Technical Data

Technical Data for SattLine version 2.2	
Operating system	Windows NT 4.0
Hardware	A PC that complies with Windows NT Compatibility List based upon a Pentium >=90 MHz. 32 MB RAM min. is recommended.
Back-up	Removable mass storage (e.g. SyQuest or DAT).
Graphical board	1024 x 768 pixels and 256 colours min.
Communication board	An Ethernet board is required. A second board can be used for redundancy.
Serial ports	Digiboard PC/2e, PC/4e, PC/8e or PC/16e is recommended. See Windows NT Compatibility List.
Printers	Alarm printers must be line oriented. Printers for reports and hardcopy must comply with the Windows NT Compatibility List.
Operator's keyboard	Standard PC keyboard or a configurable IP65/IP54 keyboard from ABB Automation.
Pointing device	Three-button mouse is recommended. A two-button mouse, track-ball or track-pad may be used.
Other devices	The system software is distributed on CD-ROM only, hence a CD drive is required.

Communication Protocols	PC	Controller
MMS on reduced OSI stack	X	X
MMS on TCP/IP (reduced OSI stack)	X	X
SattBus 1	X	X
SattBus on TCP/IP	X	
COMLI	X	X
Siemens 3964R Master 2	X	X
Allen Bradley DH+1, 2	X	
ControlNet		X
MAP/OSI (MMS on full OSI stack)2	X	
SINEC/H1 MAP 2	X	
SQL client	X	X

[1] Requires additional hardware.
[2] Requires an additional license.

Microsoft Certified Solution Provider

ABB regional center Europe and Africa
Västerås, Sweden
Phone: +46 (0) 21 34 20 00
Fax: +46 (0) 21 13 78 45

ABB regional center Americas
Wickliffe/Ohio, USA
Phone: +1 440 585 8500
Fax: +1 440 585 8756

ABB regional center Germany
Mannheim, Germany
Phone: +49 (0) 1805 266776
Fax: +49 (0) 1805 776329

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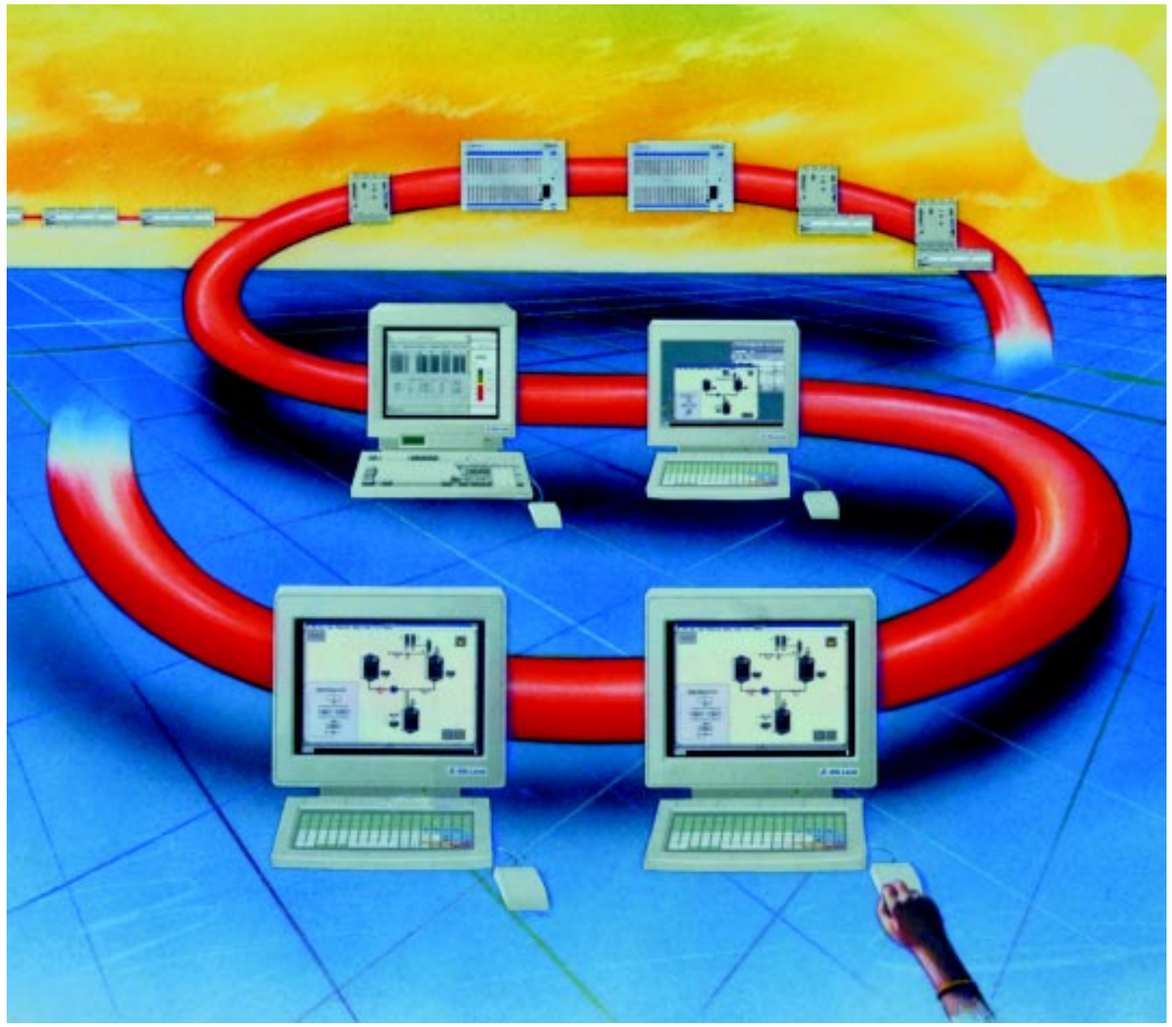
SattLine®

