚪ c ON delay   ⚪ d OFF delay

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
True Output	Will be set after the period specified in the ON delay if the Trigger Point Value becomes set. Will be unset after the period of the OFF delay if the Trigger Point Value becomes unset.	Set or unset
Complement Output	Complement of True Output Value.	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
True Output Point	Number of point at which True Output Value is held.	9 to 255
True Output Value	Will be set after the period specified in the ON delay if the Trigger Point Value becomes set. Will be unset after the period of the OFF delay if the Trigger Point Value becomes unset.	Set or unset
Complement Output Point	Number of point at which the complement of the True Output Value is held.	9 to 255
Complement Output Value	Complement of True Output Value.	Set or unset

BOOLEAN (COMBINATION OF DIGITAL INPUTS)
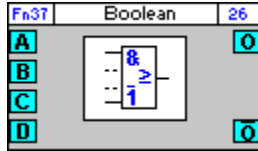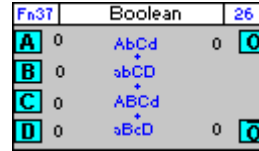
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Boolean module allows the user to perform Boolean algebraic operations on up to four digital inputs. AND, NAND, OR, NOR and NOT operations can be performed using this module.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
InputA InputB InputC InputD	The point numbers and current values of the 4 possible input points are displayed in these fields	0 or 1
True Output	Displays the point number and value of the 'true' output. This point will have a value of "1" if the expression represented in the "Constants" column is TRUE.	0 or 1
Compliment	Displays the point number and value of the 'compliment' output. This is the 'compliment' of OutputA, i.e. will have a value of "1" if the expression represented in the "Constants" column is FALSE.	0 or 1

Constants:
(UC32 only)

The "constants" column in the Boolean Combination of Digital Inputs lists 'actions' rather than ordinary constants.

There are 4 columns of checkboxes. Each column represents an "AND" action, and the results of each column are combined by "OR" to give the overall result, which is outputted from the module.

To include an input in one of the 4 "AND" operations, click on the box that is in line with that input in the required column. The box cycles through three states each time you click on it. The three states are:

☑ Include the value of the input
☐ Ignore the value of the input
☑ Include the inverse of the input value

Example:

In the following illustration the output of the module will be

```
[(A) AND not(B)]
OR
[not(A) AND not(B) AND C AND D]
OR
[B AND C]
```
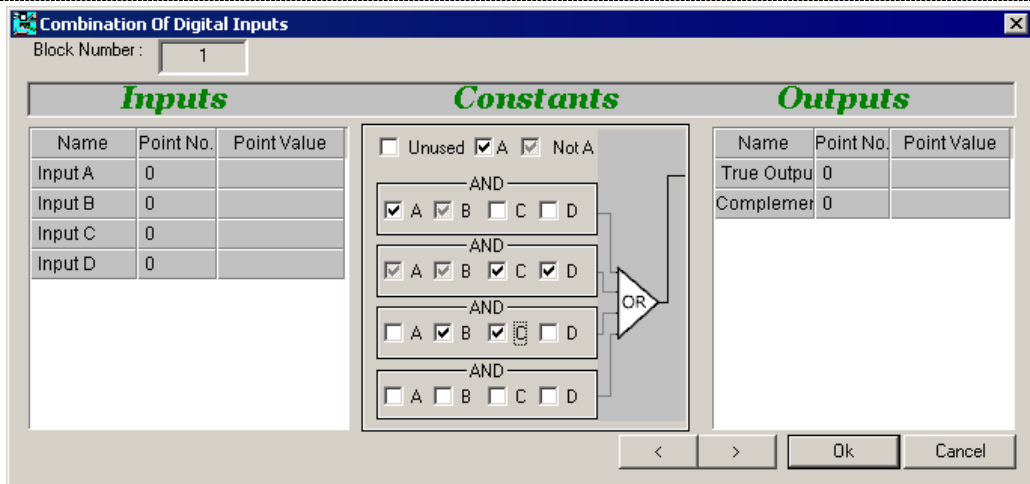
WIDE OR GATE
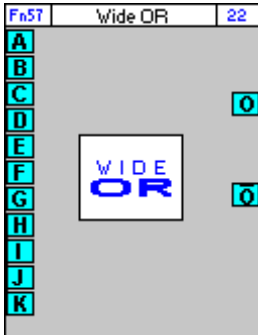
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Wide OR Gate module performs the Boolean OR operation on up to 11 digital inputs.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:	**Variable name**	**Description**	**Possible values**

Input Points A to K	Numbers of points at which digital Input Point Values A to K are held. Any Input Point without a number will be ignored in the operation of the module.	1 to 255
True Output Point	Number of point at which True Output Value is held.	9 to 255
True Output Value	Value returned when Boolean OR operation is performed on Input Point Values.	Set or unset
Complement Output Point	Number of point at which complement of True Output Value is held.	9 to 255
Complement Output Value	Complement of True Output Value.	Set or unset

Implementation of module: The Wide OR Gate module performs the Boolean OR algebraic operation on up to 11 digital inputs. This means that A OR B OR C OR D OR E OR F OR G OR H OR I OR J OR K (also written as A+B+C+D+E+F+G+H+I+J+K) = set if any one of the inputs is set

For example, If A = unset, B = unset, C = unset, D = unset, E = unset, F = unset, G = set, H = unset, I = unset, J = unset, K = unset, then

A + B + C + D + E + F + G + H + I + J + K = set, because G = set

Application: 1) The Wide OR Gate can be used to parallel up seven time schedule modules so that the user has a full week.

2) The Wide OR Gate can also be used as a common alarm - i.e. ring a bell if any of X events happens.

WIDE AND GATE
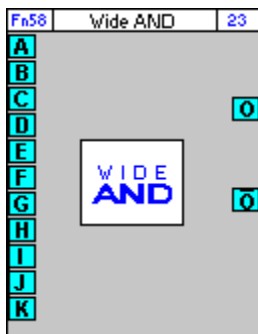
Button:	
Symbol:	
	Values not shown
	Values shown
Function of module:	The Wide AND Gate module performs the Boolean AND operation on up to 11 digital inputs.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variable

Variable name	Description	Possible values
Input Points A to K	Numbers of points at which digital Input Point Values A to K are held. Any Input Point without a number will be ignored in the operation of the module.	1 to 255
Input Point Values A to K	Values of inputs to the module. Any Input Point Value with no Input Point defined will be ignored in the operation of the module.	Set or unset
True Output Point	Number of point at which True Output Value is held.	9 to 255
True Output Value	Value returned when Boolean AND operation is performed on Input Point Values.	Set or unset
Complement Output Point	Number of point at which complement of True Output Value is held.	9 to 255
Complement Output Value	Complement of True Output Value.	Set or unset

Implementation of module: The Wide AND Gate module performs the Boolean AND algebraic operation on up to 11 digital inputs. This means that A AND B AND C AND D AND E AND F AND G AND H AND I AND J AND K (also written as ABCDEFGHIJK) = unset, if any one of the inputs is unset.

For example, If A = set, B = set, C = set, D = unset, E = set, F = set, G = set, H = set, I = set, J = set, K = set, then

A AND B AND C AND D AND E AND F AND G AND H AND I AND J AND K (also written as ABCDEFGHIJK) = unset, because D = unset

Example: The Wide AND Gate can be used if a certain number of events must happen before you can turn on another device.

WIDE INVERTER
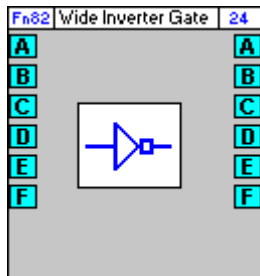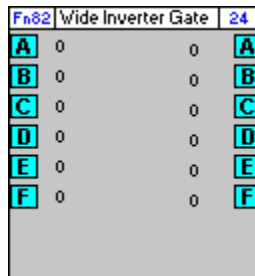
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Wide Inverter Gate module performs the Boolean INVERT operation on up to 6 digital inputs.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A to F	Numbers of points at which digital Input Point Values A to F are held. Any Input Point without a number will be ignored in the operation of the module.	1 to 255
Input Point Values A to F	Values of inputs to the module. Any Input Point Value with no Input Point defined will be ignored in the operation of the module.	Set or unset
Output Points A to F	Numbers of points at which Output Point Values are held.	9 to 255
Output Point Values A to F	Inverse of Input Point Values A to F	Set or unset

Implementation of module:

Given inputs A, B, C, D, E, F: Output A= Inverse (Input A) etc.

Application:

The Wide Inverter Gate is normally used when the output of another module needs to be inverted.

TIME SCHEDULE
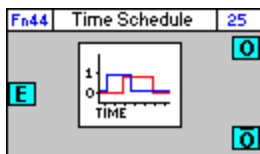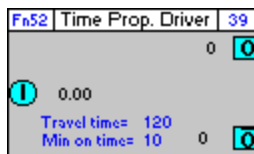
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Time Schedule module allows the user to set, for each day of the week, two start times and two stop times. If the module is enabled, then when the controller's clock registers a time between each start and stop time, on any selected day, the output of the module will be "1", and outside of those times it will be "0". This module accepts one input, which enables the operation of the module, and produces two outputs that are complements of each other.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Time Schedule Name	This is a string that will be used by the Cylon system to identify the Time Schedule defined by this dialog.	Any string.
Enabling Point	The point number and current values of the enabling point for this module are displayed here. When the value of this point is "1", the module becomes active.	0 or 1
True Output	This point will have a value of "1" if the current controller time is between either of the start and end times on any day.	0 or 1
Compliment	This is the 'compliment' of OutputA, i.e. will have a value of "0" if the current controller time is between either of the start and end times on any day.	0 or 1

Constants

The "constants" column in Time Schedule dialog lists times and days rather than ordinary constants. In this section it is possible to set two separate periods of time, during a day, at which the output of this module is to be "On" ("1"). These two times can apply on any or all days of the week.

Variable name	Description	Possible values
Times	The four times entered here govern the start and end of two periods in a day during which the output of the time schedule will be "On"	00:00 - 23:59
Days	Checkboxes are provided here for each of the 7 days of the week. Any day or group of days can be selected or deselected here, and on those days that are selected the time schedule times defined above will apply.	selected or unselected

Application:

In the dialog box above, the time schedule module is being used to turn the boilers on site on and off on in the morning and afternoon, Monday to Friday only.

Seven of these are usually used in parallel so that each day may have different on and off times.

Another use of the Time Schedule module is to reset certain parameters automatically in the middle of the night - e.g. set all the remote temperature keypad setpoints to 21º C.

HOLIDAY SCHEDULE
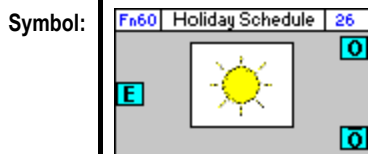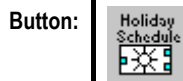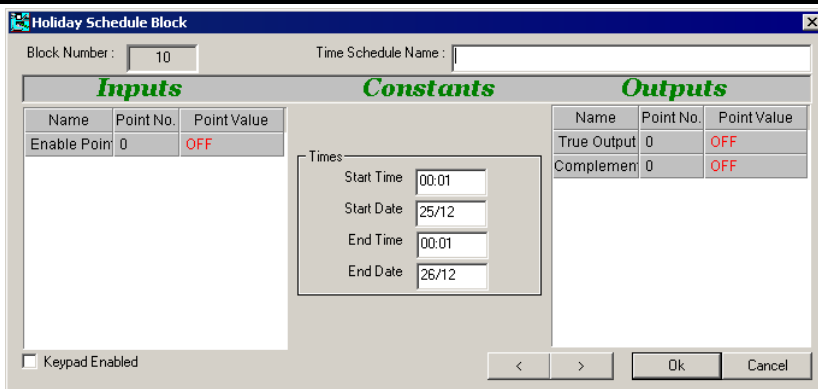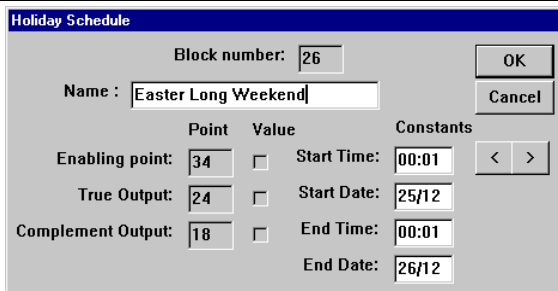
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Holiday Schedule module is intended to allow a 'holiday' period to be programmed into the controller. If the module is enabled, then when the controller's clock registers a time between the specified start time and date and the specified stop time and date, the output of the module will be "1", and outside of those times it will be "0". 'Holiday' Schedules are intended to set a building environment differently on certain days, e.g. disabling the boiler for an office block during a public holiday. This module accepts one input, which enables the operation of the module, and produces two outputs that are complements of each other.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Time Schedule Name	This is a string that will be used by the Cylon system to identify the Time Schedule defined by this dialog.	Any string.
Enabling Point	The point number and current values of the enabling point for this module are displayed here. When the value of this point is "1", the module becomes active.	0 or 1
True Output	This point will have a value of "1" if the current controller time is between the start time & date, and end time & date.	0 or 1
Compliment	This is the 'compliment' of OutputA, i.e. will have a value of "0" if the current controller time is between the start time & date, and end time & date.	0 or 1

Constants   The "constants" column in Holiday Schedule dialog lists times and days rather than ordinary constants.

In this section it is possible to set a start time and date, and an end time and date, between which the output of this module is to be "On" ("1"). The module output will be "Off" ("0") outside those times.

Note: The dates must be entered in dd/mm/yy format

Application: Given the settings in the dialog box above, the True Output Value could be used to switch on the alarm system while the Complement Output Value could be used as the Enabling Point Value for a time schedule module controlling the heating system. This would mean that the alarm system would by switched on during the holiday period and the heating system would be switched off.

This is normally used on a UC16 Keypad, or the user can override for holiday periods.

LONG PERIOD TIMER
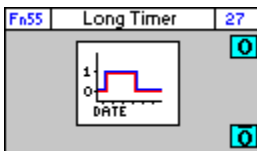
Button:	L/P Timer
Symbol:	Fn55 Long Timer 27 — Values not shown / Fn55 Long Timer 27 — Start time = 07/04/00:14:23, Stop time = 07/04/00:14:23 — Values shown
Function of module:	The Long Period Timer module allows the user to set a digital point for a specified time, which may vary from one second to several years in length. When the controller's clock registers a time between the specified start time & date and the specified stop time & date, the output of the module will be "1", and outside of those times it will be "0". This module has no inputs, and produces two outputs that are complements of each other. This is the same as the Holiday Schedule module, with the exception that there is no enabling point.

Dialog box:

If UC32 is targeted:	Long Period Timer — Block Number: 11 — Inputs / Constants (Times: Start Time 13:50:08, Start Date 10/02/04, End Time 13:50:08, End Date 10/02/04) / Outputs (True Output 0 OFF, Complement 0 OFF)
If UC/UCU is targeted:	Long Period Timer — Block number: 17 — True Output: 17, Complement Output: 20 — Start Time: 16:00, Start Date: 25/05/00, End Time: 18:30, End Date: 15/04/01

Variables:

Variable name	Description	Possible values
True Output	This point will have a value of "1" if the current controller time is between the start time & date, and end time & date.	0 or 1
Compliment	This is the 'compliment' of OutputA, i.e. will have a value of "0" if the current controller time is between the start time & date, and end time & date.	0 or 1

Constants:

The "constants" column in the Long Period Timer dialog lists times and days rather than ordinary constants.

In this section it is possible to set a start time and date, and an end time and date, between which the output of this module is to be "On" ("1"). The module output will be "Off" ("0") outside those times.

Note: The dates must be entered in dd/mm/yy format

Application:

The dialog box above shows a long period timer which is set from 25 May 2000 to 15 April 2001. The True Output Point of this module could be used as the enabling point for a time schedule module controlling the switching on and off of the heating system on a site, so that heating is only switched on during the months October to April.

ADJUST SCHEDULE
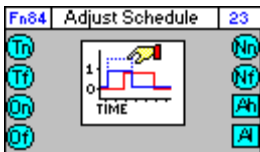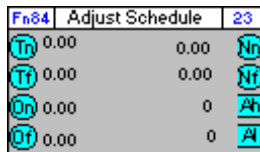
Button:	
Symbol:	Values not shown Values shown
Function of module:	This module acts as a time schedule in a Field Controller, but is tied to a Comms Controller Time Schedule. This allows controllers to act at different times in response to a master schedule.
Note:	The Time values used in the Adjust Schedule module are held in decimal format, e.g. "8.50" means 8:30 am, 15.75 means 3:45pm.

Dialog box:
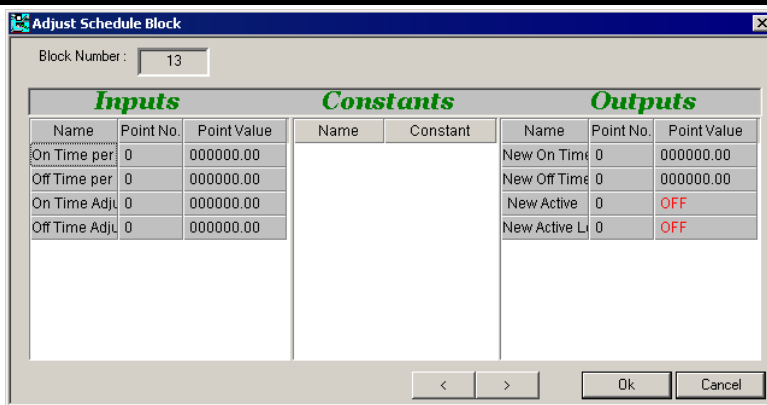
If UC32 is targeted:	
If UC/UCU is targeted:	
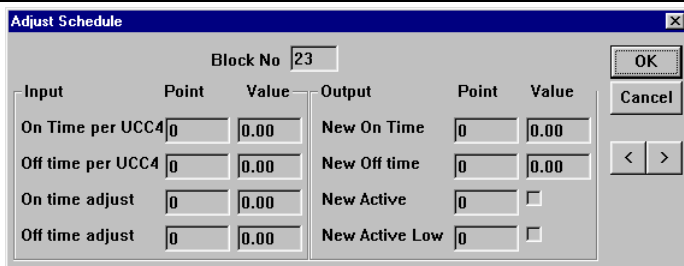
Application: A building's facilities include Heating (Air Conditioning), lighting, and Extract Fans.
The Building is occupied from 9:00am to 5:30pm. This occupancy is set in the main Comms Controller time schedule.
The heating is to be turned on 2 hours earlier, in order to bring the temperature throughout the building up to its setpoint for the start of occupancy (9:00). The lighting must be turned on at the time of occupancy, and the Extract fans 15 minutes after occupancy begins.
In this example, the Lighting could be switched directly by the Comms Controller time schedule, the Fans would be switched by an "adjust schedule" module set to 0.25hours, and the heating could be set by an "adjust schedule" module set to –-2.00 hours

Variables:

Variable name	Description	Possible values
On Time per UCC4 - Point	A Comms Controller schedule can be sent by means of a "Time Schedule Global" to a Field Controller. That global is received through a "Comms Controller Schedule" module, which gives the current on/off value, the next on time, and the next off time for the schedule. The "On Time per UCC4" point in the "Adjust schedule" module should be connected to the "Next On" point in the "Comms Controller Schedule" module.	
On Time per UCC4 - Value	This box shows the current value of the point shown in the "On Time per UCC4 – Point" box.	
Off Time per UCC4 - Point	The "Off Time per UCC4" point in the "Adjust schedule" module should be connected to the "Next Off" point in the "UCC4 Schedule" module. (see "On Time per UCC4 - Point" above)	
Off Time per UCC4 - Value	This box shows the current value of the point shown in the "Off Time per UCC4 – Point" box.	
On time adjust - point	The Adjust Schedule module will change the time schedule's "on time" by a particular value. That value is set using a separate strategy block such as a "real constant", or "analog setpoint". That value is brought into the "Adjust Schedule" block by connecting the separate block to the "on-time adjust" point.	
On time adjust - value	This box shows the current value of the point shown in the "On time adjust - point" box, i.e. the amount by which the "On time per UCC4" will be adjusted. This value may be positive or negative, and is specified as hours, in decimal format.	
Off time adjust - point	The Adjust Schedule module will change the time schedule's off time by a particular value. That value is set using a separate strategy block such as a "real constant", or "analog setpoint". That value is brought into the "Adjust Schedule" block by connecting the separate block to the "off-time adjust" point.	
Off time adjust - value	This box shows the current value of the point shown in the "Off time adjust - point" box, i.e. the amount by which the "Off time per UCC4" will be adjusted. This value may be positive or negative, and is specified as hours, in decimal format.	
New On Time – Point	The adjusted time at which the schedule is to start (become active) is calculated from "On Time per UCC4" added to "On time adjust". This value is available at a point in the strategy, which is listed in the "New On Time box".	
New On Time – Value	This box shows the current value of the point shown in the "New On Time – Point" box.	
New Off Time – Point	The adjusted time at which the schedule is to start (become active) is calculated from "Off Time per UCC4" added to "Off time adjust". This value is available at a point in the strategy, which is listed in the "New Off Time box".	
New Off Time – Value	This box shows the current value of the point shown in the "New Off Time – Point" box.	
New Active - point	The value of this point is set to ON when the adjusted schedule is 'active', and OFF when the schedule is 'inactive'	
New Active - value	This box shows the current value of the point shown in the "New Active – point" box.	
New Active low - point	This point is the complement of New Active – it is OFF when the time schedule is 'active' and ON when the schedule is 'inactive'.	
New Active low - value	This box shows the current value of the point shown in the "New Active Low – point" box.	

REAL TIME CLOCK
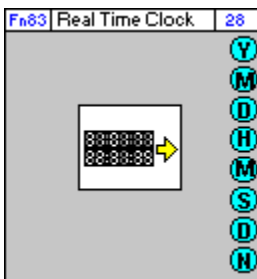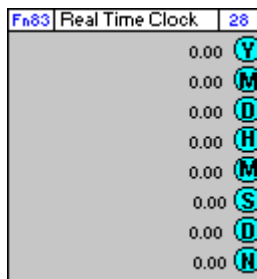
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Output Real Time Clock module produces eight outputs which contain the current year, month, day, hour, minute, second, decimal time and normal time according to the UC16 clock.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
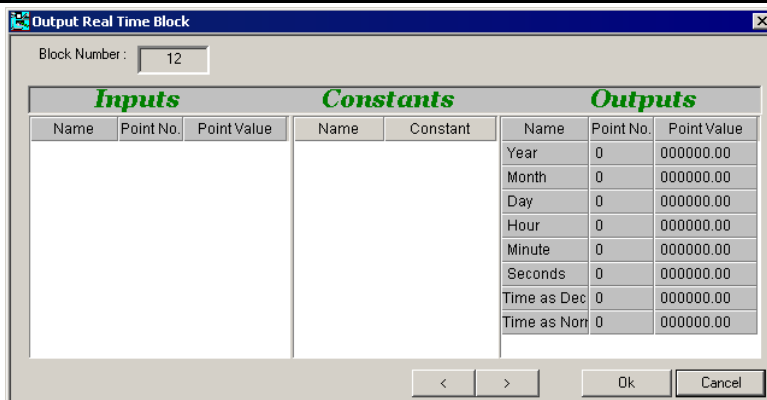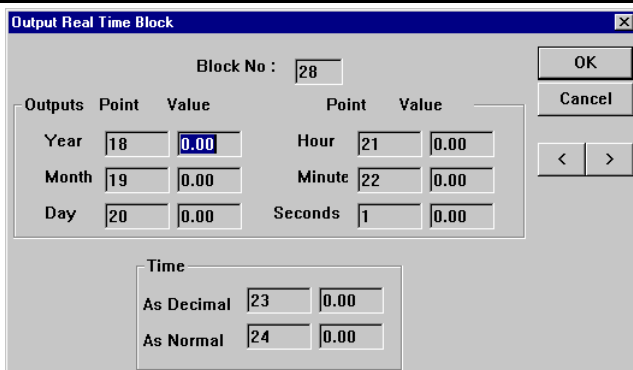
Variables:

Variable name	Description	Possible values
Year Point	Number of point at which Year Value is held.	9 to 255
Year Value	Current decade and year (e.g., 1995 is written as 95).	Positive integer
Month Point	Number of point at which Month Value is held.	9 to 255
Month Value	Current month in numerical form.	1 to 12
Day Point	Number of point at which Day Value is held.	9 to 255
Day Value	Current day of the month.	1 to 31
Hour Point	Number of point at which Hour Value is held.	9 to 255
Hour Value	Current hour of day on 24 hour clock.	0 to 23
Minute Point	Number of point at which Minute Value is held.	9 to 255
Minute Value	Current minute of the hour.	0 to 59
Second Point	Number of point at which Second Value is held.	9 to 255
Second Value	Current second of the minute.	0 to 59
Decimal Time Point	Number of point at which Decimal Time Value is held.	9 to 255
Decimal Time Value	Current hour and minutes in decimal form (e.g., 15.45 is written as 15.75).	0.00 to 23.99
Normal Time Point	Number of point at which Normal Time Value is held.	9 to 255
Normal Time Value	Current hour and minutes.	0.00 to 23.59

Application: The Real Time clock function module is used whenever the current time is needed to implement a control, e.g., to set fans to be activated a ½ hour before the building is occupied.

SECTION 24 : MATHEMATICAL MODULES

ADDER/SCALER

Button:

Symbol:
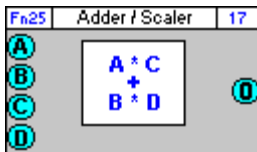
Values not shown   Values shown
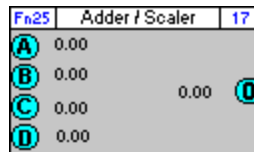
Function of module: The Adder/Scaler module adds either: two inputs or the ratio of two inputs.

Dialog box:
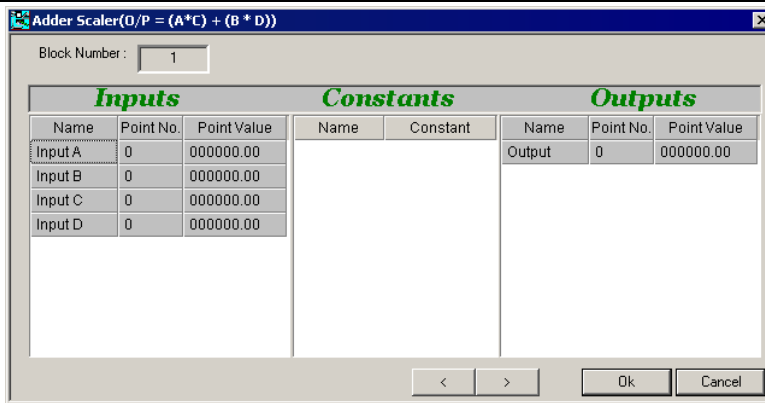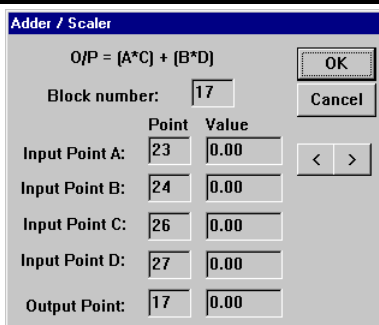
If UC32 is targeted:

If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Input Points A and B	Numbers of points at which values A and B are held.	1 to 255
Input Values A and B	Inputs which will be added or the ratios of which will be added.	Real number
Input Points C and D	Numbers of points at which values C and D are held.	1 to 255
Input Values C and D	Inputs by which inputs A and B are multiplied before adding. If no input points are specified, the default value for inputs C and D is 1.	Real number
Output Point	Number of point at which output value is held.	9 to 255
Output Value	Result of operation (A*C) + (B*D).	Real number

Implementation of module:

Given inputs A, B, C and D:

Output = (A*C) + (B*D)

Note: because of the multiplication aspect in this module, unconnected inputs are assumed to have a value of "1". This can lead to unexpected results if only two inputs are connected - for example A=1, C=0.25, B and C unconnected.

The result is not 1*0.25 as might be expected, but (1*0.25)+(1*1) = 1.25, because unconnected inputs B and C are each assumed to have a value of 1.

MINIMUM (OF 8 INPUTS) WITH MINIMUM INDICATOR

Button:

Symbol:
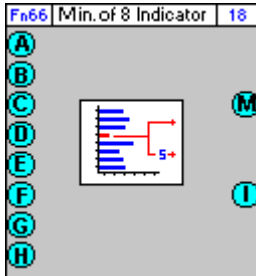
Values not shown
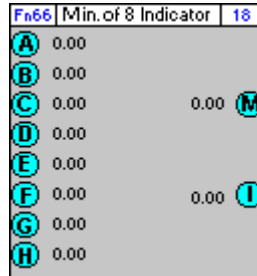
Values shown

Function of module: This module accepts up to eight analog inputs. It returns two analog outputs - the value of the smallest input, and the input (1 to 8 corresponding to inputs A to H) at which the smallest input is held.

Dialog box:

If UC32 is targeted:
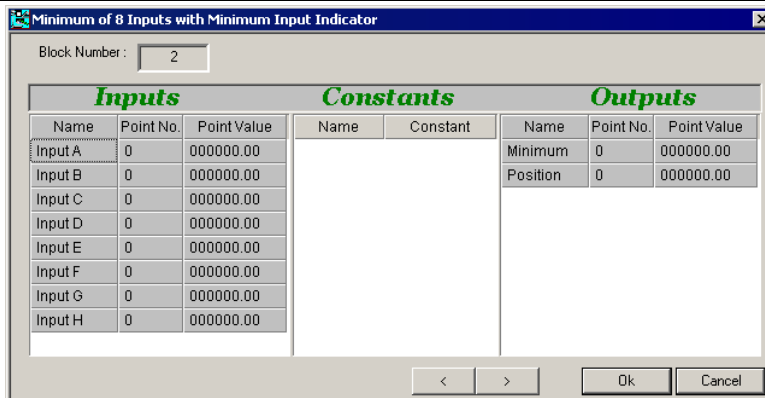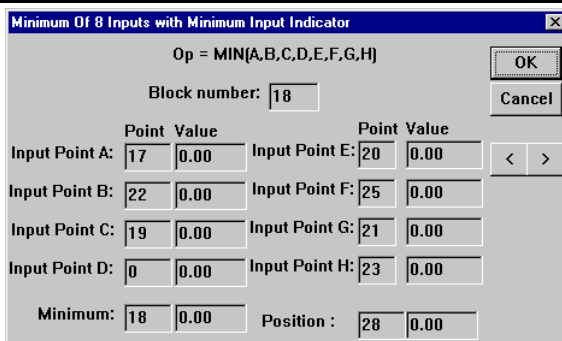
If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Input Points A to H	Numbers of points at which input values A to H are located.	1 to 255
Input Values A to H	Analog values which will be compared by the module to determine which is the smallest.	Real number
Minimum Point	Number of point at which Minimum Value is held.	9 to 255
Minimum Value	Value of smallest input.	Real number
Position Point	Number of point at which Position Value is held.	9 to 255
Position Value	Input channel of smallest input value.	1 to 8

Implementation of module:

Given Inputs A, B, C, D, E, F, G, H:

Minimum Value = Min (A, B, C, D, E, F, G, H)

Position Value = Input channel of (Min (A, B, C, D, E, F, G, H)).

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MINIMUM (OF 8 INPUTS)
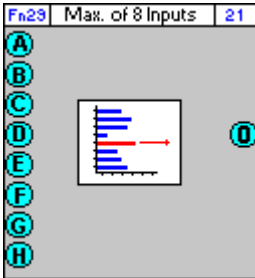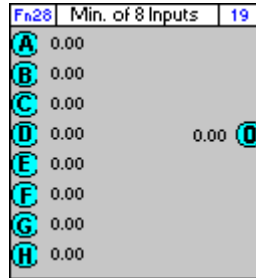
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Minimum of 8 Inputs module compares up to eight inputs and returns as output the value of the smallest input.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A to H	Numbers of points at which input values A to H are held. May be omitted. If omitted, that input will not be considered by the module.	1 to 255
Input Values A to H	Values on which module operates to produce output.	Positive real number
Output Point	Number of point at which output value is held.	2 to 255
Output Value	Value of smallest input.	Positive real number

MAXIMUM (OF 8 INPUTS) WITH MAXIMUM INDICATOR

Button:
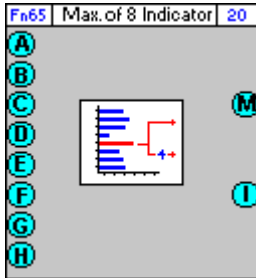
Max Ind

Symbol:

| Fn65 | Max. of 8 Indicator | 20 |

Values not shown

| Fn65 | Max. of 8 Indicator | 20 |
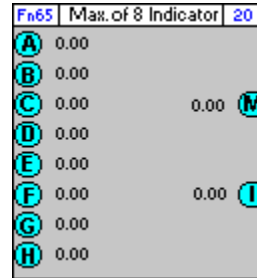
Values shown

Function of module: This module accepts up to eight analog inputs. It produces two analog outputs - the value of the largest input, and the number of the input (1 to 8, corresponding to A to H) at which the maximum value is located.

Dialog box:

If UC32 is targeted:

Maximum of 8 Inputs with Maximum Input Indicator

Block Number : 4

Inputs			Constants		Outputs		
Name	Point No.	Point Value	Name	Constant	Name	Point No.	Point Value
Input A	0	000000.00			Maximum	0	000000.00
Input B	0	000000.00			Position	0	000000.00
Input C	0	000000.00					
Input D	0	000000.00					
Input E	0	000000.00					
Input F	0	000000.00					
Input G	0	000000.00					
Input H	0	000000.00					

If UC/UCU is targeted:

Maximum of 8 Inputs with Maximum Input Indicator

O/P = MAX [A, B, C, D, E, F, G, H]

Block number: 20

	Point	Value		Point	Value
Input Point A:	19	0.00	Input Point E:	26	0.00
Input Point B:	22	0.00	Input Point F:	27	0.00
Input Point C:	23	0.00	Input Point G:	29	0.00
Input Point D:	24	0.00	Input Point H:	30	0.00
Maximum:	20	0.00			
Position :	25	0.00			

Variables:

Variable name	Description	Possible values
Input Points A to H	Numbers of points at which input values A to H are located	1 to 255
Input Values A to H	Analog values which will be compared by the module to determine which is the largest	Real number
Maximum Point	Number of point at which Maximum Value is held	9 to 255
Maximum Value	Value of largest input	Real number
Position Point	Number of point at which Position Value is held	9 to 255
Position Value	Input channel of largest input value	1 to 8

Implementation of module:

Given Inputs A, B, C, D, E, F, G, H:

Maximum Value = Max (A, B, C, D, E, F, G, H) Position Value = Input channel of (Max (A, B, C, D, E, F, G, H)).

MAXIMUM (OF 8 INPUTS)

Button:

Symbol:
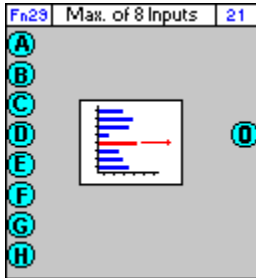
Values not shown   Values shown
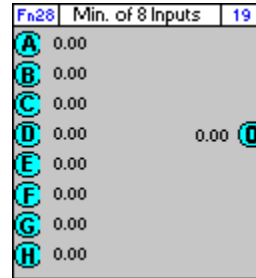
Function of module: The Maximum of 8 Inputs module compares up to eight inputs and returns as output the value of the largest input.

Dialog box:

If UC32 is targeted:

If UC/UCU is targeted:

O/P = MAX (A, B, C, D, E, F, G, H)

Block number: 21

	Point	Value		Point	Value
Input Point A:	20	0.00	Input Point E:	24	0.00
Input Point B:	25	0.00	Input Point F:	26	0.00
Input Point C:	22	0.00	Input Point G:	27	0.00
Input Point D:	23	0.00	Input Point H:	29	0.00
Output Point:	21	0.00			

Variables:

Variable name	Description	Possible values
Input Points A to H	Numbers of points at which input values A to H are held. May be omitted. If omitted, that input will not be considered by the module.	1 to 255
Input Values A to H	Values on which module operates to produce output.	Positive real number
Output Point	Number of point at which output value is held.	9 to 255
Output Value	Value of largest input.	Positive real number

AVERAGE (OF 8 INPUTS)
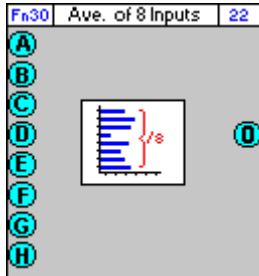
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Average of 8 Inputs module accepts up to eight inputs and returns as output the average value of the inputs.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A to H	Numbers of points at which input values A to H are held. May be omitted. If omitted, that input will not be considered by the module.	1 to 255
Input Values A to H	Values on which module operates to produce output.	Positive real number
Output Point	Number of point at which output value is held.	9 to 255
Output Value	Average value of inputs.	Positive real number

Implementation of module:

Given 8 inputs A, B, C, D, E, F, G and H:

Output = Average of A, B, C, D, E, F, G and H = (A+B+C+D+E+F+G+H)/8

SUM (OF 8 INPUTS)
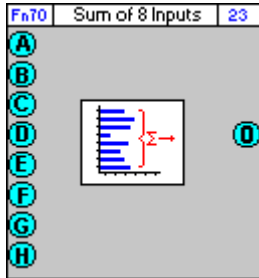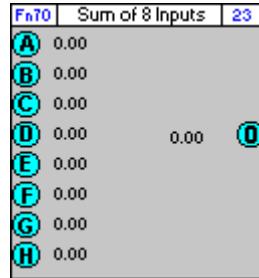
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	This module accepts up to eight analog inputs and adds them together.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
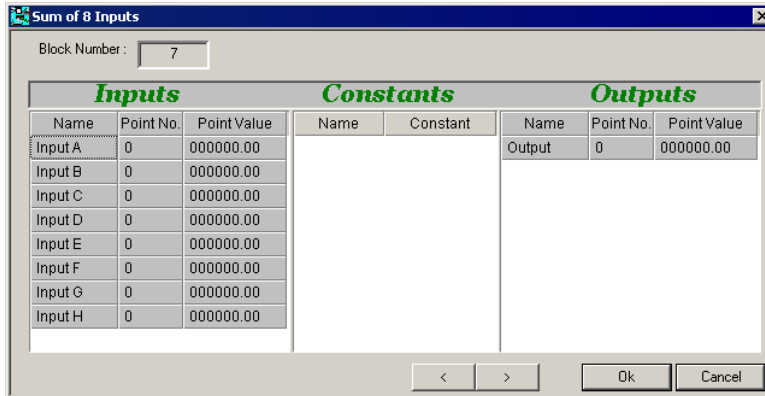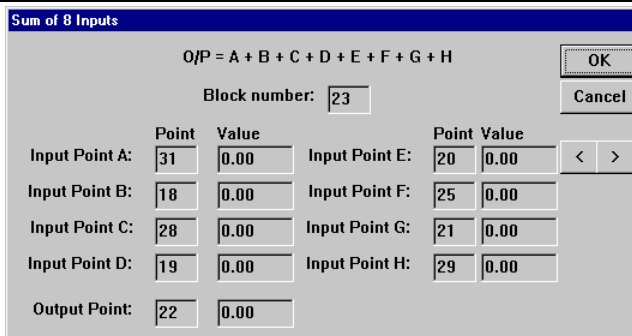
Variables:

Variable name	Description	Possible values
Input Points A to H	Numbers of points at which Input Values A to H are held.	1 to 255
Input Values A to H	Inputs to be added by module.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by summing inputs.	Real number

Implementation of module:

Given analog inputs A, B, C, D, E, F, G, H: Output = A+B+C+D+E+F+G+H

MULTIPLIER/SCALER
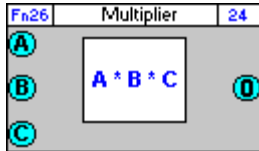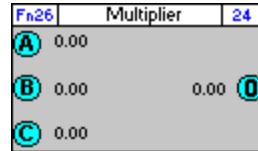
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Multiplier/Scaler module multiplies at least two, and no more than three, analog input values and returns the result as an output.

Dialog box:
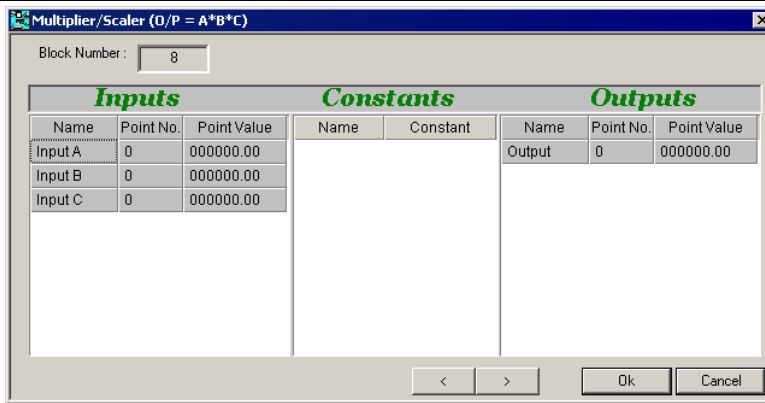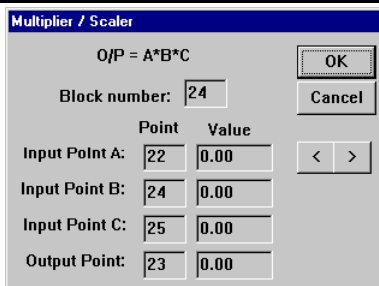
If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A, B and C	Numbers of points at which values of inputs A, B and C are held.	1 to 255
Input Point Values A, B and C	Values on which module operates to produce output.	Real numbers
Output Point	Number of point at which value of output is held.	9 to 255
Output Point Value	Value produced by multiplication of inputs.	Real number

Implementation of module:

Given inputs A, B, C:

Output = A*B*C

DIVIDER/SCALER

Button:

Divider

Symbol:

Fn27	Divider	25
A	B * C / A	
B		O
C		

Values not shown

Fn27	Divider	25
A	0.00	
B	0.00	0.00 O
C	0.00	
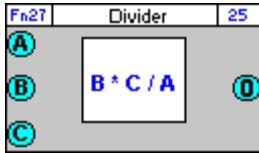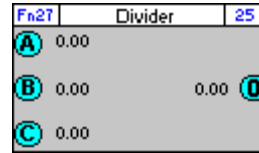
Values shown

Function of module:

The Divider/Scaler module divides one input by another and multiplies the result by the third input.

Dialog box:

If UC32 is targeted:
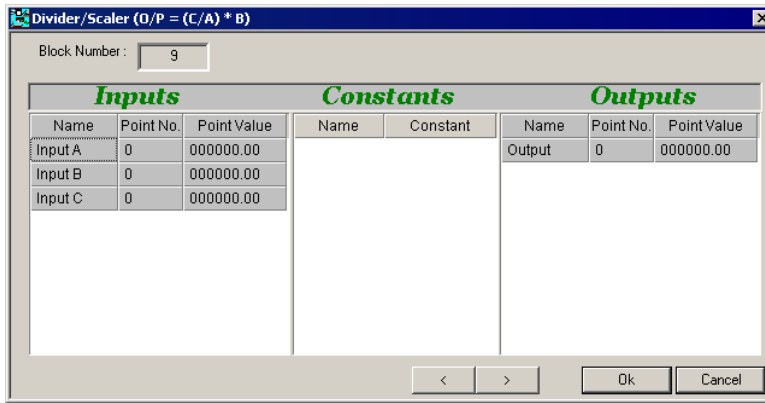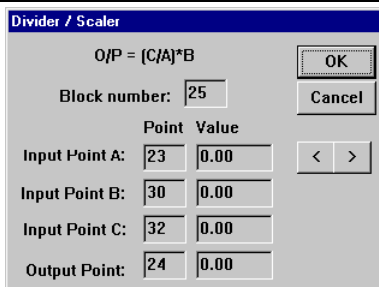
Divider/Scaler (O/P = (C/A) * B)

Block Number : 9

Inputs			**Constants**		**Outputs**		
Name	Point No.	Point Value	Name	Constant	Name	Point No.	Point Value
Input A	0	000000.00			Output	0	000000.00
Input B	0	000000.00					
Input C	0	000000.00					

‹ › Ok Cancel

If UC/UCU is targeted:

Divider / Scaler

O/P = (C/A)*B

Block number: 25

OK Cancel

	Point	Value	
Input Point A:	23	0.00	‹ ›
Input Point B:	30	0.00	
Input Point C:	32	0.00	
Output Point:	24	0.00	

Variables:

Variable name	Description	Possible values
Input Points A, B and C	Numbers of points at which Input Values A, B and C are held.	1 to 255
Input Values A, B and C	Values on which the module operates to produce the output.	Real numbers
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by the module's operation on the inputs.	Real number

Implementation of module:

Given inputs A, B and C:

Output = (C/A)*B

ACCUMULATOR
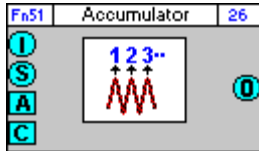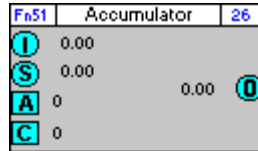
Button:	Accum.
Symbol:	Values not shown / Values shown
Function of module:	The Accumulator module is a form of counter. The module accepts two analog inputs and two digital inputs. It produces a single analog output.
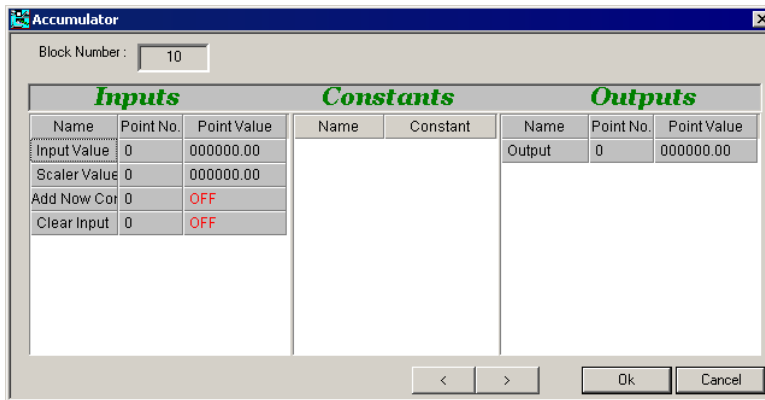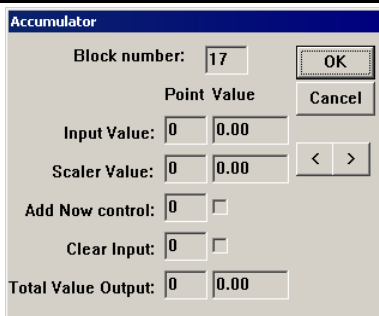
Dialog box:

If UC32 is targeted:

Block Number: 10

Inputs			Constants		Outputs		
Name	Point No.	Point Value	Name	Constant	Name	Point No.	Point Value
Input Value	0	000000.00			Output	0	000000.00
Scaler Value	0	000000.00					
Add Now Con	0	OFF					
Clear Input	0	OFF					

If UC/UCU is targeted:

Accumulator

Block number: 17

	Point	Value
Input Value:	0	0.00
Scaler Value:	0	0.00
Add Now control:	0	
Clear Input:	0	
Total Value Output:	0	0.00

Variables:

Variable name	Description	Possible values
Input Value Point	Number of point at which Input Value is held.	1 to 255
Input Value	Analog input which is multiplied by the Scaler Value to produce output.	Real number
Scaler Value Point	Number of point at which Scaler Value is held.	1 to 255
Scaler Value	Analog input which scales the Input Value by multiplication.	Real number
Add Now Control Point	Number of point at which Add Now Control Value is held.	1 to 255
Add Now Control Value	Digital input which indicates when Total Output Value is to be incremented.	Set or unset
Clear Input Point	Number of point at which Clear Input Value is held.	1 to 255
Clear Input Value	Digital input which causes the Total Output Value to be set to zero when it is set.	Set or unset
Total Value Output Point	Number of point at which Total Output Value is held.	9 to 255
Total Value Output	Final value returned when module has acted on inputs.	Real number

Implementation of module:

Given analog inputs Input Value and Scalar Value, and digital inputs Add Now Control and Clear Input:
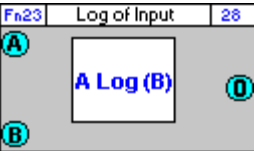
Output = (Input Value)*(Scalar Value) if Add Now Control = set and Clear Input = unset.

Output = 0 if Clear Input = set

ABSOLUTE VALUE

Button:	
Symbol:	Values not shown Values shown
Function of module:	The Absolute Value module accepts an analog input and returns its absolute value.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Point A	Number of point at which Input Value A is held.	1 to 255
Input Value A	Value on which module operates to get output.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by getting absolute value of Input Value A.	Positive real number

Implementation of module:

Given Input A:

Output = ABS (A)

LOG OF INPUT

Button:

Symbol:

| Fn23 | Log of Input | 28 | | Fn68 | Log Base e | 30 |

Values not shown

Values shown

Function of module: The Log of Input module calculates the log (base 10) of one input and multiplies it by the other input.

Dialog box:

If UC32 is targeted:

If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Input Points A and B	Numbers of points at which Input Values A and B are held.	1 to 255
Input Values A and B	Values on which module is to operate according to the formula: Output = A*Log B If no Input Point number is specified for Input B, the Input Value for B is assumed to be 1.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	A*Log B	Real number

Implementation of module:

Given inputs A, B:

Output = A*Log B

ANTILOG INPUT
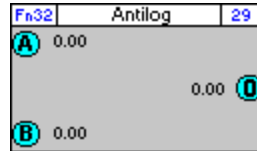
Button:	
Symbol:	Values not shown	Values shown
Function of module:	The Antilog of Input module accepts two inputs, and multiplies one by the antilog of the other to produce the output.

Dialog box:
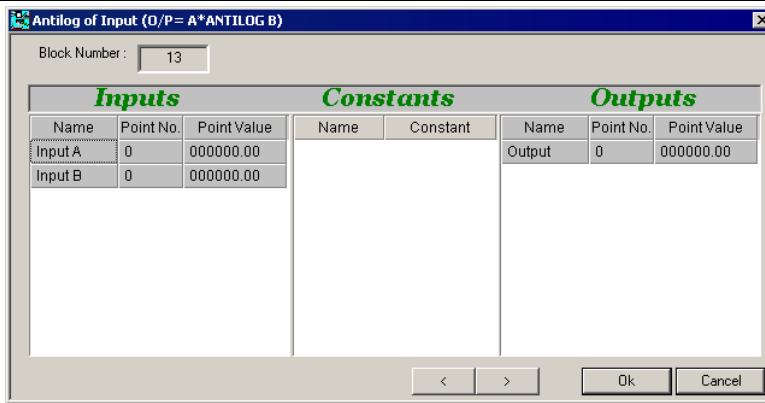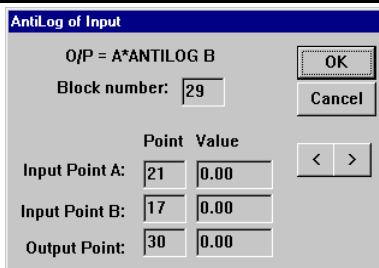
If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A and B	Numbers of points at which Input Values A and B are held.	1 to 255
Input Values A and B	Values on which module operates to produce output. Input Value A will be multiplied by the Antilog of Input Value B.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by multiplying Input A by the Antilog of Input B.	Real number

Implementation of module:

Given inputs A, B:

Output = A*Antilog B

LOG (BASE E) OF INPUT
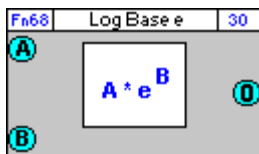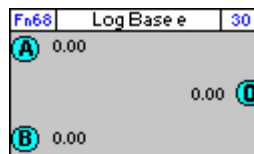
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Log (base e) module accepts two analog inputs and multiplies one by the Log (base e) of the other.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A, B	Numbers of points at which Input Values A, B are held.	1 to 255
Input Values A, B	Values on which the module operates to produce the output.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced when Input A is multiplied by the Log (base e) of Input B.	Real number

Implementation of module:

Given inputs A, B:

Output = A * ln (B)

ANTILOG (BASE E) OF INPUT
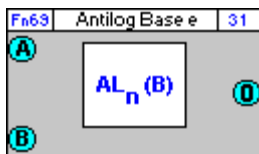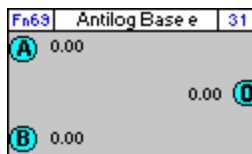
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Antilog (base e) module accepts two analog inputs and multiplies one by the Antilog (base e) of the other.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A, B	Numbers of points at which input values A, B are held.	1 to 255
Input Values A, B	Values on which module operates to produce output.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by multiplying Input Value A by Antilog (base e) of Input Value B.	Real number

Implementation of module:

Given inputs A, B:

Output = A* Antiln (B)

SQUARE ROOT
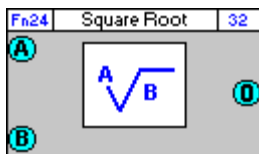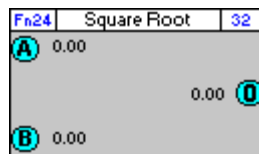
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Square Root module accepts two inputs and multiplies one by the square root of the other.

Dialog box:
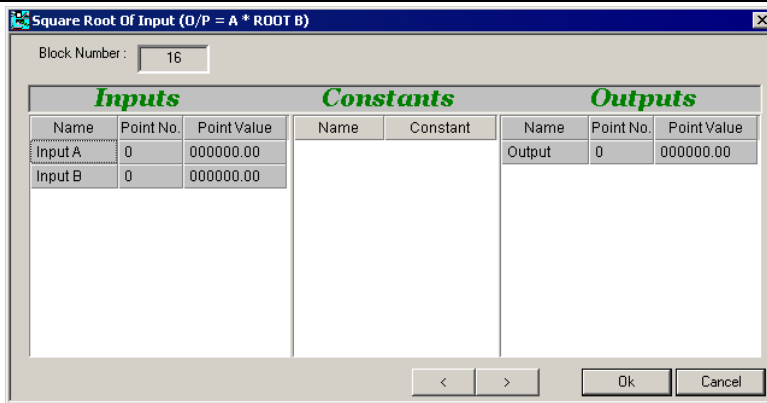
If UC32 is targeted:	
If UC/UCU is targeted:	
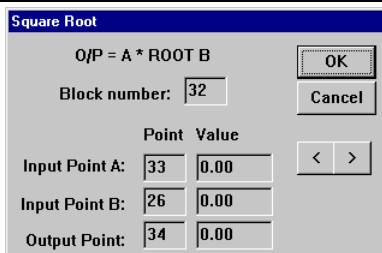
Variables:

Variable name	Description	Possible values
Inputs Points A, B	Numbers of points at which Input Values A, B are held.	1 to 255
Input Values A, B	Values on which module operates to produce output.	Positive real numbers
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced when Input Value A is multiplied by the square root of Input Value B.	Positive real number

Implementation of module:

Given inputs A, B:

Output = A* (B)1/2

ROUNDING MODULE

Appearance

Group | Button | Symbol

M (Mathematical)

Dialog box

- If UC32/BACnet-type Controller is targeted:
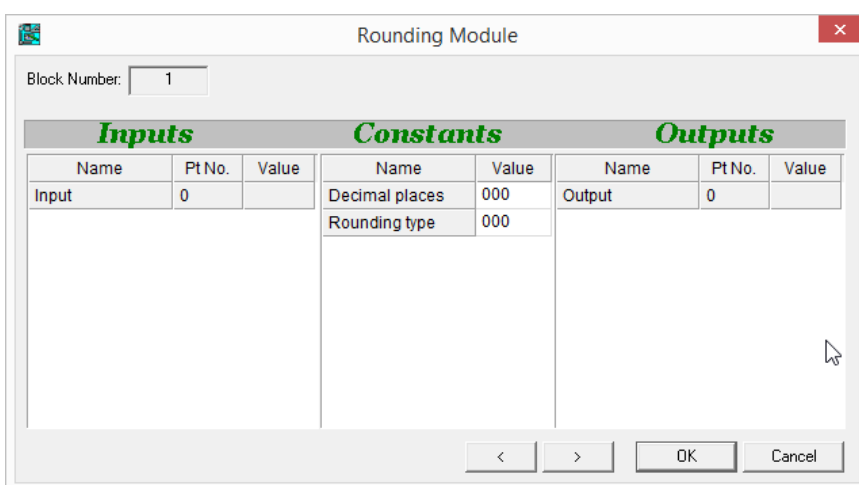
- If Legacy UC type Controller is targeted:
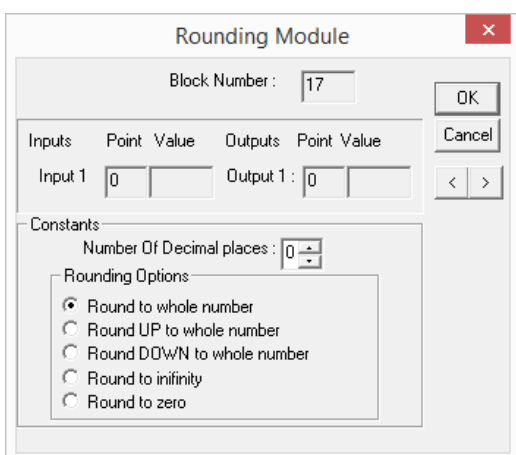
Function

The Rounding module changes its input to one of the following, depending on the option: (note – in the table below the term 'whole number' is used to refer to digit in the required decimal place).

Option 0 : the nearest whole number

Input	Output
4.8	5.0
4.2	4.0
3.6	4.0

Input	Output
-6.9	-7.0
-6.3	-6.0
-5.7	-6.0

Option 1 : the nearest whole number above

Input	Output
4.8	5.0
4.2	5.0
3.6	4.0

Input	Output
-6.9	-6.0
-6.3	-6.0
-5.7	-5.0

Option 2 : the nearest whole number below.

Input	Output
4.8	4.0
4.2	4.0
3.6	3.0

Input	Output
-6.9	-7.0
-6.3	-7.0
-5.7	-6.0

Option 3 : the nearest whole number away form 0

Input	Output
4.8	5.0
4.2	5.0
3.6	4.0

Input	Output
-6.9	-7.0
-6.3	-7.0
-5.7	-6.0

Option 4 : the nearest whole number towards 0

Input	Output
4.8	4.0
4.2	4.0
3.6	3.0

Input	Output
-6.9	-6.0
-6.3	-6.0
-5.7	-5.0

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Input	The value to be rounded	Real number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Input 1 Point	Numbers of the point at which the value to be rounded is held.	1 to 255
Input 1 Value	The value of point 1	Real Number

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Decimal Places	The number of decimal places for the value at the output point.	0-7
Rounding Type	The number of the rounding option to be used (see *Function* section on page 562)	0-4

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values	
Number of Decimal Places	The number of decimal places for the value at the output point.	0-7	
Rounding Options	The rounding option to be used (see *Function* section on page 562)	- Round to whole number - Round UP to whole number - Round DOWN to whole number - Round to infinity - Round to zero	

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Output	The rounded value generated by the module.	Integer

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Output 1 Point	Number of point at which Output Value is held.	9 to 255
Output 1 Value	Value produced by the module's operation on the input.	Integer

SUBTRACT MODULE

Appearance

Group

M (Mathematical)

Button
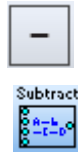
Symbol
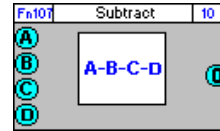
Dialog box
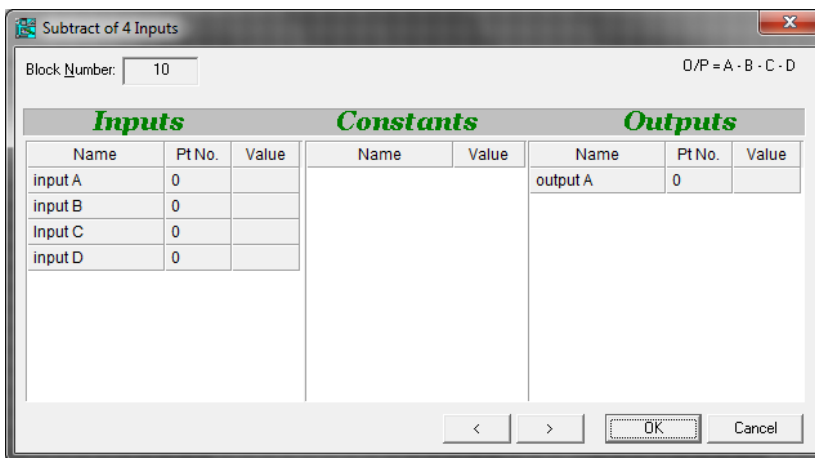
Function:

This module allows the subtraction of 3 values from a value.

$$O = A - B - C - D$$

Note: The Rescale Custom Module is available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name		Description	Possible values
Input A	A	Value from which the subtraction occurs.	Real number
Input B	B	1st subtraction value.	Real number
Input C	C	2nd subtraction value.	Real number
Input D	D	3rd subtraction value.	Real number

Outputs

Parameter Name		Description	Possible values
Output	O	Value resulting from the subtraction.	Real number

SECTION 25 : CONTROL MODULES

FORWARD PID

Appearance

Group | Button | Symbol

C (Control)

Dialog box
- If UC32/BACnet-type Controller is targeted:
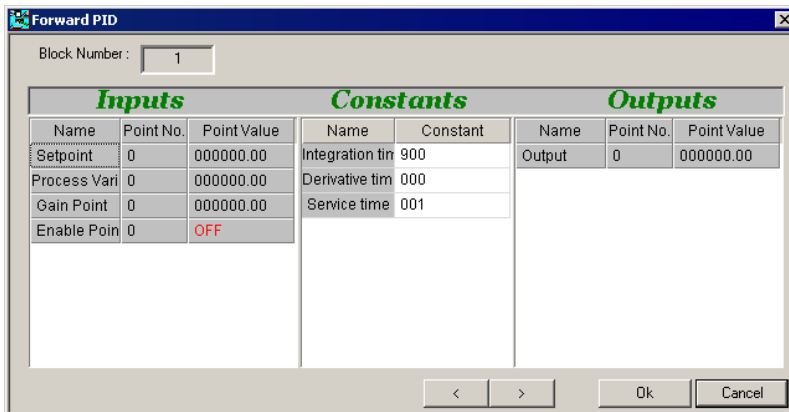
- If Legacy UC type Controller is targeted:
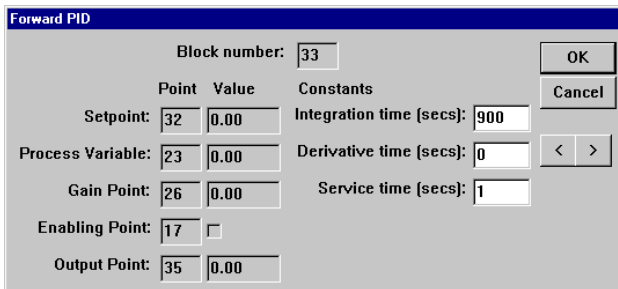
Function:

The Forward **PID** module uses a **PID** (Proportional, Integral, Derivative) loop to react to the behaviour of the system under control. Depending on how the observed process variable changes over time, the output is boosted or cut in order to speed up or slow the rate of change.

The user has the option of using proportional control alone, proportional and integral control or proportional, integral and derivative control.

The term "**Forward**" PID denotes the fact that the output is directly (rather than inversely) proportional to the input. This means the error is defined as the amount that the process variable is **above** the setpoint, and output is proportional to that error. Forward PID is used in cooling processes, where the module output drives the process variable downwards e.g. in Air Handling Units, FCUs, VAVs, etc.

> **Note**: If the plant item that is being controlled includes a heating element, a reverse PID must also be used.

For a detailed explanation of the options in PID control, see section *PID Control Options* on page 578, in the *Custom PID* module description.

Parameters

Inputs

Parameter Name	Description	Possible values
Setpoint	Desired value for Process Variable.	Real number
Process Variable	Measured value of the parameter to be controlled.	Real number
Gain Point	Proportional gain value for the loop.	Real number
Enable Point	If set (true), enables function of module If unset (false), module is disabled and returns value 0.	boolean

Constants

Parameter Name	Description	Possible values
Integration time	Period over which difference between the Setpoint value and the Process Variable value is integrated. To disable Integration, set this constant to zero.	Positive integer
Derivative time	Period over which difference between Setpoint Value and Process Variable Value is derived. To disable, set to zero.	Positive integer
Service time	Period of sampling loop output. > **Note**: Service time must be greater than 0, otherwise Integration and Differentiation will not work.	Positive integer > 0

Outputs

Parameter Name	Description	Possible values
Output	Value of the loop output - between 0 and 100%.	Positive real number

TUNEABLE FORWARD PID

Appearance

<u>Group</u>   <u>Button</u>   <u>Symbol</u>

C (Control)

<u>Dialog box</u>
- If UC32/BACnet-type Controller is targeted:

- If Legacy UC type Controller is targeted:

Function:

The Tuneable Forward **PID** module uses a **PID** (Proportional, Integral, Derivative) loop to react to the behaviour of the system under control. Depending on how the observed process variable changes over time, the output is boosted or cut in order to speed up or slow the rate of change.

The user has the option of using proportional control alone, proportional and integral control or proportional, integral and derivative control.

The term "**Forward**" PID denotes the fact that the output is directly (rather than inversely) proportional to the input. This means the error is defined as the amount that the process variable is **above** the setpoint, and output is proportional to that error. Forward PID is used in cooling processes, where the module output drives the process variable downwards e.g. in Air Handling Units, FCUs, VAVs, etc.

> **Note**: If the plant item that is being controlled includes a heating element, a reverse PID must also be used.

The term "**Tuneable**" indicates that `Integration Time` and `Derivative Time` can be set using Constants, but these can be overridden dynamically by the strategy using optional inputs.

For a detailed explanation of the options in PID control, see section *PID Control Options* on page 578, in the *Custom PID* module description.

Parameters

Inputs

Parameter Name	Description	Possible values
Setpoint	Desired value for Process Variable.	Real number
Process Variable	Measured value of the parameter to be controlled.	Real number
Gain Point	Proportional gain value for the loop.	Real number
Integration Time	If this point is connected, then its value overrides the `Integration Time` constant	Positive integer
Derivative Time	If this point is connected, then its value overrides the `Derivative Time` constant	Positive integer
Enable Point	If set (true), enables function of module If unset (false), module is disabled and returns value 0.	Boolean

Constants

Parameter Name	Description	Possible values
Integration time	Period over which difference between the `Setpoint` value and the `Process Variable` value is integrated. To disable Integration, set this constant to zero.	Positive integer
Derivative time	Period over which difference between Setpoint Value and Process Variable Value is derived. To disable, set to zero.	Positive integer
Service time	Period of sampling loop output. > **Note**: Service time must be greater than 0, otherwise Integration and Differentiation will not work.	Positive integer > 0

Outputs

Parameter Name	Description	Possible values
Output	Value of the loop output - between 0 and 100%.	Positive real number

Appearance

Group	Button	Symbol
C (Control)		

Dialog box

- If UC32/BACnet-type Controller is targeted:

- If Legacy UC type Controller is targeted:

Function:

The Reverse **PID** module uses a **PID** (Proportional, Integral, Derivative) loop to react to the behaviour of the system under control. Depending on how the observed process variable changes over time, the output is boosted or cut in order to speed up or slow the rate of change.

The user has the option of using proportional control alone, proportional and integral control or proportional, integral and derivative control.

For a detailed explanation of the options in PID control, see section *PID Control Options* on page 578, in the *Custom PID* module description.

Parameters

Inputs

Parameter Name	Description	Possible values
Setpoint	Desired value for Process Variable.	Real number
Process Variable	Measured value of the parameter to be controlled.	Real number
Gain Point	Proportional gain value for the loop.	Real number
Enable Point	If set (true), enables function of module If unset (false), module is disabled and returns value 0.	Boolean

Constants

Parameter Name	Description	Possible values
Integration time	Period over which the difference between the Setpoint value and the Process Variable value is integrated. To disable Integration, set this constant to zero.	Positive integer
Derivative time	Period over which the difference between Setpoint Value and Process Variable value is differentiated. To disable, set to zero.	Positive integer
Service time	Period of sampling loop output. **Note:** Service time must be greater than 0, otherwise Integration and Differentiation will not work.	Positive integer > 0

Outputs

Parameter Name	Description	Possible values
Output	Value of the loop output - between 0 and 100%.	Positive real number

---

TUNEABLE REVERSE PID

Appearance

Group	Button	Symbol

C (Control)

Dialog box

- If UC32/BACnet-type Controller is targeted:

- If Legacy UC type Controller is targeted:

Function:

The Tuneable Reverse **PID** module uses a **PID** (Proportional, Integral, Derivative) loop to react to the behaviour of the system under control. Depending on how the observed process variable changes over time, the output is boosted or cut in order to speed up or slow the rate of change.

The user has the option of using proportional control alone, proportional and integral control or proportional, integral and derivative control.

The term "**Reverse**" PID denotes the fact that the output is inversely proportional to the input. This means the error is defined as the amount that the process variable is **below** the setpoint, and output is proportional to that error. Reverse PID is used in heating processes, where the module output drives the process variable upwards e.g. Air Handling Units, pressure control, boiler control, FCUs, VAVs, etc.

Note: If the plant item that is being controlled includes a cooling element, a forward PID must also be used.

The term "Tuneable" indicates that Integration Time and Derivative Time can be set using Constants, but these can be overridden dynamically by the **strategy** using optional inputs.

For a detailed explanation of the options in PID control, see section *PID Control Options* on page 578, in the *Custom PID* module description.

Parameters

Inputs

Parameter Name	Description	Possible values
Setpoint	Desired value for Process Variable.	Real number
Process Variable	Measured value of the parameter to be controlled.	Real number
Gain Point	Proportional gain value for the loop.	Real number
Integration Time	If this point is connected, then its value overrides the Integration Time constant	Positive integer
Derivative Time	If this point is connected, then its value overrides the Derivative Time constant	Positive integer
Enable Point	If set (true), enables function of module If unset (false), module is disabled and returns value 0.	Boolean

Constants

Parameter Name	Description	Possible values
Integration time	Period over which the difference between the Setpoint value and the Process Variable value is integrated. To disable Integration, set this constant to zero.	Positive integer
Derivative time	Period over which the difference between Setpoint Value and Process Variable value is differentiated. To disable, set to zero.	Positive integer
Service time	Period of sampling loop output. **Note:** Service time must be greater than 0, otherwise Integration and Differentiation will not work.	Positive integer > 0

Outputs

Parameter Name	Description	Possible values
Output	Value of the loop output - between 0 and 100%.	Positive real number

CUSTOM PID

Appearance

Group	Button	Symbol
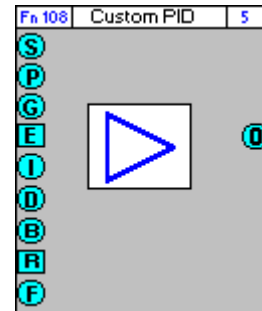
C (Control)

Dialog box

Inputs			Constants		Outputs		
Name	Pt No.	Value	Name	Value	Name	Pt No.	Value
Setpoint	0		Integration Time	900	Output	0	
Process Variable	0		Derivative Time	000			
Gain	0		Service Time	001			
Enable	0	OFF	Gain	5.00			
Integration Time	0						
Derivative Time	0						
Deadband Range	0						
Reverse Enable	0	OFF					
Offset	0						

Block Number: 5

Function:

This module uses a **PID** (Proportional, Integral, Derivative) loop to react to the behaviour of the system under control. Depending on how the observed process variable changes over time, the output is boosted or cut in order to minimise the error and attain the most efficient rate of change.

The user has the option of using proportional control alone, proportional and integral control or proportional, integral and derivative control.

This module differs from other **PID** modules in that the 'direction' of operation "**Forward**" or "**Reverse**" can be set dynamically from within the **strategy**.

A "**Deadband**" range can be defined (unlike other **PID** modules). Also, the output can be offset by a variable amount determined by the **strategy** – allowing the module to be used for heating and cooling at the same time.

Note: The Custom PID Module is available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

The term "Forward" PID denotes the fact that the output is directly (rather than inversely) proportional to the process variable – i.e. the error is defined as the amount that the process variable is **above** the setpoint, and output is proportional to that error. Forward PID is used in cooling processes, where the module output drives the process variable downwards e.g. in Air Handling Units, FCUs, VAVs, etc.

> **Note**: If the plant item that is being controlled includes a heating element, a reverse PID must also be used.

The term "Reverse" PID denotes the fact that the output is inversely proportional to the process variable – i.e. the error is defined as the amount that the process variable is **below** the setpoint, and output is proportional to that error. Reverse PID is used in heating processes, where the module output drives the process variable upwards e.g. Air Handling Units, pressure control, boiler control, FCUs, VAVs, etc.

> **Note**: If the plant item that is being controlled includes a cooling element, a forward PID must also be used.

