

# Product Guide

## SCADA Vantage™



Industrial<sup>IT</sup> Solutions™  
from ABB

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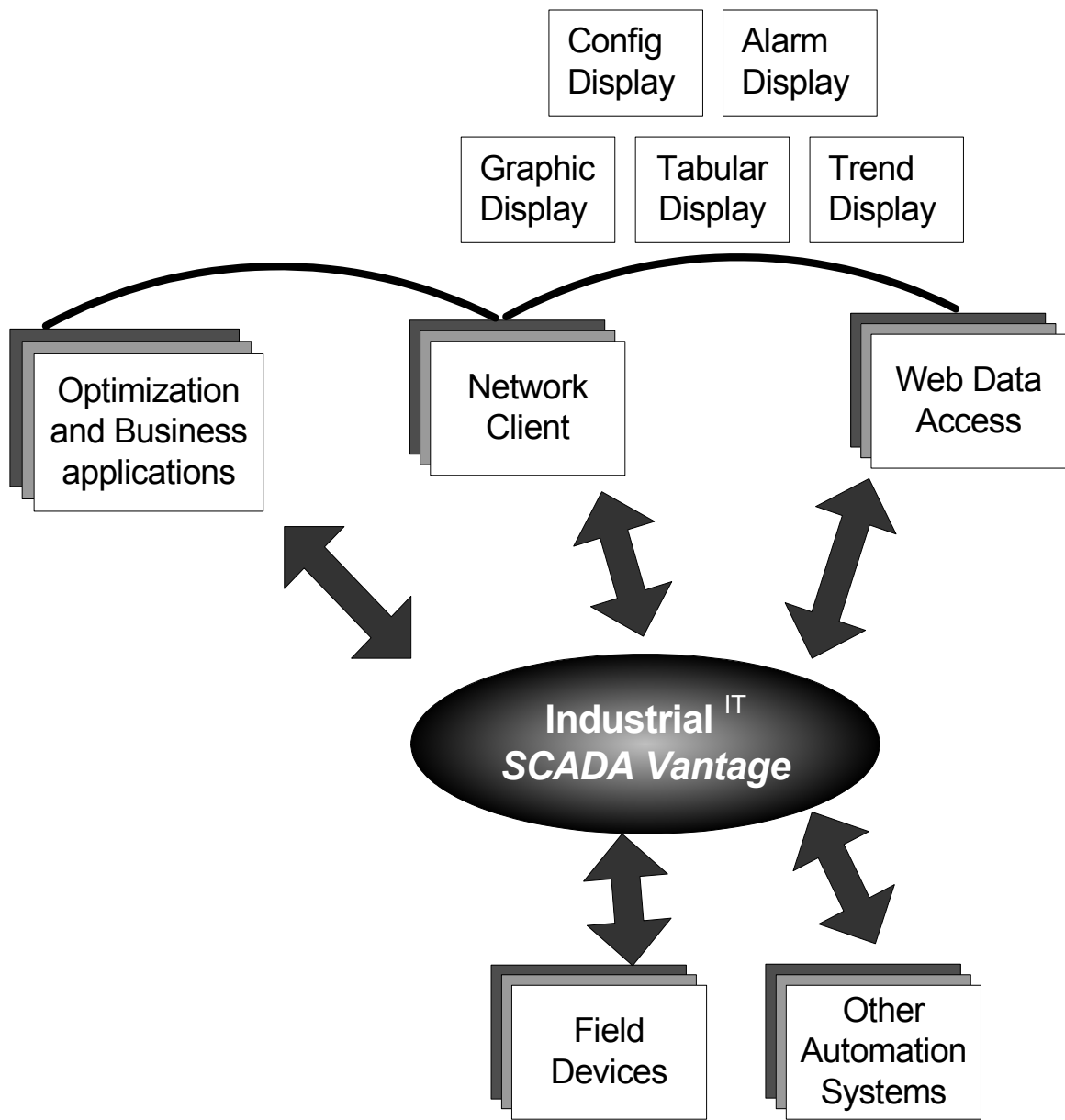
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## INTRODUCTION TO INDUSTRIAL<sup>IT</sup> SCADA VANTAGE

**INDUSTRIAL<sup>IT</sup> SCADA Vantage** is a distributed, real-time, data acquisition and control system. It was designed with more user input than any other SCADA system on the market and exclusively for the Oil and Gas Industry. *SCADA Vantage* delivers high performance, high availability, and high extensibility in a cost effective package. *SCADA Vantage* supports day-to-day operations, while enabling high-level corporate functions through the widespread distribution of real-time and historical information; refer to Figure 1 *SCADA Vantage* Architecture.