Distributed control and visualisation (DCS)



Total integration – One system, complete functionality

SattLine® is one of the most advanced control concepts on the market. SattLine combines the functionality of a Distributed Control System and the flexibility of a powerful hardware architecture.

Using graphical, object-oriented configuration, a single programming language is used for graphical operator interface, logic control and supervisory functions. The program structure follows the same logic and flow as the process itself enabling a highly flexible program, reducing development time and creating a high degree of integrity in the software.

The system is open and integrates easily into the Microsoft® Windows NT™ environment.

Object-oriented programming – one system, one language

SattLine uses a graphical, object-oriented programming language where an object can be, for example, a pump, valve, fermenter, etc. Within this object, all functions are contained including graphics and animation, operator control, control logic, alarms, recipes, data logging, etc.

Process optimisation

If a fermenter is being utilised, for example, all information about the fermenter is available on screen. Information may include a graphical representation of the fermenter, the program logic, recipe information, historical data logging, alarm logs, etc.

The operation of the control system follows the flow of the process. Operators develop a deeper understanding of the process lead to process optimisation, prevention of shutdowns, faster identification of faults, increased product quality and optimised production.

Strong installed base

SattLine has a strong installed base throughout the world.

The system is used in a variety of applications including validated pharmaceutical processes, food processing, chemical production and other process oriented industries such as mining, steel, pulp and paper, energy, water treatment, waste water treatment, tunnels, bridges and railways.

SattLine – In total control of your process

The operator in complete control

The operators can select their optimum role in the process. They can work pro-actively with the system seeking out possibilities for process optimisation and contributing to quality improvement.

Thanks to SattLine's total integration uses the same principles to view the program as to view the process.

Reducing maintenance and service

Should a fault condition occur, the operator gets an immediate alarm message. With SattLine's point and zoom feature, the operator can pull up a detailed picture of the area or the object where the fault has occurred.

The screen shows all the details that affect the function including the program logic, the image, etc. Maintenance personnel have enough information for diagnoses and can react immediately to correct the problem. Simple and intuitive fault search minimises operating interruptions and down time.

Programming made easy through the use of one tool

Through SattLine's object-oriented programming, all functions are contained within an object including graphics, operator interaction, alarm processing, control, data logging, etc. Objects can be individually created, debugged and tested.

A master library of objects is provided for many common components to reduce engineering time.

Programming is done globally, but the control of the objects is automatically distributed over the network and executed within the appropriate controller.

Clear overview for management decision making

In a complex production process, it can be difficult to get a real time overview of the process.

Running under Windows NT operating system, SattLine can easily be integrated into other management and administrative systems. SattLine can collect data from or process information into many third party databases and applications.