The term "Tuneable" indicates that although Integration Time and Derivative Time can be set within the module using Constants, these can be overridden dynamically by the **strategy** using optional inputs.

PID Control Options

Proportional control only (i.e. `Enabling point` is set (true) but `Integration time` and `Derivative time` are both set to 0)

In this case, the difference between the **Setpoint** and the **Process Variable** is calculated at set intervals (`Service Time`) and the output is set to a multiple of that difference in order to try to reduce the difference to zero.

Forward action: `Output = (Process Variable - Setpoint) * Gain`

Reverse action: `Output = (Setpoint - Process Variable) * Gain`

> **Note**: The output of the module is limited to between 0 and 100. If the error at any time is less than 0, the output of the module will be 0, and if the error multiplied by the gain gives any value greater than 100, the output of the module will be 100.

If the gain is too low, response is sluggish and the setpoint will not be reached:
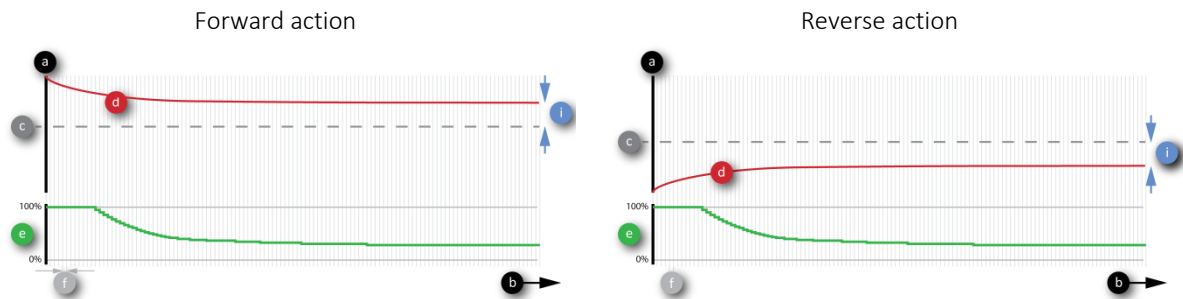
If the gain is too high, the system may become unstable:
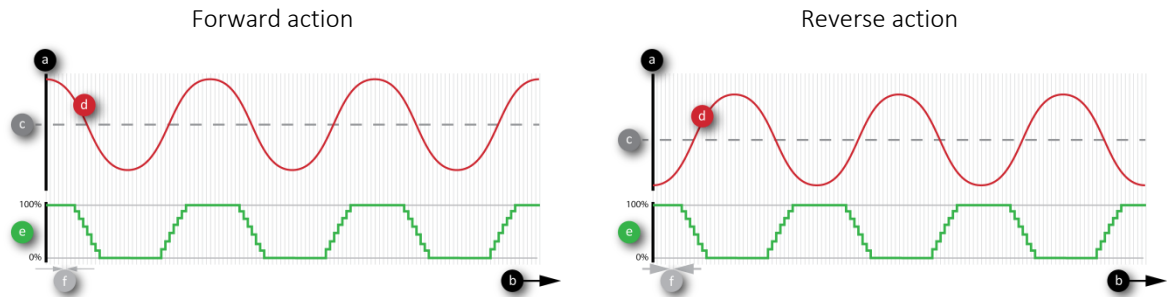
With the correct gain, a stable state can be achieved promptly and error is minimised:
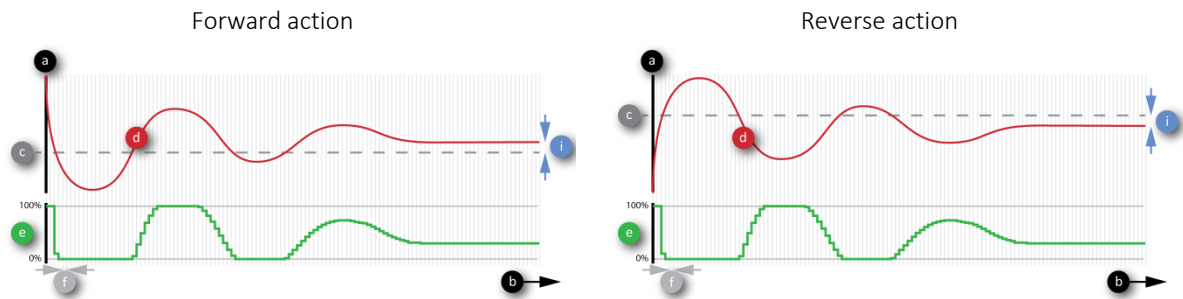
a Value axis b Time Axis c Setpoint d Process Variable e Output f Service Time i Steady-state error

However, using proportional control alone, the steady state will never match the setpoint - there will always be an error as shown above. To overcome this **Integral** control can be included.

> **Note:** Proportional control reacts to the magnitude of the error.
>
> Integral control adjusts the output based on the persistence of an error. It takes the duration of the error into account, in addition to the magnitude of the error. The rate at which the integration element is applied is based on the `Integration Time` parameter set in the PID module.

Proportional and Integral Control (i.e. `Enabling point` is set (true) and a value is specified for `Integration time` but no value is specified for `Derivative time`):

In this case, the difference between the **Setpoint** and the **Process Variable** (the error) is monitored over a period of time (the `Integration Time`), and the duration of the error is used to adjust the loop output until the setpoint is achieved. The larger the `Integration Time` , the smaller the effect of the integral element - so that the use of a larger `Integration Time` can lead to more stable control and a smaller `Integration Time` can give more responsive control.

Forward action   Reverse action

a Value axis   b Time Axis   c Setpoint   d Process Variable   e Output   f Service Time   g Integration action
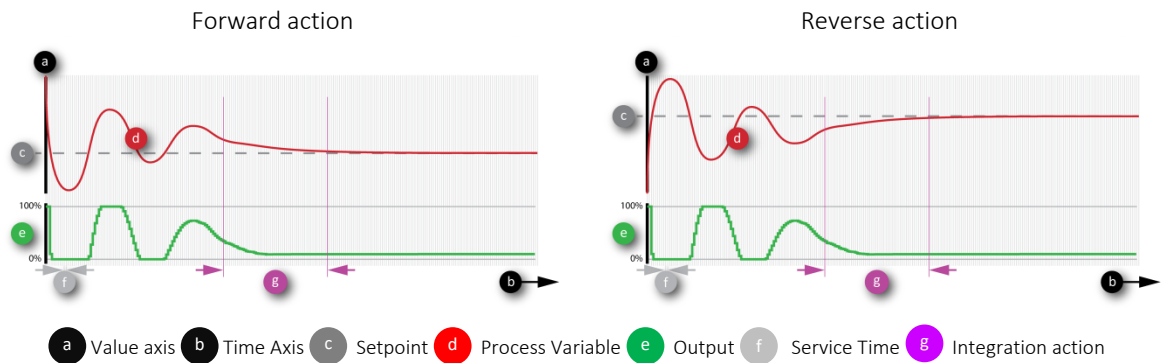
However, if the `Integration Time` is too small there is a danger that the output will be unstable.

Proportional, Integral and Derivative Control (i.e. all values specified):

> **Note:** Derivative control asesses the rate of change of the error.
>
> It is used for very fast reaction times – which is rarely required in HVAC applications.

In this case a derivative term is added to the loop output to reduce the response time. The **rate of change** of the "error" signal is noted, and the module output is modified in line with this rate of change.

| Forward action | Reverse action |

a Value axis   b Time Axis   c Setpoint   d Process Variable   e Output   f Service Time   h Derivative action
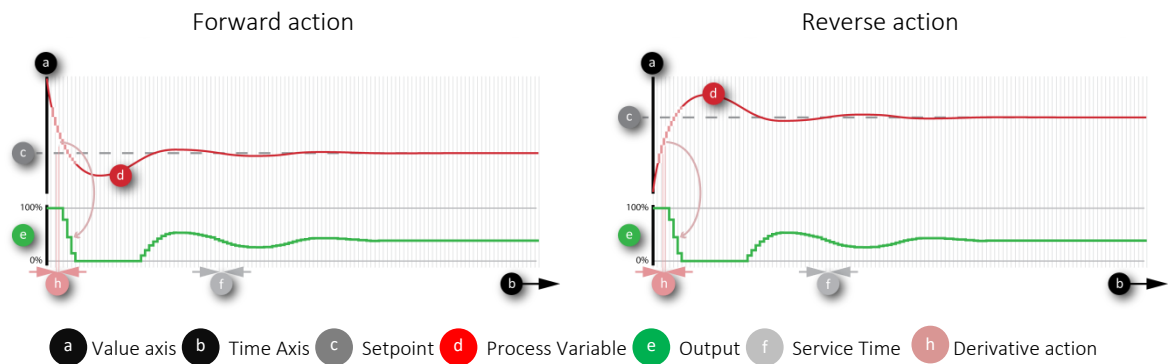
> **Note:** The use of the different types of control depends on the Proportional Band of the PID loop.
>
> `Proportional Band = 100 / Gain`
>
> `Proportional Area = Setpoint ± (Proportional Band / 2)`
>
> If the Process Variable is outside the Proportional Area, only the proportional term is used.
>
> If the Process Variable is within the Proportional Area, the integral and (optionally) derivative terms are used also.

Parameters

Inputs

Parameter Name	Description	Possible values
(S) Setpoint	Desired value for Process Variable.	Real number
(P) Process Variable	Measured value of the parameter to be controlled.	Real number
(G) Gain	Proportional gain value for the loop.	Real number
E Enable	If set, enables function of module; if unset, module is disabled and returns value 0.	On or Off
(I) Integration Time	If this point is connected, then its value overrides the Integration Time constant	Positive integer
(D) Derivative Time	If this point is connected, then its value overrides the Derivative Time constant	Positive integer
(B) Deadband	Defines a deadband range as the Setpoint plus or minus this integer value. If the Process variable is within this range, then the PID output will stop calculating and remain at the previously calculated value.	Positive integer
R Reverse	Changes the mode of the PID block between Forward and Reverse action. If unset (0) the module will use Forward action If set (1) the module will use Reverse action	On (1) or Off (0)
(F) Offset	This value is added to the output	0 % - 100 %

Constants

Parameter Name	Description	Possible values
Integration time	Period over which the difference between the Setpoint value and the Process Variable value is integrated. To disable Integration, set this constant to zero.	Positive integer
Derivative time	Period over which the difference between Setpoint Value and Process Variable value is differentiated. To disable, set to zero.	Positive integer
Service time	Period of sampling loop output. **Note:** Service time must be greater than 0, otherwise Integration and Differentiation will not work.	Positive integer > 0
Gain	If the Gain point (G) is not connected, this value is used as the Proportional gain value for the loop.	Real number

Outputs

Parameter Name	Description	Possible values

O Output	Value of the loop output - between 0 and 100%.	0% – 100%

HYSTERESIS

Appearance
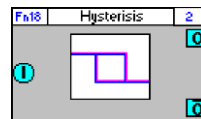
<u>Group</u>

C (Control)

<u>Button</u>

<u>Symbol</u>

<u>Dialog box</u>

- If UC32/BACnet-type Controller is targeted:
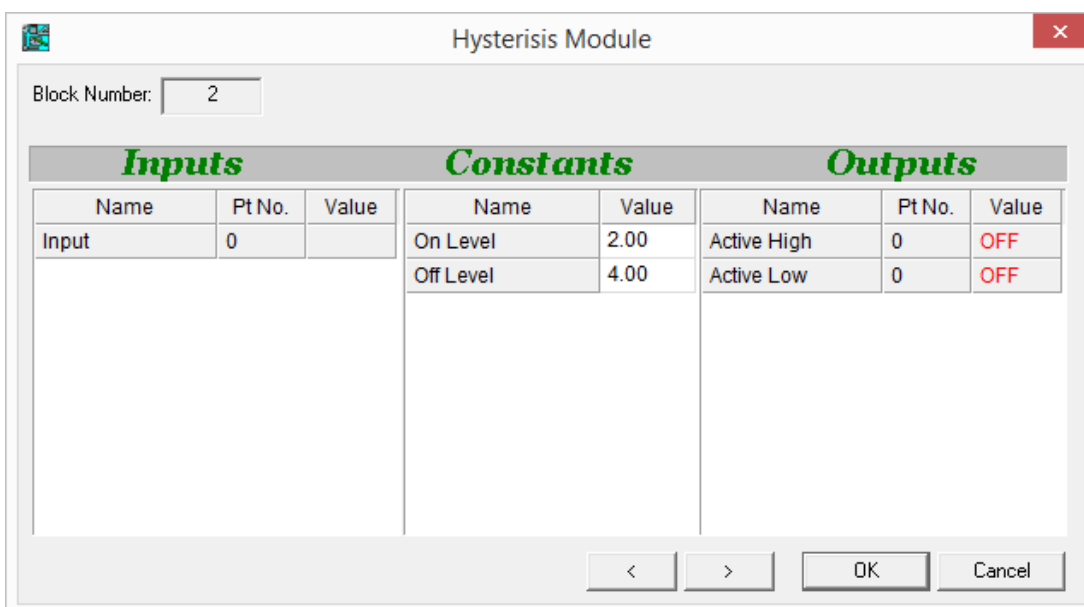
- If Legacy UC type Controller is targeted:
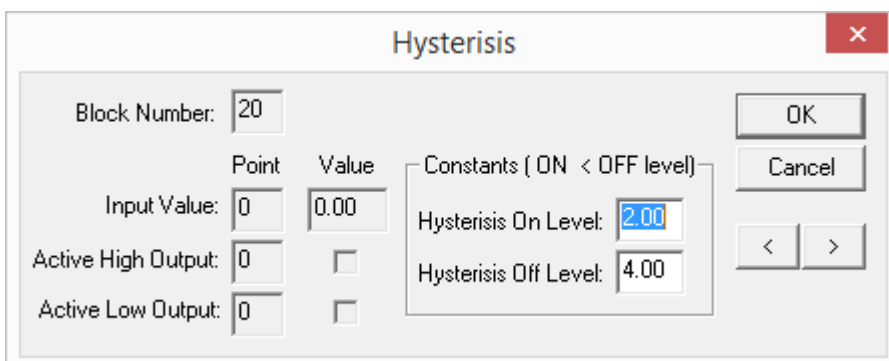
Function

The Hysteresis module accepts one analog input and compares it to two analog constants setting a digital point when the analog value rises above the first constant but not unsetting it until the value falls below the second.

The Hysteresis module is used in frost control. For example, if the outside air temperature falls below 2°, the pump must be activated and not deactivated until the outside air temperature rises above 4°.

Given input value = **IV**, Hysteresis On Level = **On Level** and Hysteresis Off Level = **Off Level**:

- If **IV** < **On Level:** Active High Output = set (On)

- If **IV** > **Off Level:** Active High Output = unset (Off)

- If **On Level** < **IV** < **Off Level:** Active High Output depends on the direction of IV as shown below:

> **Note:** On Level must always be less than Off Level.

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Input	Analog point value which is compared to the Hysteresis On Level and the Hysteresis Off Level to determine the value of the Active High Output.	Real number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Input Point	Number of point at which the Input Value is held.	1 to 255
Input Value	The value which is compared to the Hysteresis On Level and the Hysteresis Off Level to determine the value of the Active High Output.	Real number

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
On Level	Defines the level for the Input Value below which the Active High Output will be set.	Real number
Off Level	Defines the level for the Input Value above which the Active High Output will be unset.	Real number, greater than Hysteresis On Level

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Hysteresis On Level	Defines the level for the Input Value below which the Active High Output will be set.	Real number
Hysteresis Off Level	Defines the level for the Input Value above which the Active High Output will be unset.	Real number, greater than Hysteresis On Level

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Active High	A digital value that is set from the time the input value rises above the On level until it falls below the Off value.	Set or Unset
Active Low	Complement of the Active High Output Value	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Active High Output Point	Number of point at which the Active High Output Value is held.	9 to 255
Active High Output Value	Value produced by the relation between the Input Value and the Hysteresis On and Off Levels.	Set or Unset
Active Low Output Point	Number of point at which complement of Active High Output is held	9 to 255
Active Low Output Value	Complement of the Active High Output Value	Set or unset

TUNEABLE HYSTERESIS

Appearance

<u>Group</u>   <u>Button</u>   <u>Symbol</u>

C (Control)

<u>Dialog box</u>

- If UC32/BACnet-type Controller is targeted:

- If Legacy UC type Controller is targeted:

Function

The Tuneable Hysteresis module accepts accepts three analog inputs and compares one of them (Input Value) to either the other two inputs *or* two analog constants, setting a digital point when the analog value rises above the first (constant or input) but not unsetting it until the value falls below the second.

This module operates as a fixed Hysteresis module when the On and Off level inputs are not connected. However it is "Tuneable" because by connecting those points, the on and off levels can be varied in response to other elements within the Controller Strategy,

The Tuneable Hysteresis module is used in frost control. For example, if the outside air temperature falls below 2°, the pump must be activated and not deactivated until the outside air temperature rises above 4°.

Given

1. input value = **IV**,

2. Hysteresis On Level (Variable input, or constant if input point not specified) = **On Level**

3. Hysteresis Off Level (Variable input, or constant if input point not specified) = **Off Level**

then

- If **IV** < **On Level:** Active High Output = set (On)

- If **IV** > **Off Level:** Active High Output = unset (Off)

- If **On Level** < **IV** < **Off Level:** Active High Output depends on the direction of IV as shown below:
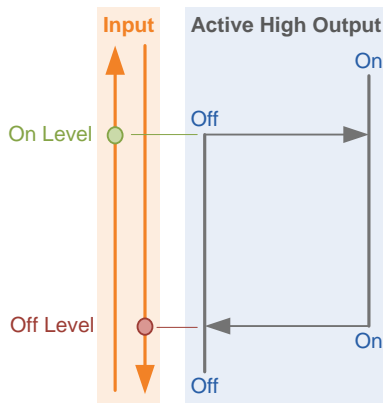
> **Note:** On Level must always be less than Off Level.

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Input	Analog point value which is compared to the Hysteresis On Level and the Hysteresis Off Level to determine the value of the Active High Output.	Real number
On Level	The value of the point connected to the Input labelled `H` .	Real number
Offlevel	The value of the point connected to the Input labelled `L` .	Real number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Input Value Point	Number of point at which Input Value is held.	1 to 255
Input Value	Value to be compared to Hysteresis On Level and Hysteresis Off Level to determine the Active High Output.	Real number
Hysteresis On Level Point	Number of point at which Hysteresis On Level Value is held. May be omitted. Used if it is required that the On level be tuneable.	1 to 255
Hysteresis On Level Value	Value to which Input Value is compared if Hysteresis On Level Point is specified. If the Input Value is less than the Hysteresis On Level Value, the Active High Output will be set.	Real number
Hysteresis Off Level Point	Number of point at which Hysteresis Off Level Value is held. May be omitted. Used if it is required that the Off level be tuneable.	1 to 255
Hysteresis Off Level Value	Value to which Input Value is compared if Hysteresis Off Level Point is specified. If the Input Value is greater than the Hysteresis Off Level Value, the Active High Output will be unset.	Real number, greater than Hysteresis On Level

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
On Level	Defines the level for the Input Value below which the Active High Output will be set.	Real number
Off Level	Defines the level for the Input Value above which the Active High Output will be unset.	Real number, greater than Hysteresis On Level

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Hysteresis On Level	Defines the level for the Input Value below which the Active High Output will be set.	Real number
Hysteresis Off Level	Defines the level for the Input Value above which the Active High Output will be unset.	Real number, greater than Hysteresis On Level

<u>Outputs</u>

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Active High	A digital value that is set from the time the input value rises above the On level until it falls below the Off value.	Set or Unset
Active Low	Complement of the Active High Output Value	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Active High Output Point	Number of point at which the Active High Output Value is held.	9 to 255
Active High Output Value	Value produced by the relation between the Input Value and the Hysteresis On and Off Levels.	Set or Unset
Active Low Output Point	Number of point at which complement of Active High Output is held	9 to 255
Active Low Output Value	Complement of the Active High Output Value	Set or unset

TIME PROPORTIONAL DRIVER

Button:

Symbol:
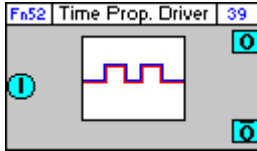
Values not shown   Values shown
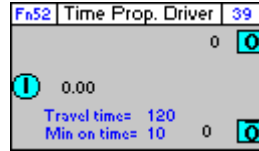
Function of module: The Time Proportional Driver module is used to simulate valve action by modulating a pump, which, unlike a split phase valve, is either fully on or fully off. The module produces a digital output which has a Duty Cycle dependent on the analog input value. There is a second digital output, which is the complement of the first.

Dialog box:

If UC32 is targeted:

If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Input Point	Number of point at which input value is held.	1 to 255
Input Value	The percentage of the Travel Time for which the True Output Value is set (e.g. an Input Value of 70 means the True Output Value should be set for 70% of the Travel Time.	0 to 100
Travel Time	The time taken for one period of the digital output to elapse.	Positive integer
Minimum On Time	The step time for the True Output, i.e. the minimum time for which the True Output must be set once it becomes set. If the Input Value is a shorter time period than the Minimum On Time, then the True Output will be set for the Minimum On Time. If the Input Value is for a longer period, then the Minimum On Time is automatically satisfied, and the True Output is set for the period specified in the Input Value.	Positive integer
True Output Point	Number of point at which True Output Value is held.	9 to 255
True Output Value	This is set for the calculated On time of the duty cycle.	Set or unset
Complement Output Point	Number of point at which complement of True Output Value is held.	9 to 255
Complement Output Value	Complement of True Output Value.	Set or unset

Implementation of module:

Given travel time = T; minimum on time = M and input point I then Duty Cycle is as follows:

True Output Value = SET for $(I*T)/100$ seconds and UNSET for $T - ((I*T)/100)$

if $(I*T)/100 > M$

Otherwise:

True Output Value = SET for M seconds and UNSET for T-M seconds

Application: Used with a control valve with wax heating coil.

RAISE/LOWER DRIVER

Appearance

Group	Button	Symbol
C (Control)		
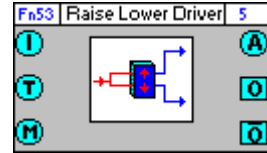
Dialog box

- If UC32/BACnet-type Controller is targeted:

If an analog output is connected, the Outputs column changes:

- If Legacy UC type Controller is targeted:

Function

The Raise/Lower Driver module is used to drive a split phase motor or valve. It accepts as input the percentage opening required for the valve and produces two digital outputs that control whether the valve is opening or closing.

Given Input Value I , Current Value **CV**, Travel Time **T**:

Open Output O = set if I > CV

Close Output $\bar{o}$ = set if I < CV

Output will remain set for `abs(CV -` I `) * (T / 100)`

Example: If the current valve position is 20% open, the `Travel Time` is 100 seconds and the `Input`

Value `(I)`   is 40%, the `Open Output` `O` will be set and the time taken to reach 40% from

20% is calculated as follows:

```
Travel Time = 100 seconds => 1 second per %
```

The valve must open by (40-20)%, which will take 20 seconds).

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
`(I)` **Input Point**	The required level of opening of the valve in percentage terms (e.g. an `Input Point` value of 51 means the valve is required to be open to 51% . This is compared to the current position of the valve, the required output (`Open` or `Close`) is set and the length of time for which the output will remain set is calculated.	0 to 100 %
`(T)` **Travel time input**	This input allows the `Travel Time` constant to be overwritten by a value generated by the strategy.	Positive integer
`(M)` **Min on time input**	This input allows the `Minimum On Time` constant to be overwritten by a value generated by the strategy.	Positive integer

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
`(I)` **Input Point**	The number of the point at which the Input Value is held.	1 to 255
Input Value	The required level of opening of the valve in percentage terms (e.g. an `Input Value` of 51 means the valve is required to be open to 51%. This is compared to the current position of the valve, the required output (`Open` or `Close`) is set and the length of time for which the output will remain set is calculated.	0 to 100 %

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Travel Time	Time taken (in seconds) for the valve to open from 0% to 100%	Positive integer
Minimum On Time	Step time for the valve (i.e. if `Travel Time` is 120 seconds and `Minimum On Time` is 10 seconds, there are 12 equal steps between 0 and 100% for the valve).	Positive integer
Overdrive flag	If this value is set to 0, then if a value of 100% is entered as the `Input Point` value, the `Open` output will stay on indefinitely, and if a value of 0% is entered, the `Close` output will stay on indefinitely. This could be undesirable – for example if a valve motor is connected to the output, it would continue to drive even after the	0: Overdrive is enabled 1: Overdrive is disabled

valve has reached the end of its travel, which could cause mechanical damage.

By setting the Overdrive flag to 1, the output value will stop after a period of time, which is calculated as follows:

1) if a value of `100.0%` is set on the R/L module Input, "True Output" will remain ON for a period T:

```
T = ( (100 - X) / 100 + 1) * Tr
where:
Tr  =       Travel Time.
X   =       Current Position at the time the
new position (100.0%) is sent.
```

2) if a value of `0.0%` is set on the R/L module Input, the "Complement Output" will remain ON for a period T:

```
T = ( X / 100 + 1) * Tr
where:
Tr  =       Travel Time.
X   =       Current Position at the time the
new position (0.0%) is sent.
```

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Travel Time	Time taken (in seconds) for the valve to open from 0% to 100%	Positive integer
Minimum On Time	Step time for the valve (i.e. if Travel Time is 120 seconds and Minimum On Time is 10 seconds, there are 12 equal steps between 0 and 100% for the valve).	Positive integer

Disable Continuous Overdrive	Continuous overdrive is set ON by default. Continuous Overdrive means that if a value of 100% is entered as the Input value, the Open output will stay on indefinitely, and if a value of 0% is entered, the Close output will stay on indefinitely. This could be undesirable – for instance if a valve motor is connected to the output, it would continue to drive even after the valve has reached the end of its travel, which could cause mechanical damage. By setting the Disable Continuous Overdrive box, the output value will stop after a period of time, calculated as follows: 1) if a value of `100.0%` is set on the R/L module Input, "True Output" will remain ON for a period T:
	
	 ``` T = ((100 - X) / 100 + 1) * Tr where: Tr = Travel Time. X = Current Position at the time the new position (100.0%) is sent. ```
	 2) if a value of `0.0%` is set on the R/L module Input, the "Complement Output" will remain ON for a period T:
	
	 ``` T = (X / 100 + 1) * Tr where: Tr = Travel Time. ```
		Set or unset

```
   X    =       Current Position at the time the
new position (0.0%) is sent.
```

> **NOTE**: The Disable Continuous Overdrive box should NOT be set for older controllers (with ROM versions before 5.5.0). Disabling Continuous Overdrive is not supported in such controllers, and setting this box will cause the outputs to behave in an unpredictable manner.

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
(T) Three Step Driver output	The value of this analog output point determines the state of the raise/lower valve. > **Note**: if this point is connected, then the digital open / close outputs cannot be used.	0, 50 or 100. (0, 5 or 10 volts expressed as percentages.)
O Open Output	When this is set, the valve is driven towards the open position. > **Note**: if the digital open / close outputs are connected, then the Three Step Driver output cannot be used.	Set or unset
ō Close Output	When this is set, the valve is driven towards the closed position. > **Note**: if the digital open / close outputs are connected, then the Three Step Driver output cannot be used.	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values

O **Open Output Point**		Number of point at which Open Output Value is held.	9 to 255
Open Output Value		When this is set, the valve is driven towards the open position.	Set or unset
ō **Close Output Point**		Number of point at which Close Output Value is held.	9 to 255
Close Output Value		When this is set, the valve is driven towards the closed position.	Set or unset
T **Three Step Driver Point**		Number of the analog point that drives the raise/lower valve.	1-255
Three Step Driver Value		The value of this analog output point determines the state of the raise/lower valve. (See also UC16 R/L2 Raise/Lower Relay Module Datasheet.)	0, 50 or 100. (0, 5 or 10 volts expressed as percentages.)

HEATING CURVE

Appearance

Group	Button	Symbol
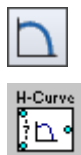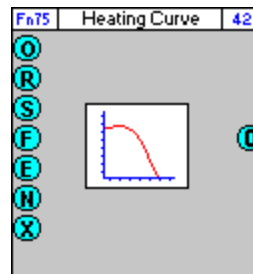
 C (Control)

Dialog box

- If UC32/BACnet-type Controller is targeted:
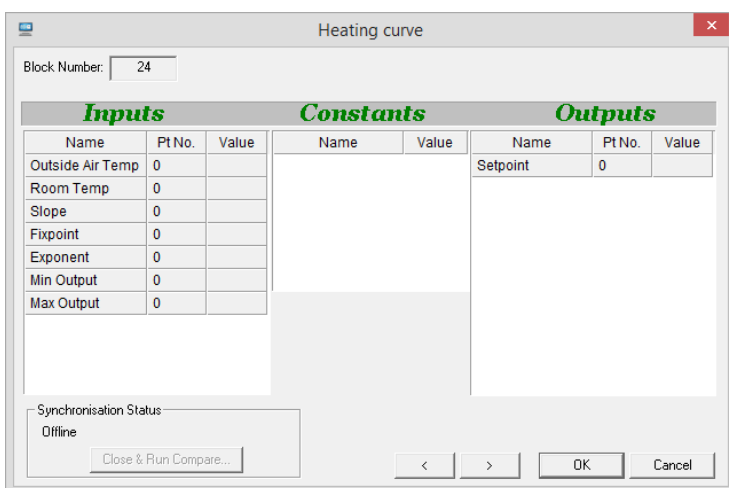
- If Legacy UC type Controller is targeted:
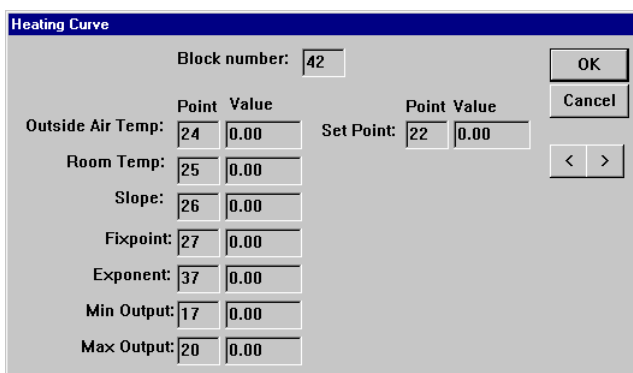
Function

The Heating Curve module is used a weather compensator with room influence.

Given the following inputs:

- Outside Temp **O**
- Room Temp **R**
- Slope **S**
- Fixpoint **F**
- Exponent **E**
- Min Output **N**
- Max Output **X**

The module calculates a Temperature Setpoint **O** as follows:

Setpoint **O** = **(** Slope **S** x **(** Room Temp **R** - Outside Temp **O**)) ^ **(** 1/ Exponent **E** **)** + Fixpoint **F**

As long as Min Output **N** < Setpoint **O** < Max Output **X**

Parameters

- Inputs

Parameter Name	Description	Possible values
Outside Air Temp Value	Measured value of outside air temperature. **Note:** If this is not less than the Room Temp value, the module assumes it is a negative temperature, since the operation of the module is invalid otherwise.	Real Number
Room Temp Value	Measured value of room temperature.	Real Number
Slope Value	Value of slope of the characteristic curve of the heating system for which the temperature setpoint is being calculated.	
Fixpoint Value	Value of desired temperature setting.	Real Number
Exponent Value	Value of exponent of characteristic curve.	Real Number
Min Output Value	Specified minimum output value.	Real Number
Max Output Value	Specified maximum output value.	Real Number

- Outputs

Parameter Name	Description	Possible values
Setpoint Value	Calculated value of temperature setpoint.	Real Number

RING COUNTER
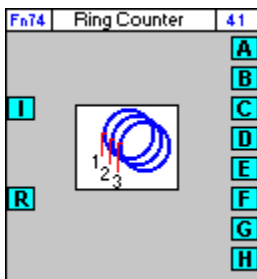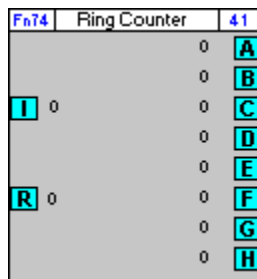
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Ring Counter module accepts two digital inputs and produces up to eight digital outputs which are determined by the state of the digital inputs.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Point to Monitor Point	Number of point at which Point to Monitor Value is held.	1 to 255
Point to Monitor Value	The state of this value determines the value of the output.	Set or unset
Reset Point	Number of point at which Reset Value is held.	1 to 255
Reset Point Value	When the Reset Point Value is set, Output Value A is set and remains so while Reset Point Value remains unchanged.	Set or unset
Output Points A to H	Numbers of points at which Output Values A to H are held.	9 to 255
Output Values A to H	Values determined by the changes of state of Point to Monitor Value.	Set or unset

Implementation of module:

When this module is serviced, the status of the Point to Monitor Value and the Reset Point Value are examined. If the Reset Point Value has become set, Output Value A becomes set and remains so while this condition persists. If the Point to Monitor Value has changed state since the last time the module was serviced, the currently set Output Value will become unset and the next Output Value will become set. If the digital point assigned to Output Channel 8 (i.e. Output Value H) is currently set, the next change of state of the Point to Monitor Value will result in Output Value A becoming set and Output Value H becoming unset. Any point numbers set to zero will be ignored.

Application:

The Ring Counter module is used in a weekly changeover of more than two plant items, e.g., pumps, boilers, chillers, etc.

DAMPING
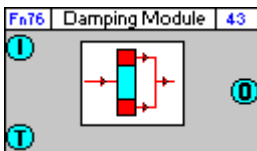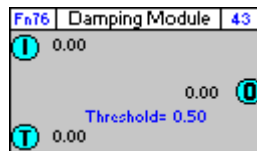
Button:	Damping
Symbol:	Values not shown Values shown
Function of module:	The Damping modules accepts two inputs, a signal input and a threshold input, and produces one output. The output is equal to the change in the value of the signal input between one service of the module and the next if the change is greater than the value of the threshold input. Otherwise, the output remains unchanged from its previous value.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Signal Point	Number of point at which Signal Value is held.	1 to 255
Signal Value	Value which will have its changes compared to the Threshold Value or Threshold Constant to produce the output.	Real number
Threshold - Constant	Constant value against which the Signal Value is compared if a Threshold Point is not specified.	Positive real number
Threshold Point	Number of point at which Threshold Value is held. May be omitted.	1 to 255
Threshold Value	If Threshold Point is specified, this is the value against which Signal Value is compared.	Positive real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value returned by the module after acting on inputs.	Real number

Implementation of module:

Given t = service period of module and given inputs A, B,

where A = A1 at time t and A=A2 at time 2t

Output = A if abs(A2-A1) > B

Application: For use in filtering inputs.

© Cylon Controls

HX DIAGRAM

Appearance

<u>Group</u>
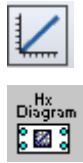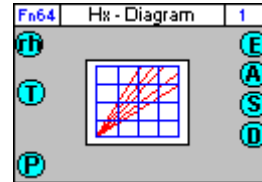
C (Control)

<u>Button</u>

<u>Symbol</u>

<u>Dialog box</u>

- If UC32/BACnet-type Controller is targeted:
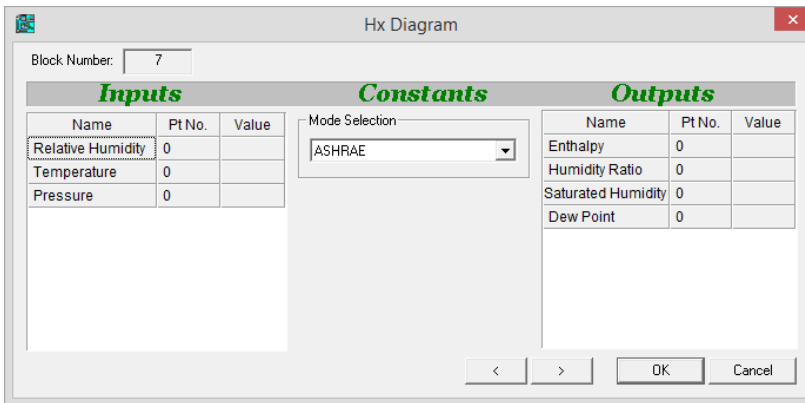
- If Legacy UC type Controller is targeted:
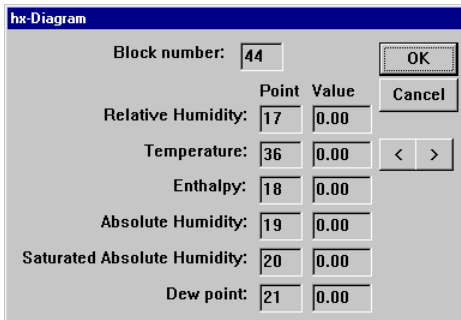
Function

The Hx Diagram module takes three analog inputs:

Temperature (T) , Relative Humidity (rh) and Static Air Pressure (P)

and produces four analog outputs:

Enthalpy (E) , Absolute humidity (A) , Saturated Absolute humidity (S) and Dewpoint (D) .

This module is intended for use in humidity control with **dewpoint** applications.

The following parameters are involved in the calculation of the outputs:

Parameter	Symbol	Unit
Saturated Water Pressure (Standard or Measured)	P_s	Pascal (Pa)
Air Temperature	t	°C
Saturated Absolute Humidity (rh = 100%)	X_s	g/Kg
Absolute Humidity	X_t	g/Kg
Enthalpy	h	Kjoules/Kg
Dewpoint	P	°C
Relative Humidity	rh	%

<u>Saturated Water Pressure (P_s) is calculated as follows:</u>

Where 0°C< **t** < 100°C:

$$P_s = 611 \times e^{(7.257\times10^{-2})t - (2.937\times10^{-4})t^2 + (9.81\times10^{-7})t^3 - (1.901\times10^{-9})t^4}$$

Where -20°C< **t** < 0°C:

$$P_s = 611 \times e^{(8.203575\times10^{-2})t - (5.268726\times10^{-4})t^2 + (2.066472\times10^{-5})t^3 - (5.88887\times10^{-7})t^4}$$

<u>The outputs are calculated as follows:</u>

Saturated Absolute Humidity (X_s):

$$X_s = \frac{6.22 \times Ps}{100 - Ps}$$

Absolute Humidity (X_t):

$$X_t = \frac{rh}{100 \times X_s}$$

Enthalpy (h):

$$h = 1.01t + X_t(1.86t + 2501)$$

Dewpoint (P): Calculation depends on value of saturated water pressure (P_s)

Where 611 Pa < **P_s** < 101330 Pa :

$$P = -24.576 \ln(P_s) + 6.2152 \left(\ln(P_s)\right)^2 - 0.47549 \left(\ln(P_s)\right)^3 + 0.016186 \left(\ln(P_s)\right)^4 + 0.01$$

Where **P_s** < 611P_a :

$$P = -36.954 \ln(P_s) + 12.3323 \left(\ln(P_s)\right)^2 - 1.44599 \left(\ln(P_s)\right)^3 + 0.0165712 \left(\ln(P_s)\right)^4$$

Note: The calculations used for Enthalpy in this module are not identical to those used in the *Enthalpy* module (see page 606).

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Relative Humidity (rh)	Analog value representing the % Relative Humidity of the air	0 to 100
Temperature (T)	Analog value representing air temperature in °C.	Real Number
Pressure (P)	Analog value representing static air pressure. If this is not connected, a value of 0 will be used.	Real Number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Relative Humidity Point	Number of point at which Relative Humidity Value is held.	1 to 255
Relative Humidity Value	Measured value of current relative humidity (%).	0 to 100
Temperature Point	Number of point at which Temperature Value is held.	1 to 255
Temperature Value	Measured value of current temperature in °C.	-20 to 100

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Mode Selection	This sets the calculation method: Cylon Metric calculations (Legacy) or ASHRAE metric calculations (ASHRAE)	• Legacy • ASHRAE

- If Legacy UC type Controller is targeted:

The legacy version of this module has no constants.

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Enthalpy (E)	Analog value representing Enthalpy (h) in kJ/kg	Real Number
Humidity Ratio (A)	Analog value representing Absolute Humidity (X_t) in g/Kg	Real Number
Saturated Humidity (S)	Analog value representing Saturated Humidity (X_s) in g/Kg	Real Number
Dew Point (D)	Analog value representing the Dew Point (P) in °C	Real Number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Enthalpy Point	Number of point at which Enthalpy Value is held.	9 to 255
Enthalpy Value	Calculated value of enthalpy using input values.	Real number
Absolute Humidity Point	Number of point at which Absolute Humidity Value is held.	9 to 255
Absolute Humidity Value	Calculated value of absolute humidity using input values.	Positive real number
Saturated Absolute Humidity Point	Number of point at which Saturated Absolute Humidity Point is held.	9 to 255
Saturated Absolute Humidity Value	Calculated Value of saturated absolute humidity using input values.	Positive real number
Dew Point	Number of point at which dew point value is held.	9 to 255
Dew Point Value	Calculated value of dew point using input values.	Real number

ENTHALPY

Appearance

Group	Button	Symbol
C (Control)	E / Enthalpy	Enthalpy symbol
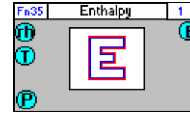
Dialog box

- If UC32/BACnet-type Controller is targeted:

Enthalpy

Block Number: 1

Inputs

Name	Pt No.	Value
Relative Humidity	0	
Temperature	0	
Pressure	0	

Constants — Mode Selection: ASHRAE

Outputs

Name	Pt No.	Value
Enthalpy	0	

- If Legacy UC type Controller is targeted:

Enthalpy

$O/P = A \times 10^{((0.0275 \times B) - 1)} + B$

Block Number: 18

	Point	Value
Input Point A:	0	0.00
Input Point B:	0	0.00
Output Point:	0	0.00

Calculation Modes: ⦿ Existing Mode ○ Imperial ○ Metric

Function

The Enthalpy module calculates the Enthalpy in a system, for use in Humidity Control.

Note: The calculations used for Enthalpy in this module (see *Outputs* section) are not identical to those used in the *HX Diagram* module (see page 603).

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Relative Humidity (rh)	Analog value representing the % Relative Humidity of the air	0 to 100
Temperature (T)	Analog value representing air temperature in °C.	Real Number
Pressure (P)	Analog value representing air pressure	Real Number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Input Points A, B	Numbers of points at which Input Values A and B are held.	1 to 255
Input Values A	Analog value representing the % Relative Humidity of the air	0 to 100
Input Values B	Analog value representing air temperature in °C.	Real Number

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Mode Selection	This sets the units for the Pressure input. If it is set to ASHRAE, the Pressure input will be interpreted as Pascals (Pa) and if it is set to Legacy, then the Pressure input will be interpreted as Pounds per square inch (psi).	• Legacy • ASHRAE

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Calculation Modes	This sets the units for the Pressure input.	• Existing Mode • Imperial • Metric

Outputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Enthalpy	Analog value representing Enthalpy in kJ/kg If the Mode Selection constant is set to "Legacy" this is calculated from: $$[\text{Relative Humidity}] * (10^{(0.0275* [\text{Temperature}])} - 1) + [\text{Temperature}]$$ If the Mode Selection constant is set to "ASHRAE" this is calculated by: $$0.24 * [\text{Temperature}] + W * (1061.0 + 0.444 * [\text{Temperature}])$$ Where W is specific humidity, calculated from [Pressure] and [Relative Humidity]	Real Number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value of (Input A) $* 10^{((0.0275* \text{Input B}) - 1)}$ + Input B.	Real Number

OPTIMIZER BLOCK A (LEGACY)

Note: **This block should not be used in a new strategy.** It remains in the Engineering Tool only to support exiting Strategies. Use the Heating and Cooling Optimizer Blocks instead as described in *SECTION 29 : Appendix :: How to add Energy Optimization to a* Strategy on page 693.

Note: To create an Optimizer strategy, use the Optimizer macro, which is available on the macro bar of the Engineering Centre. The Optimizer macro includes all the modules necessary for correct implementation of an Optimizer strategy. The following section describes 1 of those modules - Optimizer Block A.
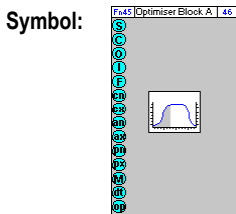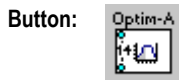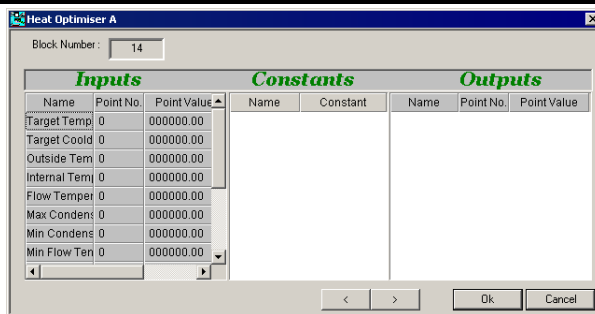
Button:

Symbol:

Values not shown

Values shown

Function of module: The Optimizer Block A function module is used together with Optimizer Block B, 7 time schedules and 2 comment blocks to create an Optimizer strategy that regulates heating and cooling processes to optimum efficiency.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:	Variable name	Description	Typical values
	Setpoint Point	The number of the setpoint that stores the target temperature for the building while it is occupied. (During occupancy).	1-255
	Setpoint Value	The target temperature for the building while it is occupied.	20 °C
	Cooldown Point	The number of the setpoint that stores the minimum desired temperature for the building while it is unoccupied.	1-255
	Cooldown Value	The minimum desired temperature for the building while it is occupied.	19
	Outside temperature Point	The number of the point that contains a reading of the temperature outside the building.	1-255
	Outside temperature Value	The level of the temperature outside the building.	11 °C
	Internal temperature Point	The number of the point that contains a reading of the temperature inside the building.	1-255
	Internal temperature Value	The level of the temperature inside the building.	20.6 °C
	Flow temperature Point	The number of the point that contains a reading of the temperature of the heating medium.	1-255
	Flow temperature Value	The level of the temperature of the heating medium.	48 °C
	Minimum temperature for condensation protection Point	The number of the analog point that specifies the lowest level to which the internal temperature can drop before condensation protection is activated.	1-255
	Minimum temperature for condensation protection Value	The lowest level to which the internal temperature can drop before condensation protection is activated.	10 °C
	Maximum temperature for condensation protection Point	The number of the input point that specifies the level the internal temperature must reach for condensation protection to cease.	1-255
	Maximum temperature for condensation protection Val	The level the internal temperature must reach for condensation protection to cease.	12 °C
	Minimum flow temperature for adaptation Point	The number of the first of the two points used by the Optimizer module to decide whether the heating characteristics for that day are to be "learned". "Learning" the heating characteristics means that the module examines the performance of the heating and cooling processes that were implemented on that day and, if necessary, adapts them the next day for greater efficiency. The following criteria must be met if adaptation (i.e. learning the heating characteristics) is to take place: • Flow temp > min flow temp for adaptation • Max flow temp during preheat < max flow temp for adaptation • Condensation protection was not active during preheat.	1-255
	Minimum flow temperature for adaptation Value	The minimum temperature the heating medium can have if adaptation is to take place. (See above.)	25 °C
	Maximum flow temperature for adaptation Point	The number of the second of the two points used by the Optimizer module to decide whether adaptation is to take place. (See "Minimum flow temperature for adaptation" above.)	1-255
	Maximum flow temperature for adaptation Value	The maximum temperature the heating medium can have if adaptation is to take place.	45 °C
	Minimum internal temperature for preheat Point	Minimum internal temperature for preheat refers to the lowest temperature the interior of the building can be if it is to reach the target temperature after the maximum preheat period. Specify here the number of the analog point that contains the minimum internal temperature for preheat.	1-255
	Minimum internal temperature for preheat Value	The lowest temperature the interior of the building can be if it is to reach the target temperature after the maximum preheat period.	12 °C
	Maximum preheat period Point	The number of the analog point that contains the maximum number of minutes to be spent on preheat.	1-255

Maximum preheat period Value	The maximum number of minutes to be spent on preheat.	180
Maximum cooldown period Point	The number of the analog point that contains the maximum number of minutes to be spent on cooldown.	1-255
Maximum cooldown period Value	The maximum number of minutes to be spent on cooldown	180
Dead time Point	The number of the analog point that contains the length of time from when preheat begins that there is a response in internal temperature.	1-255
Dead time Value	The length of time from when preheat begins that there is a response in internal temperature. (Expressed in minutes.)	3
Overlap period Point	Overlap period refers to the maximum number of minutes that preheat is allowed to continue into the occupancy period if the internal temperature has not reached the target temperature by the start of occupancy. Specify here the number of the analog point that contains the value of the overlap period.	1-255
Overlap period Value	The maximum number of minutes that preheat is allowed to continue into the occupancy period if the internal temperature has not reached the target temperature by the start of occupancy	30

Implementation of Module:

The Optimizer has 2 main stages of operation.

1. The first stage takes place when the learning factor (See Optimizer Block B) is 5 or below. This equation is based on the initial building constants. This stage uses a straight line formula.

P = A(X-Y) +B

where:

P =Preheat Time

X is the target temperature.

Y is the current internal temperature.

A and **B** are the initial building constants.

2. The second stage is when the learning factor is over 5 and this equation is based on the calculated building constants. The equation is a second order equation.

Example:

This example shows a building that is to be occupied from 8.am and 5.pm. The Optimizer is required to have heated the building to a Target Temperature of 20 DegC by 8 am. and to have the heat on no longer than is necessary for the temperature to remain at the Target Temperature for Cooldown at 17:00. This is generally about 1 DegC below the Daytime Target Temperature. It has to calculate therefore when to switch the heat on and when to turn it off again.

At 04:00 the building is at 16 DegC. The System Off flag is operational, showing that the heating system is switched off. At 07:00 the flag is switched off and the building is placed in the preheat period. The pump is switched on. There is a short Dead time period which is the period between when the heating is switched on and the building begins to heat up. The Maximum Preheat period that is allowed is 3 hours. At 08:00 the building is heated to the required temperature and Day Control takes over. There is an Overlap period of 1 hour. Day Control is unrelated to the Optimizer itself, i.e., it is a separate control.

At 16:00, Day Control ends and the Optimizer becomes operational again as the System Off Flag is switched On. Cooldown is about to begin. The aim is to have the temperature remaining at the Cooldown Target Temperature until 17:00, but for no longer after that than is absolutely necessary. There is, however, a Maximum Cooldown Period of 2 hours before which the Optimizer cannot start the cooldown process. This means that, as the building is going to become unoccupied at 17:00, cooldown cannot be started before 15:00. By 18:00 the building has reached the minimum unoccupied temperature of 16 °C.

Outputs

4:00	6:00	8:00	10:00	12:00	14:00	16:00	18:00	20:00

Cooldown Mode	0	0	0	0	0	1	1	1	0
System Off Flag	1	1	0	0	0	0	0	1	1
In Preheat Period	0	1	1	0	0	0	0	0	0
Day Control	0	0	1	1	1	1	0	0	0
Pump Status(Optimum On/ Off Flag)	0	1	1	1	1	1	1	1	0
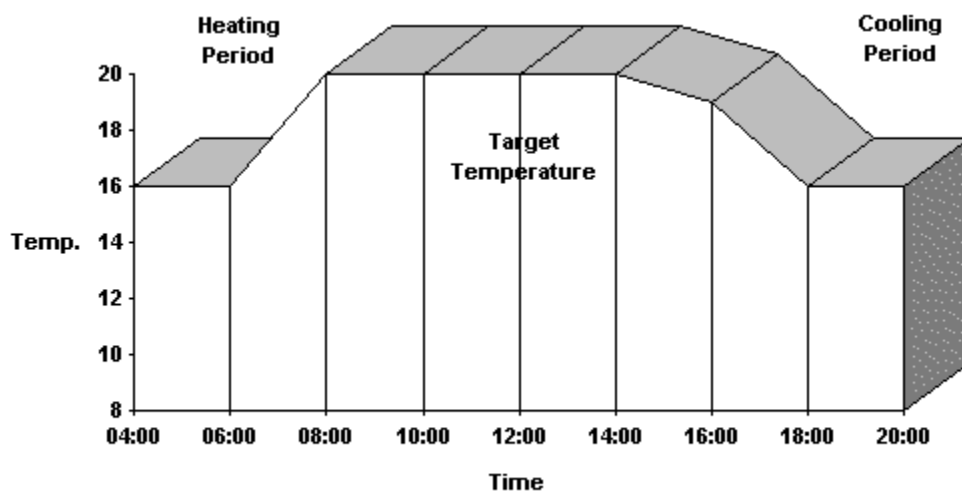
Application:	The Optimizer block A function module is used only when creating an Optimizer strategy, i.e., a control strategy that allows the heating and cooling processes in a plant to be self-adapting for optimum efficiency.

OPTIMIZER BLOCK B (LEGACY)

Note:	**This block should not be used in a new strategy.** It remains in the Engineering Tool only to support exiting Strategies. Use the Heating and Cooling Optimizer Blocks instead as described in *SECTION 29 : Appendix :: How to add Energy Optimization to a Strategy on page 693*.

Note:	To create an Optimizer strategy, use the Optimizer macro, which is available on the macro bar of the Engineering Centre. The Optimizer macro includes all the modules necessary for correct implementation of an Optimizer strategy. The following section describes 1 of those modules - Optimizer Block B.

Button:

Symbol:
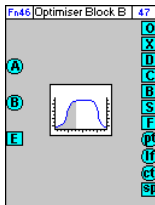
Value not shown   Value shown
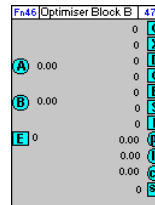
Function of module: The Optimizer Block B function module is used together with Optimizer Block A, 7 time schedules and 2 comment blocks to create an Optimizer strategy that regulates heating and cooling processes to optimum efficiency.

Dialog box:
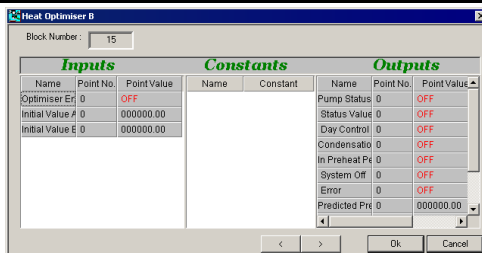
If UC32 is targeted:	
If UC/UCU is targeted:	
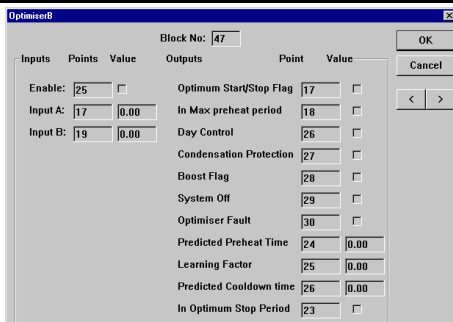
Variable name	Description	Possible values
Enable Point	The number of the digital point which, if set, will enable the Optimizer.	1-255
Enable Value	If set, this value will enable the Optimizer. If unset, the Optimizer will not be enabled.	Set or unset.
Input A Point	The number of the first of the 2 constants that are used by the Optimizer module to learn the heating characteristics of the site.	1-255
Input A Value	The value of the first constant that is used to learn the heating characteristics of the site. The value should be such that the building always reaches its target temperature before occupancy.	25
Input B Point	The number of the second constant that is used by the Optimizer module to learn the heating characteristics of the site.	1-255
Input B Value	The value of the second constant that is used to learn the heating characteristics of the site. The value should be such that the building always reaches its target temperature before occupancy.	26
Optimum Start/Stop Flag Point	The number of the digital output point which becomes set once the optimum start/stop time has been decided.	1-255
Optimum Start/Stop Flag Value	This digital point becomes set when the Optimizer module has calculated an optimum start/stop time. Setting this flag switches on a pump.	Set or unset
In Max Preheat Period Point	The number of the digital output point that becomes set when the Optimizer strategy is within the preheat period.	1-255
In Max Preheat Period Value	The digital output point that becomes set when the Optimizer strategy is within the preheat period. At this point, the optimum preheat period is being calculated.	Set or unset
Day Control Point	The number of the digital output point which becomes Set when the plant is in Day Control mode.	1-255
Day Control Value	This point is set when the plant is in Day Control mode, otherwise it is unset.	Set or Unset
Condensation Protection Point	The number of the digital output point which, when set, activates condensation protection.	1-255
Condensation Protection Value	When condensation protection is activated, this point becomes set.	Set or unset.
Boost Flag Point	The number of the digital output point which becomes set when the plant is in Preheat.	1-255
Boost Flag Value	When the controller time equals the predicted preheat time, this value becomes set and the plant switches to preheat.	Set or unset.
System Off Point	The number of the digital output point which becomes set when the heating system is turned off.	1-255
System Off Value	When the heating system is turned off, this value is set.	Set or unset
Optimizer Fault Point	The number of the digital output point which becomes set when an error occurs in the Optimizer strategy.	1-255

Variables:

Optimizer Fault Value	When an error occurs in the Optimizer strategy, this value is set, in which case the Optimizer will not service.	Set or unset.
Predicted Preheat Time Point	The number of the analog point which specifies the time that the Optimizer module predicts preheat will occur.	1-255
Predicted Preheat Time Value	The time predicted by the Optimizer module that preheat will occur. The time is expressed in the 24-hour clock, i.e., 00.01-24.00.	07.15
Learning Factor Point	The number of the analog point that specifies whether the Optimizer module is "learning" the heating characteristic.	1-255
Learning Factor Value	The value of the analog point that specifies whether the Optimizer module is "learning" the heating characteristic. Each time the Optimizer strategy controls the heating & cooling process in the plant to optimum efficiency, this value is incremented by 1.	1-255
Predicted Cooldown Point	The number of the analog point that contains the predicted time for cooldown.	1-255
Predicted Cooldown Value	The value of the analog point that contains the predicted time for cooldown.	18.45
In Optimum Stop Period Point	The number of the digital output point that becomes set when the Optimizer is in cooldown mode.	1-255
In Optimum Stop Period Value	This point becomes set at the predicted cooldown time and remains set for 3 hours during which time the cooldown process is monitored.	Set or unset.

Implementation of module:

Learning Factor: "Learning" the heating characteristics means that the module examines the performance of the heating and cooling processes that were implemented on that day and, if necessary, adapts them the next day for greater efficiency. Each time the Optimizer strategy functions correctly by reaching the target temperature and fulfilling the plant requirements, the Learning Factor point is incremented by 1 until it reaches 255. It then stops incrementing even though the Optimizer continues to learn the heating characteristics of the plant.

Initial Value A and B: These building constants are used during the first 4 days of operation of the Optimizer. The Optimizer assumes that it takes at least 4 days of correct operation before any of the learnt data is reliable. During this period a linear equation is used to calculate the Start time for preheat:

$$P = A(X-Y) + B$$

where

X is the target temperature.

Y is the current internal temperature.

A and **B** are the building constants.

The values selected for A and B should be such that the building should always reach Target temperature before occupancy. The values A and B are no longer used after 4 days of correct operation.

Day Control: Day control comes into operation under any of the following conditions:

1. Internal Temperature > Target Temperature.

2. Current Time > (Occupancy Time + Overlap period)

3. If the internal temperature drops below the cooldown target temperature during cooldown. In this case, Day Control comes on and remains on until the end of occupancy.

System Off: The digital output point System Off is SET when the heating system is turned off. This mode is in operation under any of the following conditions:

Current Time > Unoccupancy Time.

Current Time > Optimum Stop Time.

Application:

The Optimizer Block B function module is used when creating an Optimizer strategy, i.e., a control strategy that allows the heating and cooling processes in a plant to be self-adapting for optimum efficiency. To create an Optimizer strategy, simply use the Optimizer macro from the macro bar or, alternatively, connect the following function modules: 7 time schedules, 2 comment blocks, an Optimizer block A and an Optimizer block B.

COOLING OPTIMIZER BLOCK A (COOL-OPA)

Appearance

Group

 (Control)

Button

Symbol
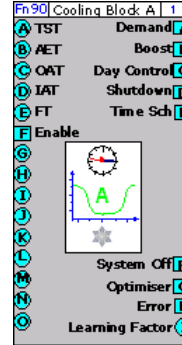
Dialog box

Inputs			Constants		Outputs		
Name	Pt No.	Value	Name	Value	Name	Pt No.	Value
Startup Target Tem	0		Min Flow Adapt Temp	007	Demand	0	OFF
Shutdown Target T	0		Max Flow Adapt Tem	010	Startup Status	0	OFF
OAT	0		Max Startup Temp	030	Day Control Status	0	OFF
IAT	0		Max Startup Time	090	Shutdown Status	0	OFF
Flow Temp	0		Max Shutdown Time	090	Time Sch. Active	0	OFF
Enable	0	OFF	Dead Time	020	System Off Status	0	OFF
Min Flow Adapt Ten	0		Max Overlap Time	020	Optimiser Status	0	OFF
Max Flow Adapt Ter	0		Initial Linear Model A	010	Error Status	0	OFF
Min Starup Temp	0		Initial Linear Model E	050	Learning Factor	0	
Max Starup Time	0						
Max Shutdown Time	0						
Dead Time	0						
Max Overlap Time	0						
Initial Linear Model	0						
Initial Linear Model	0						

Function:

The Cooling Optimizer Block A (Cool-OpA) function module is used together with Heating Optimizer Block A, Heating Optimizer Block B, Cooling Optimizer Block B and 7 time schedules to create an Optimizer strategy that regulates heating and cooling processes to optimum efficiency.

See *SECTION 29 : Appendix :: How to add Energy Optimization to a* Strategy on page 693 for details.

> **Note**: The Optimizer Modules are available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name	Description	Possible values
Startup Target Tem	**Target Start Temperature (TST)** The temperature that must be reached at the start of Occupancy.	Real Number
Shutdown Target T	**Allowable End Temperature (AET)** The temperature that must be maintained until the end of Occupancy.	Real Number
OAT	**Outside Air Temp (OAT)** Current temperature of the ambient air outside the building.	Real Number
IAT	**Inside Air Temperature (IAT)** Current inside air temperature.	Real Number
Flow Temp	**Flow Temp (FT)** Current temperature of the Conditioning medium (Heating or Cooling). While it is recommended that this be used, if the medium Flow Temperature is not available, this input can remain disconnected. (if this is the case, then the 'Sanity Check' condition described on page 701 will be ignored)	Real Number
Enable	**Enable** Input signal to enable or disable Optimizer operation. Does not disable Fabric Protection operation. If not connected then assumed to be enabled	Binary
Min Flow Adapt Tem	Values can be either fixed as Constants within the module or set from external values within control strategy, usually setpoints.	Real Number
Max Flow Adapt Tem		
Min Startup Temp	If these points are not attached, then the values set in the Constants section will be used.	Real Number
Max Startup Time		Integer (minutes)
Max Shutdown Time		Integer (minutes)
Dead Time		Integer (minutes)
Max Overlap Time		Integer (minutes)
Model A Value		

Model B Value		

Constants

Parameter Name	Description	Possible values
Min Flow Adapt Tem	**Flow Min Temp (FTmin) / Flow Max Temp (FTmax)**	Real Number
Max Flow Adapt Tem	**FTmin** and **FTmax** define a range outside which the temperature of the conditioning medium must be before the start of Boost. **FTmin** is the bottom of this range, and **FTmax** is the top of this range. In Heating Optimization, the flow temperature must be below the minimum temperature in the range, (i.e. below the value of **FTmin**) at the start, and must rise past the maximum temperature (**FTmax**) during the boost period. In Cooling Optimization, the flow temperature must be above the temperature range before Boost, (i.e. above the value of **FTmax**) at the start, and must fall below the minimum temperature (**FTmin**) during the boost period. If the flow temperature does not meet these conditions before the start of Boost, the Learning process will not take place in the Optimizer (see page 701).	
Min Startup Temp	**Startup Temp (IATstart)** If there is no historical data available (i.e. when algorithm is initialized) this value is used as the limit value (minimum for heating, maximum for cooling) of the IAT at the start of the maximum Boost. (This value is only used once, to initialize the adaptive Model at start of Learning)	Real Number
Max Startup Time	**Boost Max Period** The maximum time in minutes of the Startup ("Boost") period	Integer (minutes)
Max Shutdown Time	**Falloffdown Max Period** The maximum time in minutes of the Shutdown ("Falloff") period	Integer (minutes)
Dead Time	**Deadtime (DT)** The Optimizer will add this period of time to the Startup ("Boost") time that it has calculated, in order to determine the actual Boost time that it will use. If there is no historical data available (i.e. when algorithm is initialized), this value (in minutes) is used as an estimate of the time between the start of heating or cooling action, and any corresponding change in temperature inputs. (This value is used once to initialize the adaptive Model at start of Learning, and in Fabric Protection)	Integer (minutes)
Max Overlap Time	**Overlap Period** If target temperature is not met by the start of Occupancy, this is the number of minutes for which Boost will continue to operate after the start of Occupancy to try and reach the target.	Integer (minutes)
Initial Linear Model A	**Linear Model A Value (A) / Linear Model B Value (B)**	
Initial Linear Model E	Linear Model parameters used initially by the Optimizer module to estimate Boost start time.	

Outputs

Parameter Name	Description	Possible values
Demand	**Demand** This is the Optimized output - it indicates whether or not the conditioning plant should be active.	Binary
Startup Status	**Boost** This indicates that conditioning plant should be operating at full capacity to achieve target temperature in the optimum time. This bypasses weather compensation etc.	Binary
Day Control Status	**Day Control Status** Indicates whether or not the Optimizer is in "Day Control" mode.	Binary
Shurtdown Status	**Cooldown Status** Indicates whether or not the Optimizer is in Cooldown ("Shutdown") mode. This output remains on for 3 hours, during which the Optimizer continues to monitor the Internal temperature falloff, to ensure the optimal falloff time is used.	Binary
Time Sch. Active	**Time Schedule Status (Occupancy times)** This output is intended to show when there is an ON signal from any of the Optimizer Time Schedule blocks. However, it is not enabled by default, in order to use it you must connect all of the Time Schedule Module outputs to the inputs on Optimizer Block B.	Binary
System Off Status	**System Off Flag** This value is ON when neither the Optimizer nor Occupancy is in force.	Binary
Optimiser Status	**Optimizer Status** This shows when the Optimizer is in Startup mode – i.e. Maximum Boost time plus overlap.	Binary
Error Status	**Error Status** Error indication. This value is ON if the sequence of Time Schedule and Optimizer blocks is not correct. When this value is ON, Optimizer operation is disabled, but Fabric Protection operation will still operate.	Binary
Learning Factor	**Learning Factor** This outputs the current value of the Learning Factor.	Real Number

COOLING OPTIMIZER BLOCK B (COOL-OPB)

Appearance

Group
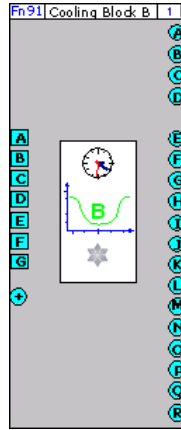
C (Control)

Button

Symbol

Dialog box

Inputs			Constants		Outputs		
Name	Pt No.	Value	Name	Value	Name	Pt No.	Value
Mon Time Sch Sate	0	OFF			Predicted Startup T	0	
Tue Time Sch Sate	0	OFF			Predicted Shutdow	0	
Wed Time Sch Sate	0	OFF			Time Until Occupie	0	
Thu Time Sch Sate	0	OFF			Time Until Unoccup	0	
Fri Time Sch Sate	0	OFF			Mon On Time	0	
Sat Time Sch Sate	0	OFF			Mon Off Time	0	
Sun Time Sch Sate	0	OFF			Tue On Time	0	
DT	0				Tue Off Time	0	
					Wed On Time	0	
					Wed Off Time	0	
					Thu On Time	0	
					Thu Off Time	0	
					Fri On Time	0	
					Fri Off Time	0	
					Sat On Time	0	
					Sat Off Time	0	
					Sun On Time	0	
					Sun Off Time	0	

Function:

The Cooling Optimizer Block B (Cool-OpB) function module is used together with Heating Optimizer Block A, Heating Optimizer Block B, Cooling Optimizer Block A and 7 time schedules to create an Optimizer strategy that regulates heating and cooling processes to optimum efficiency.

See *SECTION 29 : Appendix :: How to add Energy Optimization to a Strategy on page 693* for details.

> **Note**: The Optimizer Modules are available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name	Description	Possible values
Mon Time Sch State **Tue Time Sch State** **Wed Time Sch State** **Thurs Time Sch State** **Fri Time Sch State** **Sat Time Sch State** **Sun Time Sch State**	**Occupancy** A set of 7 on/off times, one for each day of the week, defining the times during which the building is occupied, i.e. the times during which the Building conditions are to be controlled.	Field Controller Schedule output
DT	Dead Time (not used)	(not used)

Outputs

Parameter Name	Description	Possible values
Predicted Startup T	**Predicated Boost Start Time** The value of this point is a "Decimal Time" representation of the time at which Boost will start. (e.g. 9.3 represents 9:30 am). **Note**: this value is only updated when Optimizer Status is ON.	Digital Time (0-24)
Predicted Shutdown	**Predicated Cooldown Start Time** The value of this point is a "Decimal Time" representation of the time at which Cooldown will start. (e.g. 15.15 represents 3:15 pm) **Note**: this value is only updated when Falloff Status is ON.	Digital Time (0-24)
Time Until occupied	**Time until Occupancy Start** This a "Decimal Time" representation of the time remaining until the start of Occupancy (e.g. 1.5 means 1 hour and 50 minutes remaining).	Digital Time (0-24)
Time Until Unoccupied	**Time until Occupancy End** This a "Decimal Time" representation of the time remaining until the end of Occupancy (e.g. 7.35 means 7 hours and 35 minutes remaining).	Digital Time (0-24)
Mon On Time **Mon Off Time** **Tues On Time** **Tues Off Time** **Wed On Time** **Wed Off Time** **Thurs On Time** **Thurs Off Time** **Fri On Time** **Fri Off Time** **Sat On Time** **Sat Off Time** **Sun On Time** **Sun Off Time**	**Time Schedule Content outputs** On Optimizer block B there are a number of outputs that provide useful information about Time Schedule settings. There is one pair for each of the Optimizer Time Schedule modules, showing the on time and off time for each schedule module, in "Decimal Time" (14.25 = 2:25 pm)	Digital Time (0-24)

HEATING OPTIMIZER BLOCK A (HEAT-OPA)

Appearance

<u>Group</u>

C (Control)

<u>Button</u>

Heat-OpA

<u>Symbol</u>

<u>Dialog box</u>

Function:

The Heating Optimizer Block A (Heat-OpA) function module is used together with Heating Optimizer Block B, Cooling Optimizer Block A, Cooling Optimizer Block B and 7 time schedules to create an Optimizer strategy that regulates heating and cooling processes to optimum efficiency.

See *SECTION 29 : Appendix :: How to add Energy Optimization to a Strategy on page 693* for details.

> **Note**: The Optimizer Modules are available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name	Description	Possible values
Startup Target Tem	**Target Start Temperature (TST)** The temperature that must be reached at the start of Occupancy.	Real Number
Shutdown Target T	**Allowable End Temperature (AET)** The temperature that must be maintained until the end of Occupancy.	Real Number
OAT	**Outside Air Temp (OAT)** Current temperature of the ambient air outside the building.	Real Number
IAT	**Inside Air Temperature (IAT)** Current inside air temperature.	Real Number
Flow Temp	**Flow Temp (FT)** Current temperature of the Conditioning medium (Heating or Cooling). While it is recommended that this be used, if the medium Flow Temperature is not available, this input can remain disconnected. (if this is the case, then the 'Sanity Check' condition described on page 701 will be ignored)	Real Number
Enable	**Enable** Input signal to enable or disable Optimizer operation. Does not disable Fabric Protection operation. If not connected then assumed to be enabled	Binary
Min Flow Adapt Tem	Values can be either fixed as Constants within the module or set from external values within control strategy, usually setpoints.	Real Number
Max Flow Adapt Tem		
Min Startup Temp	If these points are not attached, then the values set in the Constants section will be used.	Real Number
Max Startup Time		Integer (minutes)
Max Shutdown Time		Integer (minutes)
Dead Time		Integer (minutes)
Max Overlap Time		Integer (minutes)
Model A Value		

Model B Value		

Constants

Parameter Name	Description	Possible values
Min Flow Adapt Tem	**Flow Min Temp (FTmin) / Flow Max Temp (FTmax)**	Real Number
Max Flow Adapt Tem	**FTmin** and **FTmax** define a range outside which the temperature of the conditioning medium must be before the start of Boost. **FTmin** is the bottom of this range, and **FTmax** is the top of this range. In Heating Optimization, the flow temperature must be below the minimum temperature in the range, (i.e. below the value of **FTmin**) at the start, and must rise past the maximum temperature (**FTmax**) during the boost period. In Cooling Optimization, the flow temperature must be above the temperature range before Boost, (i.e. above the value of **FTmax**) at the start, and must fall below the minimum temperature (**FTmin**) during the boost period. If the flow temperature does not meet these conditions before the start of Boost, the Learning process will not take place in the Optimizer (see page 701).	
Min Startup Temp	**Startup Temp (IATstart)** If there is no historical data available (i.e. when algorithm is initialised) this value is used as the limit value (minimum for heating, maximum for cooling) of the IAT at the start of the maximum Boost. (This value is only used once, to initialise the adaptive Model at start of Learning)	Real Number
Max Startup Time	**Boost Max Period** The maximum time in minutes of the Startup ("Boost") period	Integer (minutes)
Max Shutdown Time	**Cooldown Max Period** The maximum time in minutes of the Shutdown ("Cooldown" or "Falloff") period	Integer (minutes)
Dead Time	**Deadtime (DT)** If there is no historical data available (i.e. when algorithm is initialised), this value (in minutes) is used as an estimate of the time between the start of heating or cooling action, and any corresponding change in temperature inputs. (This value is used once to initialise the adaptive Model at start of Learning, and in Fabric Protection)	Integer (minutes)
Max Overlap Time	**Overlap Period** If target temperature is not met by the start of Occupancy, this is the number of minutes for which Boost will continue to operate after the start of Occupancy to try and reach the target.	Integer (minutes)
Initial Linear Model A	**Linear Model A Value (A) / Linear Model B Value (B)**	

Initial Linear Model E	Linear Model parameters used initially by the Optimizer module to estimate Boost start time.	