Other Windows applications can be initiated directly from SattLine, for instance, by clicking on a process object, an Excel file can be produced with that day's production statistics.

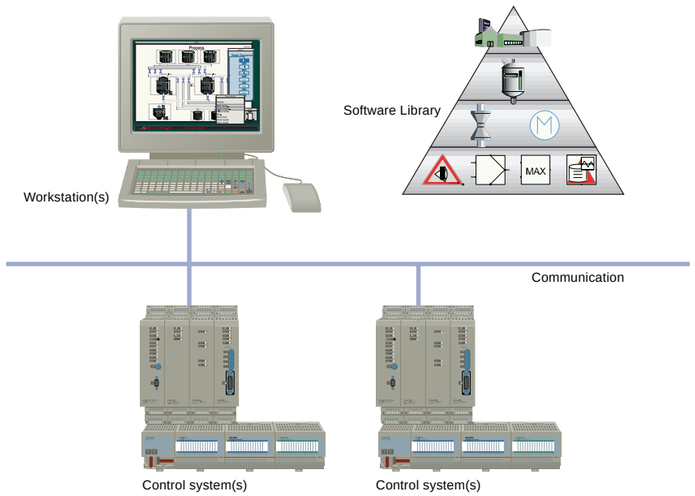
- Improved development facilities for the operator
- High reuse through object-oriented functions
- Fast fault search with integrated program and graphics
- High reliability and openness through Windows NT

- True object-oriented structure
- Same interface for all users
- Adaptable license types
- Efficient communication

Architecture

SattLine looks the same, works the same, and has the same functionality no matter the application and system size. Thus, you can grow with the same system without replacing or reconfiguring anything which is already done.

The system consists of both a software and a hardware part.



Software: modules

SattLine control programs are built by designing and assembling modules (objects). Lower level modules implement process objects like valves or basic functions like event detection.

The modules are stored in libraries containing graphics and program code. Basic objects can be used to form higher hierarchies like a mix tank, raw material intake, etc.

The software reuse enables fast program configuration, high quality development, and consistency, with kept flexibility.

Software: program

A program is a hierarchical module collection of graphics, equations, variables, etc. The program can be distributed so that the station or controller can execute several programs.

A program can refer to libraries for module and data type definitions. The programs can also exchange information.

Software: library

A library is very similar to a program, but is only used to define modules and data types. Libraries may refer to other libraries and can be used by many programs.

Functions

Software: communication
The communication between the stations and the controller (within a program) is automatically set up by the system. There are integration functions via ODBC or via OLE. Other Windows programs can be started from commands inside SattLine.

Hardware: user interface
The user interface consists of four license types that run on Microsoft Windows NT and on PC/Intel.

The Workstation can be used for supervision, programming, maintenance, data storing, etc.

The Viewer station is a low cost license limited for a few hours of operation after each start and without programming.

The Local station is a local operator station license for shop floor control. The license is limited in size and has no programming.

The Programming station is a license for programming and testing only.

Hardware: control system
The control system is modular and mounted on a standard DIN-rail. The system consists of modules power supply, CPU, Ethernet communication, Fieldbus and serial communication. These modules can be freely combined.

The CPUs are available with varying memory and speed. All CPU types are compatible with the same functionality.

The I/O system is based on three module types: adapter, terminal base and electronics. The I/O modules are available as digital, analogue, pulse and combined input and output.

The I/O can be installed centrally or distributed.

The I/O modules can be changed on-line and the I/O system can be set to fail-safe mode.

Hardware: communication
The communication between the different SattLine nodes is based on MMS and standard Ethernet (single or redundant). There are various communication protocols available like Profibus, COMLI, SattBus, ABDH+, etc.

SattLine contains a number of libraries. Modules in the libraries are used to solve general functions to provide process control as required from a DCS system.

The modules describe control solutions at different levels. Modules for physical objects like valves or motors, modules for analogue control algorithms or special function modules are natural parts of the SattLine libraries.

The modules include functions like alarm and event management, history logging and journal handling, control loop modules, report configuration modules, I/O configuration modules, etc.

Generally, a module can contain, besides control algorithms through sequences and equation blocks, variables and parameters for these algorithms and also graphics for presentation and interaction as well as other modules.

- Integrated open standard function libraries
- Advanced control loop algorithms
- Comprehensive alarm and event management
- Efficient data logging and reporting

Alarm and Event Management
Alarms as well as events are not restricted to a change of a variable in the system, but also have further information as Tag, Event text, Severity, Class, Type of event, Time filters and Status text.

The time stamped events can be shown in different lists, printed on different printers or acknowledged/logged in different workstations.

For quick action, an event can initiate a process command or pop up a window containing more information or instructing the operator how to act.

- Operator function
- Total overview
- Information zoom
- Operator security

History Logging
Historical data can be logged on one or several workstations as a journal file on disk. The journal can contain history data as well as single snapshots of data or manually entered data. Operation as read, write, etc. on the journal can be performed from any workstation or process controller.

A journal contains data marked with time and tag. The storage is either done cyclically or event triggered or a combination.

Different data can be stored in the same journal e.g. batch journal containing events, history trends and reports related to a specific batch.

Control Loops
PID modules and supporting modules make it possible to create cascade-, feed forward- and split range control loops. The PID function has anti reset windup facility, bumpless transfer between manual and automatic modes, low pass filter for the derivative part of the PID, autotuning with gain scheduling and dead time control function.

As special modules fuzzy control, stiction compensator - a control function for compensation of static friction in control valves and a control loop performance monitor for detection of oscillations are available.

For the analogue signals, functions as scaling, filtering, linearization, limitation, integration and differentiation are possible.

Other modules for generation of set point ramps and other profiles, combining PID's via multiplexes or max./min. selectors or three point controllers with feedback are part of the control loop library.

Other functions
Time channel modules are used for periodic starting and stopping of process objects according to the system clock, weekdays, holidays, etc.

Automatic check of feedback signals (ACOF) from e.g. valves can be supervised by standard modules.

Time controlled alarm activation according to different alternatives e.g. while opening or while closing are available.

Object runtime supervision (RUTI) is a function supervising total runtime of process objects like motors.

The operator's tool
Working in the familiar Microsoft® Windows NT™ environment, SattLine provides help and guidance to the operator by means of menus.

Mouse clicking on a symbol automatically displays the right menu.

Function keys, mouse or a combination of the two can be chosen as operator tool.

Text information to guide the operator can be displayed by starting Microsoft Word documents or popping up SattLine windows displaying actual process graphics or text information.

Operator ergonomics
Tests show that more than four colours tend to cause fatigue. That is why graphics in SattLine use greys as basic colours and avoid contrasting or strident colours. The result is a screen that is easy on the eyes and one the operator can monitor for a long time.

Colours and symbols are used as information signals.

Symbols can be hidden or displayed depending on the status of the process signal.

Security
Access to operators' actions can be through privileges and log-in functions.

Each SattLine module normally corresponding to a process object can belong to one or more groups of defined operators, thereby, giving access to allowed actions.

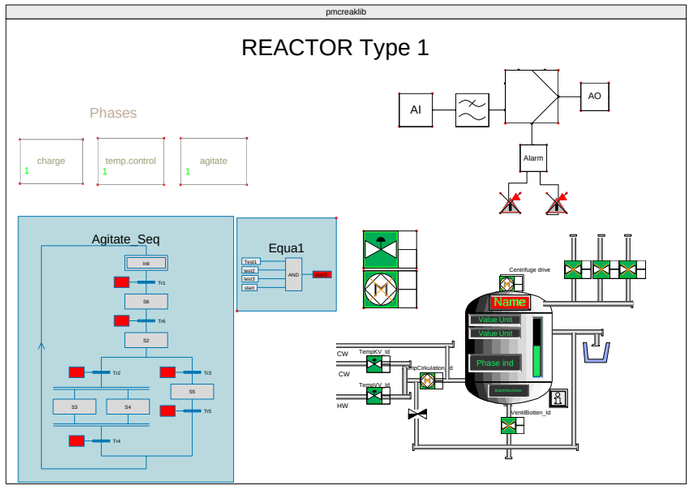
Log-in can be done by operator class and password by keyboard and/or magnetic card readers.

Programming

SattLine is based on three-dimensional objects for either process plant items or system functions. These objects are build up using a high level graphics language.

When they are tested, they are stored in object libraries for further use. The objects - pumps, valves, vessels, complete processes, etc. - are available “off the self” only requiring connection.

Changes are done on the library module and the other identical objects will “inherit” the modification. Thereby, considerable configuration time is saved and engineering costs are reduced.