<u>Outputs</u>

Parameter Name	Description	Possible values
Demand	**Demand** This output indicates whether or not the conditioning plant should be active.	Binary
Startup Status	**Boost** This indicates that conditioning plant should be operating at full capacity to achieve target temperature in the optimum time. This bypasses weather compensation etc.	Binary
Day Control Status	**Day Control Status** Indicates whether or not the Optimizer is in "Day Control" mode.	Binary
Shurtdown Status	**Falloff Status** Indicates whether or not the Optimizer is in Falloff ("Shutdown") mode. This output remains on for 3 hours, during which the Optimizer continues to monitor the Internal temperature falloff, to ensure the optimal falloff time is used.	Binary
Time Sch. Active	**Time Schedule Status** This output is intended to show when there is an ON signal from any of the Optimizer Time Schedule blocks. However, it is not enabled by default, in order to use it you must connect all of the Time Schedule Module outputs to the inputs on Optimizer Block B.	Binary
System Off Status	**System Off Flag** This value is ON when neither the Optimizer nor Occupancy is in force.	Binary
Optimiser Status	**Optimizer Status** This shows when the Optimizer is in Startup mode – i.e. Maximum Boost time plus overlap.	Binary
Error Status	**Error Status** Error indication. This value is ON if the sequence of Time Schedule and Optimizer blocks is not correct. When this value is ON, Optimizer operation is disabled, but Fabric Protection operation will still operate.	Binary
Learning Factor	**Learning Factor** This outputs the current value of the Learning Factor.	Real Number

HEATING OPTIMIZER BLOCK B (HEAT-OPB)

Appearance

Group

C (Control)

Button

Symbol

Dialog box

Function:

The Heating Optimizer Block B (Heat-OpB) function module is used together with Heating Optimizer Block A, Cooling Optimizer Block A, Cooling Optimizer Block B and 7 time schedules to create an Optimizer strategy that regulates heating and cooling processes to optimum efficiency.

See *SECTION 29 : Appendix :: How to add Energy Optimization to a* Strategy on page 693 for details.

> **Note**: The Optimizer Modules are available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name	Description	Possible values
Mon Time Sch State	**Occupancy** A set of 7 on/off times, one for each day of the week, defining the times during which the building is occupied, i.e. the times during which the Building conditions are to be controlled.	Field Controller Schedule output
Tue Time Sch State		
Wed Time Sch State		
Thurs Time Sch State		
Fri Time Sch State		
Sat Time Sch State		
Sun Time Sch State		
DT	Dead Time (not used)	(not used)
Min Fabric Protection	Overrides for the Fabric Protection constants	Real Number
Max Fabric Protection		Real Number

Constants

Parameter Name	Description	Possible values
Min Fabric Protection	**Fabric Protection Min Temp (FPTmin)**	Real Number
Max Fabric Protection	**Fabric Protection Max Temp (FPTmax)** "Fabric Protection" activates when temperature drops below FPTmin and continues to operate until temperature reaches FPTmax.	Real Number

Outputs

Parameter Name	Description	Possible values
Predicted Startup T	**Predicated Boost Start Time** The value of this point is a "Decimal Time" representation of the time at which Boost will start. (e.g. 9.3 represents 9:30 am). **Note**: this value is only updated when Optimizer Status is ON.	Digital Time (0-24)
Predicted Shutdown	**Predicated Cooldown Start Time** The value of this point is a "Decimal Time" representation of the time at which Cooldown will start. (e.g. 15.15 represents 3:15 pm) Note: this value is only updated when Falloff Status is ON.	Digital Time (0-24)
Time Until occupied	**Time until Occupancy Start** This a "Decimal Time" representation of the time remaining until the start of Occupancy (e.g. 1.5 means 1 hour and 50 minutes remaining).	Digital Time (0-24)
Time Until Unoccupied	**Time until Occupancy End** This a "Decimal Time" representation of the time remaining until the end of Occupancy (e.g. 7.35 means 7 hours and 35 minutes remaining).	Digital Time (0-24)
Mon On Time **Mon Off Time** **Tues On Time** **Tues Off Time** **Wed On Time** **Wed Off Time** **Thurs On Time** **Thurs Off Time** **Fri On Time** **Fri Off Time** **Sat On Time** **Sat Off Time** **Sun On Time** **Sun Off Time**	**Time Schedule Content outputs** On Optimizer block B there are a number of outputs that provide useful information about Time Schedule settings. There is one pair for each of the Optimizer Time Schedule modules, showing the on time and off time for each schedule module, in "Decimal Time" (14.25 = 2:25 pm)	Digital Time (0-24)
Fabric Protection S	**Fabric Protection Status** Indicates whether or not the Optimizer is in "Fabric Protection" mode. (Heating Block B only)	Binary

CBT STAT MODULE

Appearance

Group   Button   Symbol
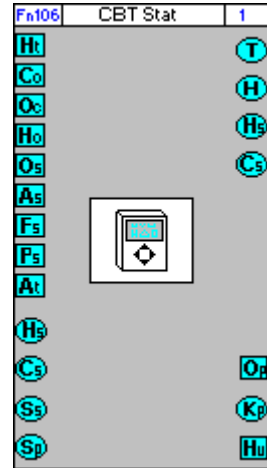
C (Control)

> **Note**: This button is only visible if targeted controller is CBT12iVAV type.

Dialog box

Function:

This module brings allows operation of the CBT-STAT keypad device to be customized.

Parameters

Inputs

Parameter Name	Description	Possible values
Heating Symbol	The status of the "Heating" symbol on the CBT-STAT display.	On or Off
Cooling Symbol	The status of the "Cooling" symbol on the CBT-STAT display.	On or Off
Occupied Symbol	The status of the "Occupied" symbol on the CBT-STAT display.	On or Off
House Symbol	The status of the "House" symbol on the CBT-STAT display.	On or Off
Override Symbol	The status of the "Override" symbol on the CBT-STAT display.	On or Off
Alarm Symbol	The status of the "Alarm" symbol on the CBT-STAT display.	On or Off
Fan Symbol	The status of the "Fan" symbol on the CBT-STAT display.	On or Off
Program Symbol	The status of the "Program" symbol on the CBT-STAT display.	On or Off
Allow Set Temp Mods	If enabled, the user will be able to modify Temperature setpoint from the CBT-STAT.	On or Off
Heating SP	The value that will be used as the Heating setpoint unless overridden by the user on the CBT-STAT.	Any real number
Cooling SP	The value that will be used as the Cooling setpoint unless overridden by the user on the CBT-STAT.	Any real number
Temp SP Step Size	The value by which the setpoint changes for each keypress on the CBT-STAT.	Any real number. Default is 0.1
Temp SP Span	The range within which the user can adjust the setpoint on the CBT-STAT keypad.	Any real number. Default is 2.0 (i.e. setpoint can be adjusted by ± 2.0 degrees)

Constants

Parameter Name	Description	Possible values
Line 1 Display	The value that will be displayed on the first line of the CBT-STAT display.	Current Temperature or Current Set Point
Line 2 Display	The value that will be displayed on the second line of the CBT-STAT display.	Current Humidity or Current Set Point
Units	The units in which temperature values will be displayed on the CBT-STAT.	Farenheit or Celcius
Menu Timeout	The period of inactivity after which the CBT-STAT will exit Engineering mode and return to its default display.	1 - 30
Password	A password to be entered on the CBT-STAT in order to enter Engineering mode.	0 - 9999

Outputs

Parameter Name	Description	Possible values
Stat Temperature	The temperature reading from the CBT-STAT's inbuilt temperature sensor is reflected here.	Any real number
Stat Humidity	The temperature reading from the CBT-STAT's inbuilt humidity sensor (if present) is reflected here.	Any real number
Heating SP	The value of the point connected to Heating SP input is reflected here unless the user is permitted to override it, in which case this output will give the value set on the CBT-STAT.	Any real number
Cooling SP	The value of the point connected to Cooling SP input is reflected here unless the user is permitted to override it, in which case this output will give the value set on the CBT-STAT.	Any real number
Stat Operational	Indicates if the CBT-STAT communications is operational.	On or Off
User Mode Key Press	Indicates that a CBT-STAT button has been pressed and identifies which one.	0 – no button is pressed 1– Up key is pressed 2– Down key is pressed 4– Left key is pressed 8– Right key is pressed 16– Abort key is pressed
Has Humidity Sensor	Indicates if the CBT-STAT has an in-built humidity sensor.	

DEADBAND VARIABLE MODULE

Appearance
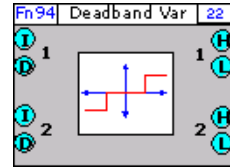
Group	Button	Symbol

Dialog box

Inputs			Constants		Outputs		
Name	Pt No.	Value	Name	Value	Name	Pt No.	Value
Input 1	0		Type 1	002	High 1	0	
Deadband 1	0		Type 2	002	Low 1	0	
Input 2	0		DB 1	2.00	High 2	0	
Deadband 2	0		DB 2	4.00	Low 2	0	

Function:

A "deadband" is a tolerance applied to a setpoint, such that if the measured temperature is outside that band the control algorithms are applied, but if the measured temperature is within the band control is not applied (control is 'dead').

The Deadband Variable module is a dual-channel module, in that it comprises two identical functions – allowing it to provide a deadband for heating and a deadband for cooling in a single module.

The "deadband" tolerance can be applied above the nominal value, straddling the nominal value or below the nominal value.

Each 'channel' of the Deadband module has a nominal value input (I) , a Deadband input (D) (which overrides the internal 'Deadband constant) and a High (H) and Low (L) output
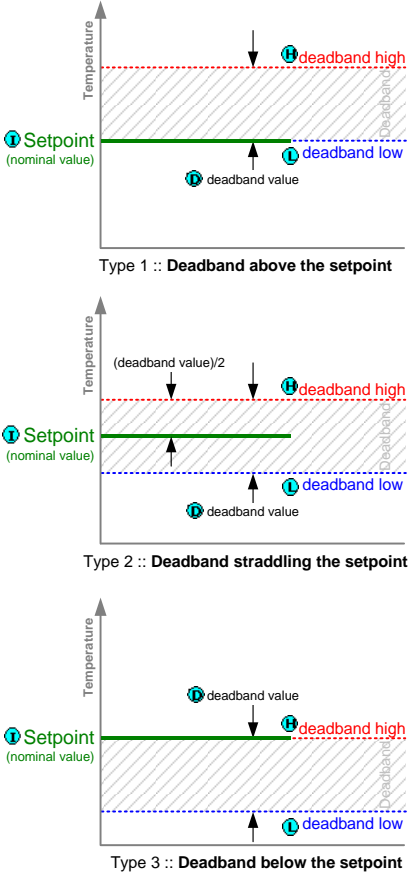
> **Note**: The Deadband Variable Module is available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name	Description	Possible values
Input 1	Value to which deadband will be applied for channel 1	Real Number
Deadband 1	If connected, this value is used as the deadband for channel 1	Real Number
Input 2	Value to which deadband will be applied for channel 2	Real Number
Deadband 2	If connected, this value is used as the deadband for channel 2	Real Number

Constants

Parameter Name	Description	Possible values
Type 1 **Type 2**	The Deadband Type may be **above** , **straddling** or**below** the nominal value). Type 1 :: **Deadband above the setpoint** Type 2 :: **Deadband straddling the setpoint** Type 3 :: **Deadband below the setpoint**	• 1 (above the nominal value), • 2 (straddling the nominal value) • 3 (below the nominal value).
DB 1	If the Deadband 1 input is not connected, then this constant is used as the deadband for channel 1	Real Number
DB 2	If the Deadband 2 input is not connected, then this constant is used as the deadband for channel 2	Real Number

Outputs

Parameter Name	Description	Possible values
High 1	If type = "**above**" (type 1) then this is input 1 plus deadband 1 (H= I + DB) If type = "**straddle**" (type 2) then this is input 1 plus half of deadband 1 (H = 1 + DB/2) If type="**below**" (type 3) then this is the same value as input 1 (H = I)	Real Number
Low 1	If type = "**above**" (type 1) then this is the same value as input 1 (L= I) If type = "**straddle**" (type 2) then this is input 1 less half of deadband 1 (L = 1 - DB/2) If type="**below**" (type 3) then this is input 1 less deadband 1 (L = I - DB)	Real Number
High 2	If type = "**above**" (type 1) then this is input 2 plus deadband 2 (H= I + DB) If type = "**straddle**" (type 2) then this is input 2 plus half of deadband 2 (H = 1 + DB/2) If type="**below**" (type 3) then this is the same value as input 2 (H = I)	Real Number
Low 2	If type = "**above**" (type 1) then this is the same value as input 2 (L= I) If type = "**straddle**" (type 2) then this is input 2 less half of deadband 2 (L = 1 - DB/2) If type="**below**" (type 3) then this is input 2 less deadband 2 (L = I - DB)	Real Number

SECTION 26 : FUNCTION MODULES

RESCALE FROM 0 - 100

Button:

Symbol:
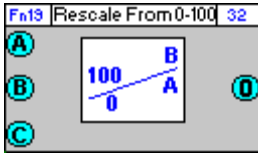
Values not shown   Values shown
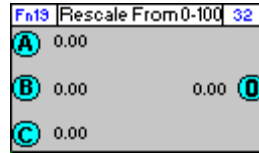
Function of module: The Rescale from 0 to 100 module rescales a value between 0 and 100 according to programmable limits. The module requires three analog inputs and produces one analog output.

Dialog box:

If UC32 is targeted:

Rescale from 0-100(O/P = A+(C*B-A)/100)

Block Number : 1

Inputs			Constants		Outputs		
Name	Point No.	Point Value	Name	Constant	Name	Point No.	Point Value
Input A	0	000000.00			Output	0	000000.00
Input B	0	000000.00					
Input C	0	000000.00					

If UC/UCU is targeted:

Rescale From 0 to 100

Op = Rescale from 0 to 100 dependant on A and B

Block number: 32

	Point	Value
Input Point A:	0	0.00
Input Point B:	0	0.00
Input Point C:	0	0.00
Output Point:	21	0.00
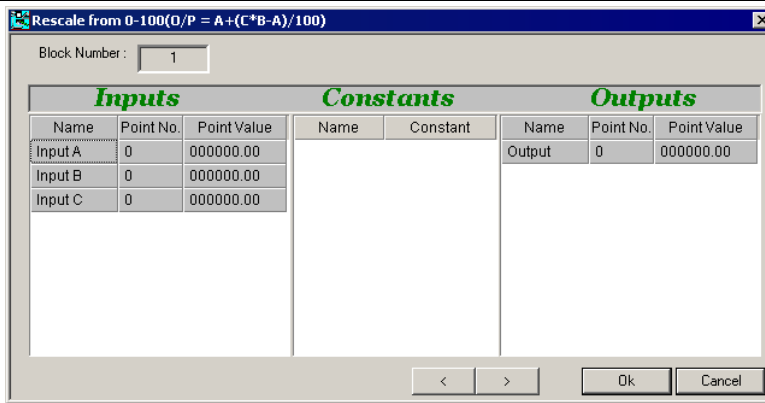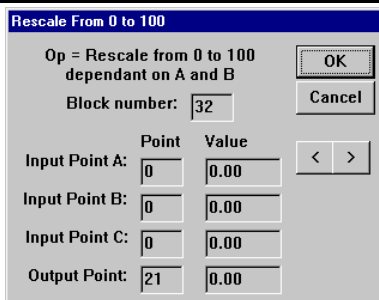
Variables:

Variable name	Description	Possible values
Input Points A, B, C	Numbers of points at which Input Values A, B, C are held.	1 to 255
Input Values A, B, C	Input Value A = lower limit for rescale Input Value B = upper limit for rescale Input Value C = variable to be rescaled	Positive integers up to 100
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by acting on Input Values according the following equation: Output = A+((C*(B-A))/100)	Positive integer up to 100

Implementation of module:

Given lower limit = A, upper limit = B and variable to be rescaled = C: Output = $A+((C*(B-A))/100)$

Application:

Rescaling active inputs, e.g., light sensor or lux sensor. 0 = 0 Lux, 100 = 20 000 Lux.

RESCALE TO 0 - 100

Button:

Symbol:
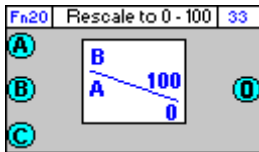
Values not shown   Values shown
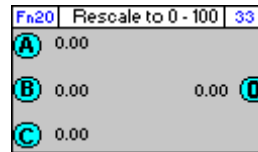
Function of modules: The Rescale to 0 and 100 module expresses in percentage terms an input that is within programmable limits. The module requires three analog inputs and produces a single analog output.
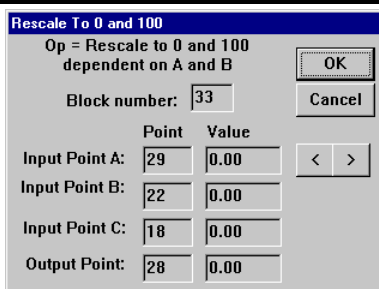
Dialog box:

If UC32 is targeted:

If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Input Points A, B, C	Numbers of points at which Input Values A, B, C are held.	1 to 255
Input Values A, B, C	Input Value A = lower limit of rescale Input Value B = upper limit of rescale Input Value C = Variable to be rescaled	Positive integers up to 100
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced from inputs according to the equation: Output = 100*(C-A)(B-A).	Positive integer up to 100

Implementation of module: Given lower limit = A, upper limit = B and variable to be rescaled = C:

$$\text{Output} = 100*((C-A)/(B-A))$$

LIMIT AT MINIMUM AND MAXIMUM
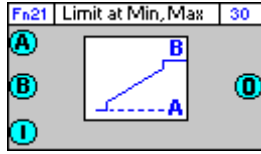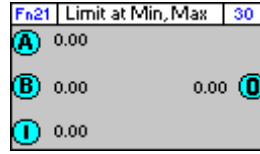
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Limit at Min and Max module limits an analog input between programmable maximum and minimum values. The module accepts three analog inputs and produces one analog output.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
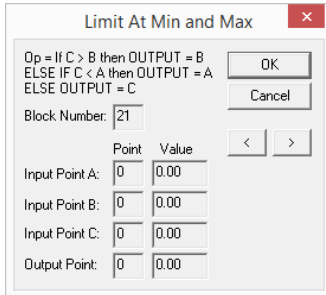
Variables:

Variable name	Description	Possible values
Input Points A, B, C	Numbers of points at which Input Values A, B, C are held.	1 to 255
Input Values A, B, C	Input Value A = Minimum allowable output Input Value B = Maximum allowable output Input Value C = Variable to be limited between max and min values.	Real numbers
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by comparing Input C with inputs A and B.	Real number

Implementation of module:

Given Input A = Min Value, Input B = Max Value and Input C = variable to be limited:
Output = A, if C < A
Output = B, if C > B
Output = C, if A ≤ C ≤ B

Application:

AHU dampers for minimum fresh air, e.g., 20%.

ANALOG GATE
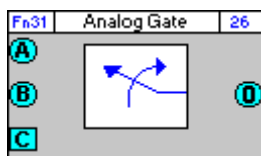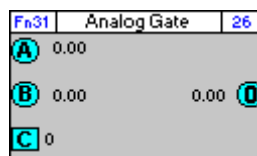
Button:	A/Gate
Symbol:	Fn31 Analog Gate 26 — Values not shown / Fn31 Analog Gate 26 — Values shown
Function of module:	The Analog Gate module allows the selection of one of two analog inputs, based on the state of the digital input. The selected analog value is returned as the output.
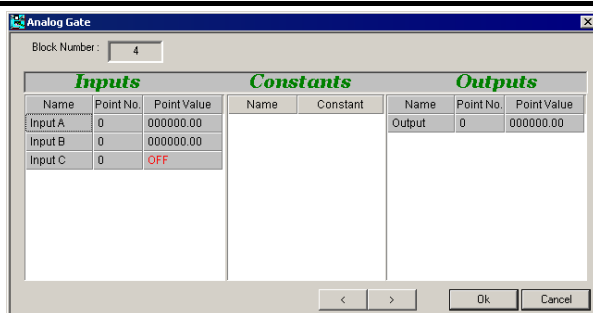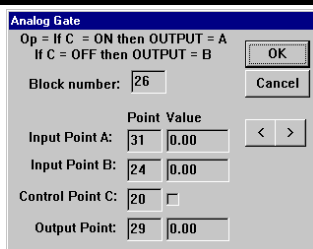
Dialog box:

If UC32 is targeted:	(Analog Gate dialog — Block Number: 4. Inputs: Input A 0 000000.00, Input B 0 000000.00, Input C 0 OFF. Constants. Outputs: Output 0 000000.00)
If UC/UCU is targeted:	(Analog Gate dialog — Op = If C = ON then OUTPUT = A, If C = OFF then OUTPUT = B. Block number: 26. Input Point A: 31 0.00. Input Point B: 24 0.00. Control Point C: 20. Output Point: 29 0.00)

Variables:

Variable name	Description	Possible values
Input Points A, B, C	Numbers of points at which Input Values A, B, C are held.	1 to 255
Input Values A, B	One of these two analog values will be returned as the Output Value, depending on the value of Input Value C.	Real numbers
Input Value C	Value that determines which of Input Values A and B is returned as the Output Value.	Set or unset
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value of Input Value A or Input Value B, depending on the value of Input Value C.	Real number

Implementation of module:

Given two analog inputs A, B and a digital input C:
Output = A, if C = set
Output = B, if C = unset

Application:

To force an output because of an event , e.g., to open an AHU heating valve to 100% if frost is ON.

COMPARATOR

Button:

Symbol:
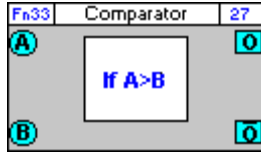
Values not shown   Values shown
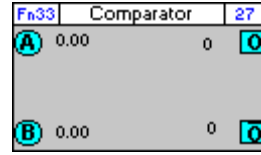
Function of module: The Comparator module accepts two analog inputs and compares them. If Input A is greater than Input B, the True Output Value is set. Otherwise it is unset.

Dialog box:

If UC32 is targeted:
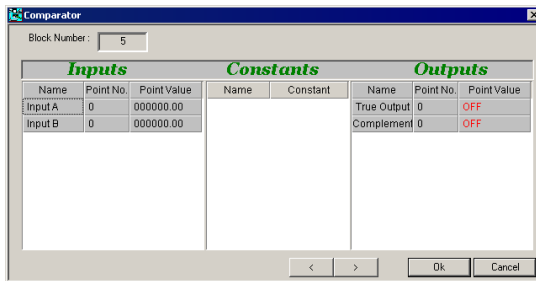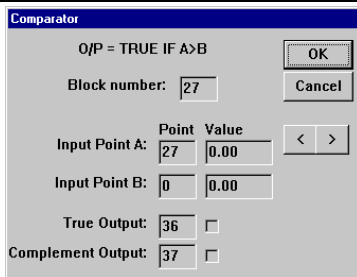
If UC/UCU is targeted:

Variables:

Variable name	Description	Possible values
Input Points A, B,	Numbers of points at which Input Values A, B, are held.	1 to 255
Input Values A, B	Analog values which will be compared to produce Output Value.	Real numbers
True Output Point	Number of point at which True Output Value is held.	9 to2 55
True Output Value	Value produced by comparison between Input Values A and B according to the equation Output = True if A > B.	Set or unset
Complement Output Point	Number of point at which complement of True Output Value is held.	9 to 255
Complement Output Value	Complement of True Output Value.	Set or unset

Implementation of module: Given Input Values A, B
Output = set, if A > B; Output = unset if A ≤ B

WINDOW COMPARATOR
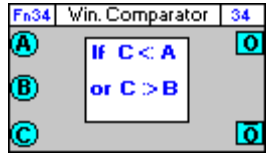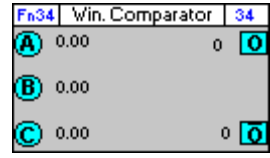
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Window Comparator module compares one analog input with two others, and sets the True Output Value if the compared value is less than the lower value or greater than the higher value. If the compared value falls between the other two values, or equals either of them, the True Output Value is unset. The module accepts three analog inputs and produces two digital outputs which are complements of each other.

Dialog box:
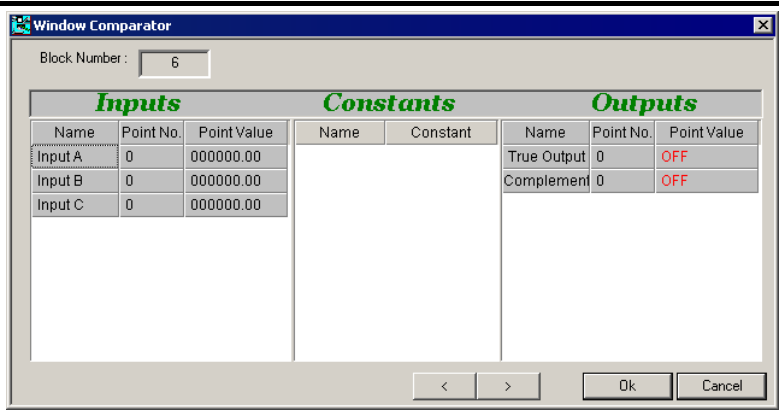
If UC32 is targeted:	
If UC/UCU is targeted:	
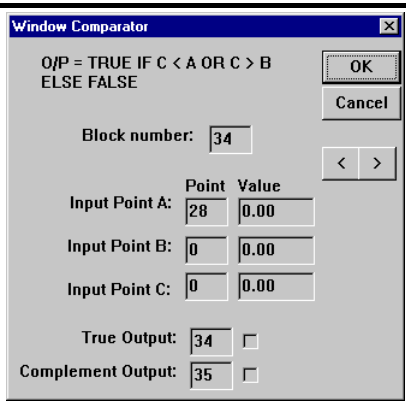
Variables:

Variable name	Description	Possible values
Input Points A, B, C	Numbers of points at which Input Values A, B, C are held.	1 to 255
Input Value A	If Input Value C is less than this value, the True Input Value will be set.	Real number
Input Value B	If Input Value C is greater than this value, the True Input Value will be set.	Real number
Input Value C	This value is compared to Input Values A and B to produce the True Output Value.	Real number
True Output Point	Number of point at which True Output Value is held.	9 to 255
True Output Value	Value determined by relation between Input Value C and Input Values A and B.	Set or unset
Complement Output Point	Number of point at which complement of True Output Value is held.	9 to 255
Complement Output Value	Complement of True Output Value.	Set or unset

Implementation of module:

Given analog inputs A, B, C:

Output = set, if C < A OR C> B

Output = unset if A ≤ C ≤ B

Application:

To monitor the level of liquid in a tank. The module will cause an alarm if the level is not within the higher and lower limits.

LIMIT TO 0 OR 100
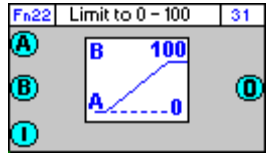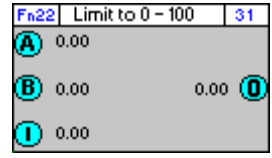
Button:	
Symbol:	Values not shown Values shown
Function of module:	The Limit to 0 or 100 module compares an analog input to two programmable limits. If it falls below the minimum limit, a value of 0 is returned as output. If it is above the maximum limit, a value of 100 is returned. If the input falls between the two limits, the input value is returned as the output.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Input Points A, B, C	Numbers of points at which Input Values A, B, C are held.	1 to 255
Input Values A, B, C	Input Value A = lower limit Input Value B = upper limit Input Value C = variable to be compared.	Real numbers less than 100
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by the relation between Input Value C and Input Values A and B.	Real number less than 100

Implementation of module:

Given Input Value A = lower limit, Input Value B = upper limit
and Input Value C = variable to be compared:

Output = 0, if C < A

Output = 100, if C > B

Output = C, if A ≤ C ≤ B

Application:

To limit signal output.

RESCALE CUSTOM MODULE

Appearance

Group

F (Function)

Button

Symbol
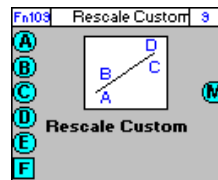
Dialog box

Block Number: 6

Inputs				Constants			Outputs		
Name	Pt No.	Value		Name	Value		Name	Pt No.	Value
Input A	0						Output	0	
Input B	0								
Input C	0								
Input D	0								
Input E	0								
Enable	0	OFF							

Note on Firmware

Module only available from version 6.2.1 (Unitron)

< > OK Cancel

Function:

This module takes a value that varies between two limits, and generates a new value that varies in the same proportion between two different limits.

Input Value **E** is scaled from range [**A** -> **B**] to range [**C** -> **D**] and the result is outputted on **M**

$$M = \left((E - A) * \frac{(D - C)}{(B - A)} \right) + C$$

If limiting enabled (**F** == 1) then

```
If ( M < C ) then M becomes set to C
If ( M > D ) then M becomes set to D
```

Note: The Rescale Custom Module is available only with Unitron Firmware version 6.2.1 or later, or CBM/CBT Firmware version 7.6.8 or later.

Parameters

Inputs

Parameter Name		Description	Possible values
FROM Lower	(A)	Lower limit of rescale FROM.	Real number
FROM Upper	(B)	Upper limit of rescale FROM.	Real number
TO lower	(C)	Lower limit of rescale TO.	Real number
TO Upper	(D)	Upper limit of rescale TO.	Real number
Input Value	(E)	Value that is going to rescaled from its original range to a new range.	Positive integer
Limit Enable	F	If limiting is enabled then the output will be limited between the lower rescale TO limit and the upper rescale TO limit. If disabled the output can be outside limits but will follow the slope of the limits.	Boolean On or Off

Outputs

Parameter Name	Description	Possible values
Output (M)	The scaled Value.	Real number

SECTION 27 : STATISTICAL MODULES

DATALOG

Button:

Symbol:
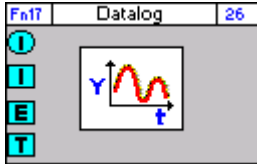
Function of module:

The Datalog module logs the values of a given analog or digital point over a period of time. For example, a datalog on an output point could monitor valve positions, or a datalog on an input could log Room Temperature. The number of datalogs that can be used and the number of samples each datalog can store is dependent on the type of controller for which the strategy is being created. Consult the controller datasheet for further information.

Dialog box:

If UC32 is targeted:
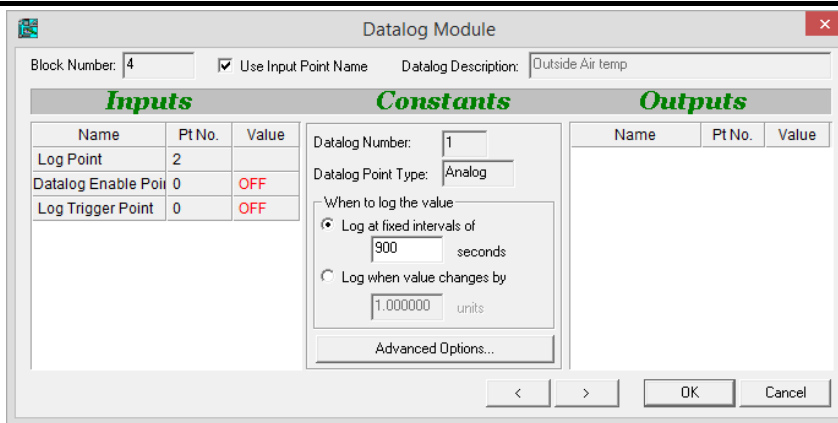
If UC/UCU is targeted:
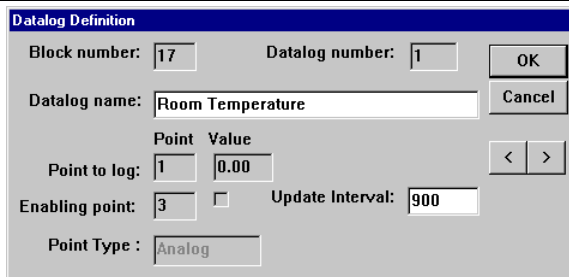
Variables:

Variable name	Description	Possible values
Datalog Description (UC32) Datalog Name (UC/UCU)	A name assigned by the user to identify the datalog within the Cylon system.	Any string
Log Point (UC32) Point to Log (UC/UCU)	The point number and value of the point being logged is displayed in this field, if the logged point is analog.	Real number
Datalog Enable (UC32) Enabling Point (UC/UCU)	The point number and current values of the enabling point for this module are displayed here. Whenever the value of this point is "1", the "**Log Point**" will be logged.	1 or 0
Log Trigger point	In Time stamped datalogs, it is possible to record data when this trigger point changes. If the trigger point is not connected, logging occurs according to the 'minimum change' parameter below.	1 or 0
Digital Log Point	The point number and value of the point being logged is displayed in this field, if the logged point is digital.	1 or 0

Constants

The "constants" column in the Datalog module dialog various options rather than ordinary constants. In this section it is possible to read or set the following values, and options:

Variable name	Description	Possible values
Datalog Number	This field displays the number used by the Unitron Command Centre Datalog Manager to access the data collected by this module.	Depends on controller type
Datalog Point Type (UC32) Point Type (UC/UCU)	This field displays the type of point that this module is logging.	Analog or Digital
Log at fixed intervals of (UC32) Update Interval (UC/UCU)	The length of time (in seconds) between logged values, if the datalog is a regularly sampled ('normal') type.	Integer
Datalog Types - Type	Selects the type of sampling method used by the module, with values logged either at regular intervals ('normal') or when specified conditions arise ('Time Stamped').	"Normal" or "Time Stamped".
Log when the value changes by	If the datalog type is set to 'Time Stamped' (see Advanced Options), and if the type of point being logged is analog, it is possible to trigger a sample whenever the point value changes by more than a particular amount. This field specifies that amount of change.	Real Number

Advanced Options:

If the 'Advanced Options' button is pressed, the following parameters become available:

Variable name	Description	Possible values
Datalog Length	This field displays the length of the datalog based on current datalog type and storage format settings.	512, 585, 582, 819, or 1024.
Link Datalog	This links datalogs for use in cascading datalogs (not yet implemented)	none
Storage Format	(this feature is not yet implemented)	none
Advanced Format Ids	(this feature is not yet implemented) If this box is ticked, then the drop-down list of storage formats will contain extra sub-divisions of the main formats, giving extra flexibility.	Checked or cleared
Number of decimal places for keypad display	This parameter is passed to a keypad program if one is created that displays this datalog. The value of this parameter sets the number of decimal places that will be shown on the keypad screen for each value in the datalog.	Any integer
Log Trigger options	Time stamped datalogs can be set to record the value of a point when the value of a separate '**Trigger Point**' changes. This parameter defines whether this change is from 0 to 1 (rising edge), from 1 to 0 (falling edge) or any change (any edge). The any edge option is the default setting for this parameter.	Any Edge, Rising Edge, or Falling Edge

Implementation of module:

If the Enabling Point Value is set, the datalog module is active. The module samples the Point to Log Value at intervals as specified by the Update Interval for a normal datalog, or according to the criteria specified for a time stamped datalog. The number of samples which can be stored in a datalog is either 102 or 192, or up to 1024, depending on the controller type. Details can be found on the controller's datasheet. When all possible samples have been taken, the data can be processed by the Datalog application and displayed graphically or in tabular form.

Application:

To monitor a plant item over a period of time.

ALARM RECORD
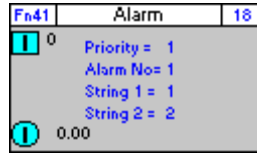
Button:	
Symbol:	
	Values not shown Values shown
Function of module:	The Alarm Record module monitors the state of a digital point and generates an alarm if the point becomes set. The Alarm application handles such alarms and may be programmed to display or print alarm messages for certain levels of alarm.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	

Variables:

Variable name	Description	Possible values
Alarm Description (UC32) Text (UC/UCU)	A name assigned by the user to identify the alarm record within the Cylon system. This string is used when an alarm is displayed on the keypad.	Any string
Input Point	This is a digital point, that when its value is "1", the current alarm record becomes active.	1 or 0
Alarm Point	This is an analog point, associated with the alarm condition triggering the current alarm record. The value of this point will be reported to Unitron Command Centre when the alarm record becomes active.	Any integer
Output	This feature is not yet implemented	

Constants: The "constants" column in the Alarm Record module dialog holds various options rather than ordinary constants. In this section it is possible to read or set the following values, and options:

Variable name	Description	Possible values
Alarm Number	This field displays the number used by the Cylon system to access statistics for this module.	Any integer
Alarm Priority (UC32) Priority (UC/UCU)	A 'priority' number may be assigned to the alarm here, which can be used by the Cylon system to identify the appropriate reaction to an occurrence of this alarm.	An integer between 1 and 255.
Start String (UC32) Start Alarm (UC/UCU)	This field shows the text of the alarm string that is to be displayed in Unitron Command Centre when the alarm record governed by this module becomes active.	Any of the Comms Controller strings that are currently set up in the Cylon database.
Start String : insert button	Pressing this button opens the Comms Controller Alarm String dialog, so that a 'Start String' can be set for the current Alarm Record module.	N\A
Start String : delete button	Pressing this button clears the "Start String" display box.	N\A
Stop String (UC32) End Alarm (UC/UCU)	This field shows the text of the alarm string that is to be displayed in Unitron Command Centre when the alarm record governed by this module becomes inactive.	Any of the Comms Controller strings that are currently set up in the Cylon database.
Stop String : Insert button	Pressing this button opens the Comms Controller Alarm String dialog, so that a 'Start String' can be set for the current Alarm Record module.	N\A
Stop String : Delete button	Pressing this button clears the "Start String" display box.	N\A

Implementation of module: When the Alarm Records module is serviced, the state of the Input Point is examined. If it is set, the specified alarm are generated and passed to the Alarm Handler and the statistics associated with this module are updated.

Application: To alert the engineer of any plant item that is malfunctioning, e.g., a pump trip, boiler lockout, etc.

CONTROL FLAGS
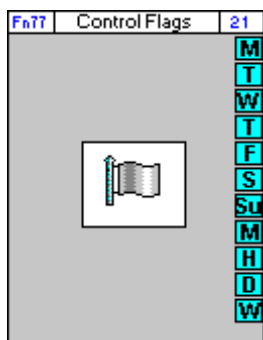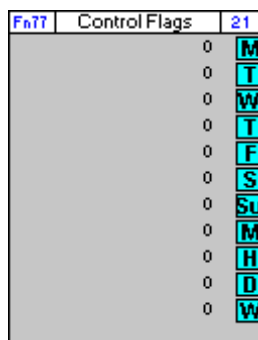
Button:		
Symbol:		
	Values not shown	Values shown
Function of module:	The Control Flag module produces 11 digital output signals which depend on the UC16's real-time clock settings.	

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
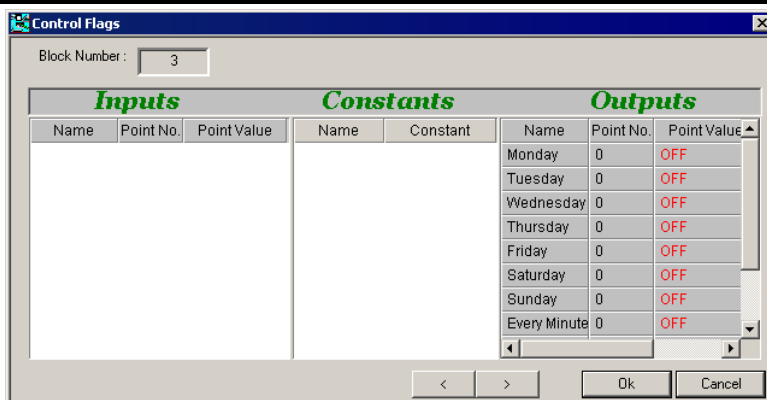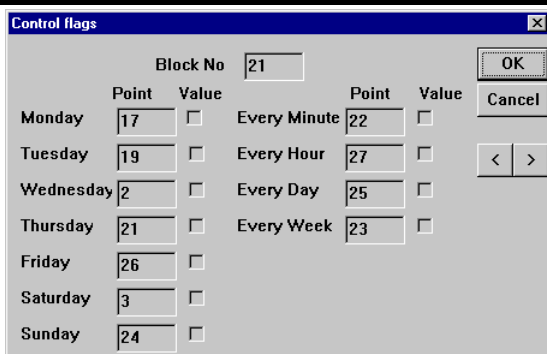
Variables:

Variable name	Description	Possible values
Monday to Sunday (Points)	Numbers of points at which Monday to Sunday Values are held.	17 to 255
Monday to Sunday (Values)	One of these digital point values is set when the UC16's real time clock indicates that the current day of the week corresponds with that point. For example, the Monday variable will be set from 00:00:00hrs until 23:59:59hrs on Monday.	Set or unset
Every Minute Point	Number of point at which Every Minute Value is held.	17 to 255
Every Minute Value	This digital point value will change state each time the minute count on the UC16's real-time clock is incremented.	Set or unset
Every Hour Point	Number of point at which Every Hour Value is held.	17 to 255
Every Hour Value	This digital point value will change state each time the hour count on the UC16's real-time clock is incremented.	Set or unset
Every Day Point	Number of point at which Every Day Value is held.	17 to 255
Every Day Value	This digital point value will change state each time the UC16's real-time clock changes from 23:59:59 to 00:00:00.	Set or unset
Every Week Point	Number of point at which Every Week Value is held.	17 to 255
Every Week Value	This digital point value will change state each time the UC16's real time clock changes from 23:59:59 on a Sunday to 00:00:00 on a Monday.	Set or unset

Implementation of module: When this module is serviced, the variables change state according to the changes in value of the UC16's real-time clock.

Application: This module can be used for Duty/Standby selection of plant items.

Statistical Modules

RUN TIME

Appearance

Group	Button	Symbol

S (Statistical)

Run Time

Fn73 | Run Time | 26

Dialog box

- If UC32/BACnet-type Controller is targeted:
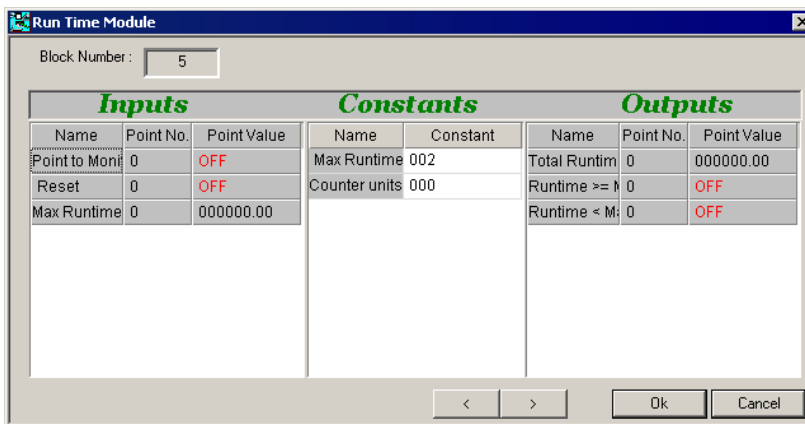
- If Legacy UC type Controller is targeted:
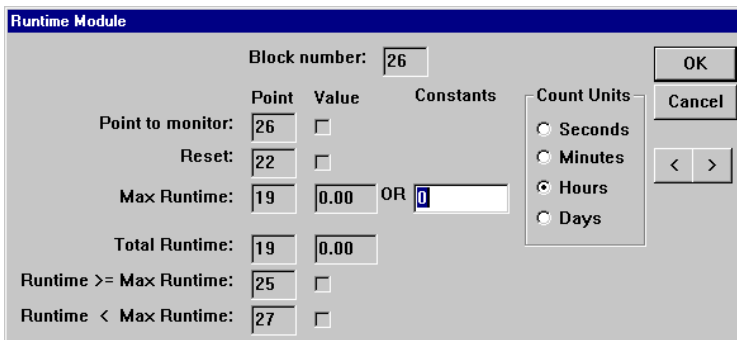
Function

The Run Time module records the total length of time for which a plant item has been in operation. It also determines whether or not the plant item has been in use for a greater length of time than the pre-specified Max Runtime . It can be used to indicate when a plant item needs to be serviced.

If **I**   Point to Monitor this is set, **T**   Total Runtime Value is incremented each time a time unit (defined by the Count Units constant) elapses. If **T**   Total Runtime Value exceeds **M**   Max Runtime Value , the **H**   Runtime>= Max Runtime is set and **L**   Runtime < Max Runtime is unset. Otherwise, the reverse is the case.

Parameters

Inputs

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
I **Point to Monitor**	Indicates whether plant item is in use or not.	Set or unset
R **Reset**	If this is set, **T** Total Run Time value is reset to 0.	Set or unset
M **Max Runtime**	This value overrides the Max Runtime constant, and represents the maximum length of time for which plant item should be run.	Positive real number

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
I **Point to Monitor**	Number of point at which Point to Monitor value is held.	1 to 255
Point to Monitor Value	Indicates whether plant item is in use or not.	Set or unset
R **Reset Point**	Number of point at which Reset value is held.	1 to 255
Reset Value	If this is set, the Total Run Time value is reset to 0.	Set or unset
M **Max Runtime Point**	Number of point at which Max Runtime value is held.	17 to 255
Max Runtime Value	This value overrides the Max Runtime constant, and represents the maximum length of time for which plant item should be run.	Positive real number

Constants

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
Max Runtime	Maximum length of time for which plant item should be run, if **M** Max Runtime input is not connected.	Positive real number
Count Units	Choice of units for **T** Total Runtime count.	0: seconds 1: minutes 2: hours 3: days 4: 100 milliseconds

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
Max Runtime - Constant	Maximum length of time for which plant item should be run, if **M** Max Runtime input is not connected.	Positive real number
Count Units	Choice of units for **T** Total Runtime count.	Seconds / minutes / hours / days

<u>Outputs</u>

- If UC32/BACnet-type Controller is targeted:

Parameter Name	Description	Possible values
(T) **Total Runtime**	Number of Count Units periods of time during which [I] Point to Monitor value has been set.	Positive real number
[H] **Runtime > = Max Runtime**	This is set if (T) Total Run Time value is greater than or equal to (M) Max Runtime value, otherwise unset.	Set or unset
[L] **Runtime < Max Runtime**	This is set if (T) Total Run Time value is less than (M) Max Runtime value, otherwise unset.	Set or unset

- If Legacy UC type Controller is targeted:

Parameter Name	Description	Possible values
(T) **Total Runtime Point**	Number of point at which Total Runtime value is held.	17 to 255
Total Runtime Value	Number of Count Units periods of time during which [I] Point to Monitor value has been set.	Positive real number
[H] **Runtime > = Max Runtime Point**	Number of point at which Runtime > = Max Runtime value is held.	17 to 255
Runtime > = Max Runtime Value	This is set if (T) Total Run Time value is greater than or equal to (M) Max Runtime value, otherwise unset.	Set or unset
[L] **Runtime < Max Runtime Point**	Number of point at which Runtime < Max Runtime value is held.	17 to 255
Runtime < Max Runtime Value	This is set if (T) Total Run Time value is less than (M) Max Runtime value, otherwise unset.	Set or unset

SYSTEM FLAGS
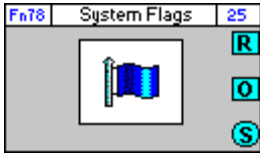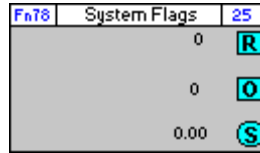
Button:	
Symbol:	Values not shown Values shown
Function of module:	The System Flags module gives information about how long the UC16 is taking to fully service the control strategy and also indicates the status of the UC16 within the system.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
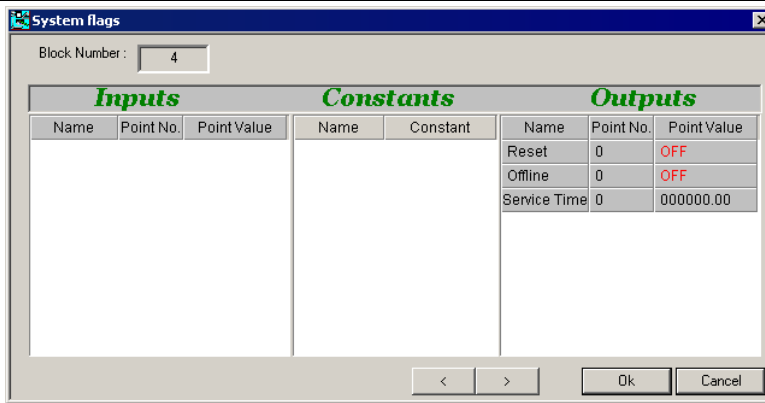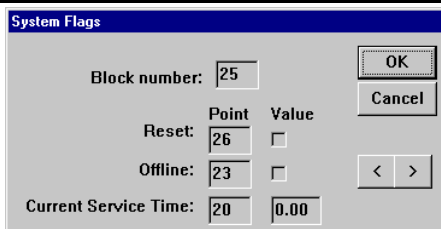
Variables:

Variable name	Description	Possible values
Reset Point	Number of point at which Reset value is held.	17 to 255
Reset Value	This value is set when the UC16 is reset. Remains set for one service period.	Set or unset
Offline Point	Number of point at which offline value is held.	17 to 255
Offline Value	This value is set if the UC16 has not received any communication from the Comms Controller in the previous 60 seconds.	Set or unset
Current Service Time Point	Number of point at which Current Service Time value is held.	17 to 255
Current Service Time Value	Time taken (in seconds) for the UC16 to fully complete one service of the control strategy.	Positive integer

Implementation of module:

When the module is serviced, the variables are reset according to the state of the UC16.

SECONDS RUN

Button:

Symbol:

Values not shown	Values shown

Function of module: The Seconds Run module counts the number of seconds up to four digital values have been set.

Dialog box:

If UC32 is targeted:
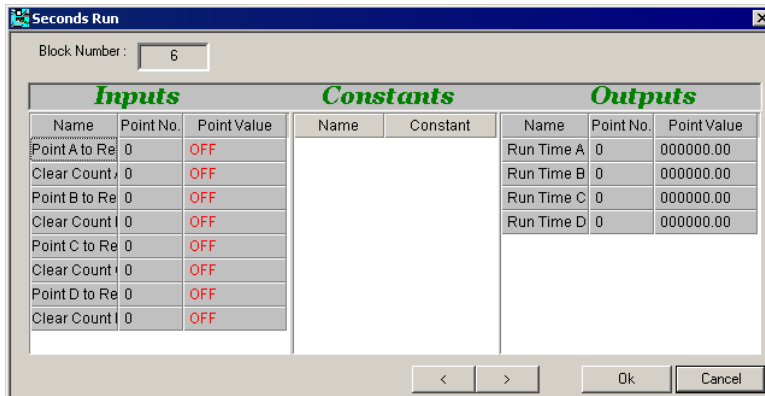
If UC/UCU is targeted:
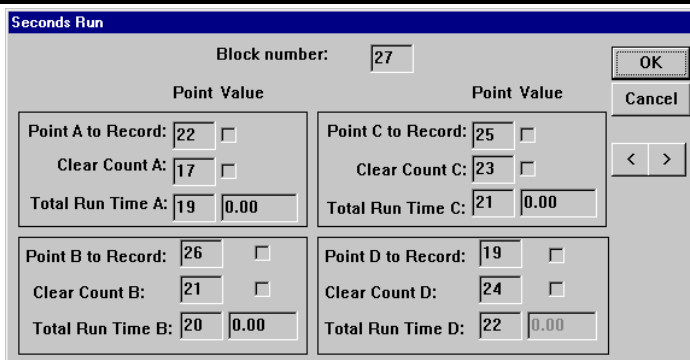
Variables:

Variable name	Description	Possible values
Points to Record A, B, C, D	Numbers of points at which digital values A, B, C, D are stored. Any point number set to zero is ignored.	1 to 255
Points to Record (Values) A, B, C, D	Values of digital points A, B, C, D which the module will time when set.	Set or unset
Clear Count Points A, B, C, D	Numbers of points at which Clear Count Values A, B, C, D are held.	1 to 255
Clear Count Values A, B, C, D,	When this value is set, the Total Run Time Value is set to 0.	Set or unset
Total Run Time Points A, B, C, D	Number of point at which Total Run Time Value is held.	9 to 255
Total Run Time Values A, B, C, D	Value of count in seconds of length of time Point to Record Value has been set.	Positive integer

Implementation of module:

Given Point X to Record:

If Clear Count X Value is unset and Point X to Record Value is set,

Total Run Time X = time in seconds that Point X Value is set

COUNTER

Button:

Symbol:
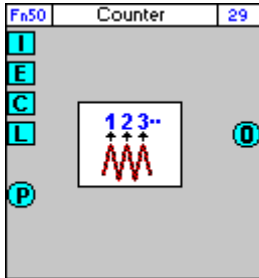
Values not shown   Values shown
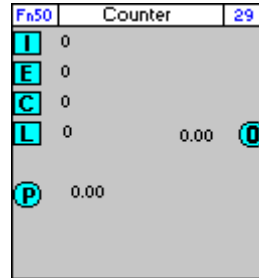
Function of module: The Counter module counts the number of times a specified digital value changes state.

Dialog box:

If UC32 is targeted:
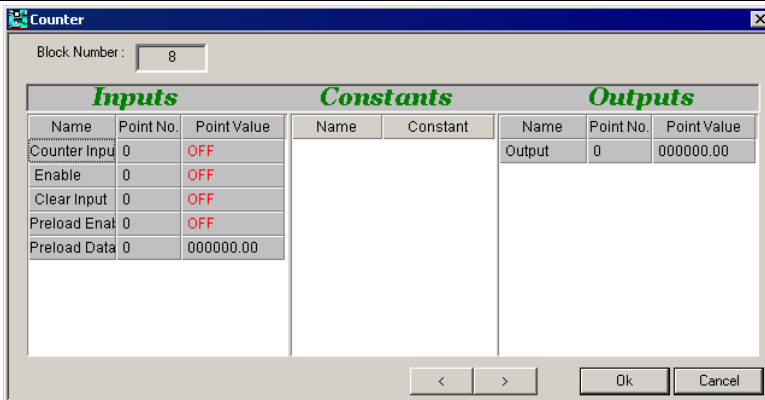
If UC/UCU is targeted:
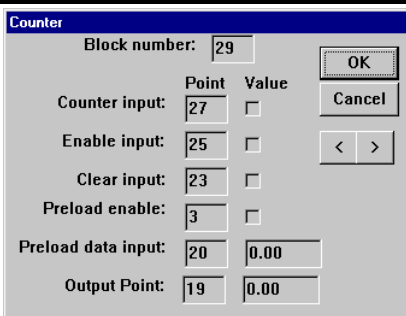
Variables:

Variable name	Description	Possible values
Counter Input Point	Number of point at which Counter Input Value is held.	1 to 255
Counter Input Value	The number of changes of state of this value will be counted by the module.	Set or unset
Enable Input Point	Number of point at which Enable Input Value is held. May be omitted.	1 to 255
Enable Input Value	If Enable Input Point is specified, this value must be set for the Output Value to be incremented.	Set or unset
Clear Input Point	Number of point at which Clear Input Value is held. May be omitted.	1 to 255
Clear Input Value	If Clear Input Point is specified, the Output Value will be set to 0 each time the Clear Input Value moves from unset to set.	Set or unset
Preload Enable Point	Number of point at which Preload Enable Value is held.	1 to 255
Preload Enable Value	This works with the Preload Data Input Value to allow the Output Value to be preloaded with a programmable analog figure.	Set or unset
Preload Data Input Point	Number of point at which Preload Data Input Value is held.	1 to 255
Preload Data Input Value	This works with the Preload Enable Value to allow the Output Value to be preloaded with a programmable analog figure.	Real number
Output Point	Number of point at which Output Value is held.	9 to 255
Output Value	Value produced by action of module on inputs.	Integer

Implementation of module:

When this module is serviced, if the Preload Enable Value is set and the Enable Input Point Value is set, the Preload Data Input Value will be written as the Output Value. When the Preload Enable Value becomes unset, the Output Value will be incremented each time the Counter Input Value changes from unset to set. If the Clear Input Value goes from unset to set at any time, the Output Value is immediately set to 0.

Application:

For metering energy and water flow.

NUMBER OF ACTIVE DIGITAL INPUTS

Button:

Symbol:
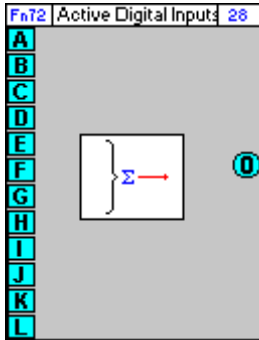
Values not shown   Values shown

Function of module: The Number of Active Digital Inputs module accepts up to 12 digital inputs. It counts the number of inputs which are set, and returns this analog value as its output.

Dialog box:
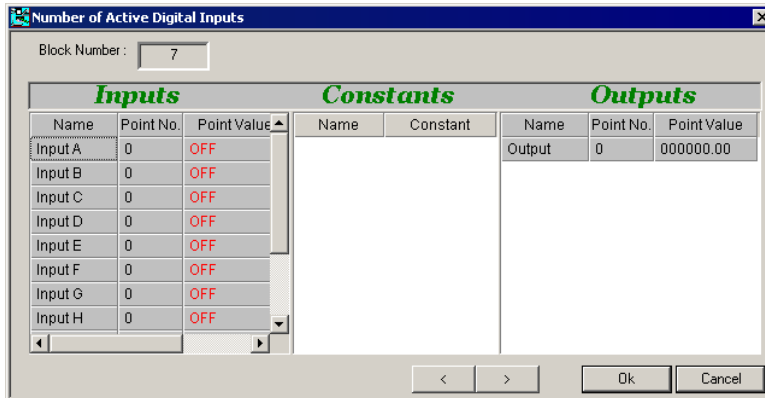
If UC32 is targeted:

If UC/UCU is targeted:
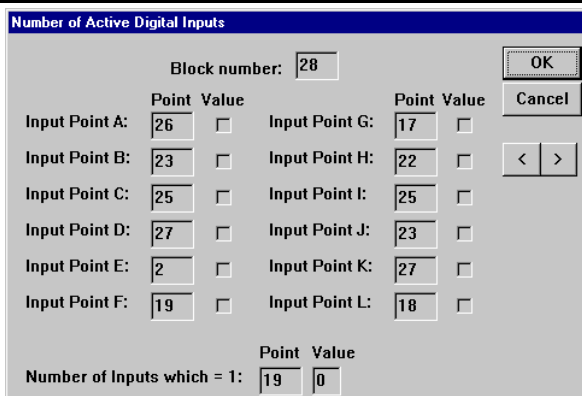
Variables:

Variable name	Description	Possible values

Input Points A to L	Numbers of points at which Input Values A to L are held.	1 to 255
Input Values A to L	Digital values. The module counts the number of these values which are set and returns the value as its output.	Set or unset
Number of Inputs which = 1 (Point)	Number of point at which Number of Inputs which = 1 Value is held.	9 to 255
Number of Inputs which = 1 (Value)	Number of inputs which = 1.	0 to 12 (Integer)

Implementation of module:

Given inputs A to L:

Output = No of inputs which are set

Application:

To calculate the number of areas in the site that require heating.

COMMENT BLOCK

Button:	
Symbol:	 Values not shown Values shown
Function of module:	The Comment module can contain up to 14 alphanumeric characters, which are usually descriptions of hardware points or modules. The comment module is referenced in the described module's dialog box.

Dialog box:

If UC32 is targeted:	
If UC/UCU is targeted:	
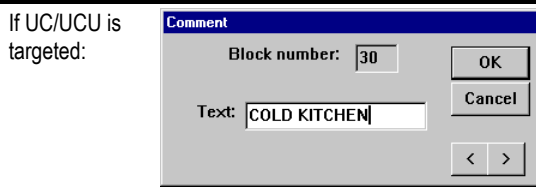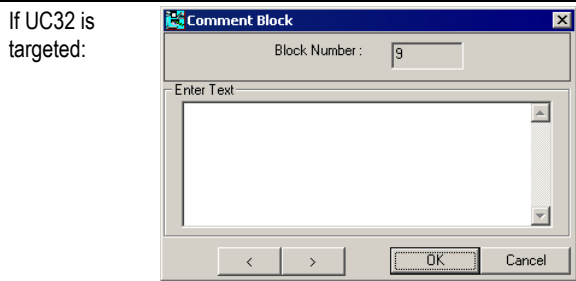
Variable:	*Variable name*	*Description*	*Possible values*
	Text	String	Up to 14 alphanumeric characters.

HOA POT VALUE

> **Note:** This module is a service module for use ONLY with UC16s which have been fitted with a HOA board.

Button:

Symbol:

Values not shown

Values shown
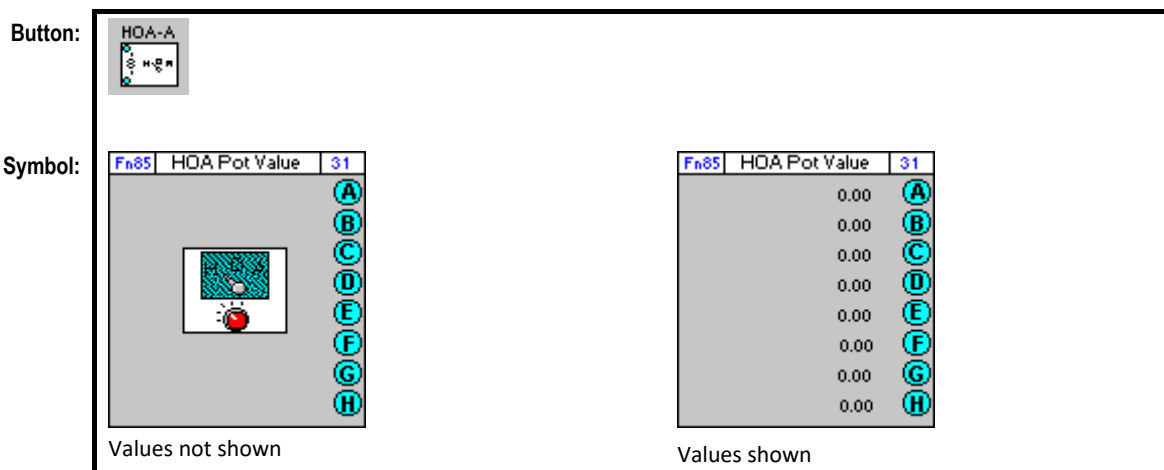
Function of module:

The HOA Pot Value module allows the user to view the eight pot values on the HOA board. These pot values represent the hardware outputs 9 to 16 if the HOA switches are set to Hand or Off. The hardware output values are not represented if the HOA switches are set to Auto.

Dialog box:

If UC32 is targeted:	Not applicable
If UC/UCU is targeted:	
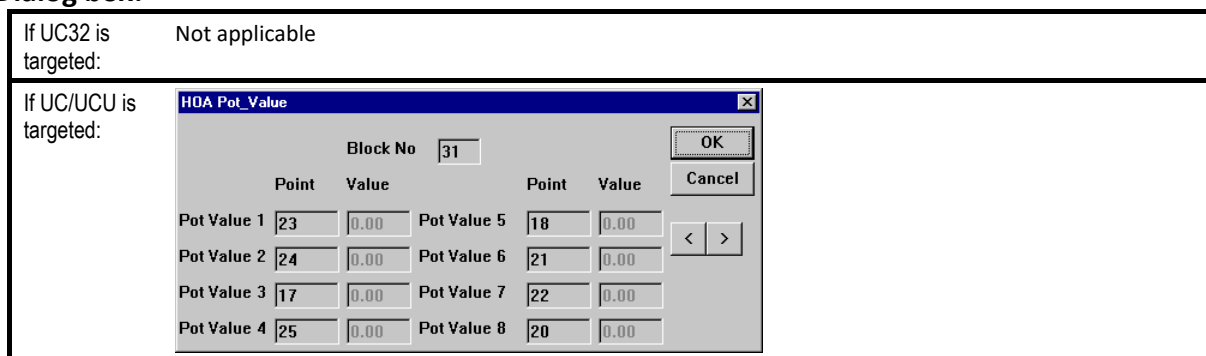
Variables:

Variable name	Description	Possible values
Pot Values Points 1 to 8	Numbers of points at which Pot Values 1 to 8 are held	17 to 255
Pot Values 1 to 8	= 0 if HOA switch is set to Off = 0 if HOA switch is set to Auto = value of corresponding hardware point if HOA switch is set to Hand	0 to 100

Implementation of module:

When the HOA Pot Value module is viewed, it is possible to tell if the HOA switches are set to Hand or not. If they are set to Hand, the Pot Values 1 to 8 will be the same as the values of the hardware output points 9 to 16. If they are set to Off or Auto, the Pot Values 1 to 8 will be set to zero. To find out whether the HOA switches are set to Off or Auto, this module must be used in conjunction with the HOA switch state module.

Application:

For commissioning and servicing plant items.

HOA SWITCH STATE

Note:	This module is a service module for use ONLY with UC16s which have been fitted with a HOA board.

Button:

Symbol:

Values not shown   Values shown

Function of module:

The HOA Switch State module allows the user to view the switch state of the eight switches on the HOA board. This module is used in combination with the HOA Pot value module to verify the values of hardware output points 9 to 16.

Dialog box:

If UC32 is targeted:	Not applicable
If UC/UCU is targeted:	

SECTION 28 : BACNET MODULES

BACNET TIME SCHEDULE

Appearance

<u>Group</u>

L (Logic)

<u>Button</u>

<u>Symbol</u>
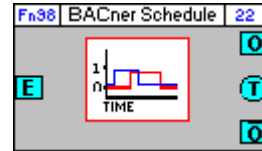
<u>Dialog box</u>
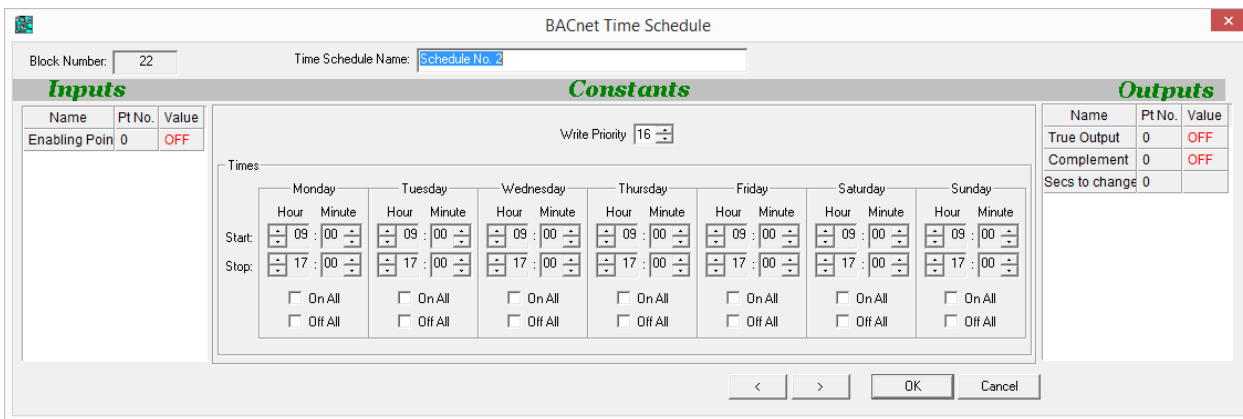
Function

The BACnet Time Schedule block allows the user to pre-load a single start time and a single stop time for each day of the week to be used in a locally-hosted BACnet weekly schedule.

If the module is enabled, then when the controller's clock registers a time between the start and stop time on each day, the output of the module will be "1", and outside of those times it will be "0".

This module accepts one input, which enables/disables the operation of the module, but leaving this input unattached will allow the schedule to run normally.

The module produces tree outputs: the present value of the schedule, the inverse of the present value and the number of seconds until the next scheduled change.

Parameters

Time Schedule Name

User defined name for the BACnet schedule object.

Inputs

Parameter Name	Description
Enabling Point	Displays the number of the digital point that is connected to the enabling input ("E") of the block. If the digital point is true the time schedule is enabled and will output accordingly, if the point is false then the block will output false.

Constants

Parameter Name	Description
Write Priority	The priority at which the BACnet time schedule block will write at. By default this is set to 16.
Times	The days of the week and times between which the schedule will start and stop.

Outputs

Parameter Name	Description
True Output	The current status of the schedule.
Compliment	The inverse of the current schedule status.
Secs to change	The number of seconds remaining until the output will change.

BACNET ALARM

> **Note**: This strategy-based method of generating binary alarms has been made redundant by the alarming functionality now native in all Inputs, Values and Outputs. This block has been left in place to support existing strategies that use this block, but should not be used in a new Strategy.

Appearance

Group   Button   Symbol

S (Statistic)

Dialog box

Function

Alarms are used in a BMS system to alert site supervisors/engineers to any difficulties that may occur in a site. The Cylon BACnet range support BACnet alarm objects which can be made available to BACnet supervisors.

The alarm module is joined to a digital point. When the digital point has the value 1, the alarm module is activated. The digital value may indicate if an error condition, for example a sensor going out of normal range or a fire alarm being activated.

Parameters

Alarm Name

A name assigned by the user to identify the BACnet Alarm object.

Inputs

Parameter Name	Description
Alarm Point	This displays the digital point number that is connected to the input of the block.

Constants

Parameter Name	Description
Notification Class	The alarm can be assigned a number through this parameter. This can be useful when grouping alarms.
Time Delay	The time delay that the block waits before making the alarm active or inactive.
Active Text	The text that is displayed on the supervisor software when the alarm is active.
Inactive Text	The text that is displayed on the supervisor software when the alarm is inactive.
Generate Alarm On	This option can be set to high value or low value by the user. If set to high value the alarm will be active when the input is true and if set to low value the alarm will be active when the input is false.
Notify Type	The Alarm notify type can be set to Alarm or an Event type.

BACNET TRENDLOG BLOCK

Appearance

Group   Button   Symbol

S (Statistic)

Dialog box

Function

BACnet Trend Logs, similar to **Unitron** Datalogs, allow point values in a **Controller** to be recorded over a period of time. For example, a **Trend Log** on an output point could monitor valve positions, or a **Trend Log** on an input could log outside air temperature.

The input point value can be logged either at regular intervals or when the value changes by a defined amount.

The recorded data can be later retrieved, displayed and analyzed with the **Datalog Manager** application.

The number of Trend Logs that can be added to a **Strategy** depends on the **Controller** on which the **Strategy** runs. For example a **CBM24** can have up to 32 Trend Logs and a **CBT12iVAV** can have up to 4.

> **Note**: To find out the maximum number of Trend Log that a Strategy can support, open the Strategy, select View > Managers and open the Resources tab in the Managers dialog.

Parameters
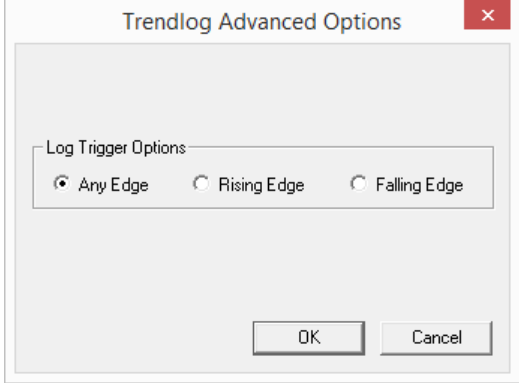
Datalog Description

A name assigned by the user to identify the BACnet Trend Log object.