- Efficient software reuse
- Fast software validation
- Simulation possibilities
- Object-oriented configuration

Modules and Libraries

Programs are build by designing and assembling modules following object-oriented structures. Common is the possibility to collect all aspects of a process object, process unit or production cell into a module: control code, supervision, data storage, graphics, interaction, etc.

The programmer builds and reuses instantiated modules that control and calculates, act as function blocks, or correspond to process objects.

The modules are combined hierarchically to form process objects of increasing size and complexity.

Editing Environment

SattLine has many standard tools to simplify programming.

Multi-programming allows several programmers to work, develop, debug and test programs parallel on different workstations.

Validity checks and the graphical programming lead to higher program quality.

Automatic distribution of code generated on-line on a workstation via the network to both the controllers and the other workstations.

Change control log keeps track of program versions.

Run-mode programs are executed on distributed stations, exchanging variable values.

Simulate-mode is used for off-line tests of user programs on a workstation.

Edit-mode enables all functions for entry and modification of programs, modules and pictures.

Editing Tools

There are several tools to help the programmer, for instance:

- On-line manuals for quick help.
- Network distribution of program version.
- Module overview window to ease navigation in the module hierarchy.
- Graphics and text to indicate errors, like undeclared variables, invalid combinations, incorrect procedure calls.
- Possibility to request program verifications at any time.

Editing and Display

The program objects in modules (equations and sequences) are programmed and displayed graphically. Sequences are displayed in accordance with the Grafcet and IEC standards for sequential flow charts. For equations, four different layout methods - function block, formula, structured text or ladder layout - are used.

Basic and system defined objects like equations, sequence entry and graphical objects are used to build pictures and programs. On functionally higher object levels, basic objects, module templates, modules from libraries are combined, modified and adapted by connecting parameters. All levels are used when designing new modules.

Objects can be moved, duplicated, deleted, rotated and so on. To configure I/O signals, a graphical picture of the I/O module is used. Connection is done by choosing the signals from a list.

Batch and Recipe

- Recipe and batch functionality according to ISA S88.01-1995
- Validation following GAMP
- Standard operating system and database communication
- Multinational users/ references

Recipe structure

Recipes are hierarchical in two levels. The first level is the main recipe with a sequence of operations. The second level is the operation recipe which consists of a sequence of recipe phases. The recipe phase has a formula, i.e. a set of parameters, and a reference to an equipment phase. The equipment phase is an object-oriented module for the phase control, operator interactions, graphics and logics for e.g. heating or charging.

Recipe editor

The recipe editor is used to create and edit recipes; document them and store them on disk. Stored recipes can be edited and documented. The recipe has a header and a procedure.

The procedure consists of a sequence of operations or phases. The sequences of a recipe can be arranged as a chain of consecutive operations or phases. The chain can be branched into parallel or alternative branches.

The recipe sequence can have jumps to other steps within the recipe.

Recipe execution control

Control recipes are created from master recipes with the process manager. A control recipe is valid for one batch. By defining several batches, a number of batches in a sequence can be produced from the same master recipe.

The editor of the process manager is used to edit running control recipes on-line. The operator can follow the recipe execution dynamically, since the dynamic status of the different steps is displayed.

Batch logging

Each unit contains a batch logger which logs process values, events and operator’s interaction in a batch journal.

The journals can be transferred to other programs, databases or computer systems by means of standard software e.g. OLE, ODBC, SQL, etc.

Safety

For high safety reasons, SattLine provides an advanced system of operator privileges. The privilege system is divided in operator and operator classes. Access to the system can be performed by operator name and password or by external means like magnetic card readers, etc.

The execution of the recipe is handled locally in the SattLine process controller to avoid production stop by a faulty operator station or break down in communication.

Validation

The development of the libraries strictly follows ISO 9000 with regard to hardware and software. Projects are executed according to GAMP recommendations, PGL (Pharmaceutical Guidelines) and ABB’s guidelines for project execution.

Audited supplier

World-wide leading pharmaceutical manufacturers have audited ABB’s development, production, training, after sales and maintenance departments.

Audits have shown that the manufacturers are convinced that ABB can deliver validated automation systems and software. This has been proved by many installations and successfully executed FDA inspections of the facilities. Among the customers are companies like Novo Nordisk, Hoffmann-La Roche, Novartis, Astra and others.