Inputs

Parameter Name	Description	Possible Values
Analog Log Point	The point number and value of the point being logged if the module's Analog input is connected to an analog point. *Note*: *Only one of the input points can be connected, so only the connected one is displayed in the dialog's input column.*	Real number
Digital Log Point	The point number and value of the point being logged if the module's Digital input is connected to a digital point. *Note*: *Only one of the input points can be connected, so only the connected one is displayed in the dialog's input column.*	Boooelan
Trendlog Enable	The point number and current values of the enabling point for this module. When the value of this point is "1", the "Log Point" will be logged.	1 or 0
Log Trigger Point	Data is recorded when this trigger point changes. If the trigger point is not connected, logging occurs according to the ' When to log the value ' parameters below.	1 or 0

Constants

Parameter Name	Description	Possible Values
Trendlog Number	This field displays the number used by the Datalog Manager application to access the data collected by this module.	Depends on controller type
Trendlog Point Type	This field displays the type of point that this module is logging.	"Analog" or "Digital"
When to log the value: Log at fixed intervals of	When this option is selected the `seconds` input box becomes editable, and the value of the Log Point will be recorded at regular intervals.	Integer (number of seconds)
When to log the value: Log when value changes by	When this option is selected the `units` input box becomes editable, and the value of the Log Point will be whenever that Log Point value changes by an amount greater than the number of units specified.	Integer (number of units)
Advanced Options	The Advanced Options button becomes available when the module's Log Trigger Point input (the "T" input) is connected to a digital point. This digital point can be, for example, an alarm arising, a switch being thrown, a window opening etc. When this input is connected, the Trend Log will log when the state of this input changes. Clicking on the Advanced Options button opens the Datalog Advanced Options dialog box: 	Any Edge, i.e. every time the trigger point changes state. Rising Edge, i.e. when the value of the trigger point changes from 0 to 1. Falling Edge, i.e. when the values of the trigger point changes from 1 to 0.

How to set up a BACnet Trendlog

In the case of the **Strategy** below a `BACnet Trend Log` block has been attached to a hardware point that measures temperature. The hardware point has been named "Room Temperature" and so the `BACnet Trend Log` block has taken the same name.
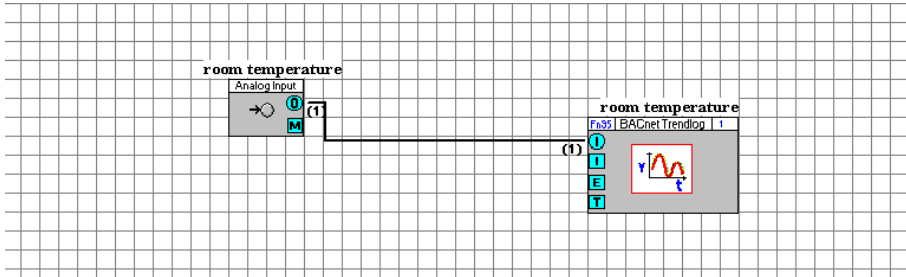
Right-clicking on the block opens the properties dialog box.

Trendlog Read Performance

It is possible to optimize the way `BACnet Trend Log` data is read by the front-end Workstation.

For example, altering the number of records that are accessed per request changes the number of records the **Controller** can return each time it obtains the network **token**. A request for up to 20 records at a time is optimal for loading an **MS/TP** packet.

Front-end Workstations can also be configured to request only new records from the Controller, which can improve the performance of the system.

STRATEGY ID BLOCK

Appearance

<u>Group</u>

S (Statistic)

<u>Button</u>

<u>Symbol</u>

<u>Dialog box</u>
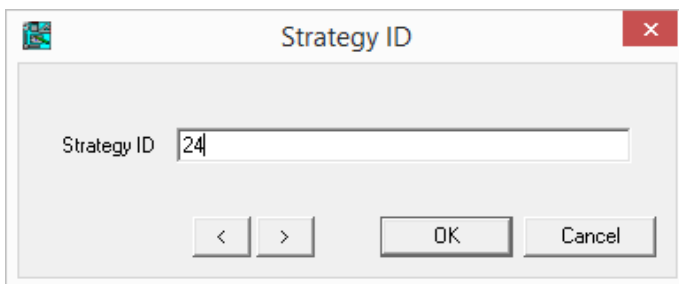
Function

The Strategy ID block allows a unique ID to be sent to a controller for use by third-party applications.

Parameters

<u>Strategy ID</u>

This is an arbitrary integer that can be used by other applications to identify the Strategy.

3RD PARTY POINT BLOCKS – [ANALOG 3RD PARTY ANALOG] AND [BINARY 3RD PARTY]

Appearance

Group	Button	Symbol
P (Points)		
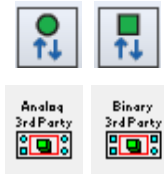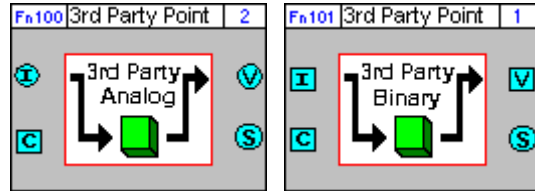
Dialog box
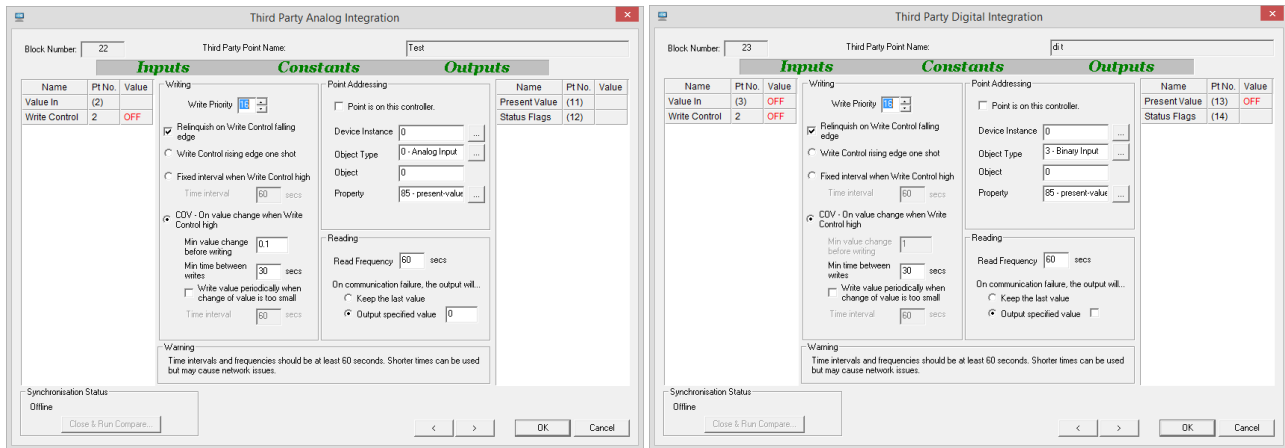
Function

The 3rd party point blocks provide a mechanism for reading and writing values from and to a third party device directly in a **Strategy**. The same mechanism can be used to also be used to access **BACnet** objects within the local **Strategy** if required.

There are two separate "3rd Party point" blocks – one that is used to move data to and from analog **Strategy** block connections and one that is used to move data to and from binary **Strategy** block connections.

Both types of 3rd party blocks can access the same **BACnet** data, which is automatically converted to the appropriate data type as the data is pulled from or pushed to the network.

Parameters

Inputs

Parameter Name	Description
Value in I	This is the value that will be written to the 3rd party device. If the analog 3rd party block is being used then an analog point must be linked to this input and if the digital 3rd party block is being used then a digital point linked to this input.
Write Control C	This is a digital input which when set to 'On' allows the value of the **Value In** input to be written to the 3rd party object, subject to the settings in the **Constants > Writing** section of the dialog.
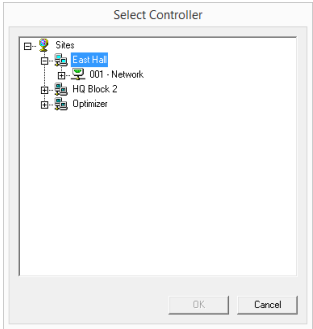
<u>Constants</u>

- Constants -Writing

These constants determine when the input value will be written to the third-party device, and the priority in that devices priority array to which the value will be written.

If the block is writing to but not reading from the third-party device, then only the input needs to be connected.

Parameter Name	Description
Write Priority	This is the element in the 3rd-party device's Priority Array to which the input value will be written. By default the value is priority `16`, but it can be set in the range `1-16`.
Relinquish on High to Low	If this box is checked, the controller will relinquish the Priority Array element set in the Write Priority constant (i.e. set it to null) when the Write Control input **C** goes from high to low.
Write Control rising edge one shot	If this option is selected, the controller will write the current Value In value to the third-party device when the Write Control **C** changes from `OFF` to `ON`. This option is only available if the Write Control input **C** is connected.
Fixed interval / Fixed interval when Write Control high	**Note:** If the Write Control input **C** is connected, the name of this parameter changes and writing is enabled only when Write Control **C** is set to `ON` (high). If it is not connected, writing is constantly enabled. If this option is selected then the controller will write the current Value In value to the 3rd-party device at regular intervals as specified in the Time Interval field. By default this interval is set to 60 seconds.
COV – On value change / COV – On value change when Write Control high	**Note:** If the Write Control input **C** is connected, the name of this parameter changes and writing is enabled only when Write Control **C** is set to `ON` (high). If it is not connected, writing is constantly enabled. If this option is selected then the controller will write to the 3rd-party device only if the Value In value changes by the amount specified in the Min value change before writing during the time period specified in Min time between writes .
Min value change before writing	This parameter specifies the amount by which the Value In value must change in order for 3rd-party writing to occur.
Min time between writes	In order to avoid a continuously-changing Value In value generating too much traffic on the BACnet system, you can limit how often the value is sent to the 3rd-party object by setting a minimum time here. This value is the number of seconds between sends.
Write value periodically when change of value is too small	If this checkbox is ticked then even if the Value In value does not change by the Min value change before writing , the controller will write the current Value In value to the 3rd-party device at regular intervals as specified in the Time Interval field. By default this interval is set to 60 seconds.

- Point Addressing Info

Parameter Name	Description
Point is on this controller	If this box is ticked then the '3ʳᵈ-party' object to which this block refers is actually in the same strategy as the block (i.e. in the "Local" device). If it is cleared the '3rd-party' object is in a different ("Remote") device. If the block is copy and pasted into a different strategy, it will remain connected to the same point if this checkbox is cleared. If the checkbox is ticked then the pasted block will try to access a point within its new strategy that matches the **Object Type** and **Object Instance** settings.
Device Instance	This is the Device Instance Number of the 3ʳᵈ-party device that will be read or written to. It is only available if the Point is on this controller checkbox is **cleared**. **Note**: You can type any number in this input, but a Site Tree is available by clicking the ... button to the right of the input field:
Object Type	Any BACnet Object Type can be entered in this field. It is used together with the Object field to specify the object which will be read or written. **Note**: You can type any number in this input, but a list of common Object Types is available by clicking the ... button to the right of the input field.
Object	This is the instance number within the selected Object Type that specifies the object which is to be read or written.
Property	This is the BACnet property of the specified object that is to be read or written. Defaults to 85-present-value. **Note**: You can type any number in this input, but a list of common BACnet Properties is available by clicking the ... button to the right of the input field.

- Constants – Reading

These constants determine how often the Present Value of the third-party object will be read and sent to the block's output V .

If the block is reading from but not writing to the third-party device, then only the output V needs to be connected.

Parameter Name	Description
Read Frequency	This is the number of seconds between reads. By default this is set to 5 seconds.
On communication failure, the output will…	If the third-party device cannot be read, then this parameter defines whether the output of the block V will either remain at the last value received, or else change to the value in this parameter's value box. The value box for Binary third-party points is a checkbox. If it is checked the output V will be set to "On", if not the output V will be set to "Off".

Outputs

Parameter Name	Description
Present Value [V]	The present value of the BACnet object is written to this output.
	If the present value cannot be read, and the `Constants` > `Default Value` is enabled, this output is set to the Default value.
	If the present value cannot be read, and the `Constants` > `Default Value` is disabled, then this output remains at its previous value.
Status Flag (S)	This is an analog value that represents a 5 bit array, which contains information about the status of communications with the third-party device.

	Function	Value = 0	Value = 1
Bit 0	Problem	No problem detected.	A problem has been detected.
Bit 1	Failure to send write	Data written to 3rd party device ok.	Write to 3rd party device failed
Bit 2	Failure to RX write ACK	Acknowledgement received ok	No acknowledgement when writing to 3rd party
Bit 3	Failure to send read.	Read request sent ok	Failed to send read request
Bit 4	Failure to RX read.	Data read from 3rd party device ok	No data received from 3rd party device

BACnet Modules

PRIORITY ARRAY BLOCKS – [ANLG PA] AND [BNRY PA]

Note: This strategy-based method for generating Priority Arrays has been made redundant by the Priority Array functionality now native in all Value and Output objects. This block has been left in place to support existing strategies that use this block, but should not be used in a new Strategy.

Appearance

<u>Group</u>

P (Points)

<u>Button</u>

<u>Symbol</u>

Dialog box

Function

BACnet value objects and BACnet output objects use a Priority Array to determine their value. Each element in the array will either have a value or be set to `null`. The 'present value' of the object is set to match the the highest priority element in the array that has a valid value.

The priority array blocks provide a method of assigning a value to an element in the Priority Array of a specific BACnet object.

There are two priority array blocks in the **Cylon Engineering Centre**:

- Priority Array Analog Object   for setting a value in the array of an Analog Value, or an Analog Output.

- Priority Array Digital Object   for setting a value in the array of a Binary Value, or a Binary Output.

If a point is connected to the block's Input Point (A) then the block will show the Priority Array of that point.

If the block's Input Point (A) is unattached then the block will show the Priority Array of the point connected to the Present Value output (Pv).

> **Note**:   If neither point is connected the block will not function, and a warning message will be displayed:
>
> Strategy Warning - Analog Priority Block is inoperable as it is not attached to any BACnet points.

The value of a single element of the array is set to match the value of the Value In (B) input when permitted to do so by the Write Control (C) input. The element to be set is defined by the Write Priority constant.

If the BACnet object to be affected is a **BACnet Output** object, the input of that object's module in the **Strategy** drawing must be connected to the output of the priority array block that matches the Write Priority setting.

If the object to be affected is a **BACnet Value** object, then the output of that object's module in the **Strategy** drawing must be connected to the Input Point (A).

The main use of the Priority Array block is to quickly and easily conditionally override outputs or values.

Parameters

<u>Inputs</u>

Parameter Name	Description
Input Point	This is the point representing the BACnet object whose Priority Array will be affected by the Priority Array block.
Value In	This is the value to which the selected priority element in the Priority Array will be set.
Write Control	This is a digital input which when set to 'On' allows the value of the Value In input to be written to the Write Priority element, subject to the settings in the Constants section of the dialog.

Constants

Parameter Name	Description
Write Priority	This is the Priority number of the element in the Priority Array that will be set. By default the value is priority 15 however it can be set in the range 1-16.
COV Value	If the COV Once High property is set, then the relevant element in the Priority Array will be set if the Value In input changes by more than the value set here in the COV Value property.
One Shot Write Low to High	If this box is checked then the relevant element in the Priority Array will be set to match the Value In input when the write control input goes from low to high.
COV Once High	If this box is checked the relevant element in the Priority Array will be set to match the Value In input when than value changes by more than the amount set in the COV Value property.
Relinquish on High to Low	If this box is checked then the relevant element in the Priority Array will be set to Null when the Write Control input goes from high to low.

Outputs

Parameter Name	Description
Present Value	This output matches the 'Present Value' of the BACnet object associated with the Input Point.
PA Bitmap	This an analog value that represents a 16 bit array, each bit representing the override status of each element in the priority array. If a specific priority has been overwritten, the bit in the PA bitmap corresponding to that element will be set to 1.
Status Bitmap	This output is not currently used.
Priority 1-16	These outputs give access to the values at each priority for the BACnet object. These outputs could be connected to a strategy that contains logic to address control situations that depend on BACnet priorities. **Note**: If a priority becomes set to a "null" value through BACnet, then the related output will remain set to the last non-null value of that priority.

SECTION 29 : APPENDIX :: HOW TO ADD ENERGY OPTIMIZATION TO A STRATEGY

A CBM, CBT or UC32 Field Controller can be configured to monitor environmental parameters over a period of time, and learn from them the optimum times for switching plant in order to minimize energy usage.

The elements of the Strategy working together to achieve this are collectively referred to as an "Optimizer". An Optimizer can be set up to govern Heating, Cooling, or a combination of both.

There are 4 separate blocks provided in the Engineering Tool for energy Optimization. It is recommended that they be used together as below.

In order to set up the Optimizer as described in this document, you will need the following product versions:

- CBM, CBT or UC32 Firmware version 6.1.7 or later

- **Cylon Engineering Centre** Software version ETv6.60 build 6 or later

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WHAT IS AN OPTIMIZER?

An Optimizer is an element within a Field Controller Strategy that acts to minimize energy consumption by observing environmental conditions over a period of time, and learning from those observations the optimum times for switching plant in order to achieve the required conditions during occupancy.
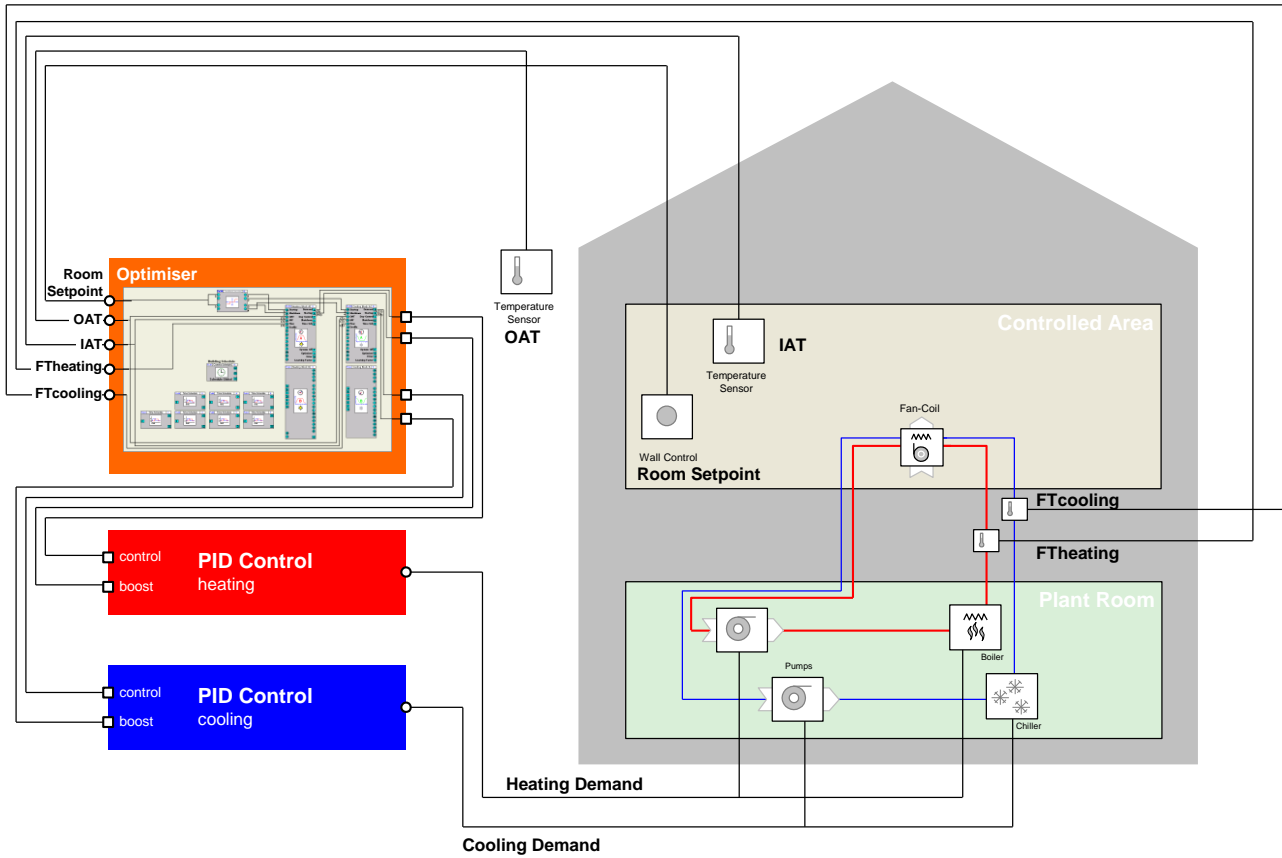
HOW DOES AN OPTIMIZER OPERATE?

Heating Optimization

To optimize heating, the heating system should start operation before occupancy starts at the latest time that would allow the required temperature to be reached just as occupancy begins.

Energy can also be saved by turning off the heating system before the end of occupancy, if this can be done without the temperature falling below acceptable levels until after the end of occupancy.
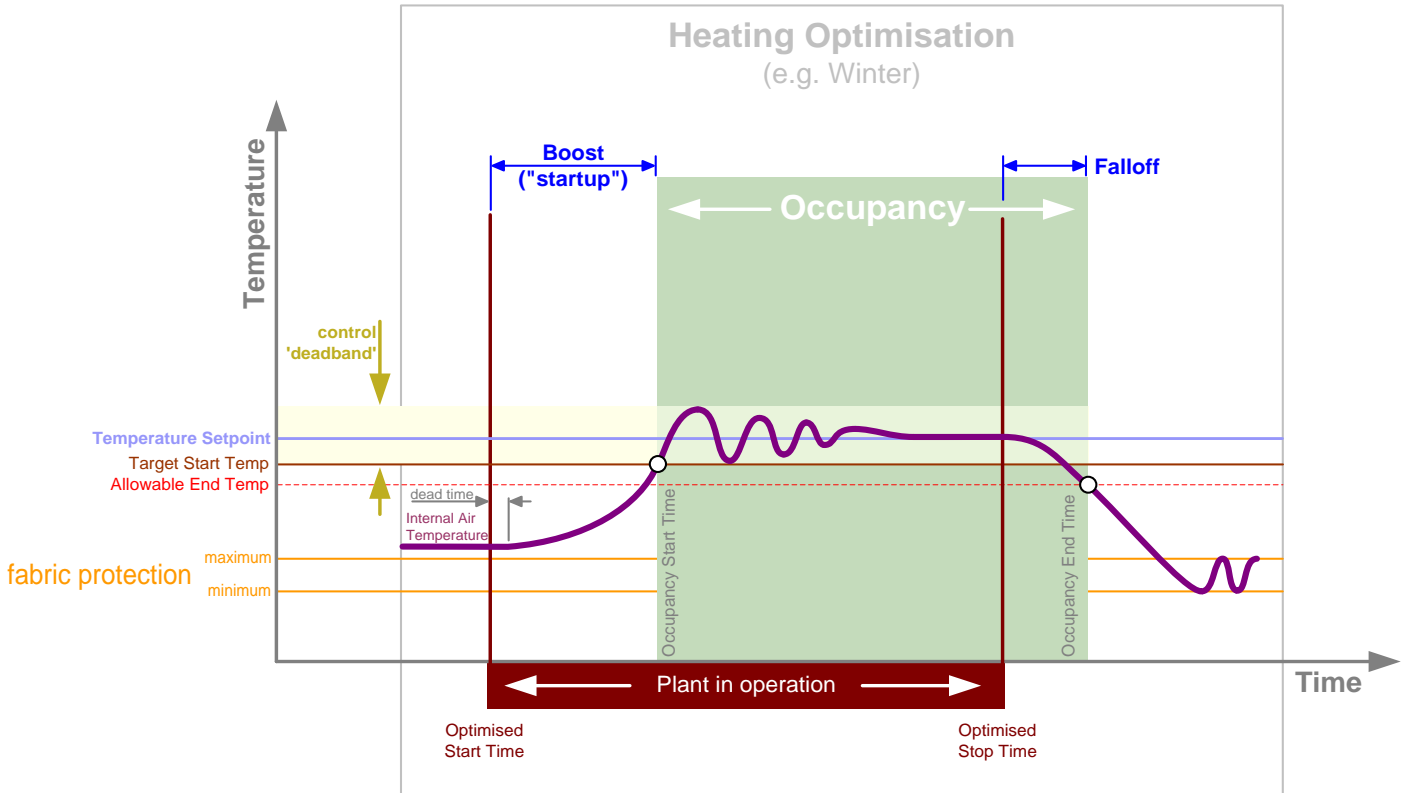
Cooling Optimization

Similarly, when optimizing the energy usage during cooling, the cooling system should start to operate at the latest time before occupancy that will allow the required temperature to be reached just as occupancy begins, and stop operating at the latest time that would allow the temperature to rise to no more than the maximum acceptable level before occupancy ends.
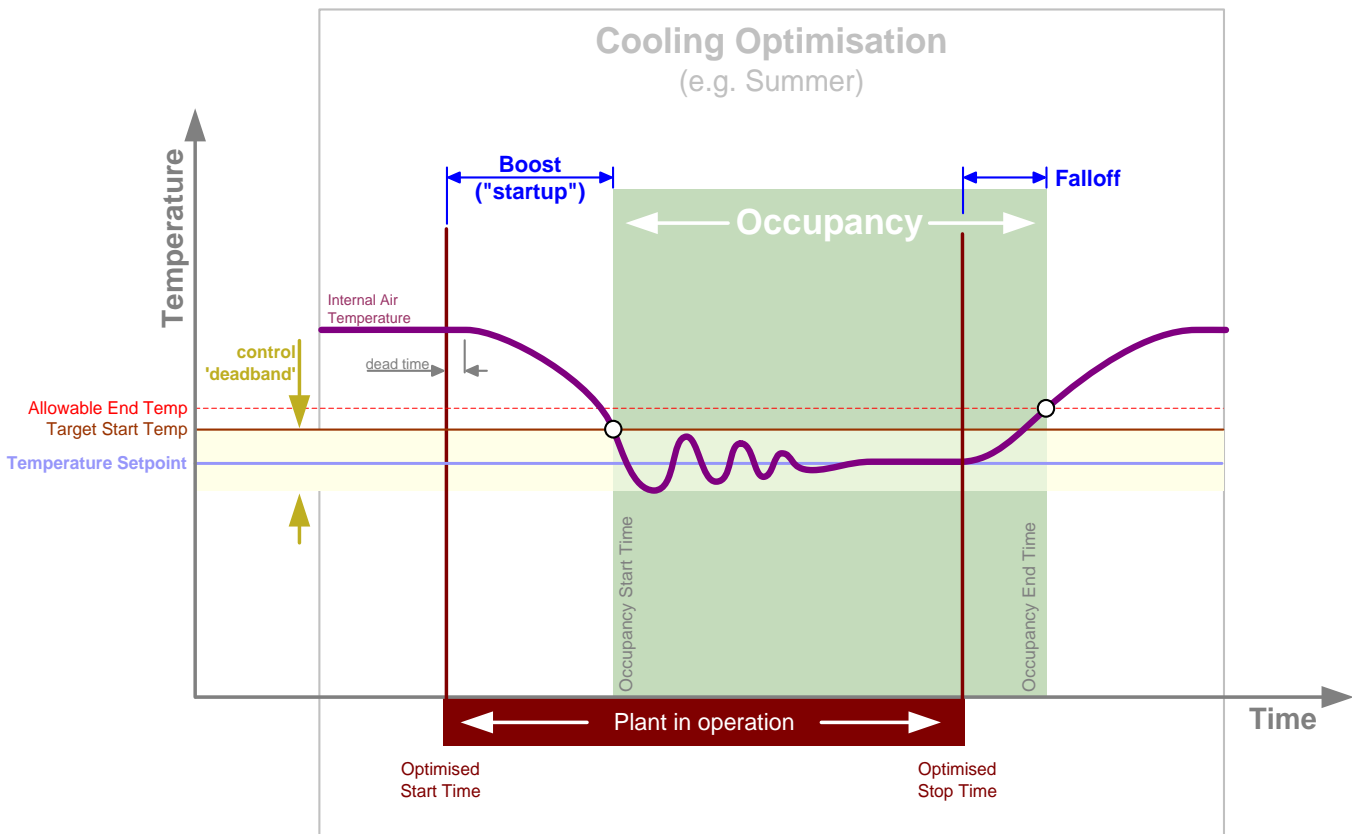
Combined Optimization

It is advisable to implement both Heating Optimization and Cooling Optimization in the same strategy. Only one of the two will operate at any one time, but by having both set up you can ensure Optimized energy use even if conditions vary widely outside of Occupancy times.

For example, temperatures outside of Occupancy could change significantly between summer and winter.

Note: Cooling Blocks A and B are only required if cooling - either free cooling or mechanical plant - is available. If not, these blocks should not be added to the Optimizer Strategy.
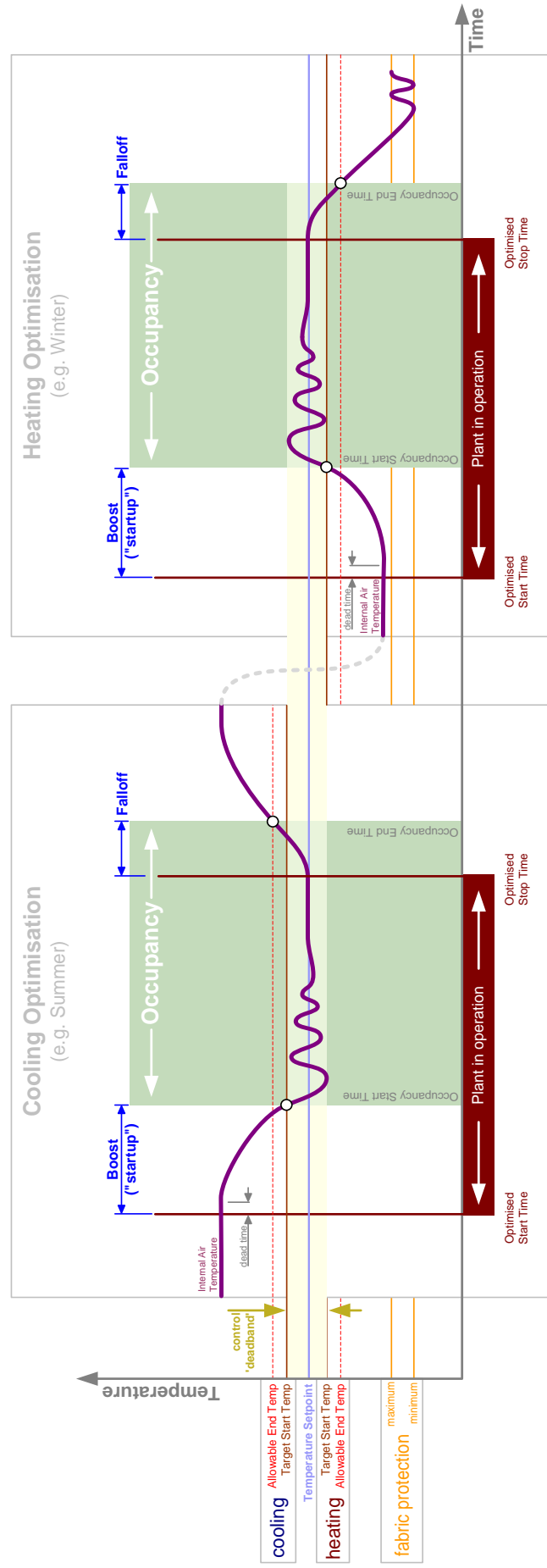
SETTING UP AN OPTIMIZER IN A FIELD CONTROLLER STRATEGY

The magnitude of the Preconditioning and Falloff ("Cooldown") times – and hence the Optimized Start and End times - are determined by analysis of historical data, carried out by the partial strategy described below.

The Optimizer modules are available on the "Control" module bar:
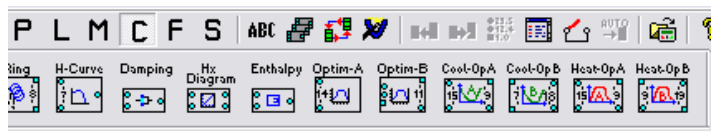
> **Note**:   Legacy Optimizer modules are still available in the "Control" module bar.
>
> New   Optimizer   Modules:
> (these modules are the ones used in this section)
>
> Legacy   Optimizer   Modules:
> (These are required for compatibility with existing Strategies only)
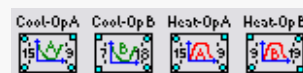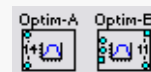
It is recommended that an Optimizer is set to monitor **both** heating and cooling. To set up such an Optimizer, the following blocks must be in sequence, so they **must** be added to the Strategy in the order shown here:

1. **Optional** BACnet Time Schedule – only if the Strategy is on a BACnet Site – see *Linking to* a BACnet on page 711.
2. Field Controller Time Schedule (Monday)
3. Field Controller Time Schedule (Tuesday)
4. Field Controller Time Schedule (Wednesday)
5. Field Controller Time Schedule (Thursday)
6. Field Controller Time Schedule (Friday)
7. Field Controller Time Schedule (Saturday)
8. Field Controller Time Schedule (Sunday)
9. Optimizer block A (Part 1 of 2) for Heating
10. Optimizer block B (Part 2 of 2) for Heating
11. Optimizer block A (Part 1 of 2) for Cooling
12. Optimizer block B (Part 2 of 2) for Cooling
13. Other Strategy modules as required.

> **Note**:   If only Heating Optimization is required, 11 and 12 above should not be added to the Strategy.
> If only Cooling Optimization is required, 9 and 10 above should not be added to the Strategy.
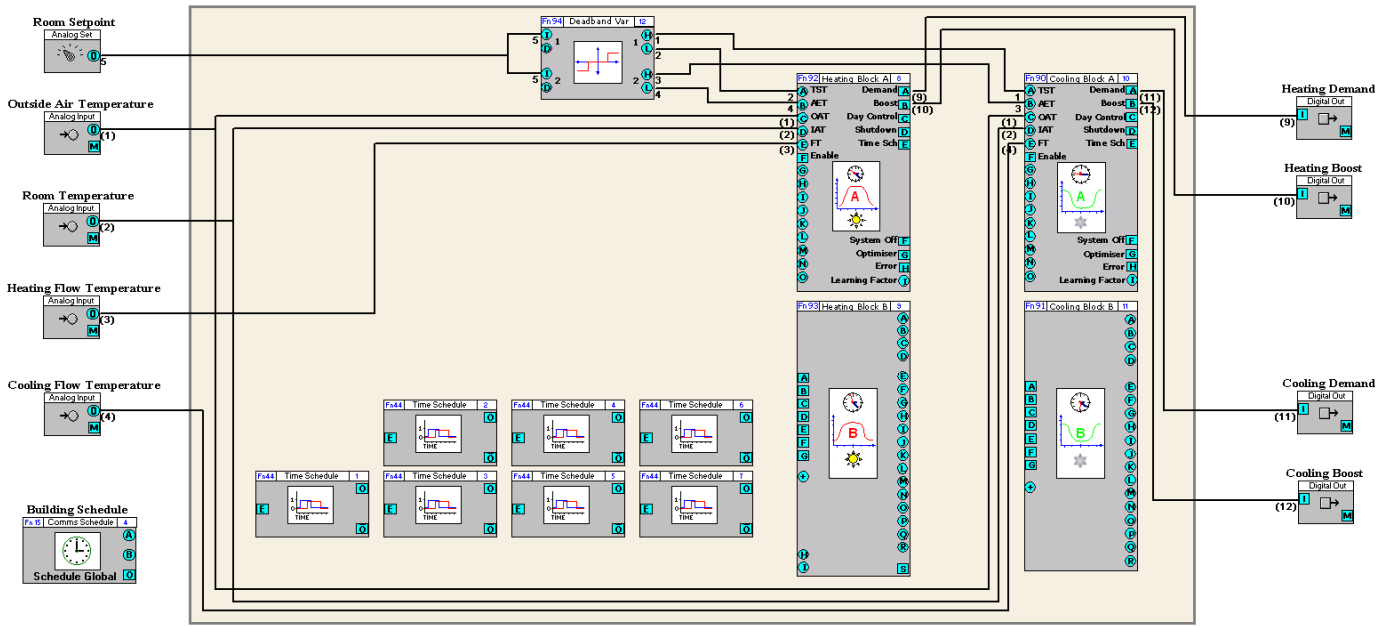
The inputs on Optimizer block A (in both Heating and Cooling) must be connected as shown above. The outputs can then be connected to the Demand and Boost points as shown.

OPERATION OF THE OPTIMIZER

Linear Model

A Linear Model is used initially by the Optimizer to estimate the Boost start time, when no historical data is available.

The Startup period is calculated as follows:

- Heating

```
Boost Period = A(TST – IAT) + B
```

- Cooling

```
Boost Period = A(IAT - TST) + B
```

Where:

A and B are user-adjustable constants (linear predictor values)

TST is Target Startup Temperature

IAT is Internal Air Temperature

Note: It is recommended that B be greater than 20 (minutes)

Learning Factor

Each time the Target Temperature is reached during the Boost period (Startup), "Learning" occurs, and the Learning Factor is incremented.

Once the Learning Factor reaches 6 or more, the Adaptive (Learned) model is used (to calculate the start time of the Boost period) instead of the Linear model.

There are a number of conditions that must be met before Learning can take place.

1. If Flow Temperature is being monitored, then in order to verify that plant is operating (Sanity Check) while the Optimizer is attempting to learn, the Flow Temperature must be outside the FTmin – FT max range as described below:
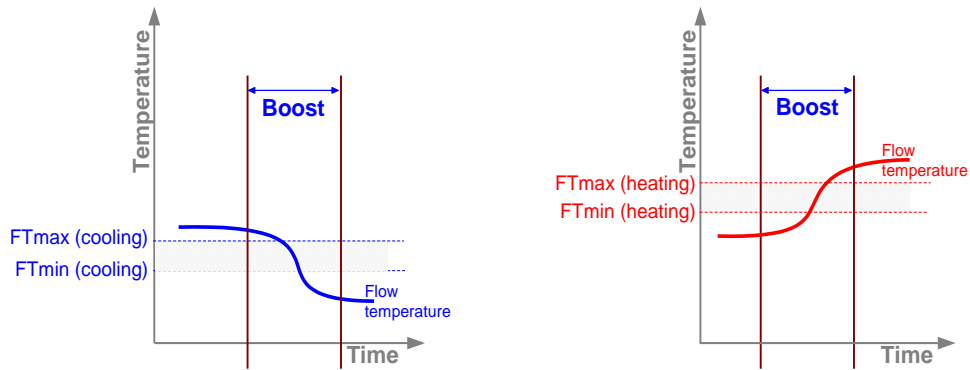
In Heating Optimization, the flow temperature must be below the minimum temperature in the range, (i.e. below the value of FTmin) at the start, and must rise past the maximum temperature (FTmax) during the boost period.

In Cooling Optimization, the flow temperature must be above the temperature range before Boost, (i.e. above the value of FTmax) at the start, and must fall below the minimum temperature (FTmin) during the boost period.

If the flow temperature does not meet these conditions before the start of Boost, the Learning process will not take place in the Optimizer.

2. Boost (Startup) period must be at least 20 minutes.

Fabric Protection

"Fabric Protection" is a behavior that can be enabled in the Optimizer, which prevents damage to fabric and other contents in the building by keeping the temperature above a specified minimum at all times.
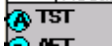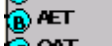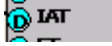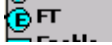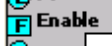
Note: Fabric Protection only applies to Heating Optimization.

INPUTS AND OUTPUTS REQUIRED FOR OPTIMIZER

A connected group of Strategy modules configured to act as an Optimizer monitors the following parameters, which are either set as constants or provided by other elements within the overall strategy:

Inputs

The following points values must be provided by points in the Strategy outside of the Optimizer section:

Parameter Name parameter description	Nature Connector diagram
Target Start Temperature (TST) The temperature that must be reached at the start of Occupancy.	[Analog Setpoint]
Allowable End Temperature (AET) The target temperature for the end of Occupancy. The Optimizer will calculate how long cooldown should take to achieve this temperature, and disable plant that length of time before the end of occupancy.	[Analog Setpoint]
Outside Air Temp (OAT) Current temperature of the ambient air outside the building.	[Analog Point]
Inside Air Temperature (IAT) Current inside air temperature.	[Analog Point]
Flow Temp (FT) Current temperature of the Conditioning medium (Heating or Cooling). While it is recommended that this be used, if the medium Flow Temperature is not available, this input can remain disconnected. (if this is the case, then the 'Sanity Check' condition described on page 701 will be ignored)	[Analog Point]
Enable Input signal to enable or disable Optimizer operation. Does not disable Fabric Protection operation. If not connected then assumed to be enabled	[Digital Point]

Note: Target Start Temperature (TST) and Allowable End Temperature (AET) can be derived from the Room Setpoint using the new Deadband module:
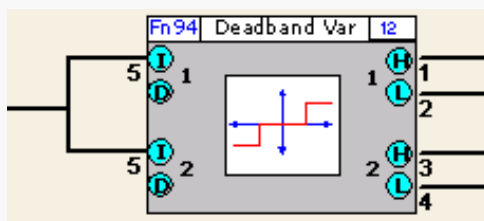
The Deadband module is a dual-channel module, in that it comprises two identical functions – allowing it to provide a deadband for heating and a deadband for cooling in a single module.

A "deadband" is a tolerance applied to a setpoint, such that if the measured temperature is outside that band the control algorithms are applied, but if the measured temperature is within the band control is not applied (control is 'dead').

Type 1 :: **Deadband above the setpoint**

Type 2 :: **Deadband straddling the setpoint**

Type 3 :: **Deadband below the setpoint**
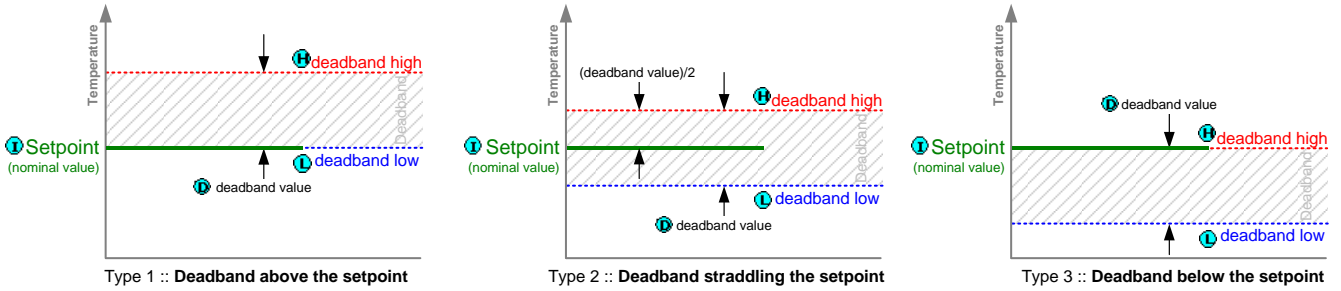
The "deadband" tolerance can be applied above the nominal value, straddling the nominal value or below the nominal value.

Each 'channel' of the Deadband module has a nominal value input , a Deadband input (which overrides the internal 'Deadband constant) and a High and Low output
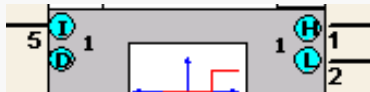
The module dialog (opened by right-clicking on the module in the Strategy) shows the values of these parameters, as well as allowing Deadband type and Deadband value constants to be set for each "channel". (The Deadband Value constant is overridden by the Deadband input , if the input is connected).
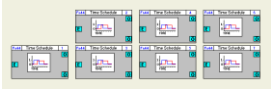
The Deadband Type value may be 1 (above the nominal value), 2 (straddling the nominal value) or 3 (below the nominal value).

Fixed Settings
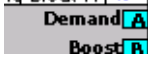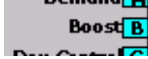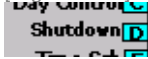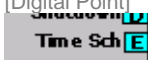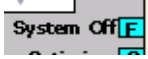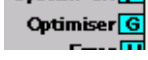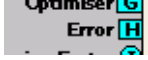
The following parameters are set within the Optimizer blocks themselves (right click on the module in the Strategy Drawing in the Engineering Tool to edit them). However, they can be overridden by external point values if required, by joining them to points in the Strategy drawing

Parameter Name parameter description	Nature Connector diagram
Occupancy A set of 7 on/off times, one for each day of the week, defining the times during which the building is occupied, i.e. the times during which the Building conditions are to be controlled.	Field Controller Schedule x7
Flow Min Temp (FTmin)	[Analog Setpoint]
Flow Max Temp (FTmax) **FTmin** and **FTmax** define a range outside which the temperature of the conditioning medium must be before the start of Boost. **FTmin** is the bottom of this range, and **FTmax** is the top of this range. In Heating Optimization, the flow temperature must be below the minimum temperature in the range, (i.e. below the value of **FTmin**) at the start, and must rise past the maximum temperature (**FTmax**) during the boost period. In Cooling Optimization, the flow temperature must be above the temperature range before Boost, (i.e. above the value of **FTmax**) at the start, and must fall below the minimum temperature (**FTmin**) during the boost period. If the flow temperature does not meet these conditions before the start of Boost, the Learning process will not take place in the Optimizer (see page 701).	[Analog Setpoint]
Startup Temp (IATstart) If there is no historical data available (i.e. when algorithm is initialised) this value is used as the limit value (minimum for heating, maximum for cooling) of the IAT at the start of the maximum Boost. (This value is only used once, to initialise the adaptive Model at start of Learning)	[Analog Setpoint]
Boost Max Period The maximum time in minutes of the Startup ("Boost") period	[Analog Setpoint]
Falloffdown Max Period The maximum time in minutes of the Shutdown ("Falloff") period	[Analog Setpoint]
Deadtime (DT) If there is no historical data available (i.e. when algorithm is initialised), this value (in minutes) is used as an estimate of the time between the start of heating or cooling action, and any corresponding change in temperature inputs. (This value is used once to initialise the adaptive Model at start of Learning, and in Fabric Protection)	[Analog Setpoint]
Overlap Period If target temperature is not met by the start of Occupancy, this is the number of minutes for which Boost will continue to operate after the start of Occupancy to try and reach the target.	[Analog Setpoint]
Linear Model A Value (A)	[Analog Setpoint]
Linear Model B Value (B)	[Analog Setpoint]

Linear Model parameters used initially by the Optimizer module to estimate Boost start time.	
Fabric Protection Min Temp (FPTmin) **Fabric Protection Max Temp (FPTmax)** "Fabric Protection" activates when temperature drops below FPTmin and continues to operate until temperature reaches FPTmax. (Heating Block B only)	[Analog Setpoint] [Analog Setpoint]

Outputs

The following values are generated by the Optimizer section of the Strategy:

Parameter Name parameter description	Nature Connector diagram
Demand This output indicates whether or not the conditioning plant should be active.	[Digital Point]
Boost This indicates that conditioning plant should be operating at full capacity to achieve target temperature in the optimum time. This bypasses weather compensation etc.	[Digital Point]
Day Control Status Indicates whether or not the Optimizer is in "Day Control" mode.	[Digital Point]
Falloff Status Indicates whether or not the Optimizer is in Falloff ("Shutdown") mode. This output remains on for 3 hours, during which the Optimizer continues to monitor the Internal temperature falloff, to ensure the optimal falloff time is used.	[Digital Point]
Time Schedule Status This output is intended to show when there is an ON signal from any of the Optimizer Time Schedule blocks. However, it is not enabled by default, in order to use it you must connect all of the Time Schedule Module outputs to the inputs on Optimizer Block B.	[Digital Point]
System Off Flag This value is ON when neither the Optimizer nor Occupancy is in force.	[Digital Point]
Optimizer Status This shows when the Optimizer is in Startup mode – i.e. Maximum Boost time plus overlap.	[Digital Point]
Error Status Error indication. This value is ON if the sequence of Time Schedule and Optimizer blocks is not correct. When this value is ON, Optimizer operation is disabled, but Fabric Protection operation will still operate.	[Digital Point]

Learning Factor

This outputs the current value of the Learning Factor.

[Analog Point]

Predicated Boost Start Time

[Analog Point]

The value of this point is a "Decimal Time" representation of the time at which Boost will start. (e.g. 9.3 represents 9:30 am).

Note: this value is only updated when Optimizer Status is ON.

Predicated Falloff Start Time

[Analog Point]

The value of this point is a "Decimal Time" representation of the time at which Falloff will start. (e.g. 15.15 represents 3:15 pm)

Note: this value is only updated when Falloff Status is ON.

Time until Occupancy Start

[Analog Point]
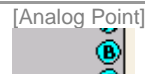
This a "Decimal Time" representation of the time remaining until the start of Occupancy (e.g. 1.5 means 1 hour and 50 minutes remaining).

Time until Occupancy End

[Analog Point]

This a "Decimal Time" representation of the time remaining until the end of Occupancy (e.g. 7.35 means 7 hours and 35 minutes remaining).

Time Schedule Content outputs

[Analog Points]

On Optimizer block B there are a number of outputs that provide useful information about Time Schedule settings. There is one pair for each of the Optimizer Time Schedule modules, showing the on time and off time for each schedule module, in "Decimal Time" (14.25 = 2:25 pm)

Fabric Protection Status

[Digital Point]
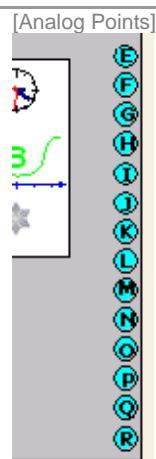
Indicates whether or not the Optimizer is in "Fabric Protection" mode. (Heating Block B only)
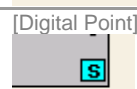
Output sequence
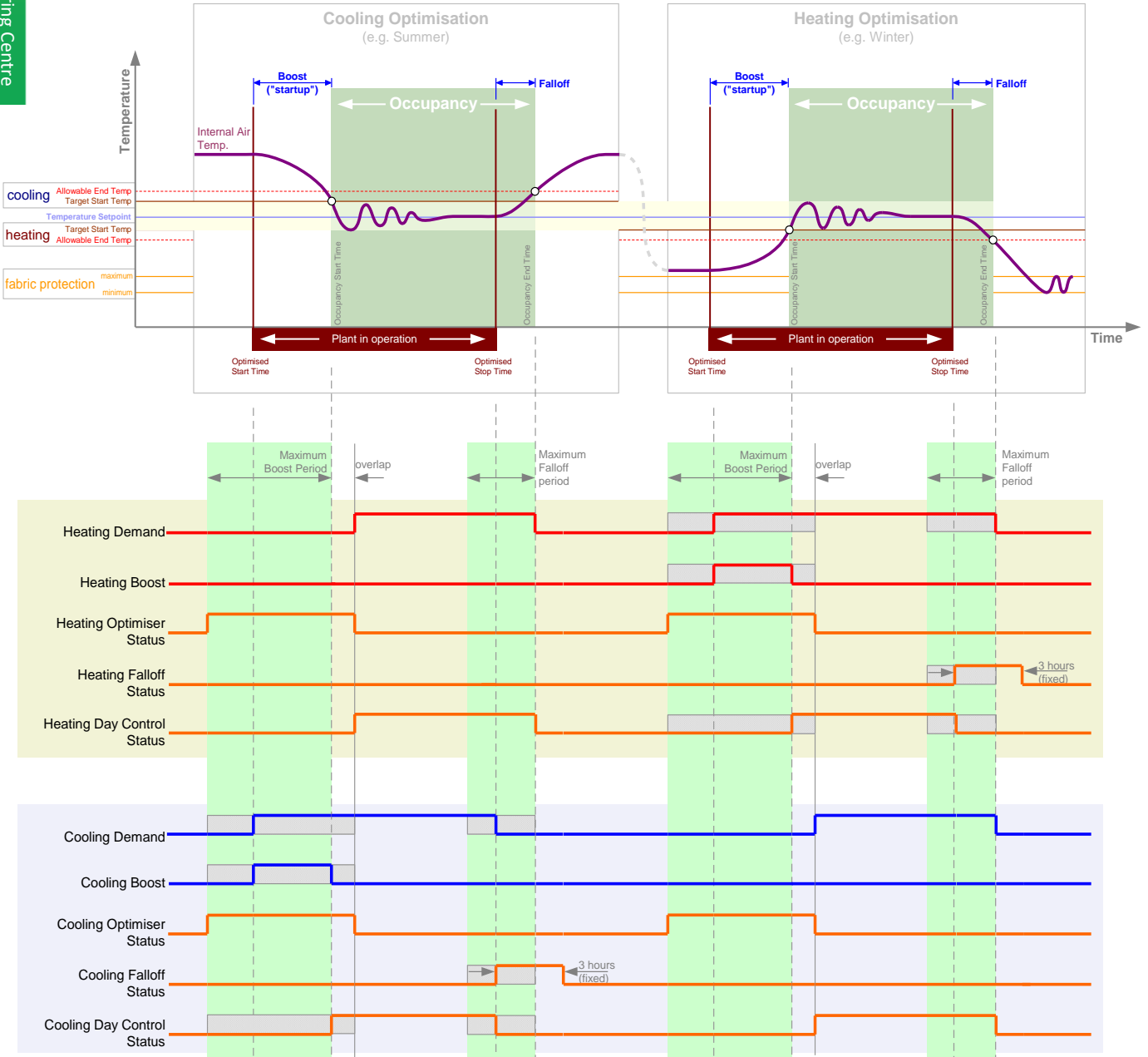
AUTOMATIC UPDATING OF OPTIMIZER TIMES – LINKING TO A COMMS CONTROLLER SCHEDULE OR BACNET SCHEDULE

The 7 Time Schedule blocks in the Optimizer can be updated manually using the Cylon Engineering Centre. However, it is normally better to link them to the main building schedule, so that the Optimizer will respond to changes made by the End User.

This can be done either by

- (Unitron systems) inserting a Comms Controller Time Schedule Global in the Strategy and linking it to the 7 consecutive Time Schedule blocks (see *Linking to a Comms Controller Schedule* below)

- {BACnet Systems) inserting a BACnet Schedule immediately before the first Optimizer Time Schedule (see *Linking to* a BACnet on page 711)

Linking to a Comms Controller Schedule

Right click on the Comms schedule GLOBAL, and the following context menu will be displayed:
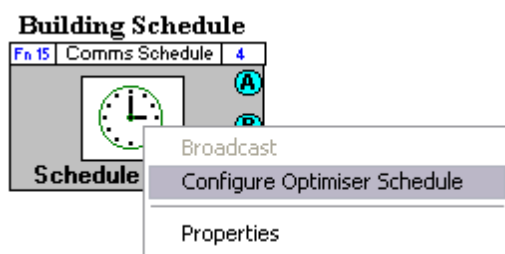
The 'Configure Optimizer Schedule' item will be available if the module has no connecting lines AND one of the following is true:

- The GLOBAL has been previously been configured for use with an Optimizer
- There are seven consecutive Field Controller time schedule blocks in the target strategy that are not being used by another Optimizer.
- If this GLOBAL has **never** been set to "broadcast"

If the 'Configure Optimizer Schedule' item in the context menu is selected, the following dialog is displayed
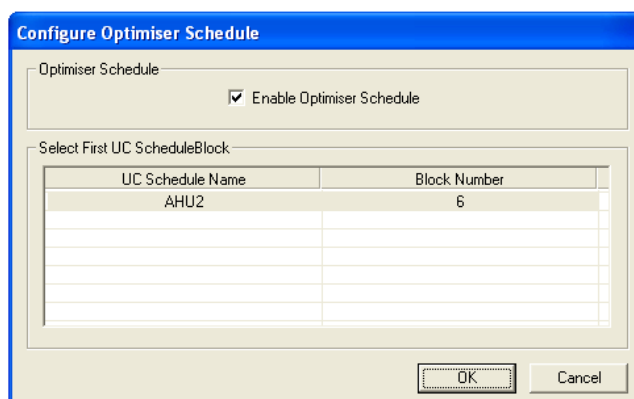
The 'Enable Optimizer Schedule' check box sets whether or not this local schedule GLOBAL will link to Optimizer Schedules. When this is un-checked, the schedule list will be disabled.

When the dialog is first displayed, if the 'Enable Optimizer Schedule' box is ticked, and the current target schedule block for the Optimizer can be selected from the schedule block list.

The 'OK' button on the dialog will be disabled if the 'Enable Optimizer' checkbox is ticked but there is no schedule block selected in the list – i.e. it will be impossible to link the Time Schedule Global to Optimizer Schedules without selecting a schedule block from the list.

Because an Optimizer must have its Time Schedules in consecutive blocks, the schedule block list will be populated with the first Field Controller time schedule from each group of 7 consecutive Field Controller time schedules. For example, if there are 7 consecutive Field Controller schedule blocks from block numbers 10 to 16, and another 7 from block numbers 28 to 34, then the first Field Controller schedule block from each group (block numbers 10 and 28) will appear in the list.

Once a local schedule GLOBAL module has been set to link to Optimizer Schedules, it will not be possible to link it to an individual point, i.e. It will not be possible to connect any lines to any of the module nodes.

Numbers of On/Off times in the Comms Controller Schedule

A Comms Controller Time Schedule may contain many sets of on/off times per day.

A Field Controller Time Schedule module has two on/off times per day.

When a GLOBAL links a Comms Controller Schedule to a set of Field Controller schedules,

- the first set of on/off times in the Comms Controller schedule is written to the first on/off time in the corresponding Field Controller Schedule within the linked group.

- The second set of on/off times in the Comms Controller Schedule is written to the second on/off time in the relevant Field Controller Schedule. If the Comms Controller Schedule only has one set of times, the second on/off time in each Field Controller schedule will be zeroed.

- Any subsequent set of on/off times in the Comms Controller schedule are ignored.

Similarly, if an exception is in operation in the Comms Controller schedule, then the first exception on/off times will be written to the first on/off time in the relevant Field Controller schedule. If there is a second exception on/off time set then this is written to the second on/off time in the relevant Field Controller schedule, if not the second set of Field Controller on/off times is zeroed. Subsequent exception on/off times are ignored.

In a typical setup, the Optimizer reads the first on/off time in the Field Controller Schedules, which is updated by the first set of on/off times in the Comms Controller schedule.

As a result, **only the first set of on/off times** in the Comms Controller schedule are relevant to the Optimizer.

Update Process

A linked Field Controller time schedule is updated daily from a Comms Controller time schedule. This is done with a two day lag so as not to affect the Optimizer performance. If a Comms Controller schedule which is associated with a Field Controller time schedule is downloaded (changed or not) an immediate update is carried out.

- Normal Delayed Updating

At 00:01 each day all local GLOBALs are examined to see if they are Optimizer-linked Time Schedule GLOBALs.

When such a GLOBAL is found, then the Comms Controller looks ahead to see if any exceptions will be coming into force over the following 5 days. If so, it loads the exception times into the relevant linked Field Controller Schedules immediately.

If an exception ceases to be in force, then the Standard times are re-loaded into the relevant Field Controller Schedules 2 days in arrears.

Handling exceptions in this way (loading 5 days in advance, and resetting 2 days in arrears) prevents interference with Optimizer operation running over midnight, and results in a week lag in the exception times taking effect.

As a consequence, for Comms Controller Schedules that are linked to an Optimizer by an Optimizer-linked Time Schedule GLOBAL it is necessary to always enter exceptions at least 5 days in advance.

> **Note**: If a Field Controller due for updating is off-line at 00:01, then it will be updated as soon as it comes back on-line - updating will not wait 24 hrs.

- Immediate Change Updating

If a Comms Controller time schedule that is associated with a Field Controller Optimizer Schedule is changed, then a full week of the new standard times or the downloaded exception days are immediately sent to the linked Field Controller schedules - possibly altering its performance.

For an 'exception' schedule, if any exception day will be active within the next 7 days (including the current day), it will be downloaded immediately. This allows the week lag (see *Normal Delayed Updating* above) to be overridden. Any downloading of the Comms Controller Time Schedule is viewed as a change even if the actual times are not changed.

An 'immediate' update takes place on the next local global service after a delay of 1 min following the download. But if the local global is not "set up" the update will not be done.

Linking to a BACnet Schedule

In a BACnet Site, an additional BACnet Schedule block is required.

It must be added immediately before the 7 weekday schedules – i.e. it must be the last block added to the strategy before the Optimizer blocks (or Optimizer macro) are added, so that the block numbers of the blocks in the Optimizer directly follow the block number of the BACnet Schedule (This is because of assumptions built into the way the external BACnet Schedule writes to the schedule blocks inside the Optimizer).
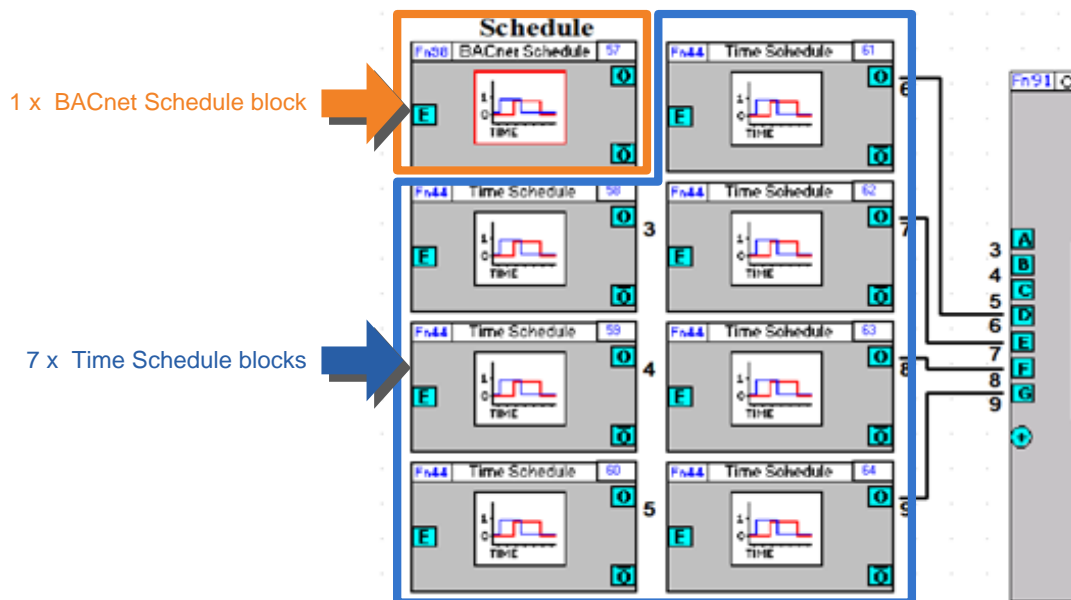
Each of the day values in this BACnet Time Schedule will be automatically copied to the relevant Time Schedule block.

SECTION 30 : APPENDIX :: PROPRIETARY BACNET PROPERTIES

The following proprietary properties are available in **Cylon BACnet Field Controller**s:

On CBT only:

Object Class: Device

Property Number	Property	Description	Read/Write	Valid values	Datatype
50771	(FS) Flash Status	This variable indicates if the CBT is currently backing up its data to flash.	Read Only	• "Flash is idle" • "Points flash in process" • "Full strategy flash in process"	Character String

On both CBM and BT controllers:

Object Class: Analog Values

Property Number	Property	Description	Read/Write	Valid values	Datatype
49492	(AT) Auto-Clear Time to Live	The Auto-Clear Function is an option whereby a temporary override value – i.e. a value written via the front end at a specified priority - has a certain "time to live" before the value at that priority is automatically reset to null. This property sets the time after which the override value will be set to null. If set to 0, this functionality is inactive	R/W	Not Bounded	Unsigned
49488	(AP) Auto-Clear Priority	This is the priority array index of the value that has a time to live when using the auto-clear functionality.	R/W	1-16	Enumerated
49475	(AC) Auto-Clear Countdown	This property states the current number of seconds until the override is cleared.	Read Only		Unsigned
54096	(SP) Save Priority Array Data Across Reboots	When set this will make the priority array save itself to flash any time there is a change to it. It is left off (set to 0) by default as most strategies will consider priority array entries to be transient data. In the event that someone has chosen to pack data in the array that won't re-establish itself naturally after a boot, then this switch can be turned on to force flash saves.	R/W	0/1	Boolean

Object Class: Binary Values

Property Number	Property	Description	Read/Write	Valid values	Datatype
49492	(AT) Auto-Clear Time to Live	The Auto-Clear Function is an option whereby a temporary override value – i.e. a value written via the front end at a specified priority - has a certain "time to live" before the value at that priority is automatically reset to null. This property sets the time after which the override value will be set to null.	R/W	Not Bounded	Unsigned
49488	(AP) Auto-Clear Priority	This is the priority array index of the value that has a time to live when using the auto-clear functionality.	R/W	1-5, 6-16	Enumerated
49475	(AC) Auto-Clear Countdown	This property states the current number of seconds until the override is cleared.	Read Only		Unsigned
54096	(SP) Save Priority Array Data Across Reboots	When set this will make the priority array save itself to flash any time there is a change to it. It is left off (set to 0) by default as most Strategies will consider priority array entries to be transient data. In the event that someone has chosen to pack data in the array that won't re-establish itself naturally after a boot, then this switch can be turned on to force flash saves.	R/W	0/1	Boolean

Object Class: Calendars

Property Number	Property	Description	Read/ Write	Valid values	Datatype
50004	(CT) Current Time	These are provided for the SI's convenience. It is the same data as the actual date and time values in the Device object but being mirrored in the schedules and calendars allows them to more easily troubleshoot their scheduling.	Read Only		Time
49988	(CD) Current Date	These are provided for the SI's convenience. It is the same data as the actual date and time values in the Device object but being mirrored in the schedules and calendars allows them to more easily troubleshoot their scheduling.	Read Only		Date

Object Class: Device

Property Number	Property	Description	Read/ Write	Valid values	Datatype
54094	(SN) Serial Number	This text string is the serial number for the controller as set in the factory.	Read Only		Character String
54089	(SI) Strategy Index Number	When the "Strategy ID" module is added to a Strategy in the Cylon Engineering Centre, its stored number will be displayed in this field, allowing the OWS to load pre-configured templates used for that particular Strategy.	Read Only		
51524	(ID) Unit Number (MSTP)	This is the MSTP address of the Device. Writing to it will cause the device to immediately drop out of the token loop and reappear in the new address specified.	R/W	0-127	Unsigned
54606	(UN) Unitron Number	This is the Unitron ID. It is advised that it be set to the same as the BACnet ID, but if required it can be written to freely via this property.	R/W	0-127	Unsigned
54612	(UT) System Up-Time (Seconds)	This is the number of seconds since the last boot.	Read Only		Unsigned
54081	(SA) Save All Data to Flash	On the CBT this will force all data to be saved to flash. On the battery backed CBM it is actually of no value.	R/W	1	Unsigned
53843	(RS) Reset/Reboot the Controller	This will cause the controller to reboot after a 300ms delay.	R/W	1	Unsigned
49491	(AS) Auto-Delete Schedule & Calendar Entries	When set, any date-specific entries will be deleted after the end of the day on which they are viable. This is intended to clear out the scheduling data for non-recurring events.	R/W	0/1	Boolean
50754	(FB) Feedback Text	This is the Engineering Centre feedback text field. When downloading a Strategy, any errors in the Strategy will be catalogued in this text variable. Writing to it clears it out, as does starting a new Strategy download.	R/W	Any write will clear out this variable	Character String

Object Class: Notification

Property Number	Property	Description	Read/ Write	Valid values	Datatype
49457	(A1) Recipient 1 Active?	Cylon supports up to 5 different recipients per notification class object. These read-only feedback variables aid in debugging any Alarm issues by indicating if any recipients are currently marked as active.	Read Only		Boolean
49458	(A2) Recipient 2 Active?				
49459	(A3) Recipient 3 Active?				
49460	(A4) Recipient 4 Active?				
49461	(A5) Recipient 5 Active?				

Object Class: Manufacturer Debug

Property Number	Property	Description	Read/ Write	Valid values	Datatype
49748	(BT) MSTP Token Round Trip in Seconds	This variable indicates the average speed of the BACnet network. It is used for determining the relative load of the BACnet network.	Read Only		Real
49747	(BS) Strategy Blocks Currently Servicing	This Unitron variable indicates the number of blocks currently servicing in the strategy	Read Only		Integer
54100	(ST) Strategy Service Time in Seconds	This Unitron variable indicates the number of blocks currently servicing in the strategy	Read Only		Real

Object Class: Schedules

Property Number	Property	Description	Read/ Write	Valid values	Datatype
50260	(DT) Schedule's Default Data Type	Writing to this variable using any of the datatypes listed to the right will cause the schedule default (and thus the schedule as a whole) to change to that datatype.	R/W	Any	• Boolean • Unsigned • Integer • Real • Enumerated • Date • Time • ObjectID
54100	(ST) Whole Seconds Until Next Transition	This feedback variable is used for Schedule troubleshooting.	Read Only		Integer
52564	(MT) Whole Minutes Until Next Transition	This feedback variable is used for Schedule troubleshooting.	Read Only		Integer
51284	(HT) Whole Hours Until Next Transition	This feedback variable is used for Schedule troubleshooting.	Read Only		Integer
52819	(NS) Next Transition State	The next time the schedule changes, this is the value that will become the present value.			Varies - based on Schedule Datatype
50004	(CT) Current Time	These are provided for the SI's convenience. It is the same data as the actual date and time values in the Device object but being mirrored in the schedules and calendars allows them to more easily troubleshoot their scheduling.	Read Only		Time
49988	(CD) Current Date	These are provided for the SI's convenience. It is the same data as the actual date and time values in the Device object but being mirrored in the schedules and calendars allows them to more easily troubleshoot their scheduling.	Read Only		Date
50754	(FB) Feedback Text	This provides information regarding the driving force behind the current present value. Messages are tailored by datatype to include the present value as well making this value suitable for OWS mirroring.	Read Only	• Default • Daily • Exception • Eff. Period • Stat Exception • Out Of Service * All of the above are also followed by data	Character String

Object Class: Unitron Schedules

Property Number	Property	Description	Read/ Write	Valid values	Datatype
49476	(AD) Active Days	This feedback variable indicates on which days of the week the schedule object is active.	Read Only	Bit 0 = Monday	Bitstring
54065	(S1) Start Time 1	Occupied Time 1	R/W	Any valid time value	Time
50481	(E1) End Time 1	Unoccupied Time 1	R/W	Any valid time value	Time
54066	(S2) Start Time 2	Occupied Time 2	R/W	Any valid time value	Time
50482	(E2) End Time 2	Unoccupied Time 2	R/W	Any valid time value	Time

SECTION 31 : APPENDIX :: CEC MACRO LIBRARY

INTRODUCTION

What are CEC Macros?

A **macro** is a combination of modules used in the **Engineering Centre** that can be saved and subsequently inserted into another **strategy** when required.

If there are parts of a **strategy** that you use frequently or if you have a special **strategy** which involves a lot of repetition, then it is quicker to use a **macro** than to continuously rewrite one piece of **strategy**.

What is the CEC Macro Library?

This **Macro Library** consists of **macros** representing standard **strategy** applications. Each represents a piece of strategy that controls a particular piece of equipment, or causes specific behaviour within a set of equipment. The following macros are included:

Macro Name	Page
Single Plant Control	719
Twin Plant Control	724
Enthalpy Difference	730
Heating Cooling and Free Energy Control	731
Heating Cooling and Free Energy Control WITH PID	734
HWS Control	737
OAT Reset with room offset	740
Reset	742
Sensor Alarm and Log	743
Sequence Control	745
Sequence Module	755
Damping	761
Frost Stages 1, 2 and 3	762
Meter	765
Optimizer	767
Seven Day Clock	769

Accessing the Macro library

The **Macro Library** is installed as part of the main **CEC** install.

The **macro**s can be easily accessed by selecting the button representing the **macro** required from the Macro bar at the bottom of the **Engineering Tool** screen and then clicking over the part of the canvas where the **macro** is to be placed. To view the function components of the **macro** click inside it with the right hand mouse button.

Information about each **macro** is also available within the **Engineering Tool**. To access this double-click the button of the desired **macro** on the bar at the bottom of the screen. This will open a text file with explanations and an example for the **macro**.

Real constants , Digital constants and Integers can be changed inside the **macro**, as can function-block variables, such as integration time in a **PID** loop. However, point numbers should not be changed or adjusted as the **macro** always takes the next available point and block numbers automatically.

SINGLE PLANT CONTROL

System overview

This macro will control any single plant* such as a pump or fan, while the optional inputs of flow, trip and pressure will generate a fault condition. This macro can be set to alarm on any fault, and/or on a maintenance runtime event.

The plant can be set to stop, run or retry when a fault is registered. It also has a "start delay" and a "run on time", and will allow both user and emergency overrides.

Inputs		Internal		Outputs	
		Values			
Flow	Flw	Plant Status	0 … 15	En	Enable
Trip	Trp	Run Time	Hours	Dmd	Demand
Pressure	PR			CF	Common Fault
Pressure SP	PRSP	**Settings**			
Reset	RS	StopOnFault (*Stop On Alarm*)	0 … 2		
Maintenance RS	MRS	StartDelay (*Plant Start Delay*)	0 … 120 s		
Override	OR	DPSFaultMonitor	0 … 1		
Demand OR Value	DMOR	MinSpeed (*Minimum Demand*)	0% … Max Demand		
Emergency OR	EOR	MaxSpeed (*Maximum Demand*)	Min Demand … 100%		
Enable	En	FaultDelay	2 … 60 s		
		FaultMonitorDelay	2 … 300 s		
		MaintenanceLimit	0 … 10,000 hrs		
		MinOffDelay (*Min Off Time*)	0 … 120 s		
		RunOnTime	0 … 900 s		
		OffSet			
		SoftStartDelay	0 … 120 s		
		FaultSelect	0 … 7		
		Gain (*PI Gain*)	0.01 … 10		
		Integral (*PI Integral*)	0 … 900 s		
		MaxPressureError (*Pressure Mismatch*)	0 … 500 pa		
		EMOverrideState (*Emergency State*)	Off : On		
		Alarms			
		Trip	Trip : Normal		
		DPS Fault	Flow Fail : Normal		
		Pressure Mismatch	Failed : Normal		
		Maintenance	Limit : Normal		
		Number of Blocks	**64**		

The term "Plant" refers to a piece of HVAC equipment

Examples

The diagrams below illustrate some scenarios in which the Single Plant Control Macro could be used:

Pump With DPS

AHU With DPS

Pump With Trip

AHU With Trip

Pump With Pressure Control

AHU With Pressure Control
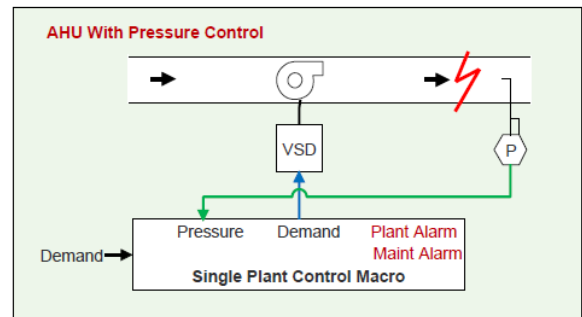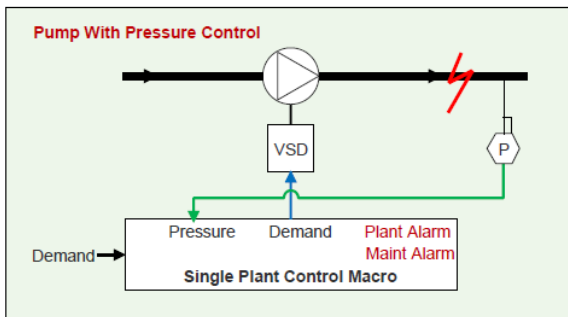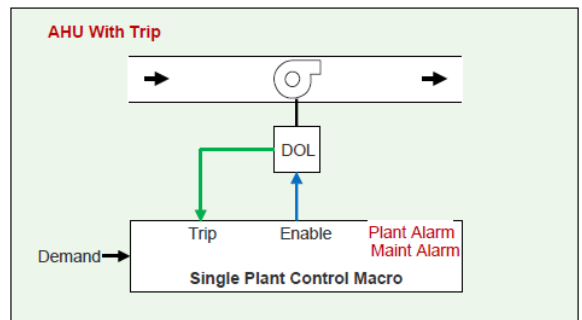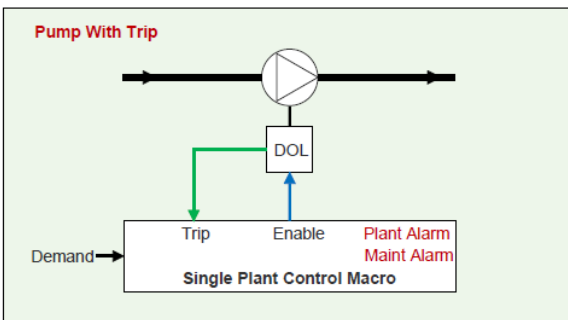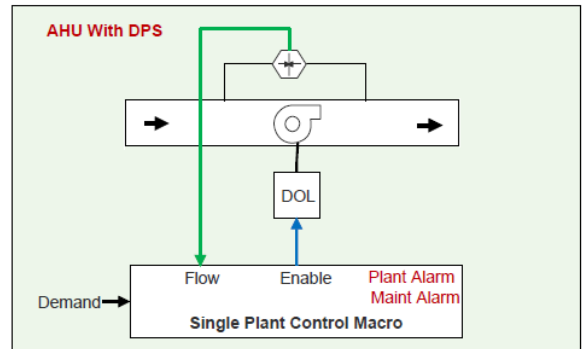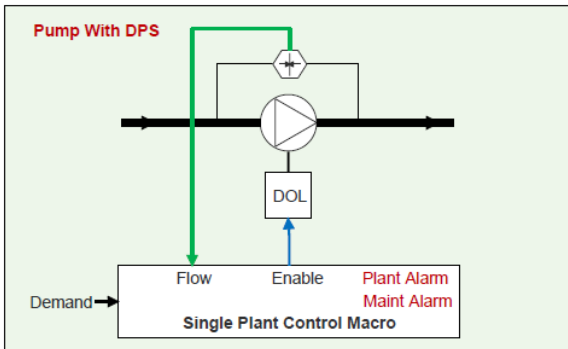
System object description

Hardware inputs

Object	Comments	Object options
Flow `Flw`	Status of a DPS monitoring the flow of the system.	0. Not used 1. Monitor flow only 2. Monitor flow and no flow
Trip `Trip`	Trip status of the starter for the plant.	0. Not used 1. Monitor
Pressure `PR`	Measurement of the static pressure in the system.	0. Not used 1. Monitor
Pressure SP `PRSP`	The demand of the system will be modulated to achieve this setpoint.	0. Not Required 1. Required.
Reset `RS`	Set to Hi to clear any active alarms.	Required if Fault Select is not 0
Maintenance reset `MRS`	Set to Hi to clear an active `Maintenance` alarm.	Required if a maintenance alarm is required.
Override `OR`	Operator override. Options 0 and 4 the system will follow the enable input. Options 2 and 6 the system will operate 24/7 but stop if set to when in alarm. Options 3 and 7 the system will run 24/7 and will ignore all alarms. Options 0-3 the demand will be in automatic control. Options 4-7 the demand will be set by the operator and the mismatch alarm will be disabled.	0. Auto 1. System always off 2. System always on (Except if Alarm) 3. System always on (Ignore Alarms) 4. Auto with Demand override 5. System always Off 6. System always on with demand override (Except if Alarm) 7. System always on (Ignore Alarms) with demand override.
Demand Override Value `DMOR`	This is the value the demand will be set to when it is overridden and the plant is enabled.	0 ⋯ 100%
Emergency OR `EOR`	Emergency Override If set to `3` the plant will be in the state set by EORS. This will take precedence over all other demands.	0. Auto 1. Off 2. On 3. Set to value of EORS
Enable `EN`	When active (on) the plant will run if no alarms or overrides are active.	1. Required

Outputs

Object	Comments	Object options
Enable `EN`	Set `active` to run the plant	1. Required
Demand `DM`	Set to the required demand to meet the pressure setpoint.	0. Not required. 1. Required.
Common Fault `CF`	Will be set if any fault either a DPS, Trip or pressure fault is active.	0. Not Used 1. Used

Internal Settings

	Comments	Object options (Default)
StartDelay **(Plant Start Delay)**	When the system calls for the plant to run, startup will be delayed for this amount of time. Used for load sequencing.	0 … 60 Seconds (10)
FaultDelay	If flow is monitored and a mismatch between the plant enable and flow status is detected, then a `Flow Failed` alarm will be raised. If pressure is monitored and a mismatch is detected between PR and PRSP ± MaxPressureError then a `Pressure Mismatch` alarm will be raised.	0 … 60 Seconds (10)
FaultMonitorDelay	When the plant starts all faults will be ignored for this time.	0 … 300 Seconds (20)
MaintenanceLimit	When the plant has run for this number of hours, a maintenance alarm is raised.	0 … 10,000 Hours (5,000)
MinOffDelay **(Min Off Time)**	Time delay between the plant stopping and being allowed to run again.	0 … 120 Seconds (30)
RunOnTime	Time in seconds the plant will run for after the enable signal has gone to Off	0 … 1200 Seconds (120)
SoftStartDelay	The minimum time taken for the demand to reach maximum if required when the system starts.	0 … 120 Seconds (30)
MinSpeed **(Minimum Demand)**	The minimum demand for the plant item to be allowed to run.	0% … Max Demand
MaxSpeed **(Maximum Demand)**	The maximum demand for the plant item to be allowed to run.	Min Demand … 100%
MaxPressureError **(Pressure Mismatch)**	The amount the pressure has to deviate from the setpoint for an alarm to be raised.	50 … 200 Pa (100) 0.007 … 0.03 psi (0.01)
EMOverrideState **(Emergency State)**	The state to which the plant will be set when an emergency state of 3 is set.	(Off): On
DPSFaultMonitor	Used to select if the flow is monitored for fault when the plant is in standby.	(0. Run Only) 1. Run and Standby
FaultSelect	Used to select which inputs are used to control plant changeover on fault.	0. None (1. DPS Only) 2. Trip Only 3. DPS + Trip 4. Pressure Mismatch 5. DPS + Pressure Mismatch 6. Trip + Pressure Mismatch 7. DPS + Trip + Pressure Mismatch
StopOnFault **(Stop On Alarm)**	Selects if a plant item should stop if in fault.	(0. Yes) 1. No-Standby plant continues to run 2. No–Plant is continuous retried.
Gain (PI Gain)	The gain for demand PI loop	0.01 … 10 (0.1)
Integral (PI Integral)	The integral for the demand PI loop	0 … 900 Seconds (0)
Offset (PI Loop Offset)	The output of the PID loop when Process Variable PV is equal to the Setpoint SP .	0-100 (50)

<u>Internal Values</u>

Object	Comments	Object options
Status	This will indicate the status of plant item. With a controlled override the plant will still follow the fault criteria. With a permanent override the plant will ignore the fault criteria and remain in the selected state.	0. Auto - Off 1. Auto - On 2. Auto – Off – Fault 3. Auto – On – Fault 4. Controlled Override – Off 5. Controlled Override – On 6. Controlled Override – Off – Fault 7. Controlled Override – On – Fault 8. Permanent Override – Off 9. Permanent Override – On 10. Permanent Override – Off – Fault 11, Permanent Override – On – Fault 16. Auto – Off With Demand OR 17. Auto – On With Demand OR 18. Contrl OR – Off With Demand OR. 19. Contrl OR – On With Demand OR. 18. Contrl OR – Off Demand OR - Fault. 19. Contrl OR – On Demand OR - Fault. 20. Permt OR – Off With Demand OR. 21. Permt OR – On With Demand OR. 22. Permt OR – Off Demand OR - Fault. 23. Permt OR – On Demand OR - Fault.
Runtime (RT)	Time the plant has run since last maintenance reset.	0….xxxx Hours

<u>Alarms</u>

Object	Comments	Object options
DPS Fault	Will alarm if DPS Fault is selected via the fault select and there is a mismatch between the run status and the DPS.	0. Not Used 1. Used
Trip	Will alarm if Trip is selected via the fault select and the trip input goes high.	0. Not Used 1. Used
Pressure Mismatch	Will alarm if Pressure Fault is selected via the fault select and there is a mismatch between required pressure and the pressure sensor.	0. Not Used 1. Used
Maintenance Alarm	Active when the plant runtime has exceeded the maintenance limit.	0. Not Used 1. Used

TWIN PLANT CONTROL

System overview

This module can be used to control any twin plant* set such as a pump set or twin fans while the optional inputs of flow, trip and pressure will generate a fault condition. This macro can be set to alarm on any fault, and/or on a maintenance runtime event.

The plant can be set to stop, run or retry when a fault is registered. It also has a "start delay" and a "run on time", and will allow both user and emergency overrides.

The lead plant can be changed either automatically or manually selected.

Inputs		Internal		Outputs	
		Values			
Flow 1	Flw1	Plant Status 1	0 ⋯ 15	En1	Enable 1
Trip 1	Trp1	Run Time 1	Hours	Dmd1	Demand 1
Flow 2	Flw2	Plant Status 2	0 ⋯ 15	En2	Enable 2
Trip 2	Trp2	Run Time 2	Hours	Dmd2	Demand 2
Pressure	PR	**Settings**		CF1	Common Fault 1
Pressure SP	PRSP	SoftStartDelay	0 ⋯ 120 s	CF2	Common Fault 2
Reset	RS	MaxPressureError	0 ⋯ 500 pa / 0 ⋯ 0.07 psi		
Maintenance RS 1	MRS1	StopOnFault	0 ⋯ 2		
Maintenance RS 2	MRS2	ChangeoverHour	0 ⋯ 23 hrs		
Lead	Lead	FaultSelect	0 ⋯ 7		
Override	OR	FaultDelay	2 ⋯ 60 s		
Demand OR Value	DMOR	Integer	0 ⋯ 900 s		
Emergency OR	EOR	ChangeoverMode	0 ⋯ 3		
Enable	En	DPSFaultMonitor	0 ⋯ 1		
		OffSet	0-100%		
		MinSpeed	0% ⋯ Max Speed		
		FaultMonitorDelay	2 ⋯ 300 s		
		Gain	0.01 ⋯ 10		
		StartDelay	0 ⋯ 120 s		
		MinOffDelay	0 ⋯ 120 s		
		MaintenanceLimit	0 ⋯ 10,000 hrs		
		RunHourChange...	0 ⋯ 10000 hrs		
		MaxSpeed	Min Speed ⋯ 100%		
		EmergencyState	Off : On		
		Monday ... Sunday	ON/OFF		
		Run On Time	0 ⋯ 900 s		
		Changeover Time	0 ⋯ 120 s		
		Alarms			
		Trip 1	Trip : Normal		
		DPS Fault 1	Flow Fail : Normal		
		Pressure Mismatch 1	Failed : Normal		
		Maintenance 1	Limit : Normal		
		Trip 2	Trip : Normal		
		DPS Fault 2	Flow Fail : Normal		
		Pressure Mismatch 2	Failed : Normal		
		Maintenance 2	Limit : Normal		
		Number of Blocks	**154**		

The term "Plant" refers to a piece of HVAC equipment

Examples

The diagrams below illustrate some scenarios in which the Twin Plant Control Macro could be used:

System object description

Inputs

Object	Comments	Object options
Flow 1 `Flw1`	Status of a DPS monitoring the flow of plant item 1.	0. Not used 1. Monitor flow only 2. Monitor flow and no flow
Trip 1 `Trp1`	Trip status of the starter for plant item 1.	0. Not used 1. Monitor
Flow 2 `Flw2`	Status of a DPS monitoring the flow of plant item 2.	0. Not used 1. Monitor flow only 2. Monitor flow and no flow
Trip 2 `Trp2`	Trip status of the starter for plant item 2.	0. Not used 1. Monitor
Pressure `PR`	Measurement of the static pressure in the system.	0. Not used 1. Monitor
Pressure SP `PRSP`	The demand of the system will be modulated to achieve this setpoint.	0. Not Required 1. Required.
Reset `RS`	Set to `Hi` to clear any active alarms.	Required if Fault Select is not 0
Maintenance reset `MRS1`	Set to `Hi` to clear an active maintenance alarm.	Required if a maintenance alarm is required.
Maintenance reset `MRS2`	Set to `Hi` to clear an active maintenance alarm.	Required if a maintenance alarm is required.
Lead LC `Lead`	`0` will automatically select the lead plant. `1` or `2` selects the lead plant but the plant will still operate as a duty/standby system. `3` or `4` only the selected plant will run.	0. Auto 1. Item 1 lead 2. Item 2 lead 3. Item 1 only 4. Item 2 only
Override `OR`	Operator override. `0` and `4` the system will follow the enable input. `2` and `6` the system will operate 24/7 but stop if set to when in alarm. `3` and `7` the system will run 24/7 and will ignore all alarms. `0-3` the demand will be in automatic control. `4-7` the demand will be set by the operator and the mismatch alarm will be disabled.	0. Auto 1. System always off 2. System always on (Except if Alarm) 3. System always on (Ignore Alarms) 4. Auto with Demand override 5. System always Off 6. System always on with demand override (Except if Alarm) 7. System always on (Ignore Alarms) with demand override.
Demand Override Value `DMOR`	This is the value to which the demand will be set when it is overridden and the plant is enabled.	Not Required
Emergency OR `EOR`	Emergency Override If set to `3` the plant will be in the state set by the EmergencyState. This will take precedence over all other demands.	0. Auto 1. Off 2. On 3. Set to value of EORS
Enable `En`	When `active` (`on`) the plant will run if no alarms or overrides are active.	Required

Outputs

Object	Comments	Object options
Enable 1 `EN1`	Set `active` to run plant item 1	Required
Demand 1 `DM1`	Set to the demand required for plant item 1 to meet the pressure setpoint.	0: Not required. 1: Required.
Enable 2 `EN2`	Set `active` to run plant item 2	Required
Demand 2 `DM2`	Set to the required demand of plant item 2 to meet the pressure setpoint `PRSP`.	0: Not required. 1: Required.
Common Fault 1 `CF1`	Will be set if any fault either a DPS, Trip or pressure fault is active.	0: Not Used 1: Used
Common Fault 2 `CF2`	Will be set if any fault either a DPS, Trip or pressure fault is active.	0: Not Used 1: Used

Internal settings

	Comments	Object options
Start Delay	When the system is called to run, the plant will be delayed by this time. Used for load sequencing.	0 ⋯ 60 s (5)
FaultDelay	If flow is monitored and a mismatch between the plant enable and flow status, then a flow failed alarm will be raised. If pressure is monitored and a mismatch between the pressure and pressure setpoint ± the "Pressure Mismatch Deviation" then a pressure mismatch alarm will be raised.	0 ⋯ 60 s (10)
FaultMonitorDelay	When the plant starts, all faults will be ignored for this time.	0 ⋯ 300 s (20)
MaintenanceLimit	When the plant has run for this number of hours, a maintenance alarm is raised.	0 ⋯ 10,000 hrs (5000)
MinOffDelay **(Min Stop Time)**	Delay between the time the plant stops and the time is allowed to run again.	0 ⋯ 120 s (120)
Run On Time	Time in seconds for which the plant will run after the enable signal has gone to `Off`	0 ⋯ 1200 s (120)
SoftStartDelay	The minimum time taken for the demand to rise to maximum, if required when the system starts.	0 ⋯ 120 s (30)
MinSpeed **(Minimum Demand)**	The minimum demand the plant item to be allowed to run.	0% ⋯ Max Demand (0)
MaxSpeed **(Maximum Demand)**	The maximum demand the plant item to be allowed to run.	Min Demand ⋯ 100% (100)
MaxPressureError **(Pressure Mismatch)**	The amount by which the pressure must deviate from the setpoint `PRSP` for an alarm to be raised.	50 ... 200 Pa (100) 0.007 ... 0.03 psi (0.01)
EmergencyState	The state to which the plant will be set when an emergency state `EOR` of 3 is set.	(Off): On
DPSFaultMonitor (Fault Monitor)	Used to select if the flow is monitored for fault when the plant is in standby.	(0. Run Only) 1. Run and Standby

	Comments	Object options
FaultSelect	Used to select which inputs are used to control plant changeover on fault.	0. None (1. DPS Only) 2. Trip Only 3. DPS + Trip 4. Pressure Mismatch 5. DPS + Pressure Mismatch 6. Trip + Pressure Mismatch 7. DPS + Trip + Pressure Mismatch
StopOnFault (Stop On Alarm)	Selects if a plant item should run if in alarm.	(0. Yes) 1. No-Standby plant continues to run 2. No–Plant is continuous retried.
Gain (PI Gain)	The gain for demand PI loop	0.01 ⋯ 10 (0.1)
Integer (PI Integral)	The integral for the demand PI loop	0 ⋯ 900 s (120)
Offset (PI Loop Offset)	The output of the PID loop when Process Variable PV is equal to the Setpoint SP .	0 ⋯ 100 (50)
SystemStartDelay (Plant Start Delay)	This specifies the delay before the lead plant will start when the system is first started.	0 … 120 s (10)
ChangoverMode (Lead Changeover)	This specifies whether the lead plant should be changed on "Time Of Day" or "Hours Run". 0 and 1 the plant lead will change immediately whether the plant is running or not. 2 and 3 the system will not change the lead plant until next system start or reset.	(0. Time Of Day – Immediate) 1. Hours Run - Immediate 2. Time Of Day – Next Start 3. Hours Hour – Next Start
ChangeoverHour (Time Of Day Change Hour)	If ChangeoverMode is set to "Time Of Day", then ChangeoverHour specifies the hour of day at which the plant will be automatically rotated.	0 ⋯ 23 hrs (2)
RunHourChange… (Hours Run Changeover)	If ChangeoverMode is set to "Hours Run", then RunHourChange specifies the time for which the lead plant will run before it is automatically rotated.	0 ⋯ 1000 hrs (100)
Monday	"Time Of Day Change Day" If ChangeoverMode is set to "Time Of Day", then these seven setpoints are used to select the day of the week on which the plant will be automatically rotated.	ON/(OFF)
Tuesday		ON/(OFF)
Wednesday		ON/(OFF)
Thursday		ON/(OFF)
Friday		ON/(OFF)
Saturday		ON/(OFF)
Sunday		(ON)/OFF

Internal Values

Object	Comments	Object options
Status Item 1 **Status Item 2**	These will indicate the status of each plant item. With a controlled override, the plant will still follow the fault criteria. With a permanent override the plant will ignore the fault criteria, and remain in the selected state.	0: Auto - Off 1: Auto - On 2: Auto – Off - Fault 3: Auto – On - Fault 4: Controlled Override – Off 5: Controlled Override – On 6: Controlled Override – Off – Fault 7: Controlled Override – On – Fault 8: Permanent Override – Off 9: Permanent Override – On 10: Permanent Override – Off – Fault 11: Permanent Override – On – Fault 16: Auto – Off With Demand OR 17: Auto – On With Demand OR 18: Contrl OR – Off With Demand OR. 19: Contrl OR – On With Demand OR. 18: Contrl OR – Off Demand OR – Fault. 19: Contrl OR – On Demand OR – Fault. 20: Permt OR – Off With Demand OR. 21: Permt OR – On With Demand OR. 22: Permt OR – Off Demand OR – Fault. 23: Permt OR – On Demand OR – Fault.
Runtime 1 (RT 1) **Runtime 2 (RT 2)**	Time for which the plant item has run since last maintenance reset.	0: Not Used 1: Used
Minimum off Time	Delay between the time that the plant stops and the time at which it is allowed to run again.	0 … 120 s

Alarms

Object	Comments	Object options
DPS Fault 1	Raise an alarm if DPS Fault is selected via the fault select and there is a mismatch between the run status and the DPS.	0: Not Used 1: Used
Trip 1	Raise an alarm if Trip is selected via the fault select and the trip input `Trp1` goes high.	0: Not Used 1: Used
Pressure Mismatch 1	Raise an alarm if Pressure Fault is selected via the fault select and there is a mismatch between required pressure and the pressure sensor.	0: Not Used 1: Used
Maintenance Alarm 1	`Active` when the plant runtime has exceeded the MaintenanceLimit parameter.	0: Not Used 1: Used
DPS Fault 2	Raise an alarm if DPS Fault is selected via the FaultSelect parameter and there is a mismatch between the run status and the DPS.	0: Not Used 1: Used
Trip 2	Raise an alarm if Trip is selected via the FaultSelect parameter and the trip input `Trp2` goes high.	0: Not Used 1: Used
Pressure Mismatch 2	Raise an alarm if Pressure Fault is selected via the FaultSelect parameter and there is a mismatch between required pressure and the pressure sensor.	0: Not Used 1: Used
Maintenance Alarm 2	`Active` when the plant runtime has exceeded the MaintenanceLimit parameter.	0: Not Used 1: Used

ENTHALPY DIFFERENCE

System overview

This module will indicate if the enthalpy or temperature is greater for the input or the output. It can be used to select the damper/thermal wheel direction on an AHU.

Inputs		Internal	Outputs	
		Values		
Temperature In	TIn	(none)	I>O	Input > Out
Humidity In	HIn	**Settings**		
Pressure In	PIn	(none)		
Temperature Out	TOut	**Alarms**		
Humidity Out	HOut	(none)		
Pressure Out	POut			
		Number of Blocks 8		

System object description

Inputs

Object	Comments	Object options
Temperature In TIn	System Input Enthalpy (temperature sensor input).	Required
Humidity In HIn	System humidity sensor input. Not used is if only temperature difference is required.	Not required
Pressure In PIn	System pressure sensor input. Used only if there is a significant difference between the Pressure Input PIn and Pressure Output POut .	Not required
Temperature Out TOut	System Output Enthalpy (temperature sensor output).	Required
Humidity Out HOut	System humidity sensor out. Not used if only temperature difference is required.	Not required
Pressure Out POut	System pressure sensor out. Used only if there is a significant difference between the Pressure Input PIn and Pressure Output POut .	Not required

Outputs

Object	Comments	Object options
Input greater than output I > O	The output will go `High` if the system input enthalpy TIn goes higher than the system out enthalpy TOut for 60 seconds. It will go `Low` if the system input enthalpy TIn goes lower than the system output enthalpy TOut for 60 seconds	Required

HEATING COOLING AND FREE ENERGY CONTROL

System overview

This module will sequence heating, cooling and free energy sources. Any **stage** can be disabled by setting its range to 0. The **cooling stage** can be overridden via an RH demand. If enabled in the settings, the **free stage** can be overridden via a CO_2 demand. If enabled in the settings, the **stages** can be forced into one of 3 modes:

0. Frost Stat (Freezestat) - a device normally fitted across a heater battery that "trips" when the temperature is too cold.
1. Frost stage 1 or 2.
2. Warmup.

Inputs		Internal		Outputs	
		Values			
Demand	Dmd	Plant Status	0 ⋯ 4	Htg	Heating
Free Direction	FDir	Settings		Free	Free Energy
CO₂ Override	COOR	FreeRange (*Free Range*)	0 ⋯ 100%	Clg	Cooling
RH Override	RHOR	HtgRange (*Heating Range*)	0 ⋯ 100%		
Frost Stat	FSta	ClgRange (*Cooling Range*)	0 ⋯ 100%		
Frost Stage 1_2	F1_2	DamperMinPos (*Damper Minimum Position*)	0 ⋯ 100%		
Warm up	WmUp	HtgFrostStatPos (*Heat Frost Stat Position*)	0 ⋯ 100%		
Enable	En	FreeFrostStatPos (*Free Frost Stat Position*)	0 ⋯ 100%		
		ClgFrostStatPos (*Cool Frost Stat Position*)	0 ⋯ 100%		
		HtgFrost1_2Pos (*Heat Frost 1 2 Position*)	0 ⋯ 100%		
		FreeFrost1_2Pos (*Free Frost 1 2 Position*)	0 ⋯ 100%		
		ClgFrost1_2Pos (*Cool Frost 1 2 Position*)	0 ⋯ 100%		
		HtgWarmUpPos (*Heat Warmup Position*)	0 ⋯ 100%		
		FreeWarmUpPos (*Free Warmup Position*)	0 ⋯ 100%		
		ClgWarmUpPos (*Cool Warmup Position*)	0 ⋯ 100%		

Alarms

(none)

Number of Blocks	15

System object description

Inputs

Object	Comments	Object options
Demand `Dmd`	This will be from a PI loop or other source determining the required demand.	Required
Free Direction `FDir`	The direction of the free energy source. Use reverse action for heating and forward action for cooling.	Off: Reverse On: Forward
CO₂ Override `COOR`	The Free Energy (Dampers) output `Free` will be set to the maximum value of the calculated demand for the Free Energy plus this input.	0 ··· 100%
RH Override `RHOR`	The cooling output `Clg` will be set to the maximum value of the calculated demand for the cooling plus this input.	0 ··· 100%
Frost Stat `Fsta`	When `Active`, the outputs will be set to the positions defined in the internal settings. This will override all other states.	Not Required
Frost Stage 1_2 `F1_2`	When `Active`, the outputs will be set to the positions defined in the internal settings.	Not Required
Warmup `WmUp`	When this is `Active` and the enable input `En` is `Off`, the outputs will be set to the positions defined in the internal settings.	Not Required
Enable `En`	When `Off`, all outputs will be `Off` unless overridden by a frost or warmup condition. When `On` the output positions will be determined by the required demand or the frost.	Off: Control disabled On: Control enabled

Outputs

Object	Comments	Object options
Heating `Htg`	Heating demand.	
Free Energy `Free`	Source for free energy dampers, heat wheel etc.	
Cooling `Clg`	Cooling demand.	

Internal Settings

Object	Comments	Object options (default)
HtgRange (*Heating Range*)	The proportion of the demand that the heating output `Htg` will take. The total of the heating, cooling and free must not exceed 100%.	0 ⋯ 100% (40%)
FreeRange (*Free Range*)	The proportion of the demand that the free energy output `Free` will take. The total of the heating, cooling and free must not exceed 100%.	0 ⋯ 100% (20%)
ClgRange (*Cooling Range*)	The proportion of the demand that the cooling output `Clg` will take. The total of the heating, cooling and free must not exceed 100%.	0 ⋯ 100% (40%)
DamperMinPos (*Damper Minimum Position*)	The minimum allowed position for the free energy output `Free` when connected to dampers. This will only apply when Control is active.	0 ⋯ 50% (10%)
HtgFrostStatPos (*Heat Frost Stat Position*)	The position to which the heating output `Htg` will go when the frost stat input is active.	0 ⋯ 100% (100%)
FreeFrostStatPos (*Free Frost Stat Position*)	The position to which the free energy output `Free` will go when the frost stat input is active.	0 ⋯ 100% (0%)
ClgFrostStatPos (*Cool Frost Stat Position*)	The position to which the cooling output `Clg` will go when the frost stat input is active.	0 ⋯ 100% (0%)
HtgFrost1_2Pos (*Heat Frost 1 2 Position*)	The position to which the heating output `Htg` will go when the frost 1_2 input is active.	0 ⋯ 100% (100%)
FreeFrost1_2Pos (*Free Frost 1 2 Position*)	The position to which the free energy output `Free` will go when the frost 1_2 input is active.	0 ⋯ 100% (0%)
ClgFrost1_2Pos (*Cool Frost 1 2 Position*)	The position to which the cooling output `Clg` will go when the frost 1_2 input is active.	0 ⋯ 100% (0%)
HtgWarmUpPos (*Heat Warmup Position*)	The position to which the heating output `Htg` will go when the warmup input is active.	0 ⋯ 100% (100%)
FreeWarmUpPos (*Free Warmup Position*)	The position to which the free energy output `Free` will go when the warmup input is active.	0 ⋯ 100% (0%)
ClgWarmUpPos (*Cool Warmup Position*)	The position to which the cooling output `Clg` will go when the warmup input is active.	0 ⋯ 100% (0%)

Internal Values

Object	Comments	Object options
Status	This will indicate the status of Control	0: Off 1: On 2: Warmup 3: Frost 1_2 4: Frost Stat

HEATING COOLING AND FREE ENERGY CONTROL WITH PID

System overview

This module will sequence heating, cooling and free energy sources. Any **stage** can be removed from the sequence by setting its range to 0. The **cooling stage** can be overridden via an RH demand. If enabled in the settings, the **free stage** can be overridden via a CO_2 demand. If enabled in the settings, the **stages** can be forced into one of 3 modes:

0. Frost Stat (Freezestat) - a device normally fitted across a heater battery that "trips" when the temperature is too cold.

1. Frost stage 1 or 2.

2. Warmup.

Inputs		Internal		Outputs	
		Values			
Process Variable	PV	Plant Status	0 ··· 4	Htg	Heating
Set Point	SP	**Settings**		Free	Free Energy
Deadband	DB	HtgGain (*Heating Gain*)	0 ··· 20 °C (32 ··· 68 °F)	Clg	Cooling
Demand	Dmd	FreeGain (*Free Gain*)	0 ··· 20 °C (32 ··· 68 °F)		
Free Direction	FDir	CClgGain (*Cooling Gain*)	0 ··· 20 °C (32 ··· 68 °F)		
CO_2 Override	COOR	HtgIntegral (*Heating Integral*)	0 ··· 900Secs		
RH Override	RHOR	FreeIntegral (*Free Integral*)	0 ··· 900Secs		
Frost Stat	FSta	ClgIntegral (*Cooling Integral*)	0 ··· 900Secs		
Frost Stage 1_2	F1_2	DamperMinPos (*Damper Minimum Position*)	0 ··· 100%		
Warm up	WmUp	HtgFrostStatPos (*Heat Frost Stat Position*)	0 ··· 100%		
Enable	En	FreeFrostStatPos (*Free Frost Stat Position*)	0 ··· 100%		
		ClgFrostStatPos (*Cool Frost Stat Position*)	0 ··· 100%		
		HtgFrost1_2Pos (*Heat Frost 1 2 Position*)	0 ··· 100%		
		FreeFrost1_2Pos (*Free Frost 1 2 Position*)	0 ··· 100%		
		ClgFrost1_2Pos (*Cool Frost 1 2 Position*)	0 ··· 100%		
		HtgWarmUpPos (*Heat Warmup Position*)	0 ··· 100%		
		FreeWarmUpPos (*Free Warmup Position*)	0 ··· 100%		
		ClgWarmUpPos (*Cool Warmup Position*)	0 ··· 100%		
		Alarms			
		(none)			
		Number of Blocks	32		

System object description

Inputs

Object	Comments	Object options
Process variable `PV`	Sensor measuring the variable to be controlled	Required
Setpoint `SP`	The target temperature	16 ⋯ 28 °C (61 ⋯ 82 °F)
Deadband `DB`	The deviation from setpoint that the heating and cooling loops will control to. The heating loop will control to `SP` − ½ `DB`. The cooling loop will control to `SP` + ½ `DB`.	1 ⋯ 4 °C (2 ⋯ 7 °F)
Demand `Dmd`	This will be from a PI loop or other source determining the required demand.	Required
Free Direction `FDir`	The direction of the free energy source. Use reverse action for heating and forward action for cooling.	Off: Reverse On: Forward
CO₂ Override `COOR`	The Free Energy (Dampers) output `Free` will be set to the maximum value of the calculated demand for the Free Energy plus this input.	0 ⋯ 100%
RH Override `RHOR`	The cooling output `Clg` will be set to the maximum value of the calculated demand for the cooling plus this input.	0 ⋯ 100%
Frost Stat `Fsta`	When `Active`, the outputs will be set to the positions defined in the internal settings. This will override all other states.	Not Required
Frost Stage 1_2 `F1_2`	When `Active`, the outputs will be set to the positions defined in the internal settings.	Not Required
Warmup `WmUp`	When this is `Active` and the enable input `En` is `Off`, the outputs will be set to the positions defined in the internal settings.	Not Required
Enable `En`	When `Off`, all outputs will be `Off` unless overridden by a frost or warmup condition. When `On` the output positions will be determined by the required demand or the frost.	Off: Control disabled On: Control enabled

Outputs

Object	Comments	Object options
Heating `Htg`	Heating demand.	
Free Energy `Free`	Source for free energy dampers, heat wheel etc.	
Cooling `Clg`	Cooling demand.	

Internal Settings

Object	Comments	Object options (default)
HtgRange (*Heating Range*)	The proportion of the demand that the heating output `Htg` will take. The total of the heating, cooling and free must not exceed 100%.	0 ⋯ 100% (40%)
FreeRange (*Free Range*)	The proportion of the demand that the free energy output `Free` will take. The total of the heating, cooling and free must not exceed 100%.	0 ⋯ 100% (20%)
ClgRange (*Cooling Range*)	The proportion of the demand that the cooling output `Clg` will take. The total of the heating, cooling and free must not exceed 100%.	0 ⋯ 100% (40%)
DamperMinPos (*Damper Minimum Position*)	The minimum allowed position for the free energy output `Free` when connected to dampers. This will only apply when Control is active.	0 ⋯ 50% (10%)
HtgFrostStatPos (*Heat Frost Stat Position*)	The position to which the heating output `Htg` will go when the frost stat input is active.	0 ⋯ 100% (100%)
FreeFrostStatPos (*Free Frost Stat Position*)	The position to which the free energy output `Free` will go when the frost stat input is active.	0 ⋯ 100% (0%)
ClgFrostStatPos (*Cool Frost Stat Position*)	The position to which the cooling output `Clg` will go when the frost stat input is active.	0 ⋯ 100% (0%)
HtgFrost1_2Pos (*Heat Frost 1 2 Position*)	The position to which the heating output `Htg` will go when the frost 1_2 input is active.	0 ⋯ 100% (100%)
FreeFrost1_2Pos (*Free Frost 1 2 Position*)	The position to which the free energy output `Free` will go when the frost 1_2 input is active.	0 ⋯ 100% (0%)
ClgFrost1_2Pos (*Cool Frost 1 2 Position*)	The position to which the cooling output `Clg` will go when the frost 1_2 input is active.	0 ⋯ 100% (0%)
HtgWarmUpPos (*Heat Warmup Position*)	The position to which the heating output `Htg` will go when the warmup input is active.	0 ⋯ 100% (100%)
FreeWarmUpPos (*Free Warmup Position*)	The position to which the free energy output `Free` will go when the warmup input is active.	0 ⋯ 100% (0%)
ClgWarmUpPos (*Cool Warmup Position*)	The position to which the cooling output `Clg` will go when the warmup input is active.	0 ⋯ 100% (0%)

Internal Values

Object	Comments	Object options
Status	This will indicate the status of Control	0: Off 1: On 2: Warmup 3: Frost 1_2 4: Frost Stat

HWS CONTROL

System overview

This module will control a **HWS Tank** (Hot Water System storage tank / hot water generator). This macro can be set up to use up to 3 different process variables (temperature or pressure sensors), and a de-stratification pump as well as analogue and digital valves. It also has the ability to run a **legionella* (Pathogen control)** cycle.

*U.S. Center of Disease Control defines Legionella as: Legionella is is a respiratory disease caused by Legionella bacteria. Sometimes the bacteria cause a serious type of pneumonia (lung infection) called Legionnaires' disease. The bacteria can also cause a less serious infection called Pontiac fever that has symptoms similar to a mild case of the flu.

Inputs		Internal		Outputs	
		Values			
High Level Temp	HTmp	(none)		AVlv	Analogue Valve
Mid-Level Temp	MTmp	**Settings**		DVlv	Digital Valve
Low Level Temp	LTmp	OffSet		DPmp	Destrat Pump
High Limit Stat	HiLS	LegionellaRunTi.. (*Legionella run time*)	0 ⋯ 120 mins		
Setpoint	SP				
Deadband	DB	LoopGain (*Loop "P"*)	2 °C ⋯ 10 ° C (36 °F ⋯ 10 °F)		
Destrat Deadband	DSDB				
Legionella Start	LStr	LoopInt (*Loop "I"*)	0 ⋯ 300 s		
Legionella Stop	LStp	LegionellaSP (*Legionella Setpoint*)	70 °C ⋯ 90 °C (18 °F ⋯ 194 °F)		
Enable	En				
		Alarms			
		High Limit	High Normal		
		Legionella Failed	Failed Normal		
		Number of Blocks	**33**		

Examples

The diagrams below illustrate some scenarios in which the **HWS Control Macro** could be used:

System object description

Inputs

Object	Comments	Object options
High Level Temp `HTmp`	HWS tank High-level temperature.	This input must be connected to a temperature sensor. If not present, then it should be connected to the low or mid sensor.
Mid-Level Temp `MTmp`	HWS tank Mid-level temperature.	This input must be connected to a temperature sensor. If not present, then it should be connected to the low or high sensor.
Low Level Temp `LTmp`	HWS tank Low-level temperature.	This input must be connected to a temperature sensor. If not present, then it should be connected to the high or mid sensor.
Hi Limit stat `HiLS`	High limit thermostat. This will close the heating valve if active.	Not required.
Setpoint `SP`	The required temperature of the hot water.	Required
Deadband `DB`	The deadband that is allowed for the hot water to deviate from the setpoint.	0 °C ⋯ 5 °C (32 °F ⋯ 41 °F)
Destrat deadband `DSDB`	The difference in temperature allowed between any of the temperature sensors before the destrat pump will be enabled.	2 °C ⋯ 5 °C (36 °F ⋯ 41 °F)
Legionella Start `LStr`	Pulsed to start the Legionella cycle. This will only start if the system enable signal `En` is `Off`. The cycle will be stopped when the legionella cycle is complete, or when the system enable signal `En` goes `On`.	Not required.
Legionella Stop `LStp`	Pulsed to stop the Legionella cycle.	Not required.
Enable `En`	Enable HWS control.	Required.

Outputs

Object	Comments	Object options
Analogue valve `AVlv`	The demand for an analogue valve.	Not required.
Digital valve `DVlv`	The demand for a digital valve.	Not required
Destrat pump `Pmp`	Enable signal for a de-stratification pump.	Not required.

Internal settings

Object	Comments	Object options (default)
LegionellaSP **(Legionella Setpoint)**	The setpoint for the *Legionella* control. The water in the calorifier will be maintained at this temperature for the time defined by the *Legionella run time*.	60 ··· 80 °C (80) 140 ··· 176 °F (176)
LegionellaRunTi.. **(Legionella run time)**	The time for which the HWS will be maintained at the *Legionella* setpoint.	0 ··· 120 mins (60)
LoopGain **(Loop "P")**	PI Loop proportional value	Required (4)
LoopInt **(Loop "I")**	PI Loop integral value	Not Required (120)
OffSet	The dead band for the demand PI loop	0 ··· 200

Alarms

Object	Comments	Object options
High Limit	An alarm will be raised if the high limit input `HiLS` goes `High`.	0: Not Used 1: Used
Legionella Failed	An alarm will be raised if the legionella cycle fails.	0: Not Used 1: Used

OAT RESET WITH ROOM OFFSET

System overview

This module can be used to calculate the required flow temperature setpoint based on outside air and an optional room temperature.

Inputs		Internal		Outputs	
		Values			
Outside Air Temp	OAT	(none)		CSP	Calculated Setpoint
Room Temp	RT	**Settings**			
Room temp Setpoint	RTSP	MaxFlow (*Flow Max*)	30 °C ... 80 °C (86 °F ⋯ 176 °F)		
Boost	BST	MaxOffSet (*Room Offset Max*)	0 °C ⋯ 10 °C (32 °F ⋯ 50 °F)		
		MinOAT (*OAT Min*)	-5 °C ⋯ 10 °C (23 °F ⋯ 50 °F)		
		MinFlow (*Flow Min*)	15 °C ⋯ 25 °C (59 °F ⋯ 77 °F)		
		MaxOAT (*OAT Max*)	15 °C ⋯ 25 °C (59 °F ⋯ 77 °F)		
		Scaling (*Room Offset Scale*)	0 ⋯ 5		
		Alarms			
		(none)			
		Number of Blocks	**10**		

System object description

Inputs

Object	Comments	Object options
OAT OAT	Outside Air Temperature.	Required
Room Temp RT	Room Temperature.	0: Not used 1: Monitor
Room Temp SP RTSP	Room Temperature Setpoint.	0: Not Used 1: Monitor
Boost BST	When set to `On` the calculated setpoint CSP will be set to the `MaxFlow` parameter	Not Required

Outputs

Object	Comments	Object options
Calculated Setpoint CSP	Calculated Setpoint	Required

Internal Settings

Object	Comments	Object options (default)
MaxOAT (OAT Max)	Maximum outside air temperature value for compensation. If OAT is above this value, then this value will be used for the calculation.	15 °C ⋯ 25 °C (20) 59 °F ⋯ 77 °F (68)
MinOAT (OAT Min)	Minimum outside air temperature value for compensation. If OAT is below this value, then this value will be used for the calculation.	-5 °C ⋯ 10 °C (0) 23 °F ⋯ 50 °F (32)
MaxFlow (Flow Max)	Maximum flow temperature value for compensation. If the Calculated flow temperature setpoint CSP is above this value, then the setpoint will be set to this value.	30 °C ⋯ 80 °C (80) 86 °F ⋯ 176 °F (176)
MinFlow (Flow Min)	Minimum flow temperature value for compensation. If the Calculated flow temperature setpoint CSP is below this value, then the setpoint will be set to this value.	15 °C ⋯ 25 °C (20) 59 °F ⋯ 77 °F (68)
MaxOffSet (Room Offset Max)	The maximum amount by which the room temperature can affect the calculated flow setpoint.	0 °C ⋯ 10 °C (5) 32 °F ⋯ 50 °F (41)
Scaling (Room Offset Scale)	Factor by which the difference between the room temperature and the setpoint is multiplied before it is added to the calculated flow setpoint.	0 ⋯ 5 (0.5)

The following formula is used calculate the flow setpoint:

```
OATCal = Maximum (MinOAT (Minimum( OAT ,  MaxOAT))

FlowCal = MaxFlow – (MaxFlow – MinFlow) * (MaxOAT – MinOAT)/ (OATCal – MinOAT)

RMoffSet = Minimum (MaxOffSet, Maximum (–MaxOffSet, (( RT  –  RTSP ) * Scaling)))


FlowTempSP = Maximum (MinFlow, Min (Minimum(FlowCal + RMOffSet, MaxFlow))
```

RESET

System overview

This module will supply a 10 second pulse from Off-On-Off for resetting plant*. When the setpoint is set to Reset (On), it will remain on for 10 seconds and then will be automatically set to Off.

Inputs	Internal	Outputs
	Values	
(none)	(none)	RS Reset
	Settings	
	(none)	
	Alarms	
	(none)	
	Number of Blocks 2	
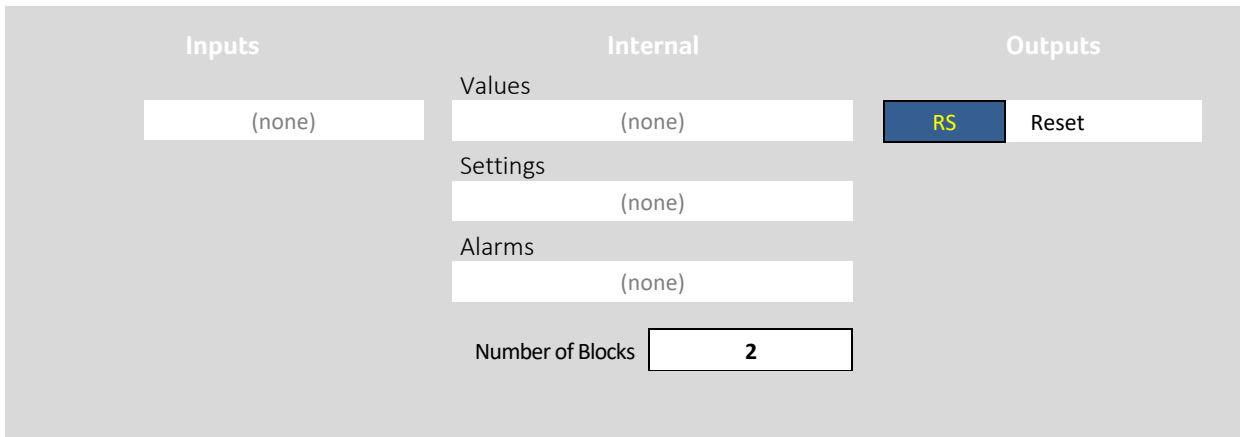
*The term "Plant" refers to a piece of HVAC equipment

System object description

<u>Outputs</u>

Object	Comments	Object options
Reset	Will go `High` for 10 seconds when set.	

<u>Internal Settings</u>

Object	Comments	Object options
Reset	Set to `On` to generate a reset pulse.	

SENSOR ALARM AND LOG

System overview

This macro will take the Process Variable and in either a Heating or a Cooling application, drive any number of Sequence Modules. The Sequence Modules are set up for individual plants which can include Chillers, Boilers and DX units.

This macro will monitor the process variable sensor, and if required generate an **out of limits alarm** and/or a **sensor failed alarm**. It will also log the sensor values.

Inputs		Internal		Outputs	
		Values			
Sensor	SIn	(none)		(none)	
Out Of Limits SP	OLSP	**Settings**			
Out Of Limits DB	OLDB	OutOfLimitsOnDe… (*Out of limits delay on time*)	0 … 600 s		
Enable Out Of Limits	EnOL	OutOfLimitsOffDe… (*Out of limits delay off time*)	0 … 600 s		
Enable Failed	EnF	FailOnDelayA (*Fail delay on time*)	0 … 600 s		
		FailOffDelayA (*Fail delay off time*)	0 … 600 s		
		FailLoSPA (*Fail Low SP*)	Unit dependent		
		FailHiSPA (*Fail Hi SP*)	Unit dependent		
		Alarms			
		Out of Limits	Alarm : Normal		
		Failed	Fail : Normal		
		Number of Blocks	**10**		

System object description

<u>Inputs</u>

Object	Comments	Object options
Sensor SIn	Sensor to be monitored.	Required
Setpoint OLSP	If the EnOL is active and the sensor value goes outside OLSP ± OLDB for the time set in Internal Setting Out Of Limits Delay On Time then an Out Of Limits alarm will be generated.	Not Required
Deadband OLDB	The deadband for the Out Of Limits alarm.	Not Required
Enable sensor out of limits EnOL	Set high (ON) to enable Out Of Limits alarm.	Off: Alarm disabled On: Alarm enable
Enable sensor failed alarm EnF	Set high (ON) to enable Sensor Failed alarm.	Off: Alarm disabled On: Alarm enable

Internal Settings

Object	Comments	Object options (default)
OutOfLimitsOnDelay **(Out of limits delay on time)**	The delay before an out of limits alarm will be generated.	Not Required (120)
OutOfLimitsOffDelay **(Out of limits delay off time)**	The delay before an out of limits alarm will be cleared.	Not Required (120)
FailOnDelay **(Fail delay on time)**	The delay before a Sensor Failed alarm will be generated.	Not Required (10)
FailOffDelay **(Fail delay off time)**	The delay before a Sensor Failed alarm will be cleared.	Not Required (10)
FailLoSP **(Fail Low SP)**	The value below which the sensor must go before it is deemed as failed.	Not Required (-20)
FailHiSP **(Fail Hi SP)**	The value above which the sensor must go before it is deemed as failed.	Not Required (130)

Alarms

Object	Comments	Object options
Out of Limits	An alarm will be raised if the sensor is outside OLSP ± OLDB for the time set in Out Of Limits Delay On Time .	0: Not Used 1: Used
Failed	An alarm will be raised if the sensor is either below the FailLoSP or above the FailHiSP for the time specified in FailOnDelay.	0: Not Used 1: Used

SEQUENCE CONTROL

System Overview

This macro can be used to sequence any number of modules. These modules can be boilers, chillers and **DX** (Direct Expansion) units. It requires the module sequence macro. The macro includes lockout and runtime alarms.

Inputs		Internal		Outputs	
		Values			
SCD2	SCD2	Plant Status	0 … 15	SCD2	SCD2
Process Variable	PV	**Settings**		SCD3	SCD3
Setpoint	SP	Gain (*PI Loop Gain*)	1 … 20		
Deadband	DB	HourOfDay (*Time Of Day (Hour)*)	0 … 23 Hours		
PI Direction	PDIR	Stage1On *	10 … 30 %		
Auto Lead Select	ALS	Stage1Off *	5 … 20 %		
Auto Demand Select	ADS	MinOnTime (*Minimum On Time*)	0 … 600 s		
Auto Module Select	AMS	StageOn*	10 … 110 %		
Boost	BST	TypeSelect *	0 … 3		
Enable	En	Integral (*PI Loop Integral*)	0 … 600 s		
		StageOff *	5 … 90 %		
		HoursRunTime	5000 Hours		
		Offset (*PI Loop Offset*)	0 … 100 %		
		MinOffTime (*Minimum Off Time*)	0 … 600 s		
		NextStageOnTime (*Next Stage On Delay*)	0 … 600 s		
		NextStageOffTime (*Next Stage Off Delay*)	0 … 600 s		
		Monday	On/Off		
		Tuesday	On/Off		
		… … … …	… … … …		
		Saturday	On/Off		
		Sunday	On/Off		
		(*Changeover Mode*)	0 … 1		
		(*PI Loop Hold*)	0 … 3		
		Alarms			
		(none)			
		Number of Blocks	**153**		

* There are four modes of operation for this sequencer: two **cascade** modes and two **parallel** modes.

- The **cascade** modes will sequence each stage individually with all enabled **stage demands** set to 100% except the last one enabled which will be modulated to achieve setpoint.

- The **parallel** modes will sequence all enabled **stage demands** to the same value. This balances the load across the boilers and allows them to run cooler, which is more efficient for condensing boilers.

Each mode is described on the following pages.

Cascade 1

This mode will:

- Enable the current stage when the calculated demand for the current stage is greater than `StageOn`.
- Disable the current stage when the calculated demand for the <u>previous</u> stage is less than `StageOff`.
- Disable Stage 1 when the demand for Stage 1 falls below `Stage1Off`.
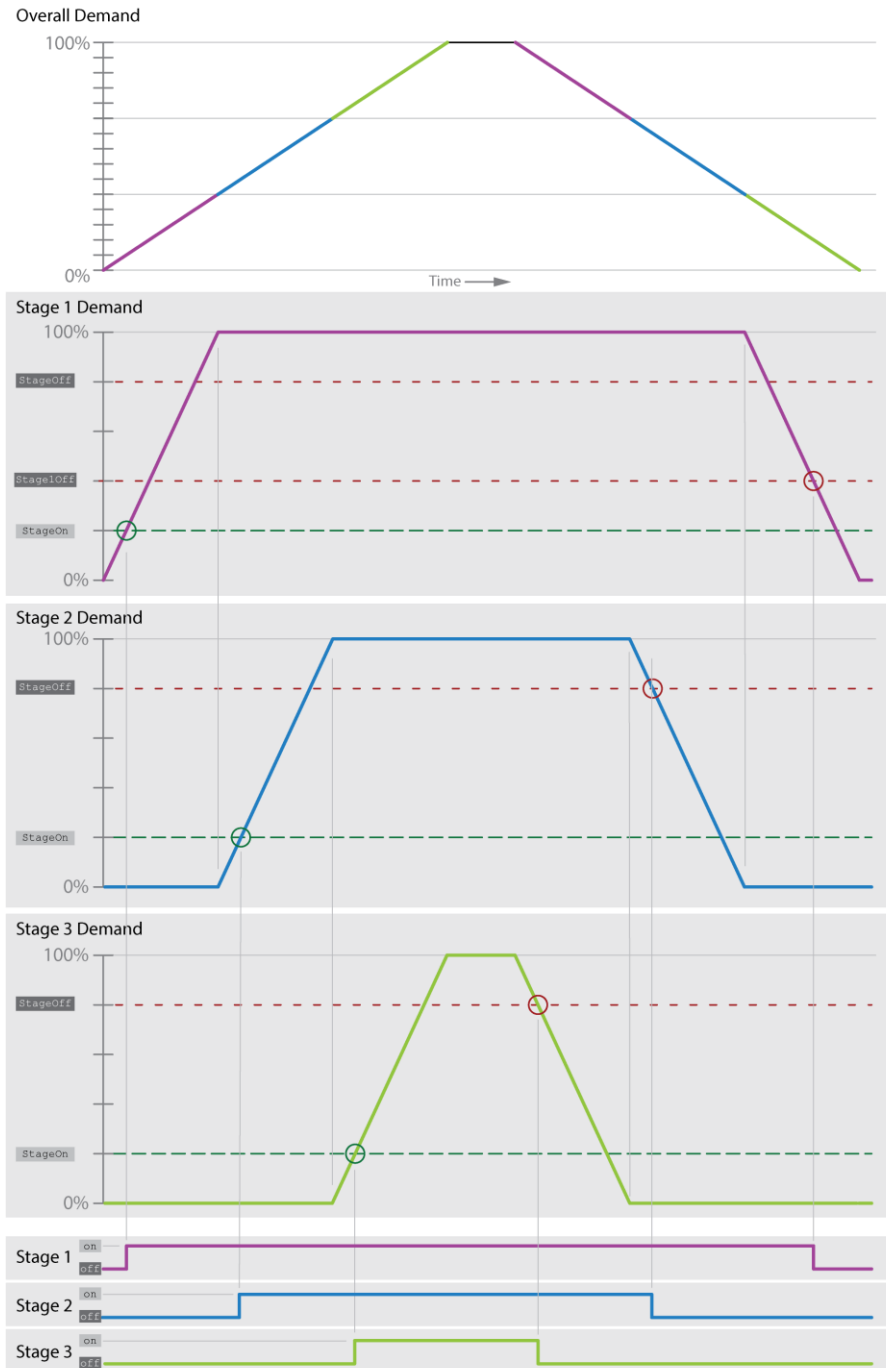
Cascade 2

This mode will:

- Enable the current stage when the calculated demand for the current stage is greater than `StageOn`.
- Disable the current stage when the calculated demand for the current stage is less than `StageOff`.
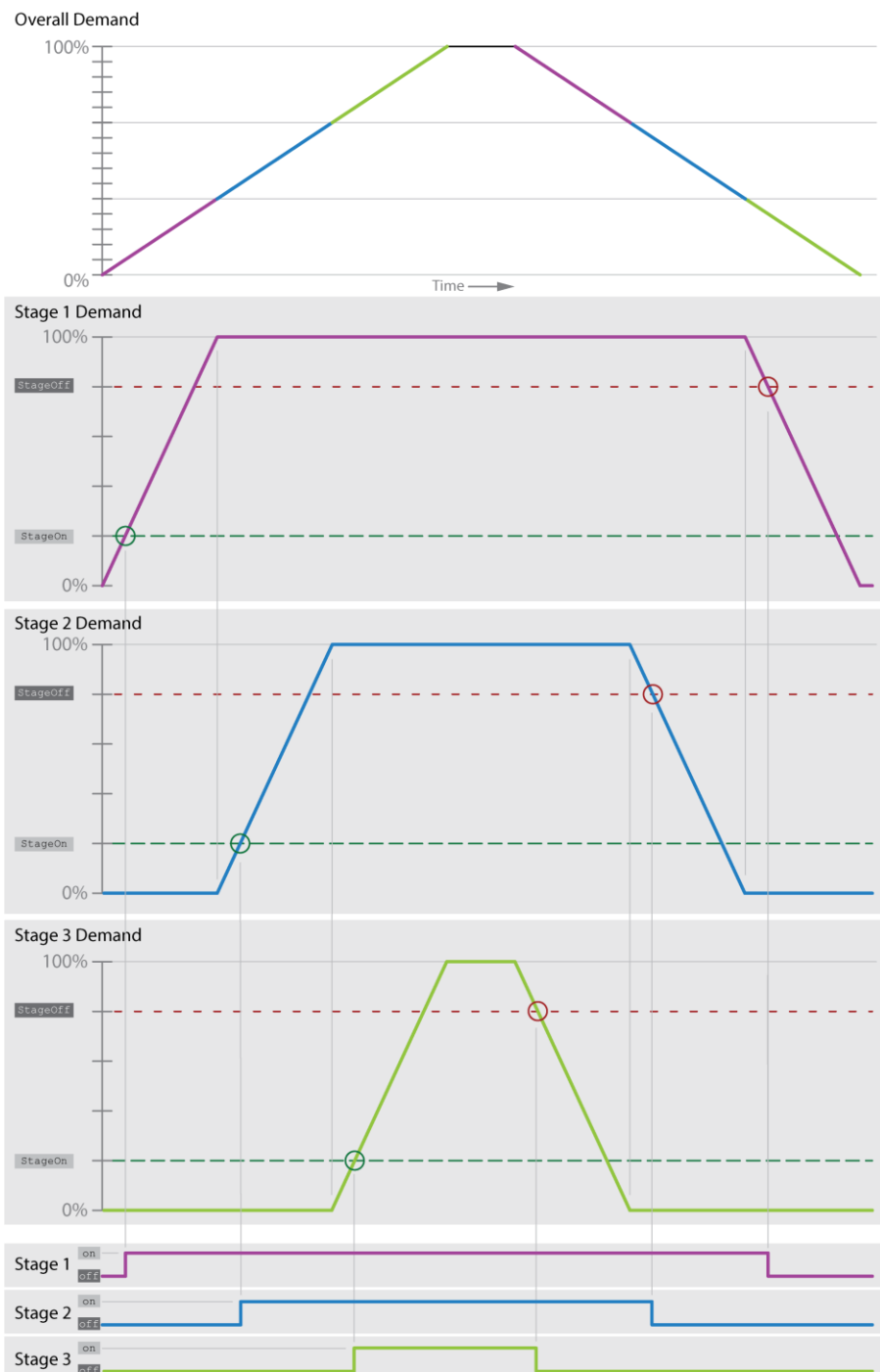
Parallel 1

This mode will:

- Enable the next stage when the calculated output for the <u>current</u> stage is greater than `StageOn`.
- Disable the current stage when the calculated demand for the current stage is less than `StageOff`
- Enable Stage 1 when the output for stage 1 is above the "`Stage1On`".
- Disable Stage 1 when the output for stage 1 falls below the "`Stage1Off`".
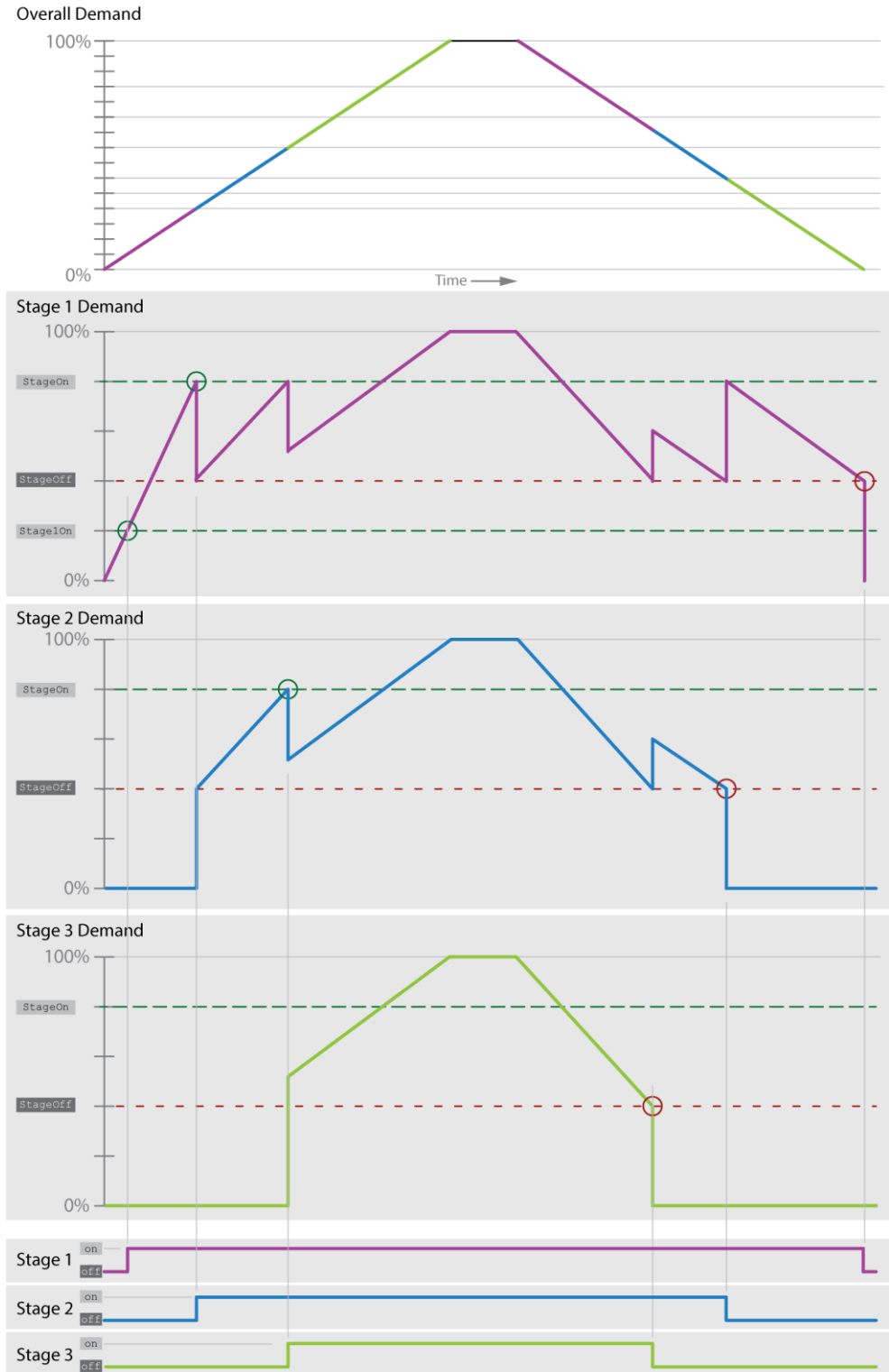
Parallel 2

This mode will:

- Enable the next stage when the calculated output for the next stage is greater than `StageOn`.
- Disable the current stage when the calculated demand for the current stage is less than `StageOff`.
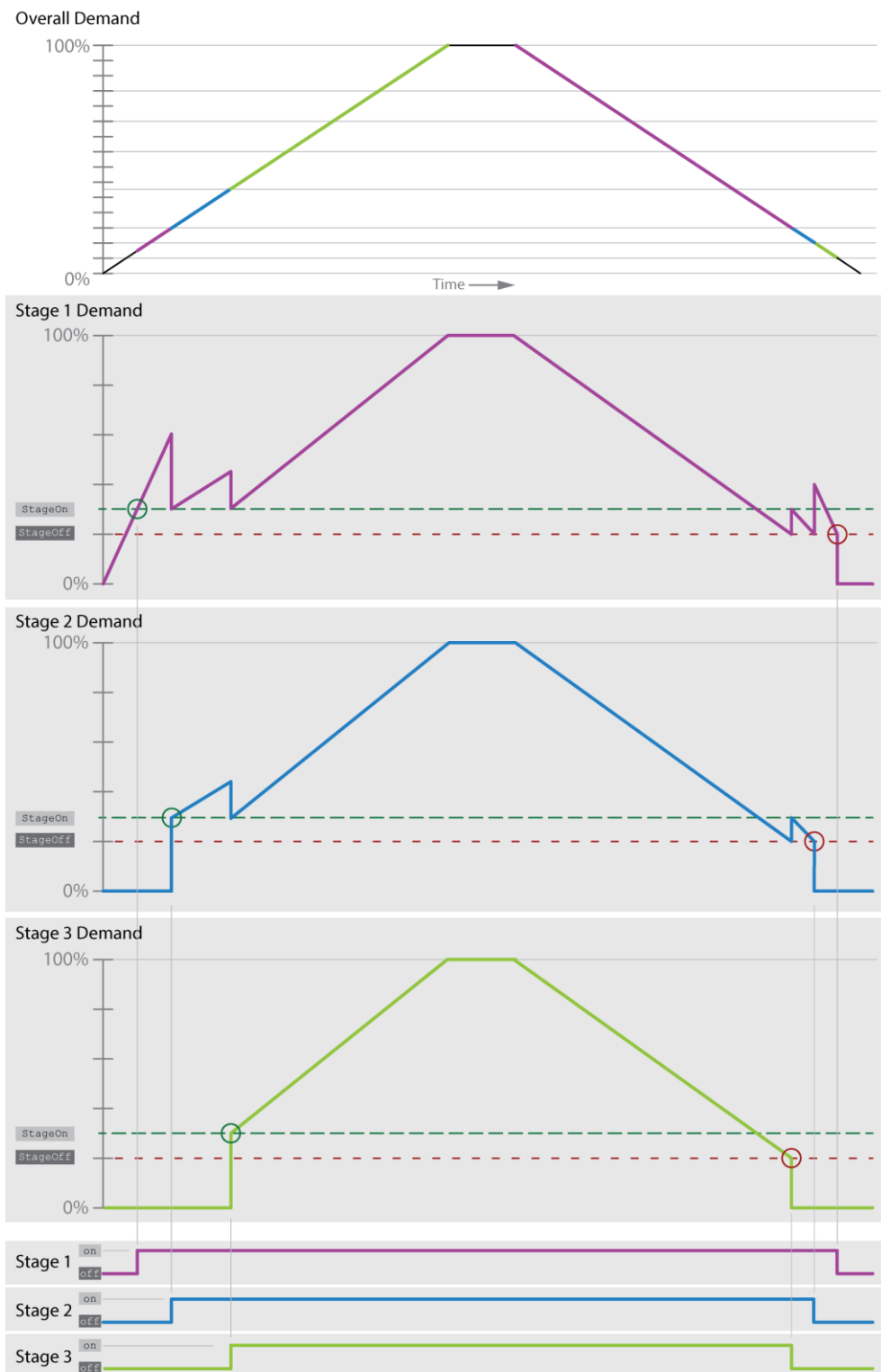
Examples

The diagram below illustrates one scenario in which the **Sequence Control Macro** could be used, and the Strategy extracts which follow illustrate how one type of scenario might be adapted to add another item of equipment:

Boiler Sequence with 2 boilers (2 sequence modules):

Note: Blue lines are normally hidden

• Macros

1. Add a **sequence control** macro with the prefix name "Boilers".

2. Add a **sequence module** macro with the prefix name "Boiler1"

3. Add a **sequence module** macro with the prefix name "Boiler2"

4. Add a **Reset** macro with the prefix name "Boiler1"

5. Add a **Reset** macro with the prefix name "Boiler"2

• I/O

1. Add Analogue input named **BoilerFlow**.

2. Add Analogue Setpoint named **BoilerFlowSP**.

3. Add Digital Input named **Boiler1Lockout**.

4. Add Digital Input named **Boiler2Lockout**.

5. Add Digital Output named **Boiler1Enable**.

6. Add Digital Output named **Boiler2Enable**.

• Connections

1. Connect SCD1 from **Boilers** to **Boiler1**

2. Connect SCD2 from **Boilers** to **Boiler1**

3. Connect SCD1 from **Boiler1** to **Boiler2**

4. Connect SCD2 from **Boiler1** to **Boiler2**

5. Connect SCD3 from **Boiler1** to **Boiler2**

6. Connect SMD from **Boiler1** to **Boiler2**

7. Connect SMD from **Boiler2** to **Boiler1**

8. Connect SCD2 from **Boiler2** to **Boilers**

9. Connect O from **BoilerFlow** to PV **Boilers**

10. Connect O from **BoilerFlowSP** to SP **Boilers**

11. Connect RS from **Boiler1** (Reset) to **Boiler1** LORS

12. Connect RS from **Boiler2** (Reset) to **Boiler2** LORS

13. Connect O from **Boiler1Lockout** to LO **Boiler1**

14. Connect O from **Boiler2Lockout** to LO **Boiler2**

15. Connect EnLo from **Boiler1** to I **Boiler1Enable**

16. Connect EnLo from **Boiler2** to I **Boiler2Enable**

Remove connections SCD2 and SMD to add another boiler:

- Macros
- I/O
- Connections

---   ---

1. Delete Line from Boiler2 SCD2 to Boiler1 SCD2
2. Delete Line from Boiler2 SMD to Boiler1 SMD

Boiler Sequence with 3rd boiler added (3 sequence modules):

Note: Blue lines are normally hidden

- Macros
- I/O
- Connections

1. Add a **Sequence** module macro with the prefix name "Boiler3"
2. Add a **Reset** macro with the prefix name "Boiler3"

1. Add **Digital Input** named Boiler3Lockout.
2. Add **Digital Output** named Boiler3Enable.

1. Connect SCD1 from Boiler2 to Boiler3
2. Connect SCD2 from Boiler2 to Boiler3
3. Connect SCD3 from Boiler2 to Boiler3
4. Connect SMD from Boiler2 to Boiler3
5. Connect SMD from Boiler3 to Boiler1
6. Connect SCD2 from Boiler3 to Boilers
7. Connect RS from Boiler3 (Reset) to Boiler3 LORS
8. Connect O from Boiler3Lockout to LO Boiler3
9. Connect EnLo from Boiler3 to I Boiler3Enable

System object description

Inputs

Object	Comments	Object options
System Control Data 2 `SCD2`	Used internally to control modules. This should be connected to the output of the last module that is being controlled.	Required
Process Variable `PV`	The temperature sensor used to sequence the boiler modules.	Required
Setpoint `SP`	The setpoint to which the boiler module sequence will control.	Required
Deadband `DB`	When the Process Variable `PV` reaches the setpoint `SP`, the control loop will remain fixed until `PV` goes outside `SP` ± `DB`.	Not Required
PI Direction `PDIR`	Selects the direction of the PI loop	0: Reverse (Heating) 1: Forward (Cooling)
Boost `BST`	Overrides the "delay on timer" allowing more than one stage to come on together.	Off: On On: Override
Auto Lead Select `ALS`	Used to fix the lead module. `0` will enable automatic lead selection.	0: Auto 1: Module 1 2: Module 2.
Auto Demand Select `ADS`	Used to override the demand calculation. `0` will enable automatic demand.	0: Auto Demand 1 ⋯ 100 : % Demand
Auto Module Select `AMS`	Used to fix the number of modules enabled. `0` will enable automatic module selection.	0: Auto > 1: value specifies the number of Modules
Enable `En`	Set this to `On` for the sequencer to operate.	Off: Sequencer Off On: Sequencer On

Outputs

Object	Comments	Object options
System Control Data 2 `SCD2`	Used internally to control the modules. This output must be connected to the first module being controlled.	Required
System Control Data 3 `SCD3`	Used internally to control the modules. This output must be connected the first module being controlled.	Required

Internal Settings

Object	Comments	Object options (default)
TypeSelect *	Specifies the type of control for the boilers - either cascade or parallel	0 = Cascade 1 1 = Cascade 2 2 = Parallel 1 3 = Parallel 2
Stage On*	Output value for next stage to be enabled.	10 % ⋯ 110 %
StageOff *	Output value for current stage to be disabled.	5% ⋯ 100 %
Stage1On *	Output value for stage 1 to be enabled.	5% ⋯ 20 %
Stage1Off *	Output value for stage 1 to be disabled.	5% ⋯ 20 %
MinOnTime (Minimum On Time)	Minimum time for which a stage is enabled before it can be disabled.	0 ⋯ 600 s
MinOffTime (Minimum Off Time)	Minimum time for which a stage is disabled before it can be enabled.	0 ⋯ 600 s
NextStageOnTime (Next Stage On Delay)	Minimum time after one stage is enabled before the next stage can be enabled (if it is required that the next stage be enabled)	0 ⋯ 600 s
NextStageOffTime (Next Stage Off Delay)	Minimum time after one stage is disabled before the next stage can be disabled (if it is required that the next stage be disabled).	0 ⋯ 600 s
Gain (PI Loop Gain)	Sets the gain for the PI Loop	1 ⋯ 10
Integral (PI Loop Integral)	Sets the integral for the PI Loop	0 ⋯ 600 s
Offset (PI Loop Offset)	The output of the PID loop when Process Variable PV is equal to the Setpoint SP .	0 ⋯ 100 (50)
HoursRunTime	Specifies whether auto changeover should change to the next module in the sequence, or to the module with the minimum run time.	0 = Hours Run 1 = Time
HourOfDay (Time Of Day (Hour))	This specifies the hour of day which the plant will be automatically rotated.	0 ⋯ 23 (2)
Monday	These seven set points are used to select the day of the week to which the plant will be automatically rotated.	On/Off
Tuesday		On/Off
Wednesday		On/Off
Thursday		On/Off
Friday		On/Off
Saturday		On/Off
Sunday		On/Off

SEQUENCE MODULE

System overview

This macro is used in conjunction with the sequence control module to control a number of plant items such as boilers and chillers. The macro includes lockout and runtime alarms.

Inputs		Internal		Outputs	
		Values			
SCD1	SCD1	Plant Status	0 … 15	SCD1	SCD1
SCD2	SCD2	Run Time	Hours	SCD2	SCD2
SCD3	SCD3	**Settings**		SCD3	SCD3
SMD	SMD	HiLo	1, 0	SMD	SMD
Lockout	LO	MaintenanceLimit	100 … 10000 hrs	EnHi	Enable High
Disable	DIS	**Alarms**		EnLo	Enable Low
Lockout Reset	LOSR	Maintenance	Limit : Normal	Dmd	Demand
Maintenance Reset	MRS				
Total Runtime Reset	TRRS	Number of Blocks	**65**		

The term "Plant" refers to a piece of HVAC equipment

Examples

The diagram below illustrates one scenario in which the **Sequence Module Macro** could be used, and the Strategy extracts which follow illustrate how one type of scenario might be adapted to add another item of equipment:

Boiler Sequence with 2 boilers (2 sequence modules):

Note: Blue lines are normally hidden

- **Macros**

1. Add a **sequence control** macro with the prefix name "Boilers".

2. Add a **sequence module** macro with the prefix name "Boiler1"

3. Add a **sequence module** macro with the prefix name "Boiler2"

4. Add a **Reset** macro with the prefix name "Boiler1"

5. Add a **Reset** macro with the prefix name "Boiler"2

- **I/O**

1. Add Analogue input named **BoilerFlow**.

2. Add Analogue Setpoint named **BoilerFlowSP**.

3. Add Digital Input named **Boiler1Lockout**.

4. Add Digital Input named **Boiler2Lockout**.

5. Add Digital Output named **Boiler1Enable**.

6. Add Digital Output named **Boiler2Enable**.

- **Connections**

1. Connect SCD1 from **Boilers** to **Boiler1**

2. Connect SCD2 from **Boilers** to **Boiler1**

3. Connect SCD1 from **Boiler1** to **Boiler2**

4. Connect SCD2 from **Boiler1** to **Boiler2**

5. Connect SCD3 from **Boiler1** to **Boiler2**

6. Connect SMD from **Boiler1** to **Boiler2**

7. Connect SMD from **Boiler2** to **Boiler1**

8. Connect SCD2 from **Boiler2** to **Boilers**

9. Connect O from **BoilerFlow** to PV **Boilers**

10. Connect O from **BoilerFlowSP** to SP **Boilers**

11. Connect RS from **Boiler1** (Reset) to **Boiler1** LORS

12. Connect RS from **Boiler2** (Reset) to **Boiler2** LORS

13. Connect O from **Boiler1Lockout** to LO **Boiler1**

14. Connect O from **Boiler2Lockout** to LO **Boiler2**

15. Connect EnLo from **Boiler1** to I **Boiler1Enable**

16. Connect EnLo from **Boiler2** to I **Boiler2Enable**

Remove connections SCD2 and SMD to add another boiler:

• Macros	• I/O	• Connections
---	---	1. Delete Line from Boiler2 SCD2 to Boiler1 SCD2
		2. Delete Line from Boiler2 SMD to Boiler1 SMD

Boiler Sequence with 3rd boiler added (3 sequence modules):

• Macros

1. Add a **Sequence** module macro with the prefix name "Boiler3"

2. Add a **Reset** macro with the prefix name "Boiler3"

• I/O

1. Add **Digital Input** named **Boiler3Lockout**.

2. Add **Digital Output** named **Boiler3Enable**.

• Connections

1. Connect SCD1 from **Boiler2** to **Boiler3**
2. Connect SCD2 from **Boiler2** to **Boiler3**
3. Connect SCD3 from **Boiler2** to **Boiler3**
4. Connect SMD from **Boiler2** to **Boiler3**
5. Connect SMD from **Boiler3** to **Boiler1**
6. Connect SCD2 from **Boiler3** to **Boilers**
7. Connect RS from **Boiler3** (Reset) to **Boiler3** LORS
8. Connect O from **Boiler3Lockout** to LO **Boiler3**
9. Connect EnLo from **Boiler3** to I **Boiler3Enable**

System object description

Inputs

Object	Comments	Object options
System Control Data 1 `SCD1`	Used internally to control the module. The input of the first module must be connected to the Sequence controller. The input of each subsequent module should be connected to the previous module.	Required
System Control Data 2 `SCD2`	Used internally to control the module. The input of the first module must be connected to the Sequence controller. The input of each subsequent module should be connected to the previous module.	Required
System Control Data 3 `SCD3`	Used internally to control the module. The input of the first module must not be connected. The input of each subsequent module should be connected to the previous module.	Required
System Module Data `SMD`	Used internally to control the module. The input of the first module must be connected to the output of the last module. The input of other modules should be connected to the previous module.	Required
Lockout `LO`	Plant lockout or fault.	Not Required
Disable `DIS`	Set to `High` to remove the module for the sequence and disable the outputs.	Not Required
Lockout Reset `LOSR`	Set to `High` to clear a lockout fault.	Not Required
Maintenance Reset `MRS`	Set to `High` to clear an active maintenance alarm.	Not Required
Total RunTime Reset `TRRS`	Set to `High` to clear the RunTime record.	Not Required

Outputs

Object	Comments	Object options
System Control Data 1 `SCD1`	Used internally to control the module. The output of the last module must not be connected. The output of other modules should be connected to the next module.	Required
System Control Data 2 `SCD2`	Used internally to control the module. The output of the last module must be connected to the sequence module. The output of other modules should be connected to the next module.	Required
System Control Data 3 `SCD3`	Used internally to control the module. The output of the last module must not be connected. The output of other modules should be connected to the next module.	Required
System Module Data `SMD`	Used internally to control the module. The output of the last module must be connected to the input of the first module. The output of other modules should be connected to the next module.	Required
Enable High `EnHi`	Active state to enable the boiler high fire to run	Not Required
Enable Low `EnLo`	Active state to enable the boiler low fire to run	Not Required
Demand `Dmd`	This is a 0 ··· 100% output used to control modulating boilers	Not Required

Internal Settings

Object	Comments	Object options (default)
HiLo	This sets the macro to control a signal fire boiler or a Hi-Lo fire.	(0: On-Off) 1: Hi-Lo
MaintenanceLimit	This is the length of time the plant can run before a maintenance alarm is raised.	100 ⋯ 10000 (5000)

Internal Values

Object	Comments	Object options
Status	This will indicate the status of module.	0: Auto – Off 1: Auto On 2: Lockout 3: Disabled
Runtime	Time the plant has run since last maintenance reset.	0: Not Used 1: Used

Alarms

Object	Comments	Object options
Maintenance Alarm	Active when the plant runtime has exceeded the MaintenanceLimit.	0: Not Used 1: Used

DAMPING

System overview

This module will dampen the rate of change of an analogue value.

Inputs		Internal		Outputs	
		Values			
Input	In		(none)	Out	Output
Disable	Dis	**Settings**			
		Maximum Change	0 ⋯ 200		
		Alarms			
			(none)		
		Number of Blocks	**13**		

System object description

Inputs

Object	Comments	Object options
Input In	The analogue value to be damped.	Required
Disable Dis	When this input is `set`, damping is NOT applied to the output.	Not Required

Outputs

Object	Comments	Object options
Output Out	The damped output.	Required.

Internal Values

Object	Comments	Object options
MaxChnage	The maximum amount of change the output is allowed per second.	0 ⋯ 200 (0.5)

FROST STAGES 1, 2 AND 3

System overview

This module will generate demands for 3 frost stages based on outside, flow and room temperatures.

- Stage 1 : Outside Air Temperature is just above freezing – start the circulation pumps to prevent the water freezing in the pipes.

- Stage 2 : Boiler flow temperature is low – enable the boilers and circulation pumps until the boiler flow temperature is above the low limit setpoint and deadband.

- Stage 3 : Fabric Protection (Space Temperature is low) – enable the boilers, circulation pumps and sace control until the Space Temperature is above the low-limit setpoint and deadband.

It will also raise alarms for each frost level if enabled.

Inputs		Internal		Outputs	
		Values			
Outside Temp	OAT	Plant Status	0 … 7	FS1	Frost Stage 1
Flow Temp	FT	**Settings**		FS2	Frost Stage 2
Room Temp	RT	Stage1SP *(Frost Stage 1 Setpoint)*	1 °C ··· 5 °C (34 °F … 41 °F)	FS3	Frost Stage 3
		Stage1DB *(Frost Stage 1 Deadband)*	1 °C ··· 4 °C (1 °F … 7 °F)		
		Stage1AlarmEn *(Frost Stage 1 Alarm Enable)*	On : Off		
		Stage2SP *(Frost Stage 2 Setpoint)*	10 °C ··· 20 °C (50 °F … 36 °F)		
		Stage2DB *(Frost Stage 2 Deadband)*	1 °C ··· 4 °C (1 °F … 7 °F)		
		Stage2AlarmEn *(Frost Stage 2 Alarm Enable)*	On : Off		
		Stage3SP *(Frost Stage 3 Setpoint)*	10 °C ··· 16 °C (50 °F … 61 °F)		
		Stage3DB *(Frost Stage 3 Deadband)*	1 °C ··· 4 °C (1 °F … 7 °F)		
		Stage3AlarmEn *(Frost Stage 3 Alarm Enable)*	On : Off		
		Alarms			
		Frost Stage 1			
		Frost Stage 2			
		Frost Stage 3			
		Number of Blocks	**11**		

System object description

Inputs

Object	Comments	Object options
Outside Temp OAT	Sensor measuring the outside air temperature	Required
Flow Temp FT	Sensor measuring the boiler flow temperature.	Not Required
Room Temp RT	Sensor measuring the room temperature.	Not Required

Outputs

Object	Comments	Object options
Frost Stage 1 FS1	On when frost stage 1 is calculated.	
Frost Stage 2 FS2	On when frost stage 2 is calculated.	
Frost Stage 3 FS3	On when frost stage 3 is calculated.	

Internal Settings

Object	Comments	Object options (default)
Stage1SP	When the outside air temperature falls below this value FS1 will be set.	1 °C ··· 5 °C (2) 34 °F … 41 °F (36)
Stage1DB	When the outside air temperature rises above Stage1SP + Stage1DB , then FS1 will be cleared.	1 °C ··· 4 °C (2) 1 °F … 7 °F (4)
Stage1AlarmEn	If this is active, then a Frost Stage 1 alarm will be raised when FS1 is set.	Off : On (Off)
Stage2SP	When the outside air temperature falls below this value FS2 will be set.	10 °C ··· 20 °C (15) 50 °F … 68 °F (59)
Stage2DB	When the outside air temperature rises above Stage2SP + Stage2DB , then FS2 will be cleared.	1 °C ··· 4 °C (2) 1 °F … 7 °F (4)
Stage2AlarmEn	If this is active, then a Frost Stage 2 alarm will be raised when FS2 is set.	Off : On(Off)
Stage3SP	When the outside air temperature falls below this value FS3 will be set.	10 °C ··· 15 °C (12) 50 °F … 59 °F (54)
Stage3DB	When the outside air temperature rises above Stage3SP + Stage3DB , then FS3 will be cleared.	1 °C ··· 4 °C (2) 1 °F … 7 °F (4)
Stage3AlarmEn	If this is active, then a Frost Stage 3 alarm will be raised when FS3 is set.	Off : On (Off)

Internal Values

Object	Comments	Object options
Status	This will indicate the status of Control	0. Off 1. Frost Stage 1 2. Frost Stage 2 3. Frost Stage 1 and 2 4. Frost Stage 3 5. Frost Stage 1 and 3 6. Frost Stage 2 and 3 7. Frost Stage 1,2 and 3

Alarms

Object	Comments	Object options
Frost Stage 1	An alarm will be raised if Frost Stage 1 is active.	0. Not Used 1. Used
Frost Stage 2	An alarm will be raised if Frost Stage 2 is active.	0. Not Used 1. Used
Frost Stage 3	An alarm will be raised if Frost Stage 3 is active.	0. Not Used 1. Used

METER

System overview

This module will monitor a pulsed or analogue meter and produce the following data.

1. Total value
2. 15-minute total log
3. 1-hour log
4. Last hour value
5. Daily log
6. Yesterday value
7. Weekly value (With external point to log)
8. Last week value
9. Monthly value (With external point to log)
10. Last month value.

Inputs	Internal	Outputs
	Values	
Pulsed Input — PIn	(none)	WLV — Weekly Log Value
Analogue In — AIn		WLT — Weekly Log Trigger
	Settings	MLV — Monthly Log Valve
	Pulse Meter Set — 0 ⋯ 10000	MLT — Monthly Log Trigger
	Alarms	
	(none)	
	Number of Blocks — **30**	
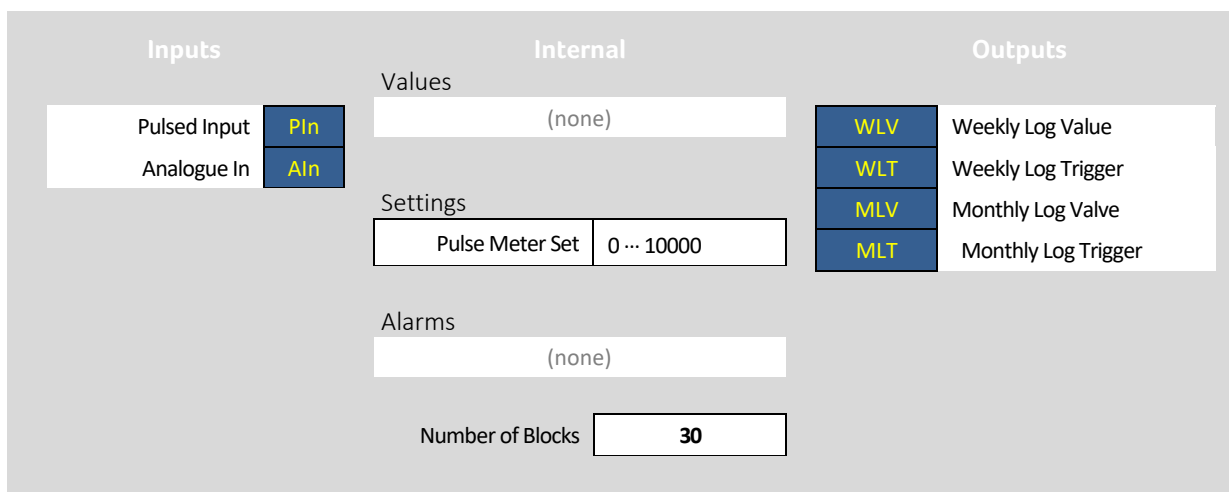
System object description

Inputs

Object	Comments	Object options
Pulsed Input PIn	Pulse meter input. The must be a universal input with the type set to Pulse(V/F) Only one input must be connected, either Pin or AIn .	Not Required
Analogue Input AIn	Must be an analogue input, typically from a Modbus meter. Only one input must be connected, either Pin or AIn .	Not Required

Outputs

Object	Comments	Object options
Weekly Log Value `WLV`	If a weekly data log is required, then connect this output to the Log Point (I or I of a datalog module. The data log must be set to Falling edge trigger only. (Advanced options).	Not Required.
Weekly Log Trigger `WLT`	If a weekly data log is required, then connect this output to the Log Trigger T of a datalog module.	Not required.
Monthly Log Value `WLV`	If a Monthly datalog is required, then connect this output to the Log Point I or I of a data log. Data log must be set to Falling edge trigger only. (Advanced options).	Not Required.
Monthly Log Trigger `WLT`	If a Monthly datalog is required, then connect this output to the Log Trigger T of a datalog module.	Not required.

Internal Settings

Object	Comments	Object options (Default)
Pulsed Meter Set (0)	The meter output will be set to this value.	0-xxxxx. (0)

OPTIMIZER

System overview

This module can be used for heating and cooling optimization. If this is used in a **Unitron strategy**, then a **Global** schedule will be required to be placed on the **strategy** immediately before you place the optimizer on the **strategy**.

Inputs		Internal	Outputs	
		Values		
Outside Air Temp	OAT	(none)	HDmd	Heat Demand
Room Temp	RT	**Settings**	HBst	Heat Boost
Room Temp Setpoint	RTSP		HDay	Heat Day
Heat Deadband	HDB	Frost SP — 8 °C ⋯ 14 °C (46 °F ⋯ 57 °F)	HFst	Heat Frost
Cool Deadband	CDB	Frost DB — 1 °C ⋯ 4 °C / 1 °F ⋯ 7 °F	CDmd	Cool Demand
		HMaxStart (Max Heat Start) — 0 ⋯ 180 mins	CBst	Cool Boost
		HMaxStop (Max Heat Stop) — 0 ⋯ 180 mins	CDay	Cool Day
		CMaxStart (Max Cool Start) — 0 ⋯ 180 mins	Sch	Schedule
		CMaxStop (Max Cool Stop) — 0 ⋯ 180 mins		
		Monday — On: Off Times		
		Tuesday — On: Off Times		
		Wednesday — On: Off Times		
		Thursday — On: Off Times		
		Friday — On: Off Times		
		Saturday — On: Off Times		
		Sunday — On: Off Times		
		Alarms		
		(none)		
		Number of Blocks — **18**		

System object description

Inputs

Object	Comments	Object options
Outside Air Temp OAT	Outside Air Temperature.	Required
Room Temp RT	Room Temperature.	Required
Room Temp Setpoint RTSP	Room Temperature Setpoint.	Required
Heat Deadband HDB	The maximum temperature by which the room temperature RT is allowed to fall below the setpoint RTSP during an optimum stop. If exceeded, the demand HDmd will be turned on.	Required for heating optimizer.
Cool Deadband HDB	The maximum temperature by which the room temperature RT is allowed to rise above the setpoint RTSP during an optimum stop. If exceeded, the demand HDmd will be turned on.	Required for cooling optimizer.

Outputs

Object	Comments	Object options (Default)
Heat Demand `HDmd`	Heating demand. `On` when heat is required.	Required for heating optimizer.
Heat Boost `HBst`	Heating Boost. `On` during a heating optimum start.	Not required.
Heat Day `HDay`	Heating Day. `On` from end of boost to start of optimum stop.	Not required.
Heat Frost `HFst`	`On` if the room temperature `RT` falls below the frost setpoint. `Off` if the room temperature `RT` is above FrostSP + FrostDB.	Not required
Cool Demand `CDmd`	Cooling demand. `On` when cooling is required.	Required for cooling optimizer.
Cool Boost `CBst`	Cooling Boost. `On` during a cooling optimum start.	Not required.
Cool Day `HDay`	Cooling Day. `On` from end of boost to start of optimum stop.	Not required.
Schedule `Sch`	`On` if the optimizer time schedule is active.	Not required.

Internal Settings

Object	Comments	Object options
FrostSP	Frost setpoint.	8 °C ⋯ 14 °C (12) 46 °F ⋯ 57 °F (54)
FrostDB	Used to select if the flow is monitored for fault when the plant is in standby.	1 °C ⋯ 4 °C (2) 1 °F … 7 °F (4)
HMaxStart	Maximum time allowed for a heating optimum start.	0 ⋯ 180 Minutes (120)
HMaxStop	Maximum time allowed for a heating optimum stop.	0 ⋯ 180 Minutes (60)
CMaxStart	Maximum time allowed for a cooling optimum start.	0 ⋯ 180 Minutes (120)
CMaxStop	Maximum time allowed for a cooling optimum stop.	0 ⋯ 180 Minutes (60)
Monday	Contains two Off:On times for Monday.	
Tuesday	Contains two Off:On times for Tuesday.	
Wednesday	Contains two Off:On times for Wednesday.	
Thursday	Contains two Off:On times for Thursday.	
Friday	Contains two Off:On times for Friday.	
Saturday	Contains two Off:On times for Saturday.	
Sunday	Contains two Off:On times for Sunday.	

SEVEN DAY CLOCK

System overview

This module gives seven local time schedules, one for each day of the week.

Inputs	Internal	Outputs
	Alarms	
(none)	(none)	True — Output
	Settings	Comp — Complement

Monday	On: Off Times
Tuesday	On: Off Times
Wednesday	On: Off Times
Thursday	On: Off Times
Friday	On: Off Times
Saturday	On: Off Times
Sunday	On: Off Times

Alarms

(none)

Number of Blocks   8
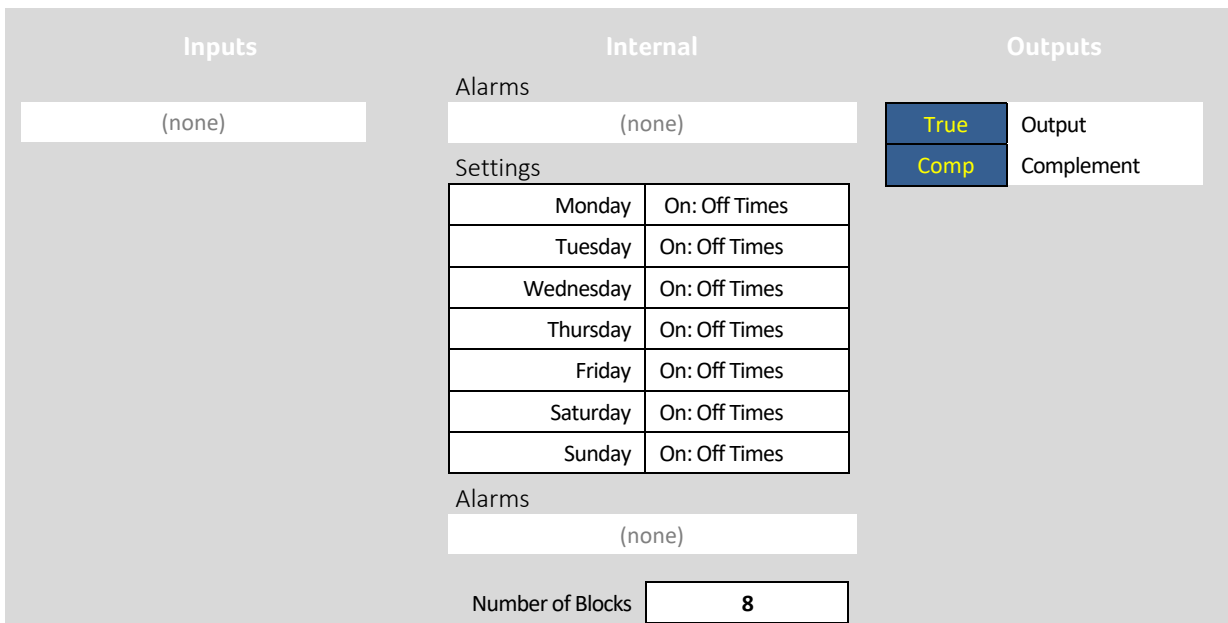
System object description

Outputs

Object	Comments	Object options
Out `True`	Will go `high` when any clock is on.	
Compliment `Comp`	Will go `low` when any clock is on.	

Internal Settings

Object	Comments	Object options
Monday	Contains two Off:On times for Monday.	
Tuesday	Contains two Off:On times for Tuesday.	
Wednesday	Contains two Off:On times for Wednesday.	
Thursday	Contains two Off:On times for Thursday.	
Friday	Contains two Off:On times for Friday.	
Saturday	Contains two Off:On times for Saturday.	
Sunday	Contains two Off:On times for Sunday.	

LEGACY MACRO LIBRARY

The **Macros** used in **CEC** 6.76 and earlier versions are still shipped with **CEC** 7.00 and later for legacy support. However, their use should be avoided, as the main Macro Library covers all of their functionality.

Legacy Macros - General

G01 Duty standby with changeover from pressure or flow switch

- Application

Pump or fan duty cycling.
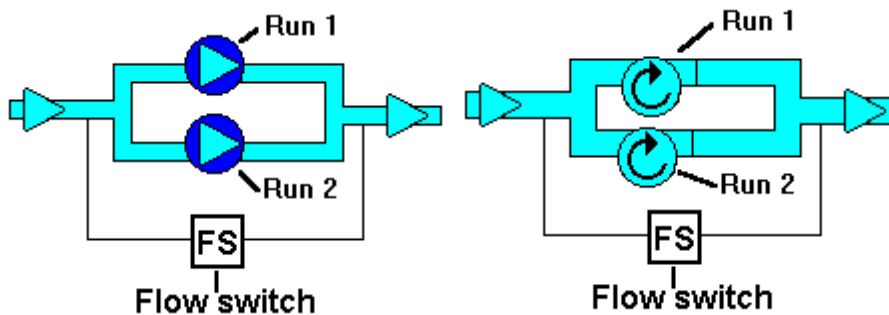
- Function of module

This module provides duty sharing between two outputs. Typical outputs include fans and pumps. The duty output changes when the changeover input changes state. When the value is 0 the duty output is R1 and when value is 1 duty output is R2. The two outputs share a common status point. In the event of duty output failing as detected by the status, then the standby output is selected. An alarm is generated indicating duty output failure. In the event of standby output failure as indicated by the status, an additional alarm is generated. The alarms are generated after 30 second time delay. The module operation is activated by an enable point. When both outputs fail they are turned off after the time delays have elapsed. To change this, the Boolean blocks for each output need to be set as follows:

Output 1: `acD+aBCD` Output 2: `acD+aBcD` (Both off)

Output 1: `cD+aBCD` Output 2: `aCD+BcD` (Both on)

Output 1: `acD+BCD` Output 2: `aCD+BcD` (Duty off and standby on)

> **Note**: The alarms are cleared by either the reset input or the enable point being set first low, then high.

- Number of Blocks

9

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Digital Inputs	Flow Status (ST)	Provides status on both Run 1 and Run 2.	
	Duty Select (DS)	Off (0): Run 1 is duty output and Run 2 is standby output. On (1): Run 2 is duty output and Run 1 is standby output.	
	Reset (RE)	When Reset is on (1) both outputs alarm 1 and alarm 2 are set to off (0).	
	Enable (EN)	This input must be set to on (1) for the module to function.	
Digital Outputs	Run 1	When Run 1 is desired output, this value is on (1). Else value is off (0).	
	Run 2	When Run 2 is desired output, this value is on (1). Else value is off (0).	
	Alarm 1	On (1) when Run 1 is on (1) and Flow Switch is off (0). Else value is off (0).	
	Alarm 2	On (1) when Run 2 is on (1) and Flow Switch is off (0). Else value is off (0).	
Parameters	Alarm Delay 1	Time that Run 1 is on (1) and Flow Switch is off (0) before Alarm 1 is set to on (1).	30 seconds
	Alarm Delay 2	Time that Run 2 is on (1) and Flow Switch is off (0) before Alarm 2 is set to on (1).	30 seconds

- Example
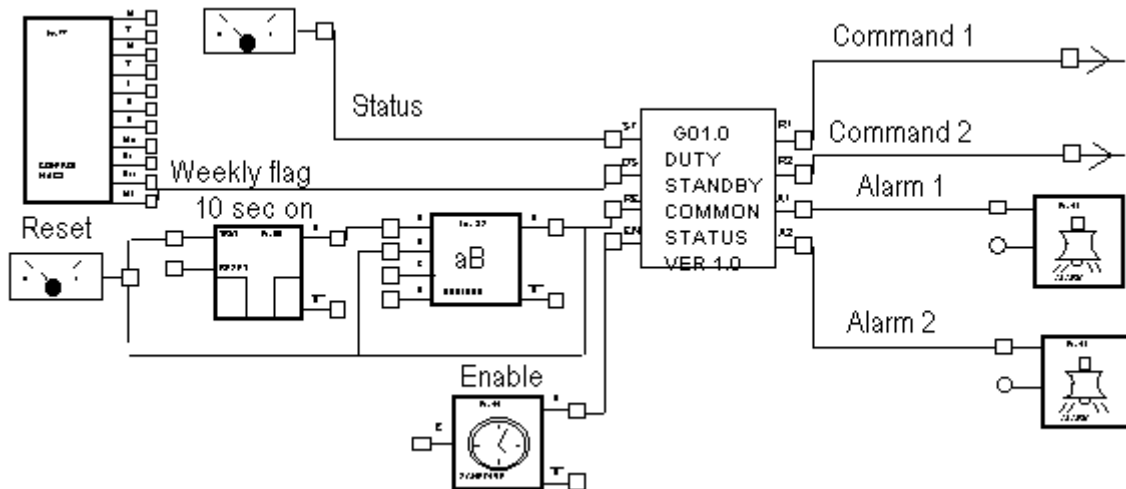
G02 Duty standby with changeover from starter trip

- Application

Pump or fan duty cycling.
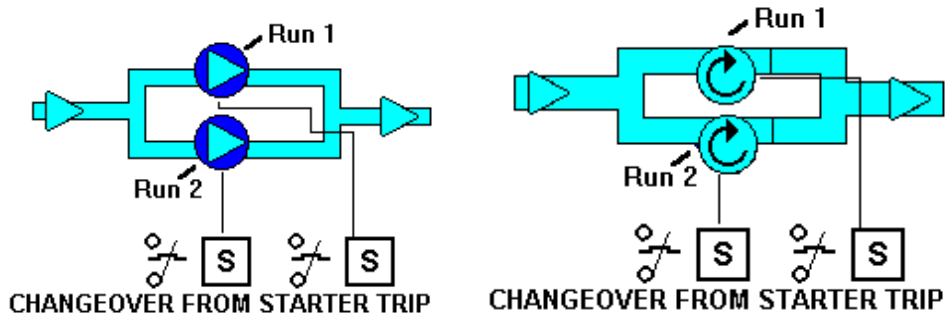
- Function of module

This module provides duty sharing between two outputs. Typical outputs include fans and pumps. The duty output changes when the changeover input changes state. When the value is 0 the duty output is R1 and when value is 1 duty output is R2. In the event of duty output failing as detected by starter trip, then the standby output is selected. An alarm is generated indicating duty output failure. In the event of standby output failure as indicated by the status, an additional alarm is generated. The alarms are generated after 2 second time delay. The module operation is activated by an enable point. When both outputs fail they are turned off after the time delays have elapsed. To change this the Boolean blocks for each output need to set as follows:

Output 1: `acD+aBCD` Output 2: `acD+aBcD` (Both off)

Output 1: `cD+aBCD` Output 2: `aCD+BcD` (Both on)

Output 1: `acD+BCD` Output 2: `aCD+BcD` (Duty off and standby on)

> **Note**:   The alarm is reset by either the reset bit or the enable flag being set off.

- Number of Blocks

8

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Digital Inputs	Starter Trip (T1)	Provides starter trip status on Run 1.	
	Starter Trip (T2)	Provides starter trip status on Run 2.	
	Duty Select (DS)	Off (0): Run 1 is duty output and Run 2 is standby output. On (1): Run 2 is duty output and Run 1 is standby output.	
	Reset (RE)	When Reset is on (1) both outputs alarm 1 and alarm 2 are set to off (0).	
	Enable (EN)	This input must be set to on (1) for the module to function.	
Digital Outputs	Run 1	When Run 1 is desired output, this value is on (1). Else value is off (0).	
	Run 2	When Run 2 is desired output, this value is on (1). Else value is off (0).	
	Alarm 1	On (1) when Run 1 is on (1) and Starter Trip 1 is on (1). Else value is off (0).	
	Alarm 2	On (1) when Run 2 is on (1) and Starter Trip 2 is on(1). Else value is off (0).	
Parameters	Alarm Delay 1	Time that Run 1 is on (1) and starter trip 1 is on (1) before Alarm 1 is set to on (1).	2 seconds
	Alarm Delay 2	Time that Run 2 is on (1) and starter trip 2 is on (1) before Alarm 2 is set to on (1).	2 seconds

- Example
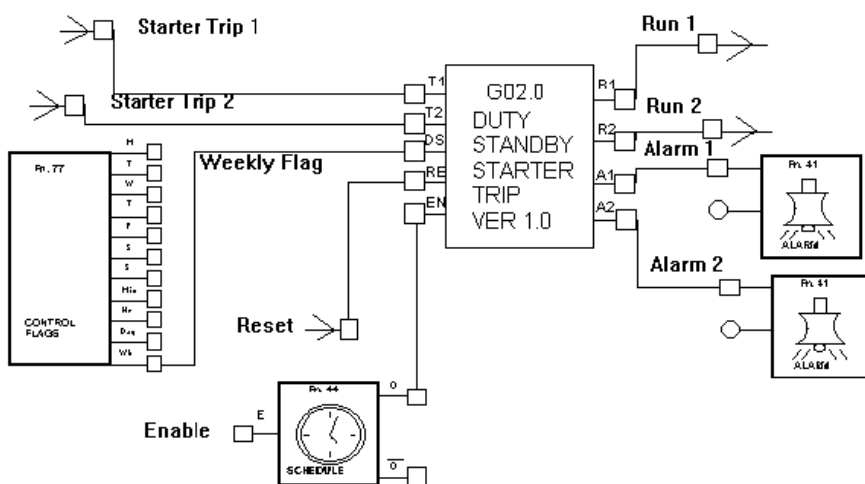
G03 Duty standby with changeover from starter status mis-match or flow switches

- Application

Pump or fan duty cycling.
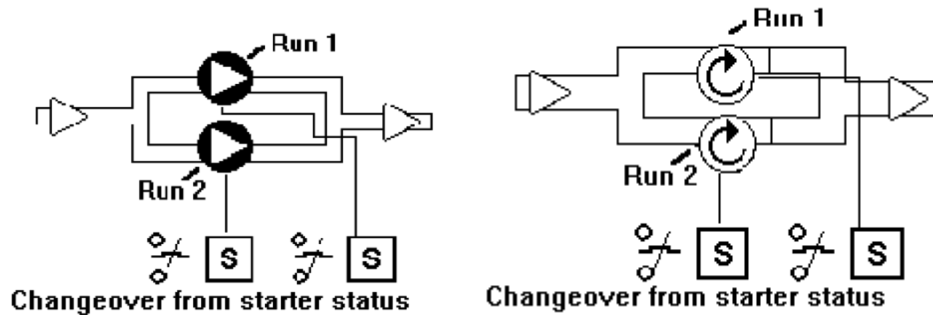
Changeover from starter status   Changeover from starter status

- Function of module

This module provides duty sharing between two outputs. Typical outputs include fans and pumps. The duty output changes when the changeover input changes state. When the value is 0 the duty output is R1 and when value is 1 duty output is R2. In the event of duty output failing as detected by starter status mis-match, or flow switch, then the standby output is selected. An alarm is generated indicating duty output failure. In the event of standby output failure, an additional alarm is generated. The alarms are generated after 30 second time delay. The module operation is activated by an enable point. When both outputs fail they are turned off after the time delays have elapsed. To change this the Boolean blocks for each output need to set as follows:

Output 1: `acD+aBCD` Output 2: `acD+aBcD` (Both off)

Output 1: `cD+aBCD` Output 2: `aCD+BcD` (Both on)

Output 1: `acD+BCD` Output 2: `aCD+BcD` (Duty off and standby on)

> **Note**: The alarm is reset via the reset bit or when the plant enable is set off.

- Number of Blocks

8

- Symbol

Variables

Variable type	Variable name	Description	Default values
Digital Inputs	Starter Status (S1)	Provides status on Run 1.	
	Starter Status (S2)	Provides status on Run 2.	
	Duty Select (DS)	Off (0): Run 1 is duty output and Run 2 is standby output. On (1): Run 2 is duty output and Run 1 is standby output.	
	Reset (RE)	When Reset is on (1) both outputs alarm 1 and alarm 2 are set to off (0).	
	Enable (EN)	This input must be set to on (1) for the module to function.	
Digital Outputs	Run 1	When Run 1 is desired output, this value is on (1). Else value is off (0).	
	Run 2	When Run 2 is desired output, this value is on (1). Else value is off (0).	
	Alarm 1	On (1) when Run 1 is on (1) and Starter Status is off (0). Else value is off (0).	
	Alarm 2	On (1) when Run 2 is on (1) and Starter Status is off (0). Else value is off (0).	
Parameters	Alarm Delay 1	Time that Run 1 is on (1) and starter status 1 is off (1) before Alarm 1 is set to on (1).	30 seconds
	Alarm Delay 2	Time that Run 2 is on (1) and starter status 2 is off (1) before Alarm 2 is set to on (1).	30 seconds

- Example
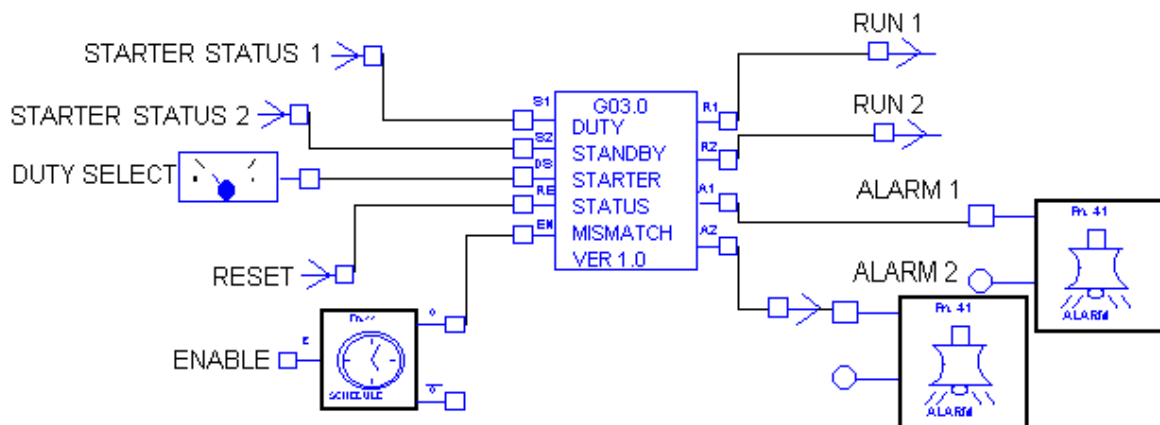
G04 Status alarm with time delay

- Application

Flow alarm on supply fan.
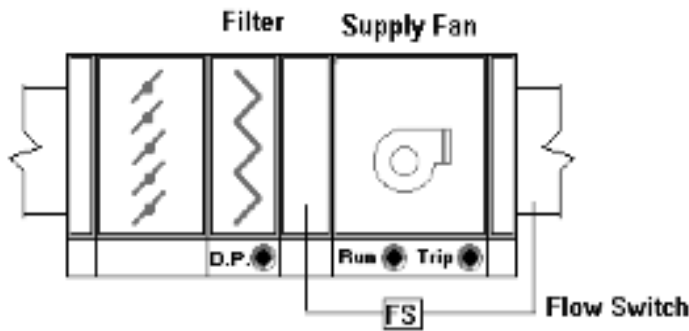
- Function of module

This macro provides for a status alarm. The macro has two inputs: enable and status. If enable is on and status is off for the on delay time period an alarm is generated and the alarm output is on. The alarm stays on for the minimum on time period. The priority and alarm number both have to be set in the alarm module.

- Number of Blocks

3

- Symbol
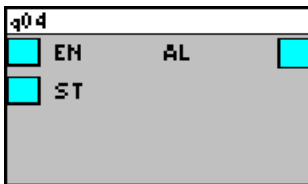
- Variables

Variable type	Variable name	Description	Default values
Digital Inputs	Enable (EN)	If this is on (1) then the Alarm State at the Status point (ST) will be passed through after the specified On Delay time (if ST remains on for that time)	
	Status (ST)	The Alarm condition that is monitored when Enable is on (1). 0 = alarm state 1 = healthy state	
Digital Outputs	Alarm (AL)	On (1) if Enable is on (1) and Status off (0) for on delay.	
Parameters	On Delay	Time that Enable is on (1) and Status is off (1) before Alarm is set to on (1).	30 seconds
	Off Delay	Time that alarm state has returned to normal before Alarm is set to off (0).	0 seconds
	Minimum Off Time	Minimum Time that Alarm is on (1).	20 seconds

- Example
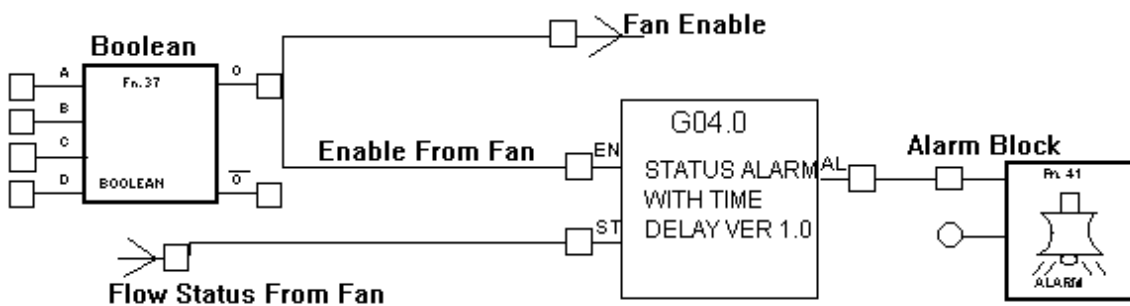
G05 Binary driver

- Application

Control of two digital output points through one analog point.
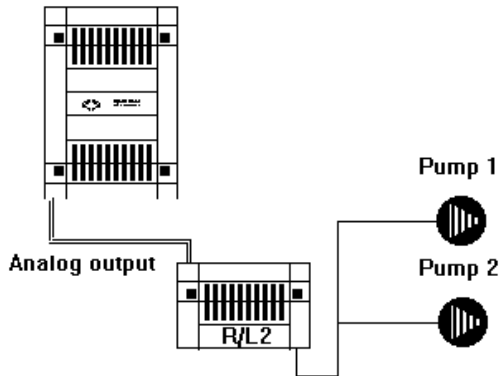
- Function of module

This macro allows control of two digital outputs through one output on a UC16, UC12 or UC8. The macro is used with the raise lower module R/L 4. The input on the R/L 4 is set to binary mode through the jumper switch. The raise lower module takes the macro output and selects the correct digital output configuration. The following is the macro output:

1. A=0, B=0, O=0%
2. A=1, B=0, O=40%
3. A=0, B=1, O=100%
4. A=1, B=1, O=70%.

- Number of Blocks

7

- Symbol
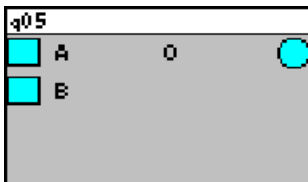
- Variables

Variable type	Variable name	Description	Default values
Digital Inputs	Input A (A)	Shows state of input point A.	
	Input B (B)	Shows state of input point B.	
Analog Outputs	Output to Raise Lower in binary mode (O)	A=0, B=0, O=0% A=1, B=0, O= 40% A=0, B=1, O=100% A=1, B=1, O=70%	0%

- Example
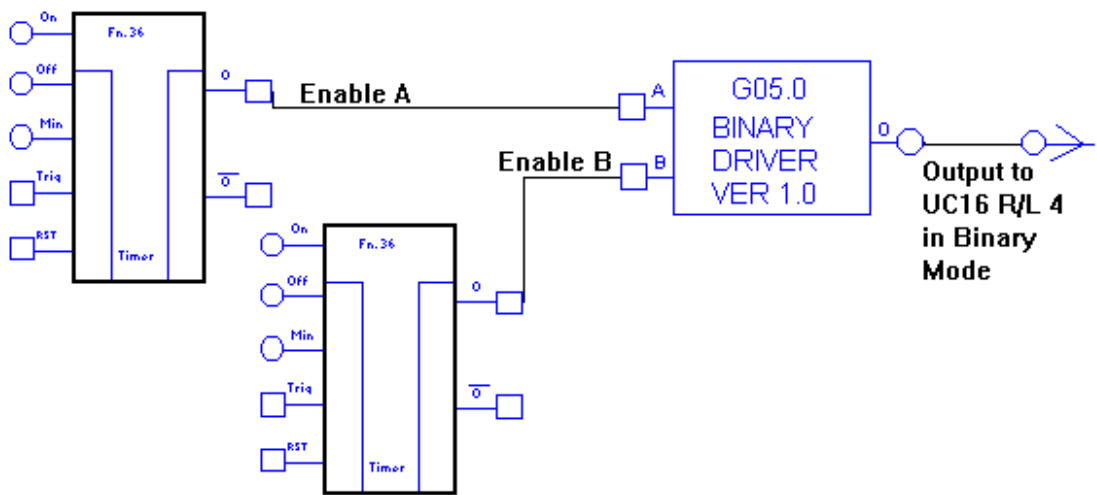
G06 Raise Lower

- Application

Control of raise lower valve through one analog point.
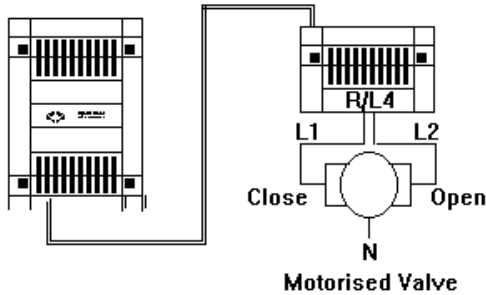
- Function of module

This macro allows control of a raise lower valve through one output on a uc16, uc12 or uc8. The macro is used with the raise lower module R/L 4. The input on the R/L 4 is set to raise lower mode through the jumper switch. The raise lower module takes the macro output and selects the correct digital output configuration. The following is the macro output:

5. R=0, L=0, O=40%
6. R=1, L=0, O=70%
7. R=0, L=1, O=0%
8. A=1, B=1, O=70%.

If both raise and lower are on then raise takes precedence.

- Number of Blocks

3

- Symbol
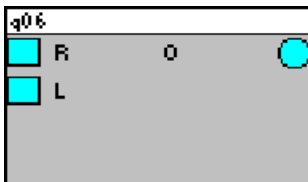
- Variables

Variable type	Variable name	Description	Default values
Digital Inputs	Raise (R)	Shows state of input point Raise.	
	Lower (L)	Shows state of input point Lower.	
Analog Outputs	Output to Raise Lower in binary mode (O)	R=0, L=0, O=40% R=1, L=0, O= 70% R=0, L=1, O=0% R=1, L=1, O=70%	0%

- Example
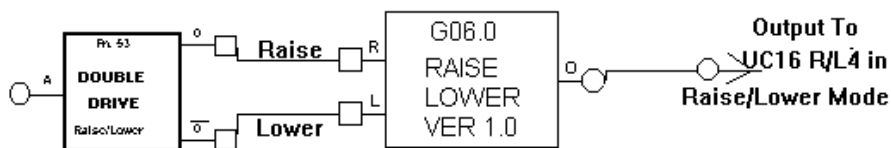
G07 Sensor out of range alarm

- Application

Room temperature alarm.
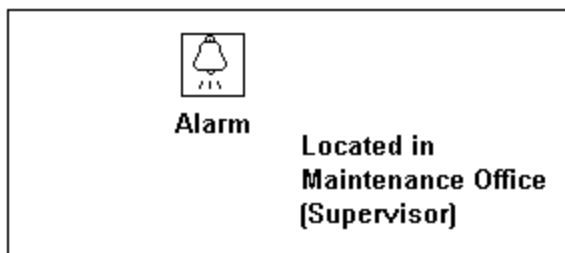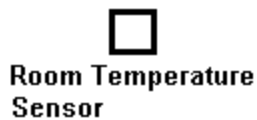
- Function of module

This module provides an alarm indicating that the sensor is out of range with time delays and minimum on time. The sensor alarm limits are set through the lower and upper inputs. When the sensor input goes out of this range an alarm is generated after the associated time delays. The sensor has an on delay, off delay, minimum on time and alarm timer reset. The alarm priority and alarm number must be set before the alarm will function properly. Each alarm should have a unique alarm number in the controller.

- Number of Blocks

4
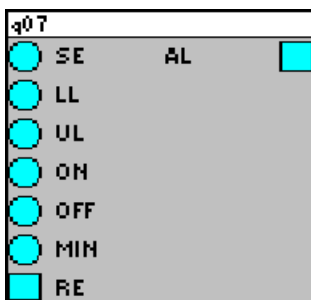
- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Sensor Input (SE)	Analog value from sensor.	
	Lower Limit (LL)	When sensor input is less than this value alarm output is set after time delays.	
	Upper Limit (UL)	When sensor input is greater than this value alarm output is set after time delays.	
	On Delay (ON)	Sensor input must be outside of range set by upper and lower limits for this time before alarm is generated.	
	Off Delay (OF)	Sensor input returns to range set by upper and lower limits for this time before alarm is condition is cleared.	
	Minimum On Time (MI)	Minimum time that alarm exists.	
Digital Input.	Reset (RE)	This input resets the alarm timer.	
Digital Outputs	Alarm (AL)	When module is in alarm condition., this value is set to on (1). Else value is off (0).	Off (0)

- Example
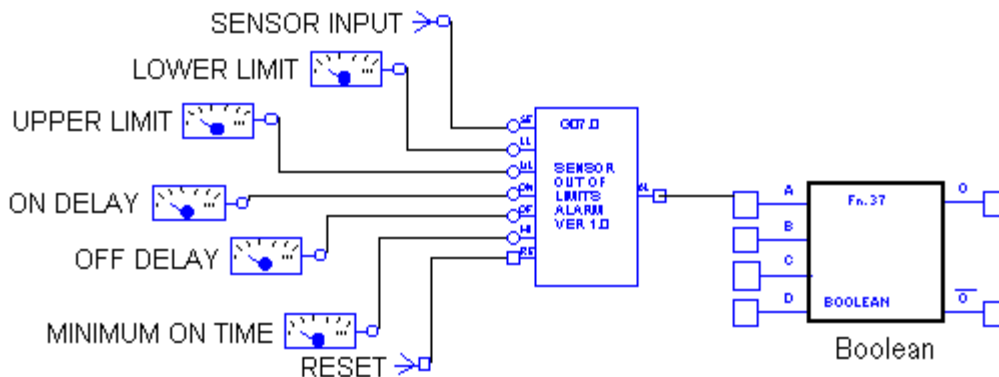
G08 Hysteresis with plus deadband

- Application

Heating enable based on room temperature.
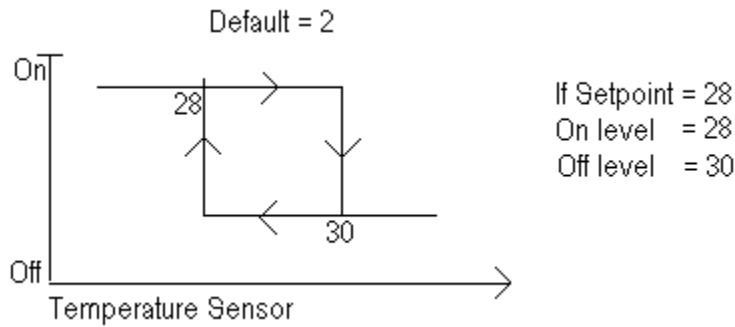
- Function of module

This module provides a hysteresis loop with a plus deadband. When the sensor input falls below the setpoint the enable output is on. The enable output remains on until the sensor input rises by 2°C (default deadband value) above the setpoint. The enable then remains off until the sensor input falls below the setpoint value.

- Number of Blocks

4

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Sensor Input (SE)	Analog value from sensor.	
	Sensor Setpoint (SP)	Setpoint for sensor.	
Digital Outputs	Enable (EN)	When sensor input is less than setpoint enable turns on. Remains on until sensor is greater than the setpoint plus deadband.	
Parameters	Plus Deadband	Sensor input must rise by this value above the setpoint before enable is set to off (this can be amended).	2 °C (4 °F)

- Example

Sensor Input
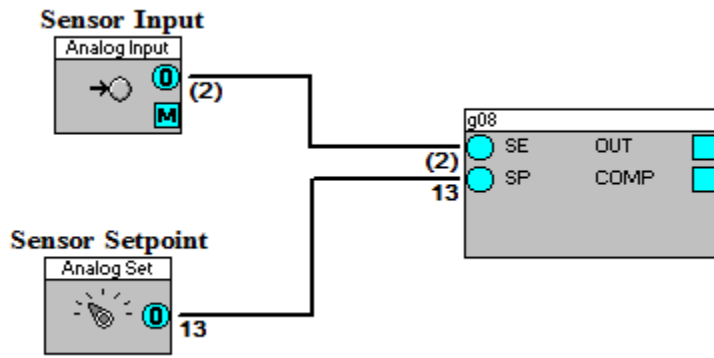
Sensor Setpoint

G09 Hysteresis with minus deadband

- Application
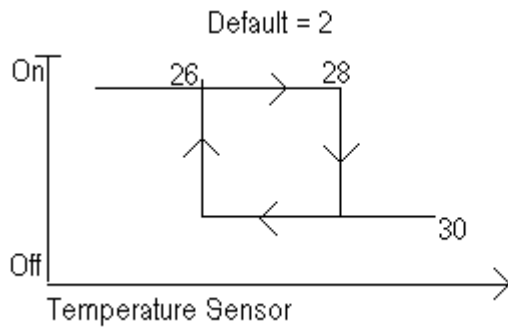
Heating enable based on room temperature.

- Function of module

This module provides a hysteresis loop with a minus deadband. When the sensor input falls below the setpoint by 2 °C (4 °F) (default deadband) the enable output is on. The enable output remains on until the sensor input rises above the setpoint. The enable then remains off until the sensor input falls below the setpoint minus deadband value.

- Number of Blocks

4

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Sensor Input (SE)	Analog value from sensor.	
	Sensor Setpoint (SP)	Setpoint for sensor.	
Digital Outputs	Enable (EN)	When sensor input is less than setpoint minus deadband enable turns on. Remains on until sensor is greater than the setpoint.	
Parameters	Minus Deadband	Sensor input must fall by this value below the setpoint before enable is set to on (this can be amended).	2 °C (4 °F)

- Example

Sensor Input
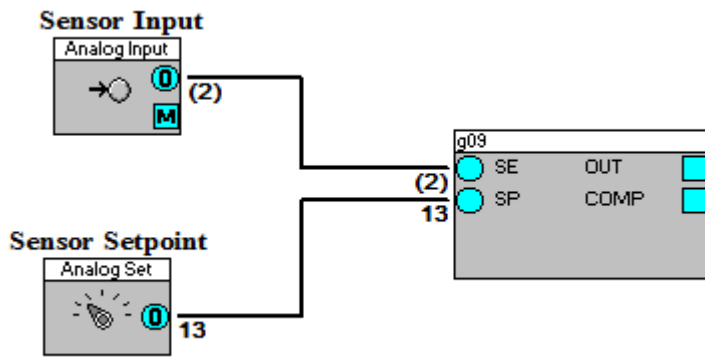
Sensor Setpoint

G10 Hysteresis with plus and minus deadband

- Application

Heating enable based on room temperature.
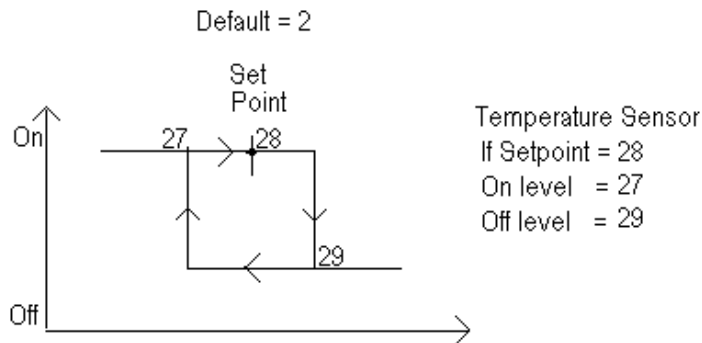
- Function of module

This module provides a hysteresis loop with plus and minus deadbands. When the sensor input falls below the setpoint by 1 °C (2 °F) (default minus deadband) the enable output is on. The enable output remains on until the sensor input rises by 1 °C (2 °F) (default plus deadband) above the setpoint. The enable then remains off until the sensor input falls below the setpoint minus deadband value.

- Number of Blocks

5

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Sensor Input (SE)	Analog value from sensor.	
	Sensor Setpoint (SP)	Setpoint for sensor.	
Digital Outputs	Enable (EN)	When sensor input is less than setpoint minus deadband enable turns on. Remains on until sensor is greater than the setpoint.	
Parameters	Plus Deadband	Sensor input must rise by this value above the setpoint before enable is set to off.	1 °C (2 °F)
	Minus Deadband	Sensor input must fall by this value below the setpoint before enable is set to on. This can be amended.	1 °C (2 °F)

- Example

SENSOR INPUT

SENSOR SETPOINT

G10.0
HYSTERESIS
WITH
PLUS +
MINUS
DEADBAND

SE

SP

EN

EN
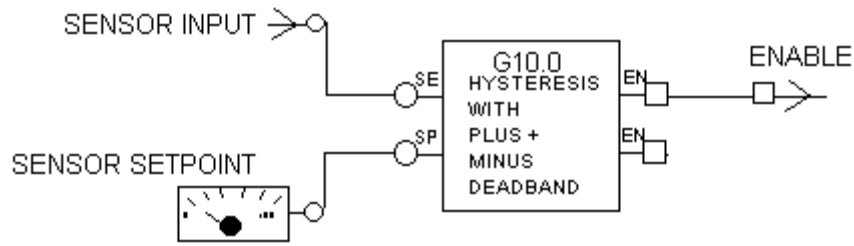
ENABLE

G11 Heating enable optimum start/stop

- Application

Optimum start/stop of central plant equipment.

Outside Sensor

Optimum start based on time schedule and internal and external temperatures.
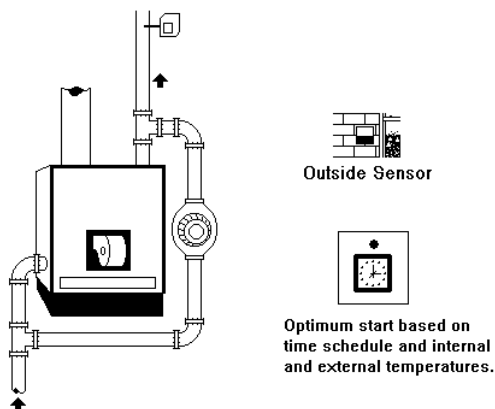
- Function of module

This module provides the optimum start/stop based on internal and external temperatures and building characteristics. The optimizer has two stages of operation. The first occurs when the learning factor is 5 or below. This equation is based on the initial building constants and is:

```
P=A(X-Y)+B
```

where P is preheat time, X is target temperature, Y is current internal temperature, and A and B are building constants.

The second stage uses a second order equation. Optimizer enable input defaults to on if the input is not attached to a point otherwise the optimizer only operates when the attached point is on. The module contains a time schedule block for each day. The time schedule set the building occupancy. All seven analog inputs must be connected for correct operation. The main output from this module is the optimum start or pump status point (PS). This point should be attached to the plant equipment that needs to be controlled. In addition to the other outputs which are explained in the variables section there is a time schedule (TS) point that connects to each time schedule block. This point is on during occupancy time.

- Number of Blocks

16

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Target Temperature (TT)	Internal temp that should be reached at occupancy time.	
	Target Cooldown Temp (TC)	Minimum permissible internal temp when occupancy period ends.	
	Outside Temp (OT)	Measured value of the outside temperature.	
	Internal Temp (IT)	Measured value of the internal temperature.	
	Flow Temp (FT)	Measured value of the heating medium temperature.	
	Condensation Setpoint (CP)	The internal temperature at which condensation is expected.	
	Max Preheat Period (MP)	Maximum permissible preheat period. A typical value is 80 minutes.	
	Max Cooldown Period (MC)	Maximum permissible cooldown period. A typical value is 80 minutes.	
	Dead Time (DT)	The length of time from start of heating until a response in Internal Temperature will be registered (minutes)	
	Overlap Period(OP)	The max. number of minutes that preheat is allowed to continue into the occupancy period, if the target temperature has not been reached by the start of occupancy (minutes)	
Digital Inputs	Optimizer Enable (EN)	Enables optimizer operation. defaults to on if point not connected otherwise point must be set on for operation.	
Analog Outputs	Predicted Preheat Time (PT)	Value predicted for preheat by module.	0 Minutes
	Learning Factor (LF)	Each time the optimizer is reaches target temp and initial plant conditions are valid this point is incremented. Max = 255.	0
	Predicted Cooldown Period (CT)	Value predicted for cooldown by module.	0 Minutes
Digital Outputs	Optimum Start (PS)	This point is SET after the optimum start/stop has been decided by the optimizer.	0ff (0)

Variable type	Variable name	Description	Default values
	Status Value (SV)	This point is SET optimizer is within maximum preheat period.	Off (0)
	Day Control (DC)	This point is SET optimizer reverts to day control. Day control occurs when internal temperature exceeds target temp, current time > (occupancy time+ overlap period) and internal temp < cooldown target temp during cooldown.	Off (0)
	Condensation Protection (CP)	Point becomes set when condensation protection is in operation.	Off (0)
	Preheat Period (PP)	Point becomes set when optimizer switches to preheat mode.	Off (0)
	System Off (SO)	Point becomes set when heating system is turned off.	Off (0)
	Error (ER)	Point becomes set when the optimizer macro is not set up correctly.	Off (0)
	Time Clock (TS)	This is used to provide the Heating Optimizer with seven Field Controller time schedules, which may be updated with a Comms Controller time schedule.	
Parameters	Max. temp. for condensation protection	Module will remain in condensation protection mode until internal temp. rises above this value.	120 °C (248 °F)
	Min. temp. for condensation protection	If plant is off and internal temp. falls below this value condensation protection mode until start.	100 °C (212 °F)
	Min. Flow Temp. for adaptation	The optimizer will only learn today's heating characteristics if flow temp<this value at start of preheat, max. flow temp during preheat>max> flow temp for adaptation and condensation protection not in force.	250 °C (482 °F)
	Max. Flow Temp. for adaptation	See Min. flow temp for adaptation.	400 °C (752 °F)
	Max. Internal Temp. for preheat	Internal temp. corresponding to that requiring maximum preheat period.	120 °C (248 °F)
	Dead Time	Time between start of preheat and change in internal temperature. Typical value is 9.	0 Minutes
	Overlap Period	Maximum time that preheat allowed to continue if internal temp has not reached target at start of occupancy. Typical value is 30.	0 Minutes
	Initial Value A	This building constant is used for first 4 good starts.	50
	Initial Value B	This building constant is used for first 4 good starts.	50
	Time Clock (TS)	This is used to provide the Heating Optimizer with seven Field Controller time schedules, which may be updated with a Comms Controller time schedule.	

- Example
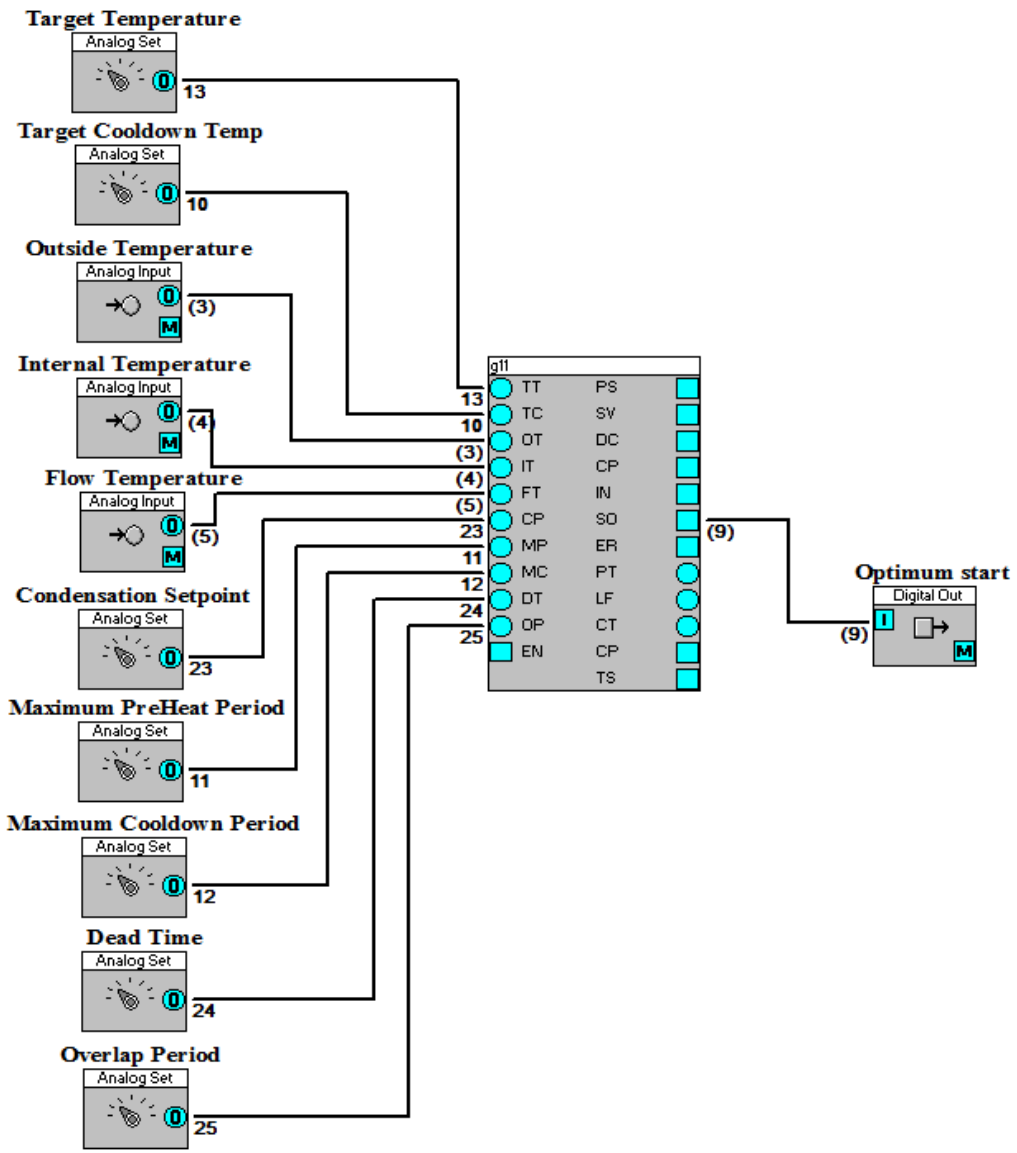
G13 Holiday Schedule

- Application

Holiday Schedules for UC16 time schedules.
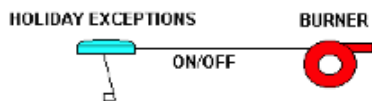
- Function of module

This macro contains five holiday schedule blocks. If any of these are on then the output is also on. The macro may be used to make holiday programming easier. There are two outputs: the true output and the inverse of the true output

- Number of Blocks

6

- Symbol
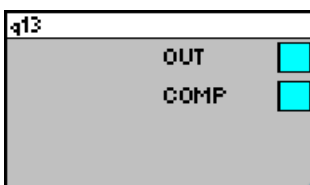
- Variables

Variable type	Variable name	Description	Default values
Digital Outputs	Holiday On (0)	On if any of the holiday outputs are on.	Off (0)
	Holiday Off (inv 0)	Off when all of the holiday outputs are off.	On (1)

- Example
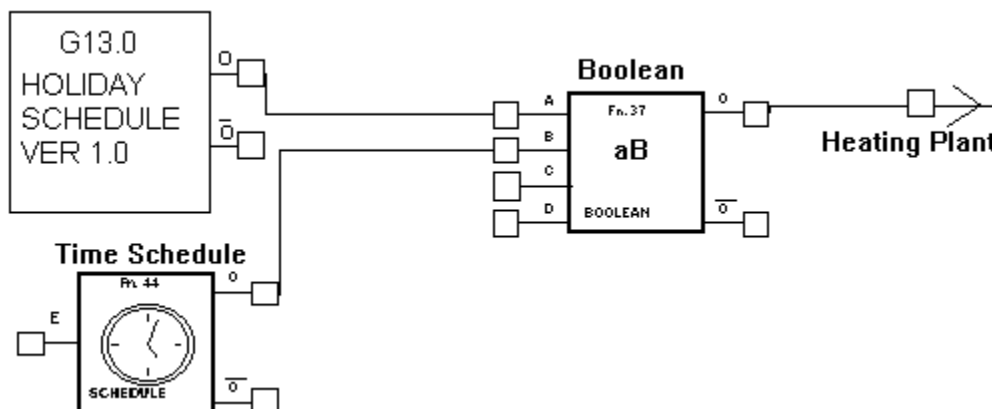
G14 Seven day schedule

- Application

Seven day time schedules.
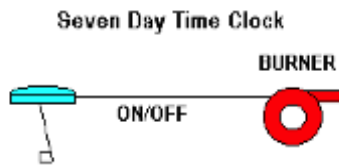
- Function of module

This macro contains seven Field Controller **Time Schedule** blocks. If any of these are on then the output is also on. The macro may be used to make time schedule programming easier. There are two outputs: the true output and the inverse of the true output. The default "on" times are Monday to Friday 08:00 ⋯ 17:00 and Saturday to Sunday 00:00 ⋯ 00:00.

- Number of Blocks

8

- Symbol
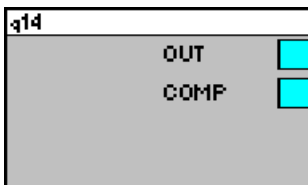
- Variables

Variable type	Variable name	Description	Default values
Digital Outputs	Time Schedule (0)	On if any of the seven day schedules are on.	
	Time Schedule Off (inv 0)	Off when all of the seven day outputs are off.	On (1)

- Example
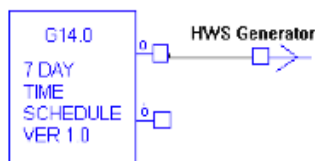
G15 Pulse metering

- Application

Monitoring and logging electricity usage on daily and hourly basis.
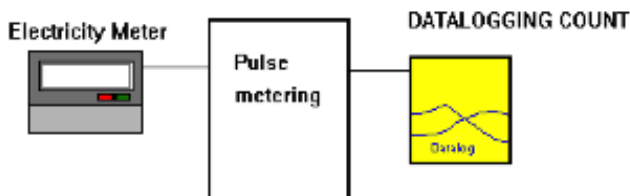
- Function of module

This macro monitors and datalogs pulse meter values on both a daily and an hourly basis. The two macro inputs are; scalar and pulse input. The scalar is the multiplier used to convert the pulses into real units such as KWH. The hourly and daily totals update every five minutes. The outputs from this macro are the total number of pulses since servicing began and the last count value. This macro will typically be used for logging electricity or other pulse output meters.

- Number of Blocks

11

- Symbol
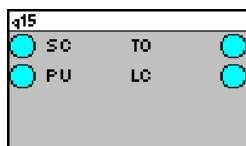
- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Scalar (SC)	Converts pulse into real value.	
	Pulse (PU)	Pulse input from meter.	
Analog Outputs	Total Count (TO)	Total pulse count since macro started servicing.	
	Last Count (LC)	Pulse count for last period.	
Parameters	Pulse period	Time interval over which pulses are counted.	300 Seconds
	Pulse Scalar	Scalar applied to pulse by meter module. This value should not be changed.	1

- Example
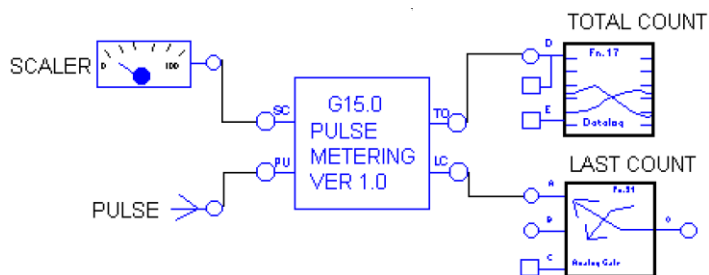
Legacy Macros - Air Systems

A01 Heating and cooling demand with deadband

- Application

Heating and cooling load calculation for air handling unit.
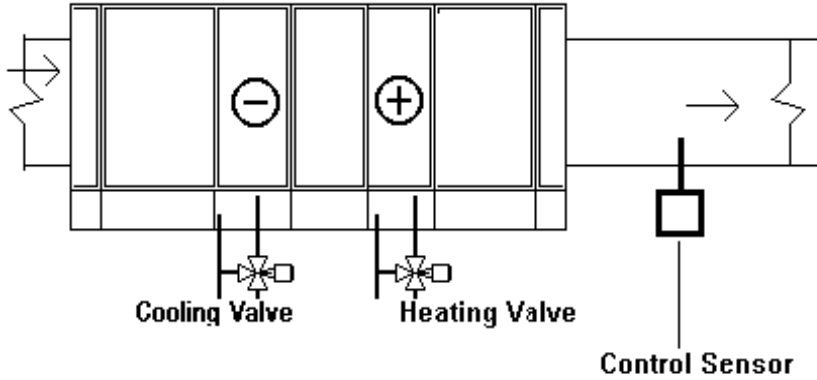
- Function of module

This macro calculates the combined heating and cooling load based on the process variable. The combined heating and cooling load is determined by subtracting the cooling load from the heating load. The output range is -100 to +100. The heating load is found by comparing the process variable with the heating setpoint using a PID loop. The cooling load is found by comparing the process variable with the cooling setpoint using a PID loop. The cooling setpoint is calculated by adding the deadband to the heating setpoint. The enable point must be set "on" for the macro to function, otherwise, the output will be 0. This macro may be used with *A04 Heating valve, cooling valve and damper control from demand.*

- Number of Blocks

9

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Process Variable (PV)	Input point that is monitored.	0 °C (32 °F)
	Heating Setpoint (SP)	The heating setpoint for the process variable.	0 °C (32 °F)
	Deadband (DB)	0 C above heating setpoint when there is no cooling.	0 °C (32 °F)
Digital Inputs	Enable (EN)	Input must be on (1) for macro to calculate combined load.	
Analog Outputs	Combined Heating and Cooling load (HC)	Calculated combined heating and cooling load. Output range: -100 full cooling 0 no heating or cooling +100 full heating	
Parameters	Heating Integral Time	Integration time applied to heating.	0 seconds
	Heating Derivative Time	Derivative time applied to heating.	0 seconds
	Cooling Gain	Proportional Gain applied to cooling.	8
	Cooling Integral Time	Integration time applied to cooling.	0 seconds
	Cooling Derivative Time	Derivative time applied to cooling.	0 seconds
	Heating Gain	Proportional gain applied to heating.	8

- Example
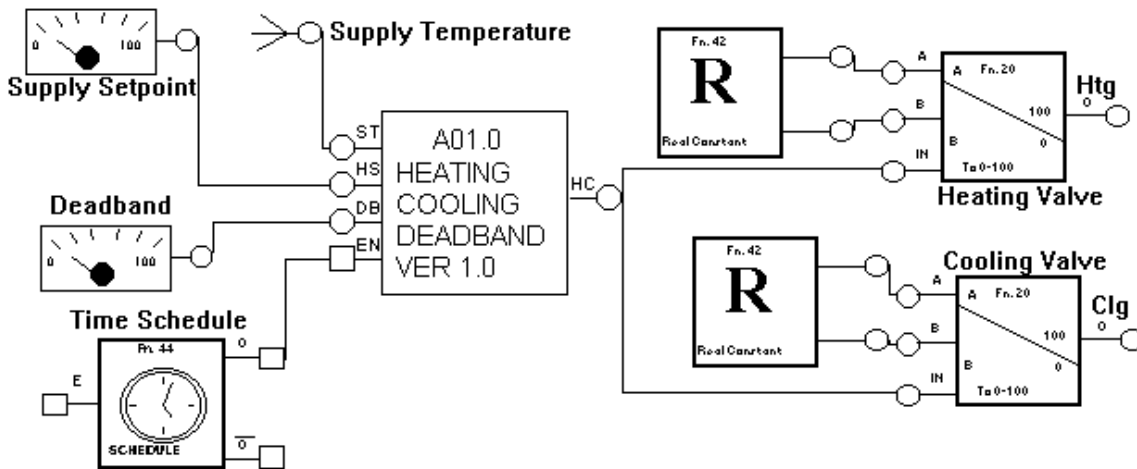
A02 Heating demand

- Application

AHU with single stage heating.
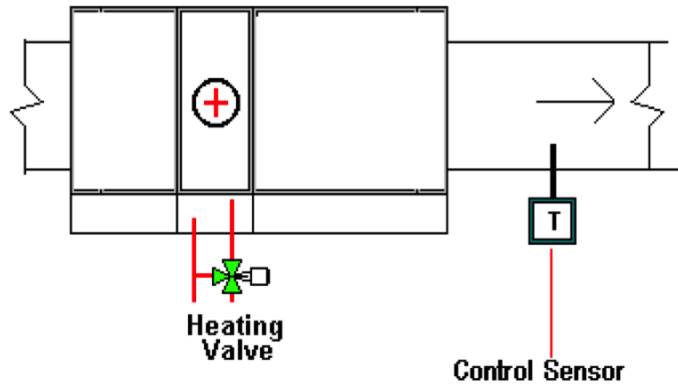
- Function of module

This macro calculates the heating load based on the process variable. The output range is 0 to +100. The heating load is found by comparing the process variable with the heating setpoint using a PID loop. The heating PID gain is set at 8. The heating PID is enabled through the enable input. When the override input is on (1) the output is set at the override value of 100%. The override replaces the PID loop output with the override value. The PID does not have to be enabled for this point to work. The override may be used for heating boost or frost protection.

- Number of Blocks:

3

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Process Variable (PV)	Input point that is monitored.	0 °C (32 °F)
	Heating Setpoint (SP)	The setpoint for the process variable.	0 °C (32 °F)
Digital Inputs	Override (OV)	When override is on (1) the heating load output is 100% otherwise heating load takes the PID output.	Off (0)
	Enable (EN)	Input must be on (1) for macro to calculate heating load.	Off (0)
Analog Outputs	Heating Valve (HV)	Output value varies between 0% (closed) to 100% (open).	0%
Parameters	Heating Gain	Proportional gain applied to the heating valve.	8
	Heating Integral Time	Integration time applied to the heating valve.	0 seconds
	Heating Derivative Time	Derivative time applied to the heating valve.	0 seconds
	Cooling Gain	Proportional gain applied to the cooling valve.	8
	Cooling Integral Time	Integration time applied to the cooling valve.	0 seconds
	Cooling Derivative Time	Derivative time applied to the cooling valve.	0 seconds

- Example

<u>A03 Cooling Demand</u>

- Application

AHU single stage cooling.
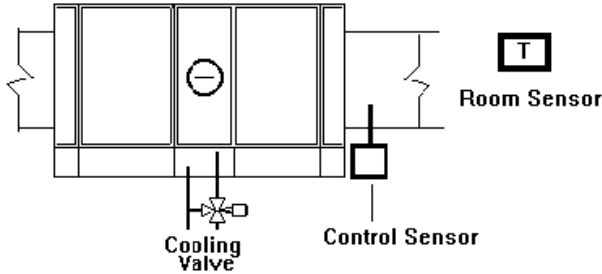
- Function of module

This module provides PID control of a cooling valve based on the process variable. When the enable input point is off the cooling valve is closed. When the enable input is on and the override input is off the cooling valve is modulated to maintain the supply temperature setpoint. When the override input is on the cooling valve goes to the override position which defaults to open.

- Number of Blocks:
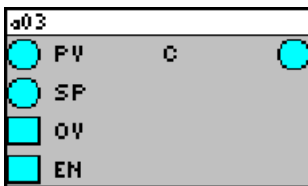
3

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Process Variable (PV)	Input point that is monitored.	0 C
	Cooling Setpoint (SP)	The setpoint for the process variable.	0 C
Digital Inputs	Override (OV)	If input is on (1) cooling valve is open (100%).	Off (0)
	Enable (EN)	This input must be on (1) for the module to work.	Off (0)
Analog Outputs	Cooling Valve (CV)	Output value varies from 0% (closed) to 100% (open).	0%
Parameters	Cooling Proportional Gain	Proportional gain applied to the cooling valve.	8
	Cooling Integral Time	Integration time applied to the cooling valve.	0 seconds
	Cooling Derivative Time	Derivative time applied to the cooling valve.	0 seconds
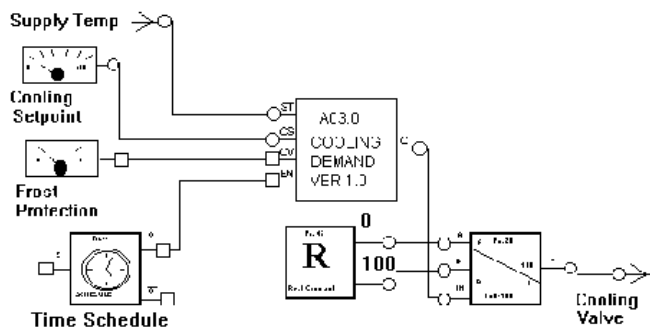
• Example

A04 Heating valve, cooling valve and damper control from demand

- Application

Dampers, heating and cooling valves for air handling unit.
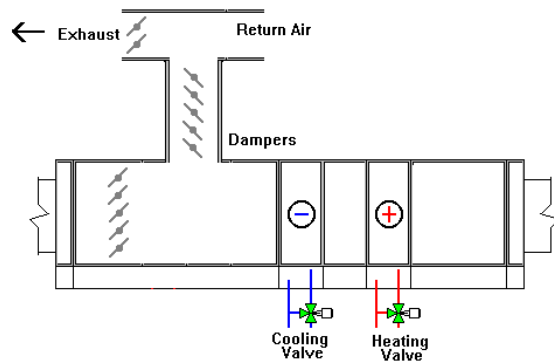
- Function of module

This macro takes the heating-cooling load output from, for example, macro *A01 Heating and cooling demand with deadband*, and stages the heating valve, damper and cooling valve. The valid input range is from -100 to +100. All outputs are linear. The heating valve operating range is set from +30 (0% open) to +100 (100% open). The damper operating range is set from +30 (0% open) to -30 (100% open). The cooling valve operating range is set from -30 (0% open) to -100 (100% open). These values may be changed in the macro if desired. The heating valve is set to 100% when the heating override is enabled. The damper is set to 0% when the damper override is enabled. The cooling valve is set to 100% when the cooling override is enabled. The damper has a minimum position set through the minimum position input. When the minimum position is set to a value greater than 0% the input from the heating cooling load macro is rescaled to the range between this value and 100%. If the input is 0% and the minimum position is 15% the output to the dampers is 57.5% which is 50% of the 15 ⋯ 100 range.

- Number of Blocks:

13

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Heating Cooling load (HC)	Calculated heating cooling load. Range is -100 to +100.	0
	Minimum Damper Position (MD)	Minimum output to the damper.	0
Digital Inputs	Heating Override (OH)	When this value is set to on (1) heating valve is set at override position.	Off (0)
	Cooling Override (OC)	When this value is set to on (1) heating valve is set at 100%.	Off (0)
	Damper Override (OD)	When this value is set to on (1) damper is set at 0%.	Off (0)
Analog Outputs	Heating Valve (HV)	Heating valve output. Range is 0% (closed) to 100% (open).	0%
	Cooling Valve (HV)	Cooling valve output. Range is 0% (closed) to 100% (open).	0%
	Damper (DA)	Damper output. Range is 0% (closed) to 100% (open).	0%
Parameters	Heating Override Position	When heating override (OH) is on (1) 100% Heating Value (HV) is set to this position.	100%
	Cooling Override Position	When Cooling Override (OC) is on (1) Cooling Value (CV) is set to this position.	100%
	Damper Override Position	When Damper Override (OD) is on (1) damper (DA) is set to this position.	0%

- Example
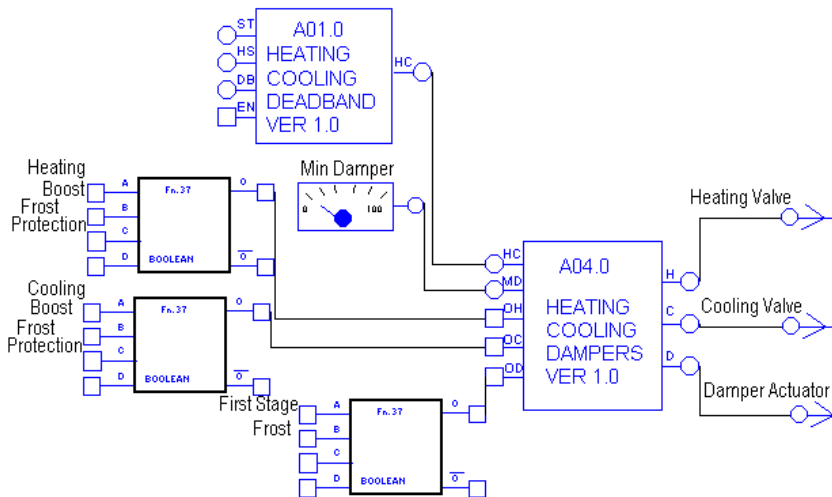
A05 Heating and cooling valve control from demand

- Application

Heating and cooling valves for air handling unit.
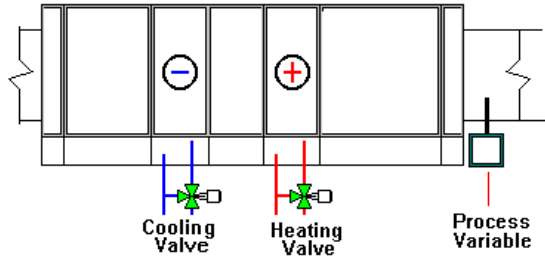
- Function of module

This macro takes the heating-cooling load output from macro A01.0, for example, and stages the heating and cooling valves. The valid input range is from -100 to +100. All outputs are linear. The heating valve operating range is set from +1 (0% open) to +100 (100% open). The cooling valve operating range is set from 0 (0% open) to -100 (100% open). These values may be changed in the macro if desired. The heating valve is set to 100% when the heating override is enabled. The cooling valve is set to 100% when the cooling override is enabled, (these override values can be amended in the macro).

- Number of Blocks

8
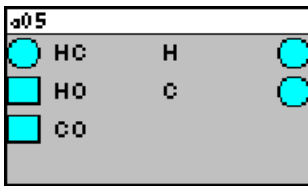
- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Heating Cooling load (HC)	Calculated heating cooling load. Range is -100 to +100.	
Digital Inputs	Heating Override (HO)	When this value is set to on (1) heating valve is set to override position.	
	Cooling Override (CO)	When this value is set to on (1) cooling valve is set to override position.	
Analog Outputs	Heating Valve (HV)	Heating valve output. Range is 0% (closed) to 100% (open).	
	Cooling Valve (HV)	Cooling valve output. Range is 0% (closed) to 100% (open).	
Parameters	Heating Override Position	When Heating Override (OH) is on (1) Heating Valve (HV) is set to this position.	100%
	Cooling Override Position	When Cooling Override (OC) is on (1) Cooling Valve (CV) is set to this position.	100%

- Example
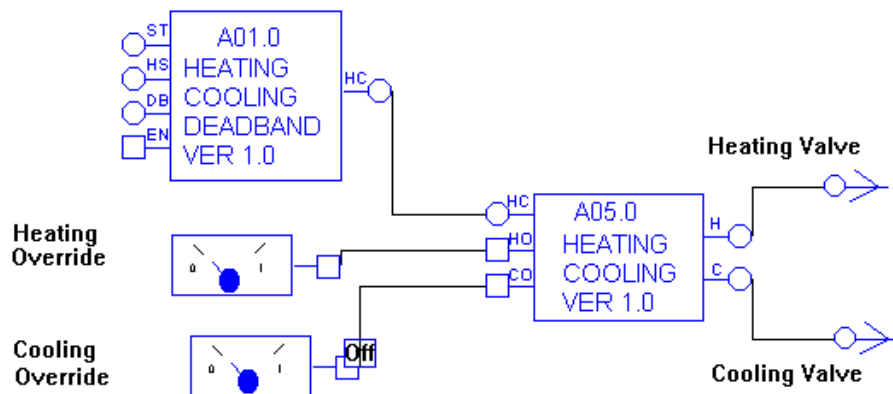
A06 Humidity control from one control sensor

- Application

Humidifier control.
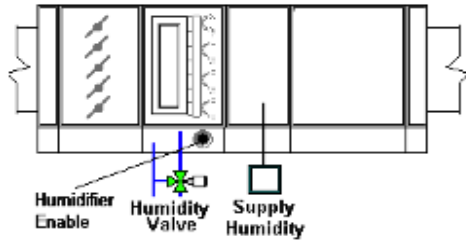
- Function of module

This macro determines the humidifier load based on the control sensor humidity. The output range is 0 to +100. The humidity load is found by comparing the supply humidity with the humidity setpoint using a PID loop. The humidifier PID gain is set at 8. The integration time is set at 600 seconds. The humidifier is enabled when the supply humidity is less than the humidity setpoint and both E1 and E2 inputs are on (1). E1 and E2 may be tied to a time schedule and the supply fan status respectively. The macro provides a humidifier demand and humidifier enable.

- Number of Blocks

8

- Symbol
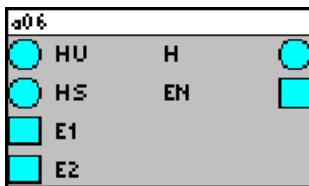
- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Supply Air Humidity (HU)	Humidity of the supply air.	% RH
	Supply Air Humidity Setpoint (HS)	Humidity setpoint of the supply air.	% RH
Digital Inputs	Enable 1 (E1)	Both E1 and E2 must be on (1) to enable humidifier and PID.	Off (0)
	Enable 2 (E2)	Both E1 and E2 must be on (1) to enable humidifier and PID.	Off (0)
Analog Outputs	Humidifier Valve (H)	Humidifier valve output. Range is 0% (closed) to 100% (open).	0%
Digital Outputs	Humidifier Enable (EN) – (optional)	Output is on (1) when E1 and E2 are on and supply humidity is less than humidity setpoint.	
Parameters	Humidifier Gain	Gain of humidity PID.	8
	Humidifier Integration	Integration time of humidity PID.	600 seconds
	Humidifier Derivative	Derivative time of humidity PID.	0 seconds
	Humidifier on Timer Delay	Humidifier enable on delay.	0 seconds

- Example
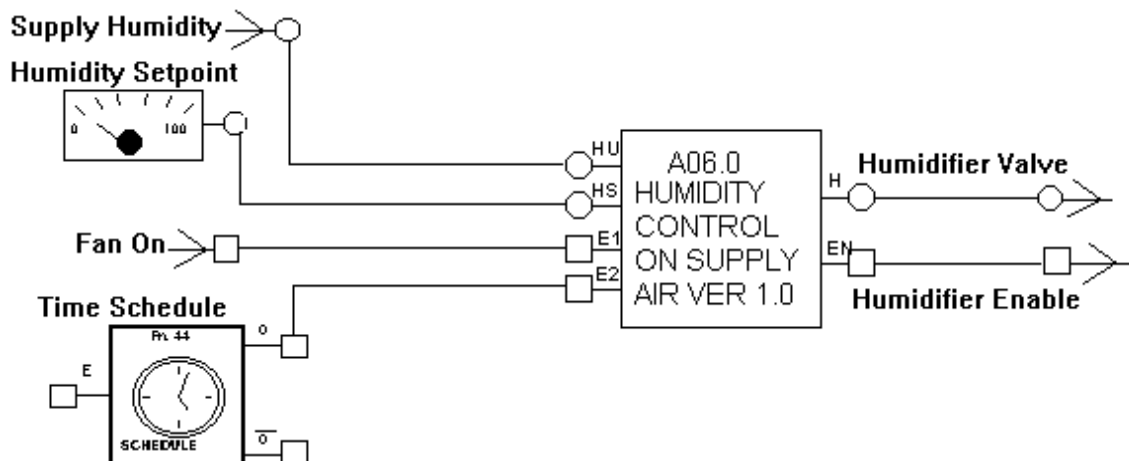
A07 Humidity control on return or room air with supply air limits

- Application

Humidifier control.
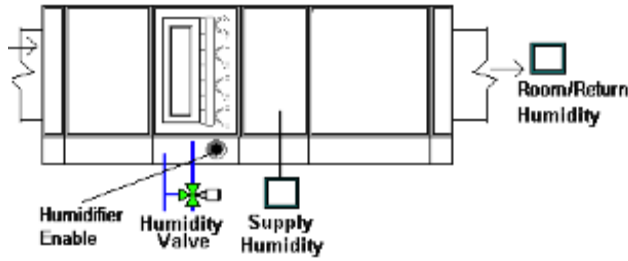
- Function of module

This macro finds the humidifier load based on the return humidity. The output range is 0 to +100. The supply humidity setpoint is calculated by comparing the return humidity with the room humidity setpoint using a PID loop. Upper and lower limits are applied to the calculated supply humidity setpoint. The resulting setpoint is then used to find the humidifier load. Both gains are set at 8. The integration times are set at 600 seconds. The humidifier is enabled when the supply humidity is less than the humidity setpoint and both E1 and E2 inputs are on (1). E1 and E2 may be tied to a time schedule and the supply fan status respectively.

- Number of Blocks

10

- Symbol
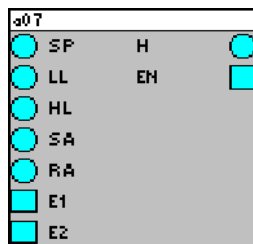
- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Return Air Humidity Setpoint (HS)	Humidity setpoint of the return air.	
	Supply Air Humidity Low Limit (LL)	Lowest setpoint for supply air humidity.	
	Supply Air Humidity High Limit (HL)	Highest setpoint for supply air humidity.	
	Supply Air Humidity (SH)	Humidity of the supply air.	
	Return Air Humidity (RH)	Humidity of the return air.	
Digital Inputs	Enable 1 (E1)	Both E1 and E2 must be on (1) to enable humidifier and PID. Should be tied to time schedule.	
	Enable 2 (E2)	Both E1 and E2 must be on (1) to enable humidifier and PID. Should be tied to time schedule.	
Analog Outputs	Humidifier Valve (H)	Humidifier valve output. Range is 0% (closed) to 100% (open).	
Digital Outputs	Humidifier Enable (EN)	Output is on (1) when E1 and E2 are on and supply humidity is less than humidity setpoint.	
Parameters	Return Humidity Gain	Gain of return humidity PID.	8
	Return Humidity Integration	Integration time of return humidity PID.	600 seconds
	Return Humidity Derivative	Derivative time of return humidity PID.	0 seconds
	Humidifier Gain	Gain of humidity PID.	8
	Humidifier Integration	Integration time of humidity PID.	600 seconds
	Humidifier Derivative	Derivative time of humidity PID.	0 seconds
Parameters	Timer	Enable Humidifier On delay – 0 seconds Off delay – 0 seconds	

- Example
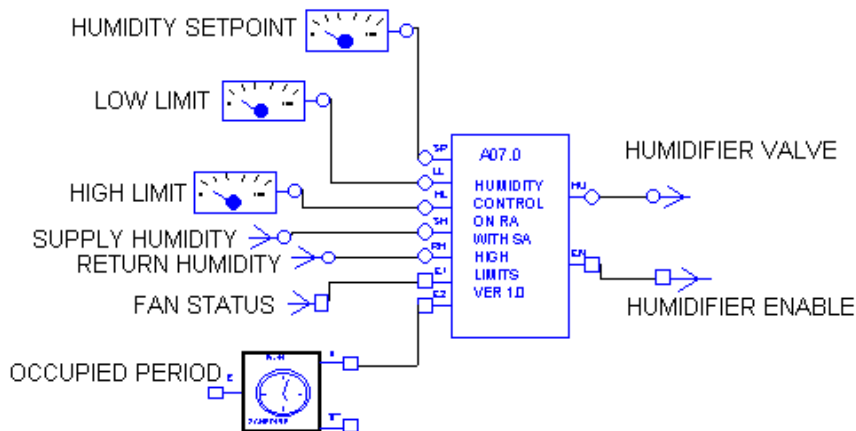
A08 Humidity and dehumidification control on return or room air with supply air limits

- Application

Humidifier and dehumidifier control.
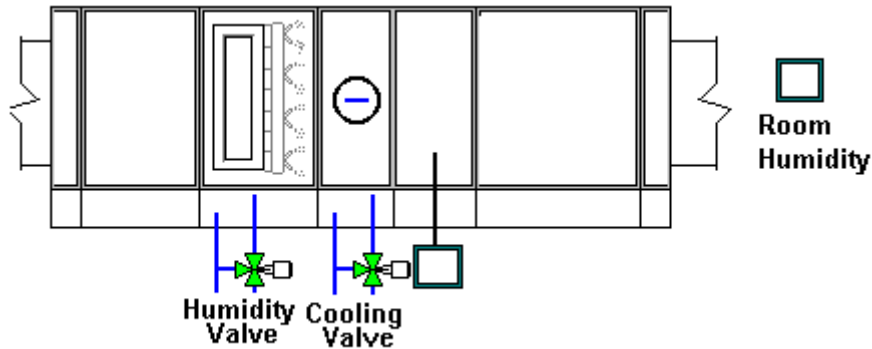
- Function of module

The supply humidity setpoint is calculated by comparing the return or room humidity with the humidity setpoint. The calculated supply humidifier setpoint has an upper limit. This high limit setpoint is used to control humidity output. The deadband is added to humidification setpoint to determine the dehumidification setpoint. The dehumidification demand is used as minimum output to cooling valve. The cooling load input should be calculated based on temperature. The macro *A03 Cooling Demand* may be used to find this value. All of the gains are set at 8. Integration times are 600 seconds. Humidification is enabled when the supply humidity is less than the humidity setpoint and both E1 and E2 are on.

- Number of Blocks

19

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Cooling Load (CL)	Cooling requirement based on temperature.	%
	Return Air Humidity Setpoint (HS)	Humidity setpoint of the return air.	
	Supply Air Humidity High Limit (HL)	Highest setpoint for supply air humidity.	
	Humidity Deadband (DB)	Added to return air humidity setpoint to get dehumidification setpoint.	
	Supply Air Humidity (SH)	Humidity of the supply air.	
	Return Air Humidity (RH)	Humidity of the return air.	
Digital Inputs	Enable 1 (E1)	Both E1 and E2 must be on (1) to enable humidifier and PID. Should be tied to time schedule.	
	Enable 2 (E2)	Both E1 and E2 must be on (1) to enable humidifier and PID. Should be tied to time schedule.	
Analog Outputs	Cooling Valve (CV)	Output to cooling valve (0 ··· 100).	
	Humidifier Valve (HV)	Humidifier valve output. Range is 0% (closed) to 100% (open).	
Digital Outputs	Humidifier Enable (EN)	Output is on (1) when E1 and E2 are on and supply humidity is less than humidity setpoint.	
Parameters	Return Humidity Gain	Gain of return humidity PID.	8
	Return Humidity Integration	Integration time of return humidity PID.	600 seconds
	Return Humidity Derivative	Derivative time of return humidity PID.	0 seconds
	Dehumidification Gain	Gain of Dehumidification PID.	8
	Dehumidification Integration	Integration time of Dehumidification PID.	600 seconds
	Dehumidification Derivative	Derivative time of Dehumidification PID.	0 seconds
	Humidifier Gain	Gain of humidity PID.	8
	Humidifier Integration	Integration time of humidity PID.	600 seconds
	Humidifier Derivative	Derivative time of humidity PID.	0 seconds

- Example
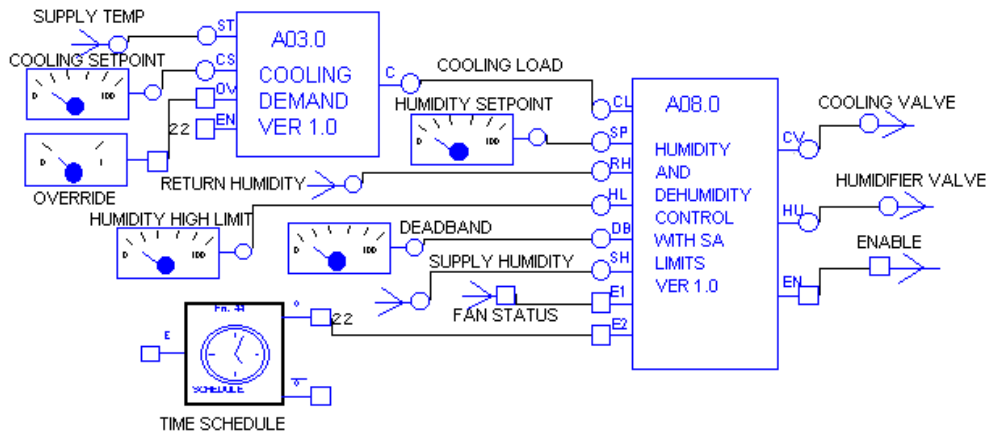
Legacy Macros - Wet Systems

W01 Weather compensator with space influence

- Application

Heating reset from outside air temperature with space influence.

- Function of module

This module provides PID control of compensated heating valve. The valve compensation is reset on outside air temperature. The flow temperature setpoint(F1) is the flow setpoint when the outdoor air temperature is 20°C. The flow temperature setpoint(F2) is the flow setpoint at 0°C. The space influence is found by multiplying the difference between the space temperature and the space setpoint by the space influence gain. The space influence is added to both flow setpoints. The compensation setpoint limits are set in the macro. The PID is enabled through the enable input point.

- Number of Blocks

10

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Flow Temperature (FT)	The temperature of the water supplied to the space.	
	Flow Setpoint at 20°C (F1)	The setpoint of the heating medium at 20°C Outdoor Temperature.	
	Flow Setpoint at 0°C (F2)	The setpoint of the heating medium at 0°C Outdoor Temperature.	
	Outdoor Air Temperature (OT)	The temperature of the outdoor air.	
	Room Setpoint (SP)	The setpoint of the space air temperature.	
	Room Temperature (RT)	The air temperature of the space.	
Digital Inputs	Enable (En)	This input must be set to on (1) for the module to function.	
Analog Outputs	Compensated Valve (HV)	The output to the compensated valve. Valid range is between 0 and 100%.	
	Compensated Setpoint (CS)	The calculated compensated setpoint.	
Parameters	Minimum Compensated Setpoint	Minimum value for the compensated setpoint.	20°C
	Maximum Compensated Setpoint	Maximum value for the compensated setpoint.	82°C
	Room Influence Gain	Gain value for room influence.	5
	Integration Time	Integration time for PID loop.	600 seconds
	Derivative Time	Derivative time for PID loop.	0 seconds
	Gain	Gain value for PID loop.	8

- Example

W02 Weather compensator with space influence and night setback
- Application

Heating reset from outside air temperature with space influence and night setback.

- Function of module

This module provides PID control of compensated heating valve. The valve compensation is reset on outside air temperature. The flow temperature setpoint (F1) is the flow setpoint when the outdoor air temperature is 20°C. The flow temperature setpoint (F2) is the flow setpoint at 0°C. The space influence is found by multiplying the difference between the space temperature and the space setpoint by the space influence gain. The space influence is added to both flow setpoints. The compensation setpoint limits are set in the macro. The PID is enabled through the enable input point. When the night setback input is on the macro uses the setback setpoint instead of the room setpoint.

- Number of Blocks

11

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Flow Temperature (FT)	The temperature of the water supplied to the space.	
	Flow Setpoint at 20°C (F1)	The setpoint of the heating medium at 20°C Outdoor Temperature.	
	Flow Setpoint at 0°C (F2)	The setpoint of the heating medium at 0°C Outdoor Temperature.	
	Outdoor Air Temperature (OT)	The temperature of the outdoor air.	
	Setback (SB)	The setpoint of the space air temperature when night setback is on.	
	Room Setpoint (SP)	The setpoint of the space air temperature when night setback is off.	
	Room Temperature (RT)	The air temperature of the space.	
Digital Inputs	Night Setback (NS)	When set to on macro uses setback input as the room setpoint else occupied setpoint is used.	
	Enable (En)	This input must be set to on (1) for the module to function.	
Analog Outputs	Compensated Valve (HV)	The output to the compensated valve. Valid range is between 0 and 100%.	
	Compensated Setpoint (CS)	The calculated compensated setpoint.	
Parameters	Minimum Compensated Setpoint	Minimum value for the compensated setpoint.	20°C
	Maximum Compensated Setpoint	Maximum value for the compensated setpoint.	82°C
	Room Influence Gain	Gain value for room influence.	5
	Integration Time	Integration time for PID loop.	600 seconds
	Derivative Time	Derivative time for PID loop.	0 seconds
	Gain	Gain value for PID loop.	8

- Example

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W03 First and second stage frost logic

- Application

Frost protection of plant equipment and condensation protection.
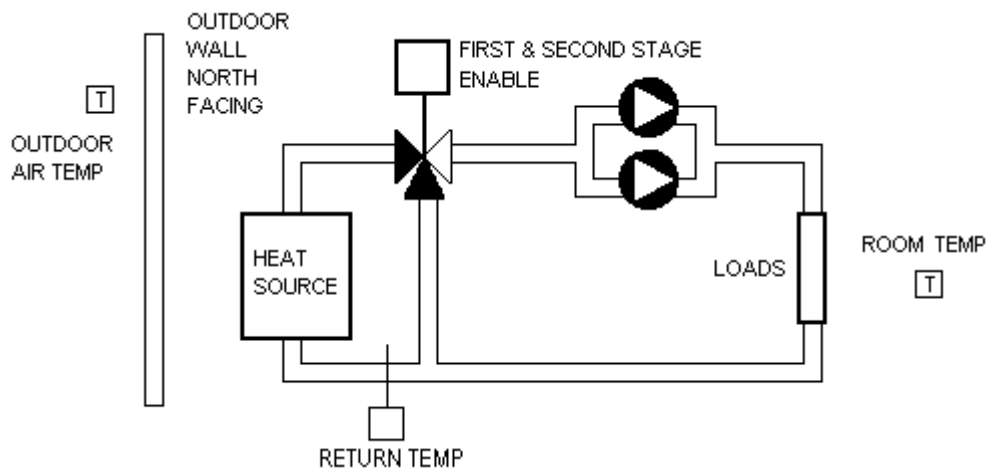
- Function of module

This macro provides first and second stage frost logic protection for heating circuits. When the outdoor air temperature is less than the setpoint stage 1 is enabled. The output remains enabled until the outdoor air temperature rises above the setpoint by 2°C. The second stage frost is only enabled when the first stage has been enabled and the boiler return temperature falls below 15°C. The second stage turns off when the boiler return temperature rises above 30°C.

- Number of Blocks

5

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Outdoor Air Temperature (OT)	The temperature of the outdoor air.	
	Stage One On Temperature (O1)	The point below which first stage enable will occur.	
	Boiler Return Temperature (RT)	The temperature of the water returning to the boiler.	
	Stage Two On Setpoint (R1)	The temperature at which the second stage enable will occur.	
Digital Outputs	First Stage Enable (S1)	When module selects First Stage Enable as desired output, this value is set to on. Otherwise value is off.	Off (0)
	Second Stage Enable (S2)	When module selects Second Stage Enable as desired output, this value is set to on. Otherwise value is off. First stage must be enabled before second stage will be enabled.	Off (0)
Parameters	Outdoor air deadband	The first stage output turns on when the outdoor air temperature is less than this value and module is enabled.	2°C
	Boiler Return deadband	The second stage output turns on when first stage is on and boiler return temperature is less than this value.	10°C

- Example
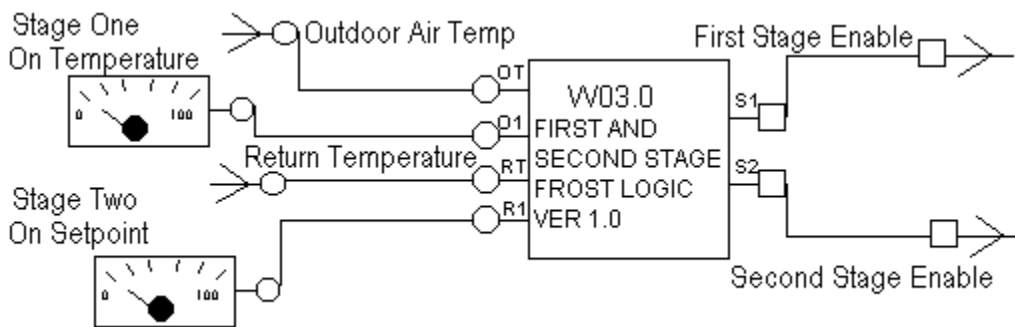
W04 Two-Boiler sequence with weekly rotation
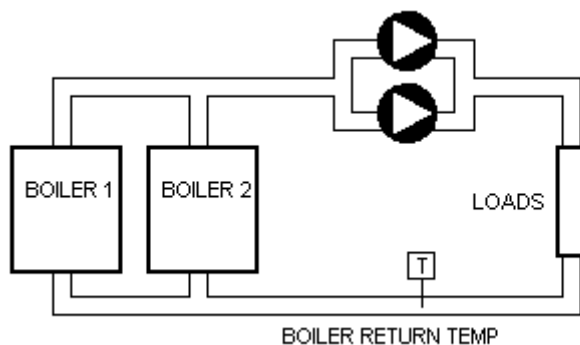
- Application

Boiler sequencing and control.

- Function of module

This macro provides control of two boilers with duty sharing. The lead boiler is rotated every week. The macro finds the heating load based on the supply setpoint when the PID is enabled. If the heating load is greater than 25% then the lead boiler is selected. The setting for the lag boiler is 99%. The boilers have an on delay of 60 seconds.

- Number of Blocks

27

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Boiler Sequence Setpoint (SP)	Setpoint of the boilers.	
	Boiler Sequence Temperature (PV)	Temperature of the boiler.	
Digital Inputs	Changeover (CO)	Weekly flag allowing lead and lag boilers to be rotated.	0
	Enable (EN)	Should be joined to time schedule. Boilers and pumps are disabled when value is 0ff	Off (0)
Digital Outputs	Boiler 1 (B1)	Output is on (1) when boiler 1 is selected as desired output.	Off (0)
	Boiler 2 (B2)	Output is on (1) when boiler 2 is selected as desired output.	Off (0)
Parameters	Lead enable	Heating load > value to enable lead boiler.	25
	Lag enable	Heating load > value to enable lag boiler.	99
	Boiler 1 on delay	Time delay before boiler 1 is set on.	60 seconds
	Boiler 2 on delay	Time delay before boiler 2 is set on.	60 seconds

- Example

W05 Two-Boiler sequence with high/low fire and weekly rotation

- Application
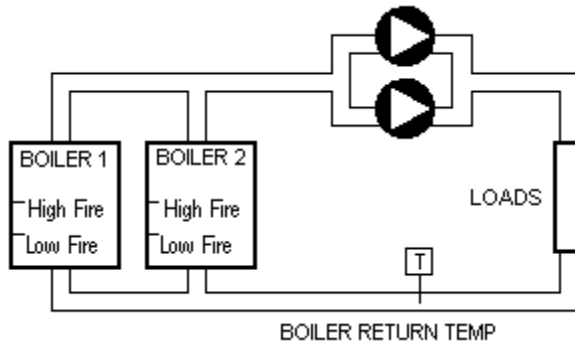
Boiler sequencing and control.

- Function of module

This macro provides control of two boilers with duty sharing. The lead boiler is rotated every week. The macro finds the heating load based on the supply setpoint when the PID is enabled. The lead boiler is selected when the load is less than 50%. When the load reaches 25% of the 0 ··· 50% range i.e. 12.5% the low fire setting on the lead is enabled. When the load reaches 99% of the 0 ··· 50% range the high fire setting on the lead is enabled. The lag boiler is selected when the load is greater than 50%. When the load reaches 25% of the 50 ··· 100% range the low fire setting on the lag is enabled. When the load reaches 99% of the 50 ··· 100% range the high fire setting on the lag is enabled. The boilers have an on delay of 60 seconds.

- Number of Blocks

34

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Boiler Sequence Setpoint (SP)	Setpoint of the boilers.	
	Boiler Sequence Temperature (PV)	Temperature of the boilers.	
Digital Inputs	Changeover (CO)	Weekly flag allowing lead and lag boilers to be rotated.	0
	Enable (EN)	Should be joined to time schedule. Boilers and pumps are disabled when value is 0ff	Off (0).
Digital Outputs	Boiler 1 Low Fire (L1)	Output is on (1) when boiler 1 low fire is selected as desired output.	Off (0).
	Boiler 1 High Fire (H1)	Output is on (1) when boiler 1 high fire is selected as desired output.	Off (0).
	Boiler 2 Low Fire (L2)	Output is on (1) when boiler 2 low fire is selected as desired output.	Off (0).
	Boiler 2 High Fire (H2)	Output is on (1) when boiler 2 high fire is selected as desired output.	Off (0).
Parameters	Lead enable	Heating load > value to enable lead boiler.	25
	Lag enable	Heating load > value to enable lag boiler.	99
	Boiler 1 low fire on delay	Time delay before boiler 1 low fire is set on.	30 seconds
	Boiler 1 high fire on delay	Time delay before boiler 1 high fire is set on.	60 seconds
	Boiler 2 low fire on delay	Time delay before boiler 2 low fire is set on.	30 seconds
	Boiler 2 high fire on delay	Time delay before boiler 2 high fire is set on.	60 seconds

- Example
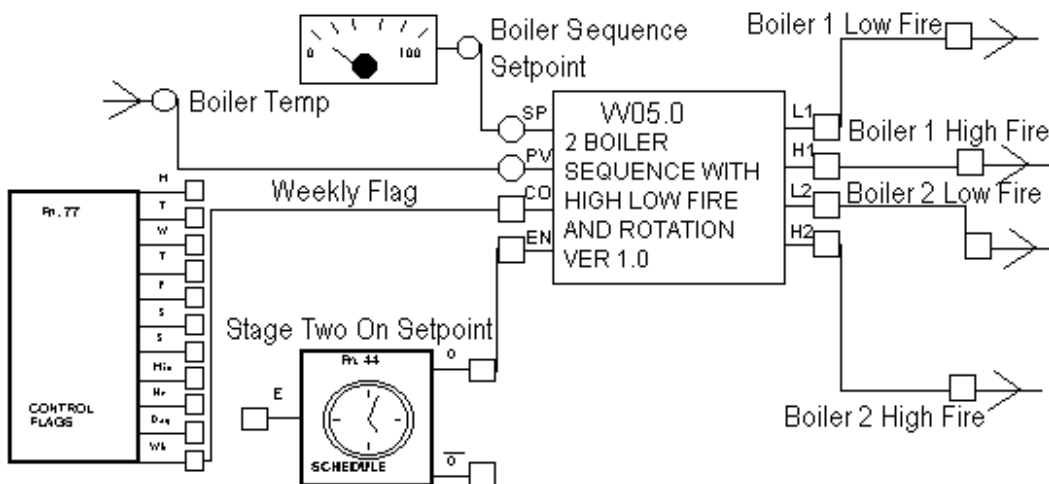
W06 Three-Boiler sequence with weekly rotation

- Application

Boiler sequencing and control.
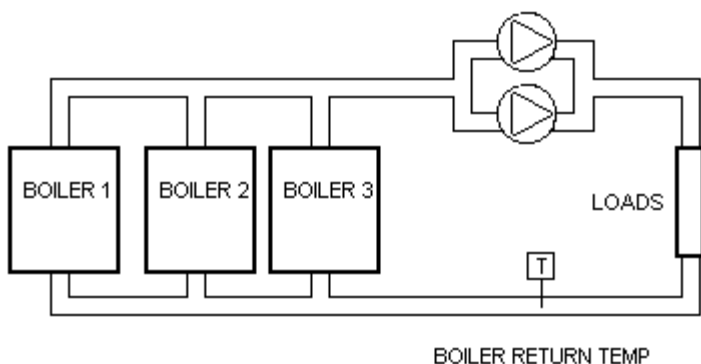
- Function of module

This macro provides control of three boilers with duty sharing. The lead boiler is rotated every week. The macro finds the heating load based on the supply setpoint when the PID is enabled. If the heating load is greater than 33% then the lead boiler is selected. The setting for the lag boiler is 66%. The setting for the lag-lag boiler is 99%. The boiler sequence is 1-2-3, 2-3-1, 3-1-2. The boilers have an on delay of 60 seconds.

- Number of Blocks

35

- Symbol

- Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Boiler Sequence Setpoint (SP)	Setpoint of the boilers.	
	Boiler Sequence Temperature (RT)	Temperature of the boilers.	
Digital Inputs	Changeover (CO)	Weekly flag allowing lead and lag boilers to be rotated.	0
	Enable (EN)	Should be joined to time schedule. Boilers and pumps are disabled when value is 0ff	Off (0)
Digital Outputs	Boiler 1 (B1)	Output is on (1) when boiler 1 is selected as desired output.	Off (0)
	Boiler 2 (B2)	Output is on (1) when boiler 2 is selected as desired output.	Off (0)
	Boiler 3 (B3)	Output is on (1) when boiler 3 is selected as desired output.	Off (0)
Parameters	Lead enable	Heating load > value to enable lead boiler.	33
	Lag enable	Heating load > value to enable lag boiler.	66
	Lag-Lag enable	Heating load > value to enable lag-lag boiler.	99
	Boiler 1 on delay	Time delay before boiler 1 is set on.	60 seconds
	Boiler 2 on delay	Time delay before boiler 2 is set on.	60 seconds
	Boiler 3 on delay	Time delay before boiler 3 is set on.	60 seconds

- Example
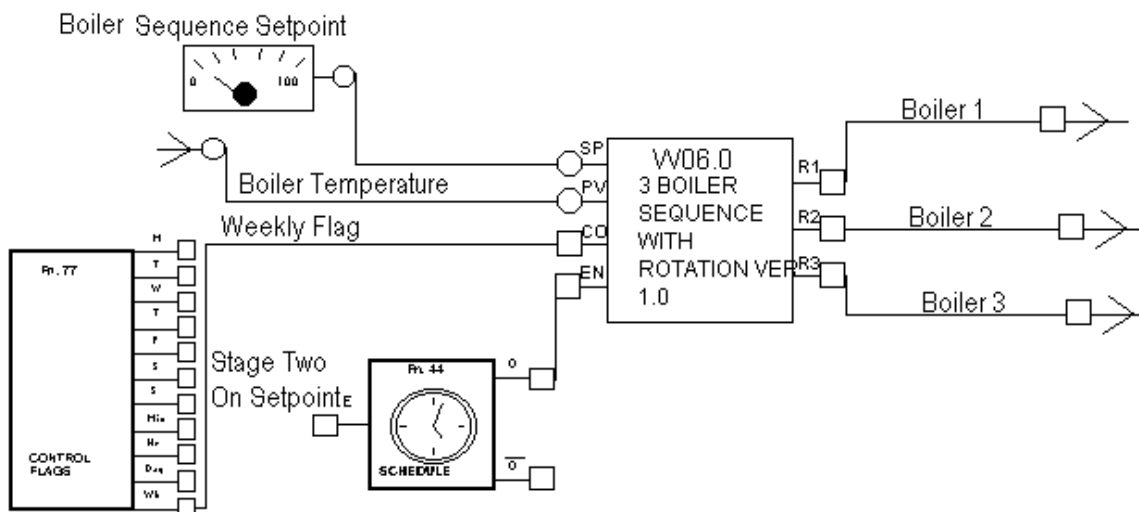
W07 First, second and third stage frost logic

- Application
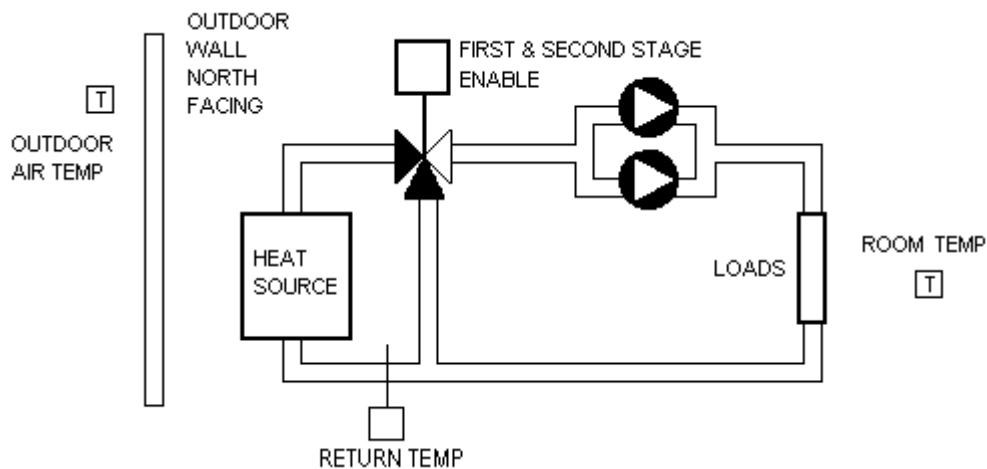
- Function of module

This macro provides first, second and third stage frost logic protection for heating circuits. When the outdoor air temperature is less than the setpoint stage 1 is enabled. The output remains enabled until the outdoor air temperature rises 2°C above the setpoint. The second stage frost is only enabled when the first stage has been enabled and the boiler return temperature falls below 15°C. The second stage turns off when the boiler return temperature rises above 30°C. When any of the room temperatures falls below 10°C the third stage is enabled. The third stage operates independently from stages 1 and 2.

- Number of Blocks

11

- Symbol

Variables

Variable type	Variable name	Description	Default values
Analog Inputs	Outdoor Air Temperature (OT)	The temperature of the outdoor air.	
	Stage One Setpoint (O1)	Setpoint which, when passed, enables first stage.	
	Boiler Return Temperature (RT)	The temperature of the water returning to the boiler.	
	Stage Two On Setpoint (R1)	Setpoint which, when passed, enables second stage.	
	Room Temperature (ST)	The temperature of the room.	
	Stage Three On Setpoint (S1)	Setpoint which, when passed, enables third stage.	
Digital Outputs	First Stage Enable (S1)	When module selects First Stage Enable as desired output, this value is set to on. Otherwise value is off.	Off (0)
	Second Stage Enable (S2)	When module selects Second Stage Enable as desired output, this value is set to on. Otherwise value is off.	Off (0)
	Third Stage Enable (S3)	When module selects Third Stage Enable as desired output, this value is set to on. Otherwise value is off.	Off (0)
Parameters	Outdoor air temperature ON value	The first stage output turns on when the outdoor air temperature is less than this value and module is enabled.	2°C
	Boiler Return temperature ON value	The second stage output turns on when first stage is on and boiler return temperature is less than this value.	15°C
	Room temperature ON value	The third stage Output turns on when minimum room temperature is less than this value.	10°C

- Example
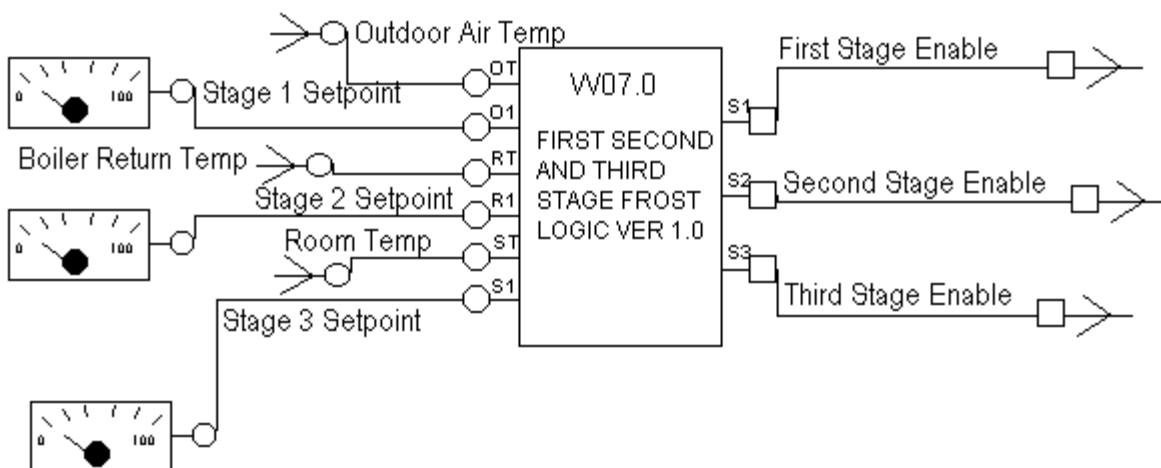
SECTION 32 : APPENDIX :: SAMPLE APPLICATIONS
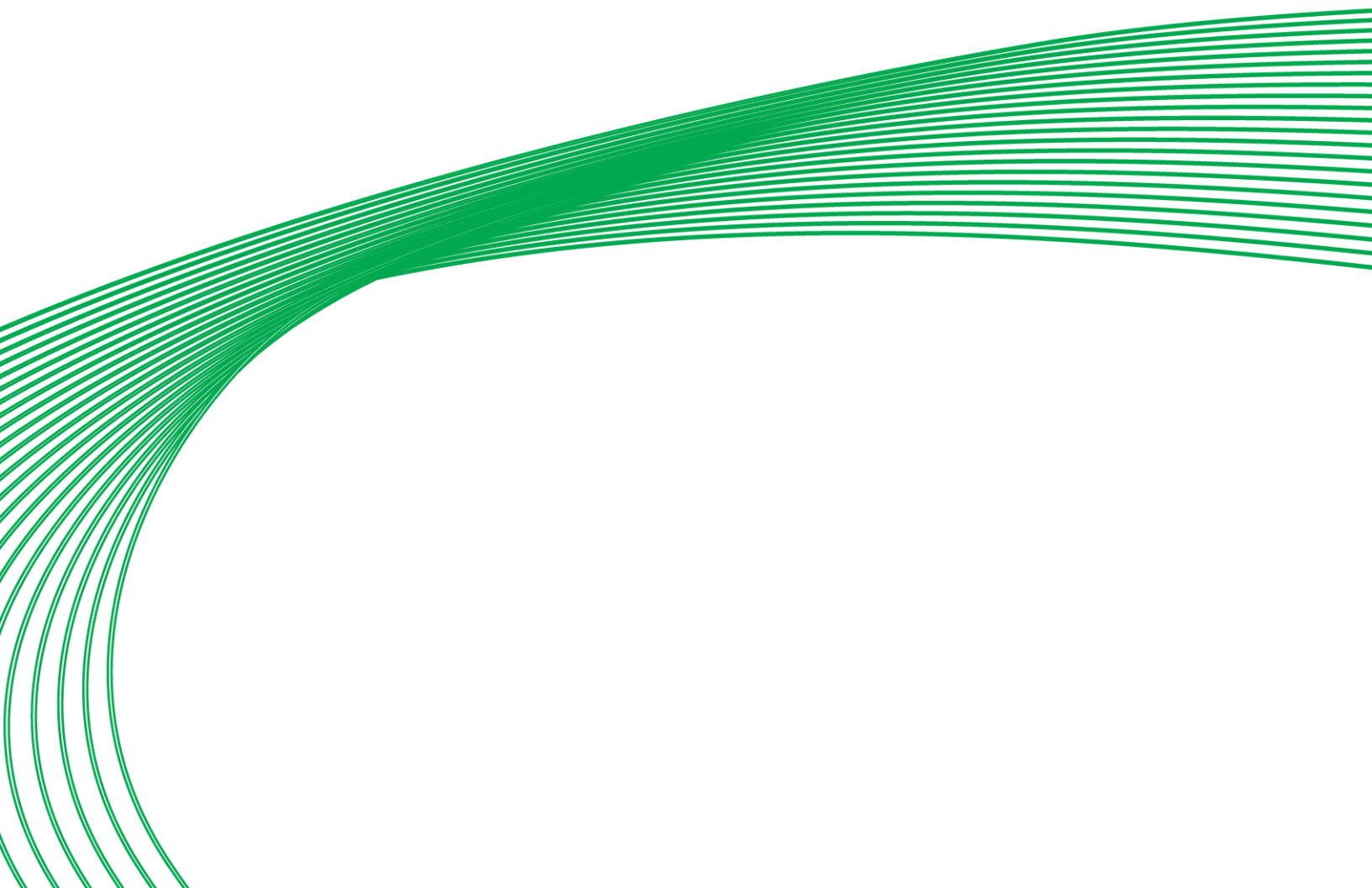
INTRODUCTION

What is the Sample Applications Library?

Cylon provides a library of pre-written **Sample Applications** that can be used to build a **Site** with the minimum effort. This **Sample Application Library** consists of pre-made **strategies** representing standard **real-world** use cases. Each Sample Application can be used as it is, by copying its content into a controller or controllers on your site. The documentation in this index can then be copied verbatim to create user documentation for the site. The following **Sample Applications** are included:

Sample Application	Page

Error! Bookmark not defined.

> **Note:** Each of the Sample Applications has certain points that are exposed on the BACnet system. In some Sample Applications, there are additional points that are available to be exposed manually if required for specific implementations.

Strategy vs Macro vs Application
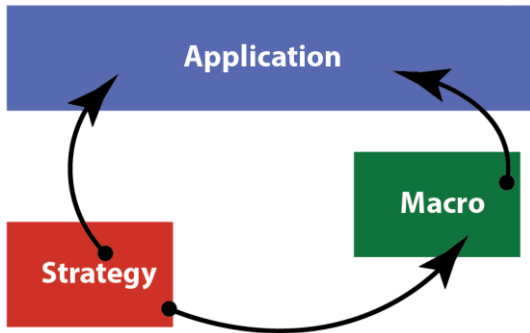
The **Cylon Engineering Centre** allows any custom **strategy** to be created by connecting modules.
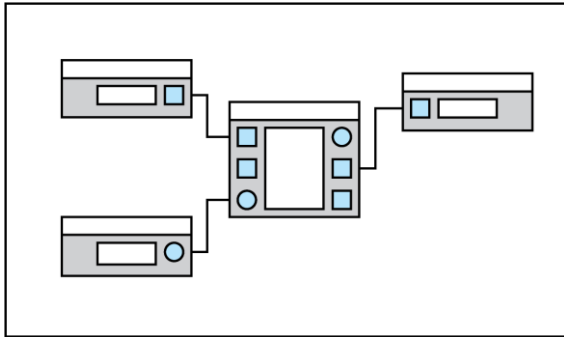
However, to save time it is possible to group elements of a strategy into a **Macro** so that their combined functionality can be easily reused:
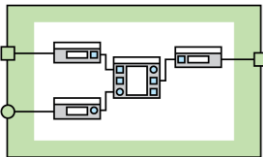
When strategy modules – and, if appropriate, macros- are combined, they provide the functionality required for a real-world **Application** such as AHU control, or Twin Pump with weekly changeover.
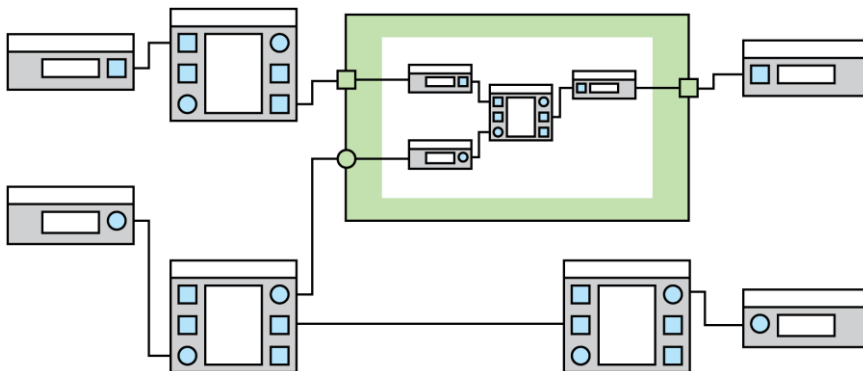
How to use CEC Sample Applications

The Sample Applications can be found in the CEC Site Tree , where there is a pre-installed site containing a controller for each Sample Application.

Each Sample Application is a pre-engineered strategy, based around one or more Macros whose internal settings can be adjusted for specific installations. The strategies can be copied as required to controllers on the user's site, and adjusted if required for the specific needs of that site. This document also contains boilerplate text specific to each Sample Application that can be copied into user documentation.

There is a section in this document for each Sample Application, and each section is in two parts:

1. The first part gives a summary of the Sample Application, lists any Macros used and shows the preset values of the each Macro's internal settings.
2. The second part is a generic description of the Sample Application that can be copied into customer-facing documentation.

If one of the Sample Applications described in this appendix provides functionality that matches or is close to the required functionality for a controller on your Site:

1. Find the corresponding Controller on the preinstalled Sample Applications Site in the CEC.
2. Copy the Strategy from the Controller into the Controller you are configuring on your own Site.
3. Adjust the Sample Application if required, by changing the options in any Macros listed in the corresponding subsection of this appendix.
4. Copy the text of the subsection (excluding the first page) into the site description document for your own Site, if required.

WET SYSTEMS

1.1.1.1 Single pump weekly changeover with DPS monitoring

Summary

This **Sample Application** will control a single pump, using a **DPS** (Differential Pressure Switch) to monitor the flow. If no flow is detected an alarm will be raised at the **Supervisor** but the pump will remain enabled. When the pump has run for 5,000 hours a **Maintenance** alarm will be raised at the **supervisor**.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User has access only to the **enable** override.

Number of **Strategy** blocks used	70

This **Sample Application** uses the following macros:

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No - Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following page.

Single pump weekly changeover with DPS monitoring

- System overview

The pump system consists of the following plant:

- Single pump with **DOL** (Direct On Line) starter.
- **DPS** (Differential Pressure Switch) across the pump.

The pump will be enabled on demand.

- System control

The system will be enabled when any plant requiring **CT** (Constant Temperature) water calls for it.

The system will be disabled when no plant requires **CT** water.

When the system is enabled any faults will be reset and the pump will be enabled.

When the system is disabled the pump control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.1.2 Single Pump Weekly Changeover with Trip Monitoring

Summary

This **Sample Application** will control a single pump. The system will monitor the **Trip** of the pump starter and if a **Trip** is detected, an alarm will be raised at the **Supervisor** and the pump will be disabled. The pump will remain disabled until the alarm is reset by the operator at the **Supervisor** or the **Enable** signal goes off. When the pump has run for 5,000 hours a **Maintenance** alarm will be raised at the **Supervisor**.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

Number of **Strategy** blocks used

70

This **Sample Application** uses the following macros:

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	2	Trip
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following page.

Single Pump Weekly Changeover with Trip Monitoring

- System overview

The pump system consists of the following plant:

- Single pump with **DOL** (Direct On Line) starter with trip contact.

The pump will be enabled on demand.

- System control

The system will be enabled when any plant requiring **CT** (Constant Temperature) water calls for it.

The system will be disabled when no plant requires **CT** water.

When the system is enabled any faults will be reset and the pump will be enabled.

When the system is disabled the pump control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump reset

The pump can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.1.3 Single Pump Weekly Changeover with Pressure Control

Summary

This **Sample Application** will control a single pump with a pressure control. If the pressure deviates from the setpoint by 10% while the system is running, then an alarm will be raised at the **supervisor** and the pump will remain disabled.

When the pump has run for 5,000 hours a **Maintenance** alarm will be raised at the **Supervisor**.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

Number of **Strategy** blocks used | 71

This **Sample Application** uses the following macros:

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	4	Pressure Mismatch
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Max Pressure Error	100	Pa
	0.01	psi
Start Delay	10	Seconds
Maintenance Limit	5000	Hours
Run On Time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following page.

Fixed Speed Weekly changeover with Pressure Control

- System overview

The pump system consists of the following plant:

- Single pump with **DOL** (Direct On Line) starter.
- Pressure sensor across the flow and return.

The pump will be enabled on demand.

- System control

The system will be enabled when any plant requiring **CT** (Constant Temperature) water calls for it.

The system will be disabled when no plant requires **CT** water.

When the system is enabled any faults will be reset and the pump will be enabled.

When the system is disabled the pump control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pressure control

When the pressure control is enabled it will ramp up the speed of the pump to achieve the required system pressure. The rate of change of the output will be limited to 3.3 % per second for the initial 30 seconds of start-up. The pressure control will then modulate the speed of the pump to maintain the required system pressure.

If the pressure sensor deviates from the required pressure setpoint by ±100pa for 10 seconds, then the pump will be deemed as **failed** and a pressure **field alarm** will be raised at the **supervisor**.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a Maintenance alarm will be raised. After the pump has been serviced, the alarm can be reset via the supervisor.

- Override

The system can be overridden `Off` or `On` via the supervisor. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a Fire alarm is detected, the pump will be stopped. When the Fire alarm has cleared the pump will then restart as per the system run, if required.

1.1.1.4 Twin Pump Weekly Changeover with DPS Monitoring

Summary

This Sample Application will control a twin pump set with a DPS to monitor the flow. It is suitable for either common DPS (Differential Pressure Switch) monitoring the two pumps or a DPS across each pump. If a common DPS is used, it must be connected to both DP1 and DP2 of the Macro.

If no flow is detected, an alarm will be raised at the supervisor and then the standby pump will be started. If no flow is detected when the standby pump is enabled, a system failed alarm will be raised at the supervisor and the standby pump will remain enabled.

When a pump has run for 5,000 hours a Maintenance alarm will be raised at the supervisor.

An override is available with 2 modes: enable and system override.

- The enable override will override the system enable and leave all safely actions enabled.

- The system override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the enable override.

The designation of "lead" pump and "standby" pump will be changed at 2:00am on Sunday.

Number of Strategy blocks used	162

This Sample Application uses the following macros:

- *Macro: TWIN PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No – Standby Run
Fault Monitor Delay	20	Seconds
Fault Delay	5	Seconds
Start Delay	10	Seconds
Runtime Limit	5000	Hours
Run on time	600	Seconds
Lead Pump Changeover	0	Time of Day
TimeOfDay (Day) (Hour)	Sun 2	Only Sunday checked Hours
Hours Run Changeover	0	Hours
Min Off Delay	120	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

Twin Pump Weekly Changeover with DPS Monitoring

- System overview

The pump system consists of the following plant:

- Two pumps with **DOL** (Direct On Line) starters.

- Two **DPS** (Differential Pressure Switches) one across each pump.

The pumps will be enabled on demand.

The pumps will operate in a duty-standby sequence with the lead pump changing each week.

- System control

The system will be enabled when any plant requiring **CT** (Constant Temperature) water calls for it.

The system will be disabled when no plant requires **CT** water.

When the system is enabled any faults will be reset and the pump will be enabled.

When the system is disabled the pump control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump rotation

The lead pump will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**:

1. To fix the lead pump disabling the automatic rotation.
2. To fix the running pump and disable the other pump.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a Maintenance alarm will be raised. After the pump has been serviced, the alarm can be reset via the supervisor.

- Override

The system can be overridden Off or On via the supervisor. If overridden Off the system will ignore all demands to run. If overridden On the system will run, but any safety interlocks will remain active.

- Fire

If a Fire alarm is detected, the pump will be stopped. When the Fire alarm has cleared the pump will then restart as per the system run, if required.

1.1.1.5 Twin Pump Weekly Changeover with Trip Monitoring

Summary

This Sample Application will control a twin pump set monitoring the pump trips.

If a trip is detected on the lead an alarm will be raised at the Supervisor, the lead pump with be stopped and the standby pump will be started.

If a trip is detected when the standby pump is enabled, a system failed alarm will be raised at the supervisor and the standby pump will be disabled. When a pump has run for 5,000 hours a Maintenance alarm will be raised at the supervisor.

An override is available with 2 modes: enable and system override.

- The enable override will override the system enable and leave all safely actions enabled.

- The system override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the enable override.

The designation of "lead" pump and "standby" pump will be changed at 2:00am on Sunday.

Number of Strategy blocks used	162

This Sample Application uses the following macros:

- *Macro: TWIN PLANT CONTROL*

Option	Value	Comment
Fault Select	2	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	No – Standby Run
Fault Monitor Delay	20	Seconds
Fault Delay	5	Seconds
Start Delay	10	Seconds
Runtime Limit	5000	Hours
Run on time	600	Seconds
Lead Pump Changeover	0	Time of Day
TimeOfDay (Day) (Hour)	Sun 2	Only Sunday checked Hours
Hours Run Changeover	0	Hours

A System Description for any system based on this Sample Application is given on the following pages.

Twin Pump Weekly Changeover with Trip Monitoring

- System overview

The pump system consists of the following plant:

- Two pumps with **DOL** (Direct On Line) starters with trip contacts.
- The pumps will be enabled on demand.

The pumps will operate in a duty-standby sequence with the lead pump changing each week.

- System control

The system will be enabled when any plant requiring **CT** (Constant Temperature) water calls for it.

The system will be disabled when no plant requires **CT** water.

When the system is enabled any faults will be reset and the pump will be enabled.

When the system is disabled the pump control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump rotation

The lead pump will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead pump disabling the automatic rotation.
2. To fix the running pump and disable the other pump.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is **in fault**, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.1.6 Twin pump weekly changeover with pressure control

Summary

This **Sample Application** will control a twin pump set with a static pressure sensor to monitor the flow.

If a pressure mismatch is detected on the lead, an alarm will be raised at the **Supervisor**, the lead pump will be stopped and the standby pump will be started.

If a pressure mismatch is detected when the standby pump is enabled, a **system failed alarm** will be raised at the supervisor and the standby pump will be disabled.

When a pump has run for 5,000 hours a **Maintenance** alarm will be raised at the **supervisor**.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

The designation of "lead" pump and "standby" pump will be changed at 2:00am on Sunday.

Number of **Strategy** blocks used	163

This **Sample Application** uses the following macros:

- *Macro: TWIN PLANT CONTROL*

Option	Value	Comment
Fault Select	4	Pressure
DPS Fault Monitor	0	Run Only
Stop on Fault	0	No – Standby Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Max Pressure Error	100	Pa
	0.01	psi
Start Delay	10	Seconds
Runtime Limit	5000	Hours
Run on time	600	Seconds
Lead Pump Changeover	0	Time of Day
TimeOfDay (Day) (Hour)	Sun 2	Only Sunday checked Hours
Hours Run Changeover	0	Hours

A System Description for any system based on this **Sample Application** is given on the following pages.

Twin pump weekly changeover with pressure control

- System overview

The system consists of the following plant:

- Two pumps with inverters.
- One pressure sensor common to both pumps.

The pump system will be enabled on demand.

The pumps will operate in a duty-standby sequence with the lead pump changing each week.

The running pump's speed will be varied to maintain the required system pressure.

- System control

The system will be enabled when any plant requiring CT (Constant Temperature) water calls for it.

The system will be disabled when no plant requires CT water.

When the system is enabled any faults will be reset and the pump will be enabled.

 When the system is disabled the pump control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be in fault.

This fault will be latched until reset by either the operator or a system restart.

A general alarm will then be raised, indicating that the pump is in fault.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pressure control

When the pressure control is enabled it will ramp up the speed of the pump to achieve the required system pressure.

The rate of change of the output will be limited to 3.3 % per second for the initial 30 seconds of start-up. The pressure control will then modulate the speed of the pump to maintain the required system pressure.

If the pressure sensor deviates from the required pressure setpoint by ±100 Pa (±0.01 psi) for 10 seconds, then the pump will be deemed as failed and a pressure field alarm will be raised at the supervisor.

- Pump rotation

The lead pump will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the supervisor.

1. To rotate the lead pump. The lead pump will still be changed automatically.
2. To fix the lead pump disabling the automatic rotation.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is **in fault**, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.2.1 VT Single pump weekly changeover with DPS monitoring

Summary

This **Sample Application** will control a single pump with a **DPS** (Differential Pressure Switch) to monitor the flow and the flow temperature (**VT** = Variable Temperature).

If no flow is detected, an alarm will be raised at the **supervisor** but the pump will remain enabled. When the pump has run for 5,000 hours a **maintenance alarm** will be raised at the **supervisor**.

The flow temperature setpoint will be reset based on the outside air temperature.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

Number of **Strategy** blocks used

| 104 |

This **Sample Application** uses the following macros:

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No - Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

VT Single pump weekly changeover with DPS monitoring

- System overview

The pump system consists of the following plant:

- Single pump with **DOL** (Direct On Line) starter.
- **DPS** (Differential Pressure Switch) across the pump.

The pump will be enabled on demand.

- **VT** (Variable Temperature) Valve control.
- **VT** flow sensor.

- System control

The system will be enabled when any plant requiring **VT** water calls for it.

The system will be disabled when no plant requires **VT** water.

When the system is enabled, any faults will be reset and both the pump and the **VT** control will be enabled.

When the system is disabled the **VT** control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- VT Control

When enabled, this will modulate the heating valve to achieve the calculated setpoint. The setpoint will be calculated based on the outside air temperature. When the outside air temperature is 2 °C (36 °F) or below, the calculated flow temperature will be 80 °C (176 °F) and when the outside air temperature is 20 °C (68 °F) or above, the calculated flow temperature will be 20 °C (68 °F).

If the flow temperature deviates from the calculated setpoint by ±2 °C (±4 °F) for 2 minutes, then an **out of limits alarm** will be raised at the supervisor.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a Maintenance alarm will be raised. After the pump has been serviced, the alarm can be reset via the supervisor.

- Override

The system can be overridden `Off` or `On` via the supervisor. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a Fire alarm is detected, the pump will be stopped. When the Fire alarm has cleared the pump will then restart as per the system run, if required.

1.1.2.2 VT Single pump weekly changeover with trip monitoring

Summary

This **Sample Application** will control a single pump and the flow temperature (**VT** = Variable Temperature).

The system will monitor the **Trip** of the pump starter. If a **Trip** is detected, an alarm will be raised at the **supervisor** and the pump will be disabled. The pump will remain disabled until the alarm is reset by the operator at the **Supervisor** or the **Enable** signal goes off.

When the pump has run for 5,000 hours a **Maintenance** alarm will be raised at the **Supervisor**. The flow temperature setpoint will be reset based on the outside air temperature.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

Number of **Strategy** blocks used

104

This **Sample Application** uses the following macros:

▪ *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	2	Trip
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

VT Single pump weekly changeover with trip monitoring

- System overview

The pump system consists of the following plant:

- Single pump with **DOL** (Direct On Line) starter with trip contact.

The pump will be enabled on demand.

- **VT** (Variable Temperature) Valve control.
- **VT** flow sensor.

- System control

The system will be enabled when any plant requiring **VT** (Variable Temperature) water calls for it.

The system will be disabled when no plant requires **VT** water.

When the system is enabled, any faults will be reset and both the pump and the **VT** control will be enabled.

When the system is disabled the **VT** control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 5 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- VT Control

When enabled, this will modulate the heating valve to achieve the calculated setpoint. The setpoint will be calculated based on the outside air temperature. When the outside air temperature is 2 °C (36 °F) or below, the calculated flow temperature will be 80 °C (176 °F) and when the outside air temperature is 20 °C (68 °F) or above, the calculated flow temperature will be 20 °C (68 °F). If the flow temperature deviates from the calculated setpoint by ±2 °C (±4 °F) for 2 minutes, then an **out of limits** alarm will be raised at the supervisor.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.2.3 VT Single pump weekly changeover with pressure control

Summary

This **Sample Application** will control a single pump with pressure control and the flow temperature (**VT** = Variable Temperature).

If the pressure deviates from the setpoint by 10% while the system is running, then an alarm will be raised at the supervisor and the pump will remain disabled. When the pump has run for 5,000 hours a **maintenance alarm** will be raised at the **supervisor**.

The flow temperature setpoint will be reset based on the outside air temperature.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

Number of **Strategy** blocks used

105

This **Sample Application** uses the following macros:

▪ *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	4	Pressure Mismatch
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Max Pressure Error	100	Pa
	0.01	psi
Start Delay	10	Seconds
Maintenance Limit	5000	Hours
Run On Time	600	Seconds
Fault Select	4	Pressure Mismatch

A System Description for any system based on this **Sample Application** is given on the following pages.

VT Single pump weekly changeover with pressure control

- System overview

The pump system consists of the following plant:

- Single pump with **DOL** (Direct On Line) starter.
- Pressure sensor across the flow and return.

The pump will be enabled on demand.

- **VT** (Variable Temperature) Valve control.
- **VT** flow sensor.

- System control

The system will be enabled when any plant requiring **VT** (Variable Temperature) water calls for it.

The system will be disabled when no plant requires **VT** water.

When the system is enabled, any faults will be reset and both the pump and the **VT** control will be enabled.

When the system is disabled the **VT** control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 5 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pressure control

When the pressure control is enabled it will ramp up the speed of the pump to achieve the required system pressure.

The rate of change of the output will be limited to 3.3 % per second for the initial 30 seconds of start-up. The pressure control will then modulate the speed of the pump to maintain the required system pressure.

If the pressure sensor deviates from the required pressure Setpoint by ±100 Pa (±0.01 psi) for 10 seconds, then the pump will be deemed as **failed** and a pressure field alarm will be raised at the supervisor.

- VT Control

When enabled, this will modulate the heating valve to achieve the calculated setpoint. The setpoint will be calculated based on the outside air temperature. When the outside air temperature is 2 °C (36 °F) or below, the calculated flow temperature will be 80 °C (176 °F) and when the outside air temperature is 20 °C (68 °F) or above, the calculated flow temperature will be 20 °C (68 °F). If the flow temperature deviates from the calculated setpoint by ±2 °C (±4 °F) for 2 minutes, then an out of limits alarm will be raised at the supervisor.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.2.4 VT Twin pump weekly changeover with DPS monitoring

Summary

This Sample Application will control a twin pump set with a DPS (Differential Pressure Switch) to monitor the flow and the flow temperature (VT = Variable Temperature).

It is suitable for either common DPS (Differential Pressure Switch) monitoring the two pumps or a DPS across each pump. If a common DPS is used, it must be connected to DP1 and DP2 of the Macro.

If no flow is detected an alarm will be raised at the Supervisor then the standby pump will be started, and if no flow is detected when the standby pump is enabled a system failed alarm will be raised at the supervisor and the standby pump will remain enabled.

When a pump has run for 5,000 hours a maintenance alarm will be raised at the supervisor. The flow temperature setpoint will be reset based on the outside air temperature.

An override is available with 2 modes: enable and system override.

- The enable override will override the system enable and leave all safely actions enabled.

- The system override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the enable override.

The designation of "lead" pump and "standby" pump will be changed at 2:00am on Sunday.

When the system is disabled the VT control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system.

| Number of Strategy blocks used | 197 |

This Sample Application uses the following macros:

- *Macro: TWIN PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No – Standby Run
Fault Monitor Delay	20	Seconds
Fault Delay	5	Seconds
Start Delay	10	Seconds
Runtime Limit	5000	Hours
Run on time	600	Seconds
Lead Pump Changeover	0	Time of Day
TimeOfDay (Day) (Hour)	Sun 2	Only Sunday checked Hours
Hours Run Changeover	0	Hours

A System Description for any system based on this Sample Application is given on the following pages.

VT Twin pump weekly changeover with DPS monitoring

- System overview

The pump system consists of the following plant:

- Two pumps with **DOL** (Direct On Line) starters.

- Two **DPS** (Differential Pressure Switch) one across each pump.

The pumps will be enabled on demand.

The pumps will operate in a duty-standby sequence with the lead pump changing each week.

- System control

The system will be enabled when any plant requiring **VT** (Variable Temperature) water calls for it.

The system will be disabled when no plant requires **VT** water.

When the system is enabled, any faults will be reset and both the pump and the **VT** control will be enabled.

When the system is disabled the **VT** control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 5 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- VT Control

When enabled, this will modulate the heating valve to achieve the calculated setpoint. The setpoint will be calculated based on the outside air temperature. When the outside air temperature is 2 °C (36 °F) or below, the calculated flow temperature will be 80 °C (176 °F) and when the outside air temperature is 20 °C (68 °F) or above, the calculated flow temperature will be 20 °C (68 °F).

If the flow temperature deviates from the calculated setpoint by ±2 °C (±4 °F) for 2 minutes, then an **out of limits alarm** will be raised at the **supervisor**.

- Pump rotation

The lead pump will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**:

1. To fix the lead pump disabling the automatic rotation.
2. To fix the running pump and disable the other pump.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.2.5 VT Twin pump Weekly Changeover with Trip Monitoring

Summary

This **Sample Application** will control a twin pump set monitoring the pump trips and the flow temperature (**VT** = Variable Temperature).

If a trip is detected on the lead an alarm will be raised at the **supervisor** then the lead pump with be stopped and the standby pump will be started. If a trip is detected when the standby pump is enabled, a **system failed alarm** will be raised at the **supervisor** and the standby pump will be disabled.

When a pump has run for 5,000 hours a **maintenance alarm** will be raised at the **supervisor**. The flow temperature setpoint will be reset based on the outside air temperature.

An override is available with 2 modes: **enable** and **system** override.

- The **enable** override will override the system enable and leave all safely actions enabled.

- The **system** override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the **enable** override.

The designation of "lead" pump and "standby" pump will be changed at 2:00am on Sunday.

When the system is disabled the **VT** control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system.

Number of **Strategy** blocks used	197

This **Sample Application** uses the following macros:

▪ *Macro: TWIN PLANT CONTROL*

Option	Value	Comment
Fault Select	2	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	No – Standby Run
Fault Monitor Delay	20	Seconds
Fault Delay	5	Seconds
Start Delay	10	Seconds
Runtime Limit	5000	Hours
Run on time	600	Seconds
Lead Pump Changeover	0	Time of Day
TimeOfDay (Day) (Hour)	Sun 2	Only Sunday checked Hours
Hours Run Changeover	0	Hours

A System Description for any system based on this **Sample Application** is given on the following pages.

VT Twin pump Weekly Changeover with Trip Monitoring

- System overview

The pump system consists of the following plant:

- Two pumps with **DOL** (Direct On Line) starters and trip contacts.
- One pressure transducer across the flow and return.

The pumps will be enabled on demand.

The pumps will operate in a duty-standby sequence with the lead pump changing each week.

- System control

The system will be enabled when any plant requiring **VT** (Variable Temperature) water calls for it.

The system will be disabled when no plant requires **VT** water.

When the system is enabled, any faults will be reset and both the pump and the **VT** control will be enabled.

When the system is disabled the **VT** control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 5 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- VT Control

When enabled, this will modulate the heating valve to achieve the calculated setpoint. The setpoint will be calculated based on the outside air temperature. When the outside air temperature is 2 °C (36 °F) or below, the calculated flow temperature will be 80 °C (176 °F) and when the outside air temperature is 20 °C (68 °F) or above, the calculated flow temperature will be 20 °C (68 °F).

If the flow temperature deviates from the calculated setpoint by ±2 °C (±4 °F) for 2 minutes, then an out of limits alarm will be raised at the **supervisor**.

- Pump rotation

The lead pump will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead pump disabling the automatic rotation.
2. To fix the running pump and disable the other pump.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is **in fault**, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.2.6 VT Twin pump Weekly Changeover with Pressure Control

Summary

This Sample Application will control a twin pump set with a static pressure sensor to monitor the flow and the flow temperature (VT = Variable Temperature).

If a pressure mismatch is detected on the lead, an alarm will be raised at the supervisor, the lead pump will be stopped and the standby pump will be started.

If a pressure mismatch is detected when the standby pump is enabled a system failed alarm will be raised at the supervisor and the standby pump will be disabled.

When a pump has run for 5,000 hours a Maintenance alarm will be raised at the supervisor.

The flow temperature setpoint will be reset based on the outside air temperature.

An override is available with 2 modes: enable and system override.

- The enable override will override the system enable and leave all safely actions enabled.

- The system override will override the system enable and ignore all safety interlocks.

It is recommended that the End User only has access to the enable override.

The designation of "lead" pump and "standby" pump will be changed at 2:00am on Sunday.

When the system is disabled the VT control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system.

Number of Strategy blocks used	198

This Sample Application uses the following macros:

- *Macro: TWIN PLANT CONTROL*

Option	Value	Comment
Fault Select	4	Pressure
DPS Fault Monitor	0	Run Only
Stop on Fault	0	No – Standby Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Max Pressure Error	100	Pa
	0.01	psi
Start Delay	10	Seconds
Runtime Limit	5000	Hours
Run on time	600	Seconds
Lead Pump Changeover	0	Time of Day
TimeOfDay (Day)	Sun	Only Sunday checked
(Hour)	2	Hours

A System Description for any system based on this Sample Application is given on the following pages.

VT Twin pump Weekly Changeover with Pressure Control

- System overview

The system consists of the following plant:

- Two pumps with inverters.
- One pressure sensor common to both pumps.

The pump system will be enabled on demand.

The pumps will operate in a duty-standby sequence with the lead pump changing each week.

The running pump's speed will be varied to maintain the required system pressure.

- System control

The system will be enabled when any plant requiring **VT** (Variable Temperature) water calls for it.

The system will be disabled when no plant requires **VT** water.

When the system is enabled, any faults will be reset and both the pump and the **VT** control will be enabled.

When the system is disabled the **VT** control will be disabled.

- Pump System Control

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 5 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A **general alarm** will then be raised, indicating that the pump is **in fault**.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pressure control

When the pressure control is enabled it will ramp up the speed of the pump to achieve the required system pressure.

The rate of change of the output will be limited to 3.3 % per second for the initial 30 seconds of start-up. The pressure control will then modulate the speed of the pump to maintain the required system pressure.

If the pressure sensor deviates from the required pressure setpoint by ±100 Pa (±0.01 psi) for 10 seconds, then the pump will be deemed as **failed** and a pressure field alarm will be raised at the supervisor.

- VT Control

When enabled, this will modulate the heating valve to achieve the calculated setpoint. The setpoint will be calculated based on the outside air temperature. When the outside air temperature is 2 °C (36 °F) or below, the calculated flow temperature will be 80 °C (176 °F) and when the outside air temperature is 20 °C (68 °F) or above, the calculated flow temperature will be 20 °C (68 °F).

If the flow temperature deviates from the calculated setpoint by ±2 °C (±4 °F) for 2 minutes, then an **out of limits alarm** will be raised at the supervisor.

- Pump rotation

The lead pump will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To rotate the lead pump. The lead pump will still be changed automatically.
2. To fix the lead pump disabling the automatic rotation.

- System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is **in fault**, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the '**hours run**' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Override

The system can be overridden Off or On via the **supervisor**. If overridden Off the system will ignore all demands to run. If overridden On the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.3.1 Four-Boiler On/Off Sequence Control

Summary

This **Sample Application** will control 4 boilers with on-off control.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler it will be taken out of the sequence until reset.

Number of **Strategy** blocks used   452

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78	°C
	(172	°F)
Deadband DB	2	°C
	(4	°F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	0	Lo

A System Description for any system based on this **Sample Application** is given on the following page.

Four-Boiler On/Off Sequence Control

- System overview.

The boiler system consists of the following plant:

- 4 Boilers with integral shunt pumps and lockout indication.
- 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the boiler control will be enabled.

When the system is disabled the boiler control will be disabled.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers as required.

If a boiler fails, then a **Boiler Lockout** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead boiler disabling the automatic rotation.
2. To fix the number of boilers in the sequence.

- System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 5,000 Hours (user adjustable) a **maintenance alarm** will be raised. After the boiler has been serviced, the alarm can be reset via the **supervisor**.

1.1.3.2 Four-Boiler Modulating Sequence Control

Summary

This **Sample Application** will control 4 boilers with modulating control.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler it will be taken out of the sequence until reset.

Number of **Strategy** blocks used   452

This **Sample Application** uses the following macros:

▪ *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78	°C
	(172	°F)
Deadband DB	2	°C
	(4	°F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

▪ *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	0	Lo

A System Description for any system based on this **Sample Application** is given on the following page.

Four-Boiler Modulating Sequence Control

- System overview.

The boiler system consists of the following plant:

- 4 Modulating Boilers with integral shunt pumps and lockout indication.
- 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the boiler control will be enabled.

When the system is disabled the boiler control will be disabled.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers and modulation as required.

When another boiler is sequenced `on`, the total required demand will be sequenced between all the enabled boilers, with the lead boilers being set to 100% demand. Therefore, if the total demand is 120% and two boilers are `on`, the lead boiler demand will be set to 100% and the demand for the lag boilers will be set to 20%.

If a boiler fails, then a **Boiler Lockout** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead boiler disabling the automatic rotation.
2. To fix the number of boilers in the sequence.
3. **To fix the demand output of the last boiler in the sequence.**

- System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 15,000 Hours (user adjustable) a **maintenance alarm** will be raised. After the boiler has been serviced, the alarm can be reset via the **supervisor**.

1.1.3.3 Two-Boiler High/Low Fire

Summary

This **Sample Application** will control 2 boilers with Hi/Lo fire control.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler it will be taken out of the sequence until reset.

Number of **Strategy** blocks used   310

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78	°C
	(172	°F)
Deadband DB	2	°C
	(4	°F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	1	Lo

A System Description for any system based on this **Sample Application** is given on the following page.

Two-Boiler High/Low Fire

- System overview

The boiler system consists of the following plant:

- 2 Hi/Lo fire boilers with integral shunt pumps and lockout indication.
- 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the boiler control will be enabled.

When the system is disabled the boiler control will be disabled.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers as required.

If a boiler fails, then a **Boiler Lockout** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead boiler disabling the automatic rotation.
2. To fix the number of boilers in the sequence.

- System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 5,000 Hours (user adjustable) a **Maintenance** alarm will be raised. After the boiler has been serviced, the alarm can be reset via the **supervisor**.

1.1.3.4 Four-Boiler On/Off Sequence Control with External shunt pump

Summary

This Sample Application will control 4 boilers with on-off control and the associated pumps.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler or associated pump it will be taken out of the sequence until reset.

Number of Strategy blocks used | 708

This Sample Application uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	0	Lo

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

Four-Boiler On/Off Sequence Control with External Shunt Pump

- System overview

The boiler system consists of the following plant:

- 4 Modulating Boilers lockout indication.
- 4 Shunt pumps
- 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the pump control will be enabled and when the **DPS** (Differential Pressure Switch) across the pump has proved flow for 30 seconds the boiler control will be enabled.

When the system is disabled the boiler control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers as required.

If a boiler fails, then a **Boiler Lockout** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead boiler disabling the automatic rotation.
2. To fix the number of boilers in the sequence.

- Boiler System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Boiler Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 5,000 Hours (user adjustable) a **Maintenance** alarm will be raised. After the boiler has been serviced, the alarm can be reset via the **supervisor**.

- Pump System control

The system will be enabled when any plant requiring CT (Constant Temperature) water calls for it. The system will be disabled when no plant requires CT water.

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be in fault.

This fault will be latched until reset by either the operator or a system restart.

A general alarm will then be raised indicating that the pump is in fault. The pump will be disabled.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is **in fault**, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Pump Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Pump Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.3.5 Four-Boiler Modulating Sequence Control with External shunt pump

Summary

This Sample Application will control 4 boilers with modulating control including the associated pumps.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler or associated pump it will be taken out of the sequence until reset.

Number of Strategy blocks used

708

This Sample Application uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	0	Lo

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

Four-Boiler Modulating Sequence Control with External Shunt Pump

- System overview

The boiler system consists of the following plant:

- 4 Modulating Boilers lockout indication.
- 4 Shunt pumps
- 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the pump control will be enabled and when the DPS (Differential Pressure Switch) across the pump has proved flow for 30 seconds the boiler control will be enabled.

When the system is disabled the boiler control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers and modulation as required.

If a boiler fails, then a Boiler Lockout alarm will be raised at the supervisor and it will be taken out of the sequence until the alarm has been reset by the supervisor.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the supervisor.

1. To fix the lead boiler disabling the automatic rotation.
2. To fix the number of boilers in the sequence.

- Boiler System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Boiler Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 5,000 Hours (user adjustable) a Maintenance alarm will be raised. After the boiler has been serviced, the alarm can be reset via the supervisor.

- Pump System control

The system will be enabled when any plant requiring **hot** water calls for it. The system will be disabled when no plant requires **hot** water.

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A general alarm will then be raised indicating that the pump is in fault. The pump will be disabled.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is **in fault**, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Pump Hours run

The system will log the '**hours run**' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a **Maintenance** alarm will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Pump Override

The system can be overridden `Off` or `On` via the **supervisor**. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a **Fire** alarm is detected, the pump will be stopped. When the **Fire** alarm has cleared the pump will then restart as per the **system run**, if required.

1.1.3.6 Four-Boiler Hi/Lo Sequence Control with External Shunt Pump

Summary

This **Sample Application** will control 2 boilers with Hi-Lo control and the associated pumps.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler or associated pump it will be taken out of the sequence until reset.

Number of **Strategy** blocks used   356

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	1	Hi

- *Macro: SINGLE PLANT CONTROL*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

Four-Boiler Hi/Lo Sequence Control with External Shunt Pump

- System overview

The boiler system consists of the following plant:

- 2 Hi-Lo Fire Boilers lockout indication.
- 2 Shunt pumps
- 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the pump control will be enabled and when the **DPS** (Differential Pressure Switch) across the pump has proved flow the boiler control will be enabled.

When the system is disabled the boiler control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers and modulation as required.

If a boiler fails, then a **Boiler Lockout** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead boiler disabling the automatic rotation.
2. To fix the number of boilers in the sequence.

- Boiler System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Boiler Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 5,000 Hours (user adjustable) a **Maintenance** alarm will be raised. After the boiler has been serviced, the alarm can be reset via the **supervisor**.

- Pump System control

The system will be enabled when any plant requiring CT (Constant Temperature) water calls for it. The system will be disabled when no plant requires CT water.

When the system is enabled any faults will be reset and the pump will be started.

When the system is enabled any faults will be reset and the pump will be started. After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed as in fault.

This fault will be latched until reset by either the operator or a system restart.

A general alarm will then be raised indicating that the pump is in fault. The pump will be disabled.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump System reset

The system can be reset via the supervisor. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a Frost Level 1 or a Frost Level 2 is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Pump Hours run

The system will log the 'hours run' for the pump. When the pump has a logged run time of 5,000 hours (user adjustable) a Maintenance alarm will be raised. After the pump has been serviced, the alarm can be reset via the supervisor.

- Pump Override

The system can be overridden `Off` or `On` via the supervisor. If overridden `Off` the system will ignore all demands to run. If overridden `On` the system will run, but any safety interlocks will remain active.

- Fire

If a Fire alarm is detected, the pump will be stopped. When the Fire alarm has cleared the pump will then restart as per the system run, if required.

1.1.3.7 Four-Boiler Modulating Parallel Control

Summary

This Sample Application will control 4 boilers with modulating control in parallel.

The lead boiler will be changed at 2:00am on Sunday. On failure of a boiler it will be taken out of the sequence until reset.

Number of Strategy blocks used	452

This Sample Application uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	Comment
Type Select	2	Parallel 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78	°C
	(172	°F)
Deadband DB	2	°C
	(4	°F)
PI Loop Gain	8	
PI Loop Integral	600	seconds
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	30	%
Stage 1 Off	10	%
Stage On	90	%
Stage Off	20	%

- *Macro: SEQUENCE MODULE*

Option	Value	Comment
Hi-Lo	0	Lo

A System Description for any system based on this Sample Application is given on the following page.

Four-Boiler Modulating Parallel Control

- System overview.

The boiler system consists of the following plant:

  - 4 Modulating Boilers with integral shunt pumps and lockout indication.
  - 1 Return temperature sensor.

The boilers will operate on demand with the lead boiler changing each week.

- System Control

The system will be enabled when any plant requiring hot water calls for it. The system will be disabled when no plant requires hot water.

When the system is enabled the boiler control will be enabled.

When the system is disabled the boiler control will be disabled.

- Boiler Control

When the system is enabled the system will determine how many boilers are required to meet the system demand and will adjust the enabled boilers and modulation as required.

When another boiler is sequenced `on`, the total required demand will be shared equally between all the enabled boilers. Therefore, if the total demand is 120% and two boilers are on, each boiler will have its demand set to 60%.

If a boiler fails, then a **Boiler Lockout** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the boiler control will remain static until the return temperature either rises 2 °C (4 °F) above or falls 2 °C (4 °F) below the required temperature.

- Boiler rotation

The lead boiler will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

  1. To fix the lead boiler disabling the automatic rotation.
  2. To fix the number of boilers in the sequence.
  3. **To fix the demand output of the last boiler in the sequence.**

- System reset

Each boiler has a reset for a lockout alarm. When active this alarm must be reset before the boiler can be made available to the boiler sequencer.

- Hours run

The system will log the hours run for each boiler. When a boiler has a logged run time of 5,000 Hours (user adjustable) a **Maintenance** alarm will be raised. After the boiler has been serviced, the alarm can be reset via the **supervisor**.

1.1.4.1 HWS with On-Off control

Summary

This Sample Application will control an HWS (Hot Water System) calorifer with On-Off valve control.

It will generate alarms on temperature out of limits and high limit.

Number of Strategy blocks used | **44**

This Sample Application uses the following macros:

- *Macro: HWS CONTROL*

Option	Value	Comment	
Setpoint SP	60 (140	°C °F)	
Deadband DB	2 (4	°C °F)	

- *Macro: SENSOR ALARM AND LOG*

  (no settings required)

A System Description for any system based on this Sample Application is given on the following page.

<u>HWS with On-Off control</u>

- System overview

The HWS (Hot Water System) consists of the following plant:

- HWS calorifer.
- HWS Valve On-Off.

The system will be enabled by a time schedule.

- System control

The system will be enabled via a user adjustable schedule initially set to 7:00 – 18:00 for Monday to Friday.

When enabled, the system will enable the temperature control.

When disabled the system will disable the temperature control.

- Temperature control.

The temperature control will enable-disable the valve to achieve a temperature of 60 °C (140 °F) in the calorifer. If the high limit stat is activated, then the system will close the valve.

If the temperature deviates from this temperature for 5 minutes, then an alarm will be raised at the supervisor indicating that the HWS system has failed.

- High Limit.

The calorifer is protected by a hard wired thermostat that will close an isolating valve. This thermostat will require a manual reset. When active, it will raise an alarm at the supervisor.

1.1.4.2 HWS control with circulation pump

Summary

This **Sample Application** will control an **HWS** (Hot Water System) calorifer with On-Off valve control valve and circulation pump.

It will generate alarms on temperature out of limits and high limit.

Number of **Strategy** blocks used	116

This **Sample Application** uses the following macros:

- *Macro: HWS CONTROL*

Option	Value	Comment
Setpoint SP	60	°C
	(140	°F)
Deadband DB	2	°C
	(4	°F)

- *Macro: SENSOR ALARM AND LOG*

    (no settings required)

- *Macro: SINGLE PLANT CONTROL*

Option	Value	
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No -Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

<u>HWS control with circulation pump</u>

- System overview

The HWS (Hot Water System) consists of the following plant:

- HWS calorifer.
- HWS Valve On-Off.
- Circulation pump with DOL (Direct On Line) starter.
- DPS (Differential Pressure Sensor) across the pump.

The system will be enabled by a time schedule.

- System control

The system will be enabled via a user adjustable schedule initially set to 7:00 – 18:00 for Monday to Friday.

When enabled, the system will enable the temperature control.

When disabled the system will disable the temperature control and after 5 minutes disable the pump control.

- Temperature control.

The temperature control will modulate the valve to achieve a temperature of 60 °C (140 °F) in the calorifer. If the high limit stat is activated, then the system will close the valve.

If the temperature deviates from this temperature for 5 minutes, then an alarm will be raised at the supervisor indicating that the HWS system has failed.

- High Limit.

The calorifer is protected by a hard-wired thermostat that will close an isolating valve. This thermostat will require a manual reset. When active it will raise an alarm at the supervisor.

- Pump control.

When the pump control is enabled any faults will be reset and the pump will be started. After the pump has run for 20 seconds the system will monitor the differential pressure across the pump, and if no flow is detected for a period of 10 seconds the pump will be deemed as in fault.

This fault will be latched until reset by either the operator or a system restart. A general alarm will then be raised indicating that the pump is in fault.

The pump will still remain enabled until the system is disabled.

When the system is disabled the pump will continue to run for 5 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Pump reset.

The system can be reset via the supervisor. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a frost level 1 or 2 is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the hours run for the pump. When the pump has a logged run time of 5,000 Hours (User adjustable) a **maintenance alarm** will be raised. After the pump has been serviced the alarm can be reset via the **supervisor**.

- Override

The system can be overridden off or on via the **supervisor**. If overridden `off` the system will ignore any demands to run. If overridden `on` the system will run but any safety interlocks will remain active.

- Fire

If a fire alarm is detected the pump will be stopped. When the fire alarm has cleared the pump will then restart as per the system run if required.

1.1.4.3 HWS control with circulation and de-stratification pump

Summary

This **Sample Application** will control an **HWS** (Hot Water System) calorifer with an analogue valve and circulation pump.

It will generate alarms on temperature out of limits and high limit.

Number of **Strategy** blocks used	182

This **Sample Application** uses the following macros:

- *Macro: HWS CONTROL*

Option	Value	Comment
Setpoint SP	60 (140	°C °F)
Deadband DB	2 (4	°C °F)
Legionella SP	80	Seconds
Legionella Run time	60	Minutes

- *Macro: SENSOR ALARM AND LOG*

    (no settings required)

- *Macro: SINGLE PLANT CONTROL (Circulation and Destrat Pumps)*

Option	Value	
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No -Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

HWS control with circulation and de-stratification pump

- System overview

The **HWS** (Hot Water System) consists of the following plant:

- HWS calorifer.
- HWS Valve 0-10V.
- Circulation pump with **DOL** (Direct On Line) starter.
- **DPS** (Differential Pressure Switch) across the Circulation pump.
- De-stratification pump with **DOL** starter.
- **DPS** across the De-stratification pump.

The system will be enabled by a time schedule.

- System control

The system will be enabled via a user adjustable schedule initially set to 7:00 – 18:00 for Monday to Friday.

When enabled, the system will enable the temperature control.

When disabled the system will disable the temperature control and after 5 minutes disable the pump control.

- Temperature control

The temperature control will modulate the valve to achieve a temperature of 60 °C (140 °F) in the calorifer. If the high limit stat is activated, then the system will close the valve.

If the temperature deviates from this temperature for 5 minutes, then an alarm will be raised at the **supervisor** indicating that the **HWS system** has failed.

- High Limit

The calorifer is protected by a hard wired thermostat that will close an isolating valve. This thermostat will require a manual reset. When active it will raise an alarm at the supervisor.

- De-stratification Pump control

When the de-stratification pump control is enabled it will monitor the high and low temperature sensors in the calorifer and if the difference is greater than 5 °C (9 °F) for 60 seconds it will enable the pump until the difference is less than 5 °C (9 °F) for 60 seconds.

After the pump has been enabled and run for 20 seconds, the system will monitor the differential pressure across the pump, and if no flow is detected for a period of 10 seconds the pump will be deemed as **in fault**.

This fault will be latched until reset by either the operator or a system restart. A general alarm will be then raised indicating that the pump is **in fault**.

The pump will still remain enabled until the system is disabled.

- De-stratification Pump reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- De-stratification Hours run

The system will log the hours run for the pump. When the pump has a logged run time of 5,000 Hours (User adjustable) a maintenance alarm will be raised. After the pump has been serviced the alarm can be rest via the **supervisor**.

- De-stratification Fire

If a fire alarm is detected the pump will be stopped. When the fire alarm has cleared the pump will then restart as per the system run if required.

- Circulation Pump control

When the circulation pump control is enabled any faults will be reset and the pump will be started. After the pump has run for 20 seconds the system will monitor the differential pressure across the pump, and if no flow is detected for a period of 10 seconds the pump will be deemed as in **fault**.

This fault will be latched until reset by either the operator or a system restart. A **general alarm** will be then raised indicating that the pump is **in fault**.

The pump will still remain enabled until the system is disabled.

When the system is disabled the pump will continue to run for 5 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Circulation Pump reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Circulation Pump frost protection

If the pump is not enabled and either a frost level 1 or 2 is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Circulation Hours run

The system will log the hours run for the pump. When the pump has a logged run time of 5,000 hours (User adjustable) a **maintenance alarm** will be raised. After the pump has been serviced the alarm can be rest via the **supervisor**.

- Circulation Override

The system can be overridden off or on via the **supervisor**. If overridden `off` the system will ignore any demands to run. If overridden `on` the system will run but any safety interlocks will remain active.

- Circulation Fire

If a fire alarm is detected the pump will be stopped. When the fire alarm has cleared the pump will then restart as per the system run if required.

1.1.4.4 HWS control with circulation pump and Legionella prevention

Summary

This Sample Application will control an HWS (Hot Water System) calorifer with an analogue valve and circulation pump.

It will generate alarms on temperature out of limits and high limit.

Number of Strategy blocks used   119

This Sample Application uses the following macros:

- *Macro: HWS CONTROL*

Option	Value	Comment
Setpoint SP	60 (140	°C °F)
Deadband DB	2 (4	°C °F)
Legionella SP	80	Seconds
Legionella Run time	60	Minutes

- *Macro: SENSOR ALARM AND LOG*

    (no settings required)

- *Macro: SINGLE PLANT CONTROL*

Option	Value	
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	1	No -Run
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

HWS control with circulation pump and Legionella prevention

- System overview

The HWS (Hot Water System) consists of the following plant:

- HWS calorifer.
- HWS Valve On-Off.
- Circulation pump with DOL (Direct On Line) starter.
- DPS (Differential Pressure Switch) across the pump.

The system will be enabled by a time schedule.

- System control

The system will be enabled via a user adjustable schedule initially set to 7:00 – 18:00 for Monday to Friday.

When enabled, the system will enable the temperature control.

When disabled the system will disable the temperature control and after 5 minutes disable the pump control.

- Temperature control.

The temperature control will enable-disable the valve to achieve a temperature of 60 °C (140 °F) in the calorifer. If the high limit stat is activated, then the system will close the valve.

If the temperature deviates from this temperature for 5 minutes, then an alarm will be raised at the supervisor indicating that the HWS system has failed.

- Legionella control.

The legionella temperature control will be activated at midnight every Saturday and run until the calorifer temperature has been at 80 °C (176 °F) for 1 hour.

If this is not achieved before the next start time a Legionella fail alarm will be raised at the supervisor and normal temperature control will be resumed.

If the high limit stat is activated, then the system will close the valve.

If the temperature deviates from this temperature for 5 minutes, then an alarm will be raised at the supervisor indicating that the HWS system has failed.

- High Limit.

The calorifer is protected by a hard wired thermostat that will close an isolating valve. This thermostat will require a manual reset. When active it will raise an alarm at the supervisor.

- Pump control.

When the pump control is enabled any faults will be reset and the pump will be started. After the pump has run for 20 seconds the system will monitor the differential pressure across the pump, and if no flow is detected for a period of 10 seconds the pump will be deemed as in fault.

This fault will be latched until reset by either the operator or a system restart. A general alarm will be then raised indicating that the pump is in fault.

The pump will still remain enabled until the system is disabled.

When the system is disabled the pump will continue to run for 5 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Pump reset.

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a frost level 1 or 2 is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Hours run

The system will log the hours run for the pump. When the pump has a logged run time of 5,000 hours (User adjustable) a maintenance alarm will be raised. After the pump has been serviced the alarm can be rest via the **supervisor**.

- Override

The system can be overridden off or on via the **supervisor**. If overridden `off` the system will ignore any demands to run. If overridden `on` the system will run but any safety interlocks will remain active.

- Fire

If a fire alarm is detected the pump will be stopped. When the fire alarm has cleared the pump will then restart as per the system run if required.

1.1.5.1 Two-Chiller On/Off Sequence Control

Summary

This **Sample Application** will control 2 chillers with on-off control.

The lead chiller will be changed at 2:00am on Sunday.

On failure of a chiller it will be taken out of the sequence until reset.

Number of **Strategy** blocks used   303

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day) **Time Of Day (Hour)**	Sun 2	Only Sunday checked Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	12 (22	°C °F)
PI Loop Integral	600	seconds
PI Offset	10	%
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	30	%
Stage 1 Off	10	%
Stage On	90	%
Stage Off	10	%

- *Macro: SEQUENCE MODULE*

Option	Value	
HiLo Select	0	Low

A System Description for any system based on this **Sample Application** is given on the following page.

Two Chiller On/Off Sequence Control

- System overview

The chiller system consists of the following plant:

- 2 Chillers with integral shunt pumps and fault indication.
- 1 Return Temperature sensor.

The chiller will operate on demand with lead chiller changing each week.

- System Control

The system will be enabled when any plant requiring chilled water calls for it. The system will be disabled when no plant requires chilled water.

When the system is enabled the chiller control will be enabled.

When the system is disabled the chiller control will be disabled.

- Chiller Control

When the system is enabled the system determines how many chillers are required to meet the system demand and adjusts the enabled chillers as required.

If a chiller fails, then a chiller failed alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved the chiller control will remain static until the return temperature either rises beyond 1 °C (2 °F) above or falls beyond 1 °C (2 °F) below the required temperature.

- Chiller rotation

The lead chiller will be automatically rotated at 2:00am on Sunday morning.

The operator will also have the following options via the **supervisor**:

- To fix the lead chiller, disabling the automatic rotation.
- To fix the number of chillers in the sequence.

- System reset

Each chiller has a reset for a failed alarm. When active, this alarm must be reset before the chiller can be made available to the chiller sequencer.

- Hours run

The system will log the hours run for each chiller. When a chiller has a logged run time of 5,000 Hours (User adjustable) a **maintenance alarm** will be raised. After the chiller has been serviced the alarm can be rest via the **supervisor**.

1.1.5.2 Two-Chiller Modulating Sequence Control

<u>Summary</u>

This **Sample Application** will control 2 chillers with modulating control.

The lead chiller will be changed at 2:00am on Sunday.

On failure of a chiller it will be taken out of the sequence until reset.

Number of **Strategy** blocks used	303

This **Sample Application** uses the following macros:

▪ *Macro: SEQUENCE CONTROL*

Option	Value	
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	12 (22	°C °F)
PI Loop Integral	600	seconds
PI Offset	10	%
Min On Time	0	seconds
Min Off Time	0	seconds
Min On Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	30	%
Stage 1 Off	10	%
Stage On	90	%
Stage Off	10	%

▪ *Macro: SEQUENCE MODULE*

Option	Value	
HiLo Select	0	Low

A System Description for any system based on this **Sample Application** is given on the following page.

Two Chiller Modulating Sequence Control

- System overview

The chiller system consists of the following plant:

- 2 Modulating Chillers with integral shunt pumps and fault indication.
- 1 Return temperature sensor.

The chiller will operate on demand with lead chiller changing each week.

- System Control

The system will be enabled when any plant requiring chilled water calls for it. The system will be disabled when no plant requires chilled water.

When the system is enabled the chiller control will be enabled.

When the system is disabled the chiller control will be disabled.

- Chiller Control

When the system is enabled the system will determine how many chillers are required to meet the system demand and will adjust the enabled boilers and modulation as required.

When another chiller is sequenced `on`, the total required demand will be shared equally between all the enabled chillers. Therefore, if the total demand is 120% and two chillers are on, each chiller will have its demand set to 60%.

If a chiller fails, then a **chiller failed** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the chiller control will remain static until the return temperature either rises 1 °C (2 °F) above or falls 1 °C (2 °F) below the required temperature.

- Chiller rotation

The lead chiller will be automatically rotated at 2:00am on Sunday morning.

The operator will also have the following options via the **supervisor**:

- To fix the lead chiller disabling the automatic rotation.
- To fix the number of chillers in the sequence.
- To fix the demand output of the last chiller in the sequence.

- System reset

Each chiller has a reset for a fault alarm. When active, this alarm must be reset before the chiller can be made available to the chiller sequencer.

- Hours run

The system will log the hours run for each chiller. When a chiller has a logged run time of 5,000 Hours (User adjustable) a **maintenance alarm** will be raised. After the chiller has been serviced the alarm can be rest via the **supervisor**.

1.1.5.3 Two-Chiller On/Off Sequence Control with Shunt pump

Summary

This Sample Application will control 2 chillers with on-off control and the associated shunt pumps.

The lead chiller will be changed at 2:00am on Sunday.

On failure of a chiller it will be taken out of the sequence until reset.

Number of Strategy blocks used | 438

This Sample Application uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	12 (22	°C °F)
PI Loop Integral	600	seconds
PI Offset	10	%
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	30	%
Stage 1 Off	10	%
Stage On	90	%
Stage Off	10	%

- *Macro: SEQUENCE MODULE*

Option	Value	
HiLo Select	0	Low

- *Macro: SINGLE PLANT CONTROL*

Option	Value	
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

Two Chiller On/Off Sequence Control with Shunt Pump

- System overview

The chiller system consists of the following plant:

- 2 Chillers with fault indication.
- 2 Shunt pumps.
- 1 Return temperature sensor.

The chiller will operate on demand with lead chiller changing each week.

- System Control

The system will be enabled when any plant requiring chilled water calls for it. The system will be disabled when no plant requires chilled water.

When the system is enabled the pump control will be enabled and when the **DPS** (differential Pressure) across the pump has proved flow the Chiller control will be enabled.

When the system is disabled the Chiller control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Chiller Control

When the system is enabled the system determines how many chillers are required to meet the system demand and adjusts the enabled chillers as required.

If a chiller fails, then a chiller failed alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved the chiller control will remain static until the return temperature either rises beyond 1 °C (2 °F) above or falls beyond 1 °C (2 °F) below the required temperature.

- Chiller rotation

The lead chiller will be automatically rotated at 2:00am on Sunday morning.

The operator will also have the following options via the **supervisor**:

- To fix the lead chiller disabling the automatic rotation.
- To fix the number of chillers in the sequence.

- Chiller System reset

Each chiller has a reset for a failed alarm. When active, this alarm must be reset before the chiller can be made available to the chiller sequencer.

- Chiller Hours run

The system will log the hours run for each chiller. When a chiller has a logged run time of 5,000 Hours (User adjustable) a **maintenance alarm** will be raised. After the chiller has been serviced the alarm can be rest via the **supervisor**.

- Pump system control

The system will be enabled when any plant requiring **chilled** water calls for it. The system will be disabled when no plant requires **chilled** water.

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A general alarm will then be raised indicating that the pump is in fault. The pump will be disabled.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump System reset

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Pump Hours run

The system will log the **hours run** for the pump. When the pump has a logged run time of 5,000 Hours (user adjustable) a **maintenance alarm** will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Pump Override

The system can be overridden `off` or `on` via the **supervisor**. If overridden `off` the system will ignore all demands to run. If overridden `on` the system will run but any safety interlocks will remain active.

- Fire

If a **fire alarm** is detected the Chiller and pump and Chiller control will be stopped. When the fire alarm has cleared the Chiller and pump will then restart as per the system control if required.

1.1.5.4 Two-Chiller Modulating Control with shunt pump

Summary

This **Sample Application** will control 4 Chillers with on-off control and the associated shunt pumps.

The lead Chiller will be changed at 2:00am on Sunday.

On failure of a Chiller it will be taken out of the sequence until reset.

Number of **Strategy** blocks used	438

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78 (172	°C °F)
Deadband DB	2 (4	°C °F)
PI Loop Gain	12 (22	°C °F)
PI Loop Integral	600	seconds
PI Offset	10	%
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	30	%
Stage 1 Off	10	%
Stage On	90	%
Stage Off	10	%

- *Macro: SEQUENCE MODULE*

Option	Value	
HiLo Select	0	Low

- *Macro: SINGLE PLANT CONTROL*

Option	Value	
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	600	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

Two-Chiller Modulating Control with Shunt Pump

- System overview

The chiller system consists of the following plant:

- 2 Chillers with fault indication.
- 2 Shunt pumps.
- 1 Return temperature sensor.

The chiller will operate on demand with lead chiller changing each week.

- System Control

The system will be enabled when any plant requiring chilled water calls for it. The system will be disabled when no plant requires chilled water.

When the system is enabled the pump control will be enabled and when the DPS (Differential Pressure Switch) across the pump has proved flow the Chiller control will be enabled.

When the system is disabled the Chiller control will be disabled and the pump will continue to run for 10 minutes to dissipate any residual heat left in the system and then the pump will be stopped.

- Chiller Control

When the system is enabled the system will determine how many chillers are required to meet the system demand and will adjust the enabled boilers and modulation as required.

When another chiller is sequenced `on`, the total required demand will be shared equally between all the enabled chillers. Therefore, if the total demand is 120% and two chillers are on, each chiller will have its demand set to 60%.

If a chiller fails, then a **chiller failed** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the chiller control will remain static until the return temperature either rises 1 °C (2 °F) above or falls 1 °C (2 °F) below the required temperature.

- Chiller rotation

The lead chiller will be automatically rotated at 2:00am on Sunday morning.

The operator will also have the following options via the **supervisor**:

- To fix the lead chiller disabling the automatic rotation.
- To fix the number of chillers in the sequence.

- Chiller System reset

Each chiller has a reset for a failed alarm. When active, this alarm must be reset before the chiller can be made available to the chiller sequencer.

- Chiller Hours run

The system will log the hours run for each chiller. When a chiller has a logged run time of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the chiller has been serviced the alarm can be rest via the **supervisor**.

- Pump system control

The system will be enabled when any plant requiring **chilled** water calls for it. The system will be disabled when no plant requires **chilled** water.

When the system is enabled any faults will be reset and the pump will be started.

After the pump has run for 20 seconds the system will monitor the differential pressure across the pump and if no flow is detected for a period of 10 seconds the pump will be deemed to be **in fault**.

This fault will be latched until reset by either the operator or a system restart.

A general alarm will then be raised indicating that the pump is in fault. The pump will be disabled.

When the system is disabled the pump will continue to run for 10 minutes to dissipate any residual heat left in the system, and then the pump will be stopped.

- Pump System reset.

The system can be reset via the **supervisor**. This will clear all latched faults. If the system is enabled and is in fault, the system will be restarted as described in System Control.

- Pump frost protection

If the pump is not enabled and either a **Frost Level 1** or a **Frost Level 2** is initiated, then the pump control will be enabled. This will remain enabled until all frost states are cleared.

- Pump Hours run

The system will log the **hours run** for the pump. When the pump has a logged run time of 5,000 Hours (user adjustable) a **maintenance alarm** will be raised. After the pump has been serviced, the alarm can be reset via the **supervisor**.

- Pump Override

The system can be overridden `off` or `on` via the **supervisor**. If overridden `off` the system will ignore all demands to run. If overridden `on` the system will run but any safety interlocks will remain active.

- Fire

If a **fire alarm** is detected the Chiller and pump and Chiller control will be stopped. When the fire alarm has cleared the Chiller and pump will then restart as per the system control if required.

1.1.6.1 Four Stage DX Cool Only Sequence Control

<u>Summary</u>

This **Sample Application** will control 4 stage **DX** (Direct Expansion) cooling control. The lead **DX** will be changed at 2:00am on Sunday. On failure of a **DX** stage it will be taken out of the sequence until reset.

Number of **Strategy** blocks used

458

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78	°C
	(172	°F)
Deadband DB	2	°C
	(4	°F)
PI Loop Gain	12	°C
	(22	°F)
PI Loop Integral	600	seconds
PI Offset	30	%
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	
HiLo Select	0	Low

A System Description for any system based on this **Sample Application** is given on the following page.

Four Stage DX Cool Only Sequence Control

- System overview

The DX (Direct Expansion) system consists of the following plant:

- 4 Stage DX unit.
- 1 Return temperature sensor.

The DX will operate on demand with lead DX unit changing each week.

- System Control

The system will be enabled when the plant requires chilled air. The system will be disabled when the plant no longer requires chilled air.

When the system is enabled the DX control will be enabled.

When the system is disabled the DX control will be disabled.

DX Control.

When the system is enabled, the system determines how many DX units are required to meet the system demand and adjusts the enabled DXs as required.

The sequencer will only enable or disable one DX unit at any given time.

Once a DX unit is enabled or disabled the sequencer will not enable or disable another unit for at least 2 minutes.

If a DX unit fails, then a DX unit failed alarm will be raised at the supervisor and it will be taken out of the sequence until the alarm has been reset by the supervisor.

When the required return temperature is achieved, the DX control will remain static until the return temperature either rises beyond 2 °C (4 °F) above or falls beyond 2 °C (4 °F) below the required temperature.

- DX rotation

The lead DX unit will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the supervisor.

1. To fix the lead DX unit disabling the automatic rotation.
2. To fix the number of DX units in the sequence.

- System reset

Each DX unit has a reset for a failed alarm. When active, this alarm must be reset before the DX unit can be made available to the sequencer.

- Hours run

The system will log the hours run for each DX unit. When a DX unit has a logged run time of 5,000 hours (user adjustable) a maintenance alarm will be raised. After the DX unit has been serviced the alarm can be reset via the supervisor.

1.1.6.2 Four Stage DX Cool Heat Sequence Control

<u>Summary</u>

This **Sample Application** will control 4 stage **DX** (Direct Expansion) cooling and heating control. The lead **DX** will be changed at 2:00am on Sunday. On failure of a **DX** stage it will be taken out of the sequence until reset.

Number of **Strategy** blocks used	464

This **Sample Application** uses the following macros:

- *Macro: SEQUENCE CONTROL*

Option	Value	
Type Select	0	Cascade 1
HoursRunTime	0	Time
Time Of Day (Day)	Sun	Only Sunday checked
Time Of Day (Hour)	2	Hours
Setpoint SP	78	°C
	(172	°F)
Deadband DB	2	°C
	(4	°F)
PI Loop Gain	12	°C
	(22	°F)
PI Loop Integral	600	seconds
PI Offset	30	%
Min On Time	0	seconds
Min Off Time	0	seconds
Next Stage On Time	60	seconds
Next Stage Off Time	60	seconds
Stage 1 On	0	%
Stage 1 Off	5	%
Stage On	10	%
Stage Off	90	%

- *Macro: SEQUENCE MODULE*

Option	Value	
HiLo Select	0	Low

A System Description for any system based on this **Sample Application** is given on the following page.

Four Stage DX Cool Heat Sequence Control

- System overview

The **DX** (Direct Expansion) system consists of the following plant:

- 4 Stage DX unit.
- 1 Return temperature sensor.

The **DX** will operate on demand with lead **DX** unit changing each week.

- System Control

The system will be enabled when the plant requires either chilled or heated air. The system will be disabled when the plant no longer requires chilled or heated air.

When the system is enabled the **DX** control will be enabled.

When the system is disabled the **DX** control will be disabled.

DX Control.

When the system is enabled, the system determines how many **DX** units are required to meet the system demand and adjusts the enabled **DX** as required.

The sequencer will only enable or disable one **DX** unit at any given time.

Once a **DX** unit is enabled or disabled the sequencer will not enable or disable another unit for at least 2 minutes.

The sequence control will determine if chilled or heated air is required, and will switch the **DX** units to the relevant mode. When a change of mode is required, the sequencer will wait until no **DX** units are enabled before sending a **mode change** to the **DX** units.

If a **DX** unit fails, then a **DX unit failed** alarm will be raised at the **supervisor** and it will be taken out of the sequence until the alarm has been reset by the **supervisor**.

When the required return temperature is achieved, the **DX** control will remain static until the return temperature either rises beyond 2 °C (4 °F) above or falls beyond 2 °C (4 °F) below the required temperature.

- DX rotation

The lead **DX** unit will be automatically rotated at 2:00am on Sunday morning. The operator will also have the following options via the **supervisor**.

1. To fix the lead **DX** unit disabling the automatic rotation.
2. To fix the number of **DX** units in the sequence.

- System reset

Each **DX** unit has a reset for a **failed** alarm. When active, this alarm must be reset before the **DX** unit can be made available to the sequencer.

- Hours run

The system will log the **hours run** for each **DX** unit. When a **DX** unit has a logged run time of 5,000 hours (user adjustable) a **maintenance** alarm will be raised. After the **DX** unit has been serviced the alarm can be reset via the **supervisor**.

AHU

2.1.1.1 AHU with Heating, Cooling and Full Fresh Air

Summary

This Sample Application will control an AHU with full fresh air dampers, heating and cooling valves.

On failure of either the supply or extract fans the AHU with be disabled until reset.

Number of Strategy blocks used | 209 |

This Sample Application uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

AHU with Heating, Cooling and Full Fresh Air

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS**.
- Heating Valve.
- Cooling Valve.
- Dampers full fresh air.
- Damper End Switch.
- Frost Stat.
- Space temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the temperature control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

Five seconds after the dampers are fully opened the supply fan control will be enabled.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

- System Control

When enabled, the system will maintain a space temperature between SP ±(DB / 2) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply and extract fans, closing the damper and stopping the temperature control.

- System Shut Down

When the schedule has ended, the extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the dampers will be closed.

Thirty seconds after the dampers have been closed the temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the DPS and if the DPS status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the supply fan has failed. This will require a system reset from the **supervisor**.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds, the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as **failed** and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**.

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (**SP**) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating and cooling valves will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (**DB**) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to **SP** − (**DB** /2). The cooling valve will be modulated to maintain the space temperature to **SP** + (**DB** /2). When the temperature is between these limits both the heating and cooling valves will be closed.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the heating valve will be opened to 100%. This will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Heating coil frost protection

The heating coil has a **frost stat** fitted across it, set to activate at 2 °C (36 °F). The stat will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated an alarm will be raised via the **supervisor**, the fans will be stopped, the heating valve opened to 100% and the cooling valve closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The **AHU** fans can be reset via a common reset on the **supervisor**.

2.1.1.2 AHU with Heating, Cooling and Dampers

Summary

This Sample Application will control an AHU with modulating air dampers, heating and cooling valves. On failure of either the supply or extract fans the AHU with be disabled until reset.

Number of Strategy blocks used | 234 |

This Sample Application uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

AHU with Heating, Cooling and Dampers.

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS**.
- Heating Valve.
- Cooling Valve.
- Dampers modulating.
- Frost **Stat**.
- Space temperature sensor.
- Outside air temperature sensor.
- Return air temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the supply fan control will be enabled.

When the supply fan is proved running the temperature control will be enabled with the dampers remaining in the fully recirculation position for 2 minutes.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

- System Control

When enabled, the system will maintain a space temperature of 21 °C (69.8 °F) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply and extract fans, fully closing the damper and stopping the temperature control.

- System Shut Down

When the schedule has ended, the extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the temperature control will be disabled fully closing the dampers.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the **DPS** and if the **DPS** status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the supply fan has failed. This will require a system reset from the **supervisor**.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**.

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating valve dampers and cooling valve will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP − (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). The dampers will be modulated to maintain SP. When the temperature is between these limits both the heating and cooling valves will be closed.

- Damper Control.

The dampers will be modulated between their minimum position of 10% (user adjustable) and fully open position.

The direction of the dampers be determined on the return temperature and the outside air temperature.

If the outside air temperature is less that the return temperature, then the dampers will modulate `open` when cooling is required.

If the outside air temperature is greater that the return temperature, then the dampers will modulate `close` when cooling is required.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the heating valve will be opened to 100%. This will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Heating coil frost protection

The **heating coil** has a **frost stat** fitted across it, set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the heating valve opened to 100% and cooling valves closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The **AHU** fans can be reset via a common reset on the **supervisor**.

2.1.1.3 AHU with Heating, Cooling and Thermal Wheel

<u>Summary</u>

This **Sample Application** will control an **AHU** with full fresh air dampers, Thermal wheel, heating and cooling valves. On failure of either the supply or extract fans the **AHU** with be disabled until reset.

Number of **Strategy** blocks used	239

This **Sample Application** uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	0	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

<u>AHU with Heating, Cooling and Thermal Wheel</u>

- System overview

This **Sample Application** will control AHU system with the following plant:

- Single speed supply fan with DPS (Differential Pressure Switch).
- Single speed extract fan with DPS.
- Heating Valve.
- Cooling Valve.
- Dampers full fresh air.
- Thermal Wheel.
- Frost Stat.
- Space temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the supply fan control will be enabled.

When the supply fan is proved running, the temperature control will be enabled with the dampers remaining in the fully recirculation position for 2 minutes.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

- System Control

When enabled, the system will maintain a space temperature of 21 °C (69.8 °F) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply and extract fans, closing the damper and stopping the temperature control.

- System Shut Down

When the schedule has ended, the extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the dampers will be closed.

Thirty seconds after the dampers have been closed the temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the DPS and if the DPS status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the supervisor indicating that the supply fan has failed. This will require a system reset from the supervisor.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**.

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating valve, thermal wheel and cooling valve will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP – (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). The thermal wheel will be modulated to maintain SP . When the temperature is between these limits both the heating and cooling valves will be closed.

- Thermal Wheel Control.

The **thermal wheel** speed will be modulated between its minimum and maximum speed to achieve the required space temperature.

If the outside air temperature is less than the return temperature, then the thermal wheel will speed will be increased when heating is required.

If the outside air temperature is greater that the return temperature, then the thermal wheel will speed will be increased when cooling is required.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the heating valve will be opened to 100%. This will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Heating coil frost protection

The heating coil has a **frost stat** fitted across it, set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the heating valve opened to 100% and the cooling valve closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The AHU fans can be reset via a common reset on the supervisor.

2.1.1.4 AHU with Heating, Cooling, Full Fresh Air and Humidity

Summary

This Sample Application will control an AHU with Humidity control, modulating air dampers, heating and cooling valves. On failure of either the supply or extract fans the AHU with be disabled until reset.

Number of Strategy blocks used   241

This Sample Application uses the following macros:

- Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

AHU with Heating, Cooling, Full Fresh Air and Humidity

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS.**
- Heating Valve.
- Cooling Valve.
- Dampers full fresh air.
- Frost Stat.
- Humidifier with 0 – 10 V control.
- Space temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the temperature control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

Five seconds after the dampers are fully opened the supply fan control will be enabled.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

Ten seconds after the extract fan is proved running, the humidity control will be enabled.

- System Control

When enabled, the system will maintain a space temperature between $SP \pm (DB / 2)$ within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply and extract fans, closing the damper and stopping the temperature control.

- System Shut Down

When the schedule has ended, the humidity control, extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the dampers will be closed.

Thirty seconds after the dampers have been closed the temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the DPS and if the DPS status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the supply fan has failed. This will require a system reset from the **supervisor.**

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds the system will monitor the DPS, and if the DPS status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor.**

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating and cooling valves will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP − (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). When the temperature is between these limits both the heating and cooling valves will be closed.

- Humidity Control

When enabled the humidity control will modulate the humidifier to maintain a supply relative humidity of 50%.

When disabled the humidity control will remain at 0%.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the heating valve will be opened to 100%. This will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Heating coil frost protection

The heating coil has a **frost stat** fitted across it, set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the heating valve opened to 100% and the cooling valve closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The **AHU** fans can be reset via a common reset on the **supervisor**.

2.1.1.5 AHU with Frost, Heating, Cooling and Full Fresh Air

Summary

This **Sample Application** will control an AHU with a frost heater battery, full fresh air dampers, heating and cooling valves. On failure of either the supply or extract fans the AHU with be disabled until reset.

Number of **Strategy** blocks used

224

This **Sample Application** uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this **Sample Application** is given on the following pages.

AHU with Frost, Heating, Cooling and Full Fresh Air

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS**.
- Frost Off Coil Temperature sensor.
- Frost Valve.
- Heating Valve.
- Cooling Valve.
- Dampers full fresh air.
- Frost Stat.
- Space temperature sensor.

- System Start up

When the AHU is enabled via the schedule, the temperature and frost control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

Five seconds after the dampers are fully opened the supply fan control will be enabled.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

- System Control

When enabled, the system will maintain a space temperature between SP ±(DB / 2) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply and extract fans and stopping the temperature control.

- System Shut Down

When the schedule has ended, the extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the dampers will be closed.

Thirty seconds after the dampers have been closed the frost and temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 10 seconds the system will monitor the **DPS** and if the **DPS** status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the supply fan has failed. This will require a system reset from the **supervisor**.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 10 seconds the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**.

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating and cooling valves will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP – (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). When the temperature is between these limits both the heating and cooling valves will be closed.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the heating valve will be opened to 100%. This will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Heating coil frost protection

The heating coil has a **frost stat** fitted across it, set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the heating valve opened to 100% and the cooling valve closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The **AHU** fans can be reset via a common reset on the **supervisor**.

2.1.1.6 AHU with Frost, Heating, Cooling and Dampers

Summary

This Sample Application will control an AHU with a frost heater battery, modulating air dampers, heating and cooling valves. On failure of either the supply or extract fans the AHU with be disabled until reset.

Number of Strategy blocks used

| 249 |

This Sample Application uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8	°C
	(14	°F)
Free Gain	12	°C
	(22	°F)
Clg Gain	8	°C
	(14	°F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

AHU with Frost, Heating, Cooling and Dampers

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS**.
- Frost Off Coil Temperature sensor.
- Frost Valve.
- Heating Valve.
- Cooling Valve.
- Dampers modulating.
- Frost **Stat**.
- Space temperature sensor.
- Outside air temperature sensor.
- Return air temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the supply fan control will be enabled.

When the supply fan is proved running the temperature control will be enabled with the dampers remaining in the fully recirculation position for 2 minutes.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

- System Control

When enabled, the system will maintain a space temperature between SP ±(DB / 2) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply and extract fans, fully closing the damper and stopping the temperature control

- System Shut Down

When the schedule has ended, the extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the temperature control will be disabled fully closing the dampers.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the **DPS** and if the **DPS** status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the supply fan has failed. This will require a system reset from the **supervisor**.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**.

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating valve dampers and cooling valve will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP − (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). The dampers will be modulated to maintain SP . When the temperature is between these limits both the heating and cooling valves will be closed.

- Damper Control.

The dampers will be modulated between their minimum position of 10% (user adjustable) and fully open position.

The direction of the dampers be determined on the return temperature and the outside air temperature.

If the outside air temperature is less that the return temperature, then the dampers will modulate `open` when cooling is required.

If the outside air temperature is greater that the return temperature, then the dampers will modulate `close` when cooling is required.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the heating and frost valves will be opened to 100%. This will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Frost Coil Control.

When the **frost coil** control is active the frost valve will be modulated to maintain an **off coil** temperature of 10 °C (50 °F). When the **frost coil** is inactive the frost valve will be closed.

- Frost coil frost protection

The heating coil has a **frost stat** fitted across it, set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the frost valve opened to 100% and the heating and cooling valves closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The AHU fans can be reset via a common reset on the supervisor.

2.1.1.7 AHU with Frost, Heating, Cooling and Thermal Wheel

Summary

This Sample Application will control an AHU with a frost heater battery, full fresh air dampers, Thermal wheel, heating and cooling valves. On failure of either the supply or extract fans the AHU with be disabled until reset.

Number of Strategy blocks used   253

This Sample Application uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	0	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

<u>AHU with Frost, Heating, Cooling and Thermal Wheel</u>

- System overview

This **Sample Application** will control AHU system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS**.
- Frost Off Coil Temperature sensor.
- Frost Valve.
- Heating Valve.
- Cooling Valve.
- Dampers full fresh air.
- Thermal Wheel.
- Frost Stat.
- Space temperature sensor.

- System Start up

When the AHU is enabled via the schedule, the supply fan control will be enabled.

When the supply fan is proved running the temperature control will be enabled with the dampers remaining in the fully recirculation position for 2 minutes.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

- System Control

When enabled, the system will maintain a space temperature of 21 °C (69.8 °F) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply, extract and fans, closing the damper and stopping the temperature control.

- System Shut Down

When the schedule has ended, the extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the dampers will be closed.

Thirty seconds after the dampers have been closed the frost and temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the **DPS** and if the **DPS** status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the supervisor indicating that the supply fan has failed. This will require a system reset from the supervisor.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor.**

- Temperature Control

The required space temperature is set via the space temperature setpoint (SP) from the supervisor. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating valve, thermal wheel and cooling valve will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP – (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). The thermal wheel will be modulated to maintain SP . When the temperature is between these limits both the heating and cooling valves will be closed.

- Thermal Wheel Control.

The **thermal wheel** speed will be modulated between its minimum and maximum speed to achieve the required space temperature.

If the outside air temperature is less than the return temperature, then the thermal wheel will speed will be increased when heating is required.

If the outside air temperature is greater that the return temperature, then the thermal wheel will speed will be increased when cooling is required.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the frost and heating valves will be opened to 100%. These will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Frost Coil Control.

When the **frost coil** control is active the frost valve will be modulated to maintain an **off coil** temperature of 10 °C (50 °F). When the **frost coil** is inactive the frost valve will be closed.

- Frost coil frost protection

The **frost coil** has a **frost stat** fitted across it set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the frost valve opened to 100% and the heating and cooling valves closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The **AHU** fans can be reset via a common reset on the **supervisor**.

2.1.1.8 AHU with Frost, Heating, Cooling, Full Fresh Air and Humidity

Summary

This Sample Application will control an AHU with a frost heater battery, humidity control, modulating air dampers, heating and cooling valves. On failure of either the supply or extract fans the AHU will be disabled until reset.

Number of Strategy blocks used | 254

This Sample Application uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

AHU with Frost, Heating, Cooling, Full Fresh Air and Humidity

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan with **DPS** (Differential Pressure Switch).
- Single speed extract fan with **DPS**.
- Frost Off Coil Temperature sensor.
- Frost Valve.
- Heating Valve.
- Cooling Valve.
- Dampers full fresh air.
- Frost Stat.
- Humidifier with 0 – 10 V control.
- Space temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the frost and temperature control will be enabled.

Ten seconds after the temperature control is enabled the dampers will open.

Five seconds after the dampers are fully opened the supply fan control will be enabled.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

Ten seconds after the extract fan is proved running, the humidity control will be enabled.

- System Control

When enabled, the system will maintain a space temperature between $SP \pm \frac{DB}{2}$ within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply, extract and temperature control.

Ten seconds after the extract fan is proved running, the humidity control will be enabled.

- System Shut Down

When the schedule has ended, the humidity control, extract and supply fans will be disabled.

Ten seconds after the fans have been disabled the dampers will be closed.

Thirty seconds after the dampers have been closed the frost and temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan will be enabled.

After the supply fan has been enabled for 20 seconds the system will monitor the **DPS** and if the **DPS** status is "no flow" for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the supervisor indicating that the supply fan has failed. This will require a system reset from the supervisor.

- Extract Fan Control

When the extract fan control is enabled the extract fan will be enabled.

After the extract fan has been enabled for 20 seconds the system will monitor the **DPS**, and if the **DPS** status is "no flow" for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the AHU is enabled, the heating and cooling valves will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F). The heating valve will be modulated to maintain the space temperature to SP − (DB /2). The cooling valve will be modulated to maintain the space temperature to SP + (DB /2). When the temperature is between these limits both the heating and cooling valves will be closed.

- Humidity Control

When enabled the humidity control will modulate the humidifier to maintain a supply relative humidity of 50%.

When disabled the humidity control will remain at 0%

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the frost and heating valves will be opened to 100%. These will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Frost Coil Control.

When the **frost coil** control is active the frost valve will be modulated to maintain an **off coil** temperature of 10 °C (50 °F). When the **frost coil** is inactive the frost valve will be closed.

- Frost coil frost protection

The **frost coil** has a **frost stat** fitted across it set to activate at 2 °C (36 °F). The **stat** will auto reset when the temperature rises to 5 °C (41 °F). If this **stat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the frost valve opened to 100% and the heating and cooling valves closed.

- Hours run

The system will log the **hours run** for both the supply and extract fans. When a fan has a logged **run time** of 5,000 hours (user adjustable) a **maintenance alarm** will be raised. After the fan has been serviced the alarm can be reset via the **supervisor**.

- Fire

If a **fire alarm** is detected the **AHU** fans are hard wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset

The **AHU** fans can be reset via a common reset on the **supervisor**.

2.1.1.9 AHU with Frost, Heating, Cooling and Dampers

Summary

This Sample Application will control an AHU with a modulating air dampers, and heating and cooling valves. On failure of either the supply or extract fans the AHU will be disabled until reset.

Number of Strategy blocks used | 234 |

This Sample Application uses the following macros:

- *Macro: HEATING COOLING AND FREE ENERGY CONTROL WITH PID*

Option	Value	
Htg Gain	8 (14	°C °F)
Free Gain	12 (22	°C °F)
Clg Gain	8 (14	°C °F)
Htg Integral	300	Seconds
Free Integral	300	Seconds
Clg Integral	300	Seconds
Damper Min Pos	10	%
Htg Frost Stat Pos	100	%
Free Frost Stat Pos	0	%
Clg Frost Stat Pos	0	%
Htg Frost 1_2 Pos	100	%
Free Frost 1_2 Pos	0	%
Clg Frost 1_2 Pos	0	%
Htg Warm Up Pos	100	%
Free Warm Up Pos	0	%
Clg Warm Up Pos	0	%

- *Macro: SINGLE PLANT CONTROL (Supply and Extract Fans)*

Option	Value	Comment
Fault Select	1	DPS
DPS Fault Monitor	0	Run Only
Stop on Fault	0	Yes
Fault Monitor Delay	20	Seconds
Fault Delay	10	Seconds
Maintenance Limit	5000	Hours
Run on time	5	Seconds

A System Description for any system based on this Sample Application is given on the following pages.

AHU with Frost, Heating, Cooling, Full Fresh Air and Humidity

- System overview

This **Sample Application** will control **AHU** system with the following plant:

- Single speed supply fan.
- Single speed extract fan.
- Pressure sensor mounted in supply fan duct.
- Pressure sensor mounted in extract fan duct.
- Heating Valve.
- Cooling Valve.
- Dampers modulating.
- Frost Stat.
- Space temperature sensor.
- Outside air temperature sensor.
- Return air temperature sensor.

- System Start up

When the **AHU** is enabled via the schedule, the temperature control will be enabled.

Ten seconds after the temperature control is enabled the supply fan control will be enabled.

Five seconds after the supply fan is proved running the extract fan control will be enabled.

- System Control

When enabled, the system will maintain a space temperature of 21 °C (69.8 °F) within the space.

If the extract fan or supply fan indicates a fault the system will be disabled, stopping the supply, extract and temperature control.

- System Shut Down

When the schedule has ended, the humidity control, extract and supply fans will be disabled.

Thirty seconds after the fans have been disabled the frost and temperature control will be disabled.

- Supply Fan Control

When the supply fan control is enabled the supply fan and pressure control will be enabled.

The pressure control will modulate the supply fan to maintain the required supply pressure setpoint.

After the supply fan has been enabled for 20 seconds the system will monitor the supply fan pressure and if the pressure is outside the supply fan pressure setpoint ±100 Pa (0.01 psi) for 10 seconds the supply fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the supply fan has failed. This will require a system reset from the **supervisor**.

- Extract Fan Control

When the extract fan control is enabled the extract fan and pressure control will be enabled.

The pressure control will modulate the extract fan to maintain the required extract pressure setpoint.

After the extract fan has been enabled for 20 seconds the system will monitor the extract fan pressure and if the pressure is outside the extract fan pressure setpoint ±100 Pa (0.01 psi) for 10 seconds the extract fan will be deemed as failed and will be disabled.

The system will raise an alarm at the **supervisor** indicating that the extract fan has failed. This will require a system reset from the **supervisor**

- Temperature Control

The required space temperature is set via the **space temperature setpoint** (SP) from the **supervisor**. This can be adjusted between 18 °C (64 °F) and 23 °C (73 °F).

When the **AHU** is enabled, the heating, dampers and cooling valves will be modulated in sequence to maintain the required space temperature.

The temperature control has a deadband (DB) of 2 °C (4 °F), if the space temperature is within the SP − (DB /2) and SP + (DB /2), the PID loop output will be held holding the cooling and heating valves at their current positions.

- Damper Control

The dampers remain fully closed for 2 minutes after being enabled. The dampers will be modulated between their minimum position and fully open position. The direction of the dampers be determined on the return temperature and the outside air temperature. If the outside air temperature is less that the return temperature, then the dampers will modulate open when cooling is required. If the outside air temperature is greater that the return temperature, then the dampers will modulate close when cooling is required.

- Frost level 1 and 2 protection

If the **AHU** is not enabled, and either a frost level 1 or 2 is initiated, then the frost and heating valves will be opened to 100%. These will remain enabled until all frost states are cleared or the **AHU** is enabled.

- Frost level 1 and 2 protection.

If the AHU is not enabled and either a frost level 1 or 2 is initiated, then the heating valve will be opened to 100%. This will remain enabled until all frost states are cleared or the AHU is enabled.

- Heating coil frost protection.

The heating coil has a frost **thermostat** fitted across it set to activate at 2 °C (36 °F).

The **thermostat** will auto-reset when the temperature rises to 5 °C (41 °F).

If this **thermostat** is activated, an alarm will be raised via the **supervisor**, the fans will be stopped, the heating valve opened to 100% and the cooling valve closed.

- Hours run.

The system will log the hours run for both the supply and extract fans.

When a fan as a logged run time of 5,000 Hours (user adjustable), a **maintenance alarm** will be raised.

After the fan has been serviced the **alarm** can be rest via the **supervisor**.

- Fire.

If a **fire alarm** is detected the **AHU** fans are hard-wired to stop. The control software will also disable the fans to stop any false alarms.

- AHU reset.

The **AHU** fans can be reset via a common reset on the **supervisor**.

UNITED STATES

PENNSYLVANIA
ONE TECHNOLOGY LANE
EXPORT, PA 15632

NEW HAMPSHIRE
25 SUNDIAL AVE - SUITE 310W
MANCHESTER, NH 03103

T (724) 733-2000
F (724) 327-6124
E CONTACTUS@CYLON.COM

IRELAND

CYLON CONTROLS LTD
CLONSHAUGH BUSINESS &
TECHNOLOGY PARK
CLONSHAUGH
DUBLIN 17
IRELAND
T + 353 1 245 0500
F + 353 1 245 0501
E INFO@CYLON.COM

UK

CYLON CONTROLS UK LTD
BIRMINGHAM BUSINESS PARK
1310, SOLIHULL PARKWAY
BIRMINGHAM
WEST MIDLANDS
B37 7YB
UNITED KINGDOM
T + 44 870 178 1800
F + 44 870 403 6570
E INFO@CYLON.COM

WWW.CYLON-AUTOMATRIX.COM
WWW.CYLON.COM