**Figure 1 SCADA Vantage Architecture**

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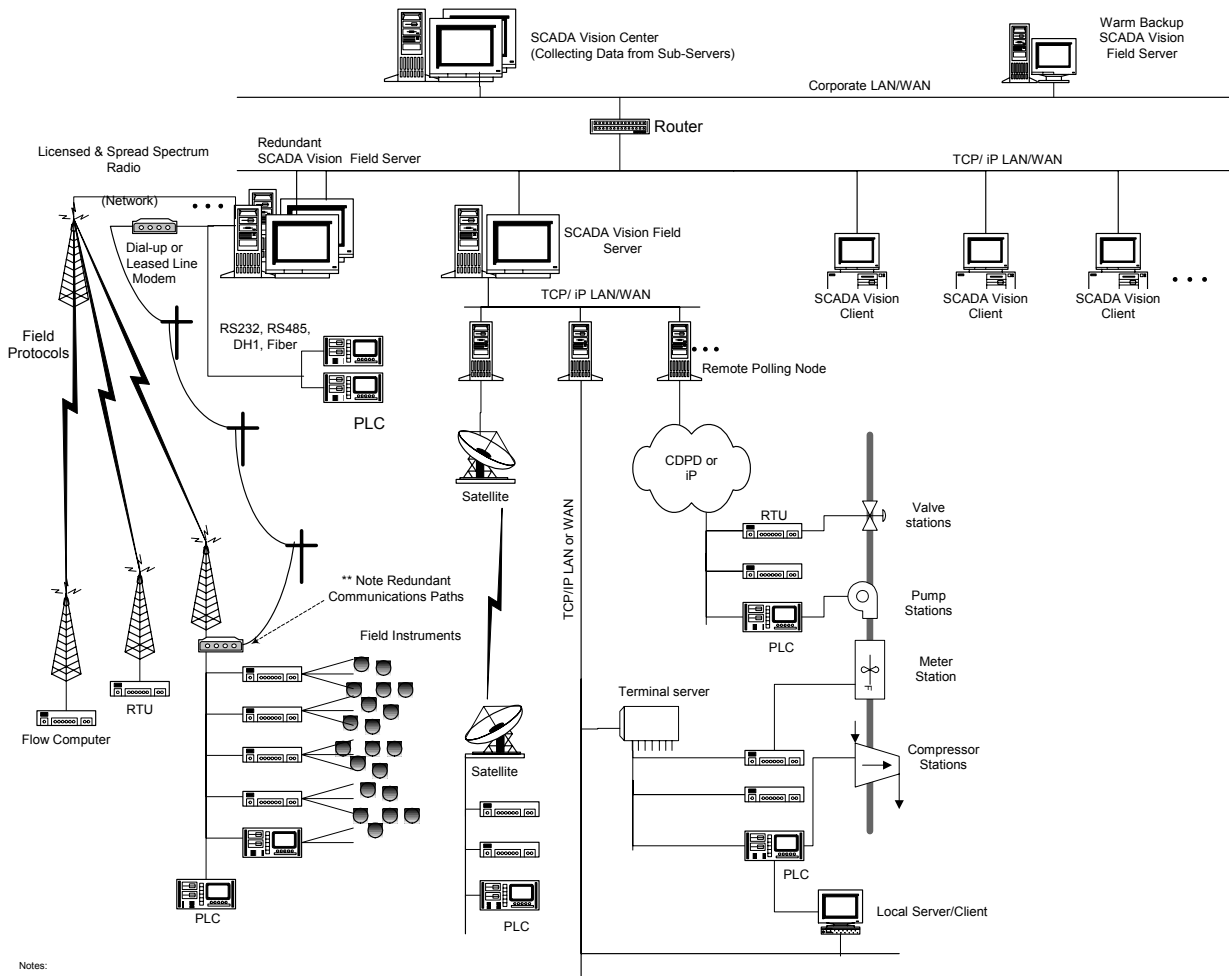
## Overview of INDUSTRIAL<sup>IT</sup> SCADA Vantage

*SCADA Vantage* is designed to meet the requirements of oil & gas upstream and midstream industries including, gathering, transmission and distribution pipelines, industries. Key foundations in the design and development of INDUSTRIAL<sup>IT</sup> SCADA *Vantage* include:

- High performance
- Ease of support and maintainance
- High availability
- Low total cost of ownership
- Use of industry standards (Microsoft, ODBC, SQL, VB, OPC, etc.)
- Run on Windows compatible hardware
- Usable throughout a company as a Human Machine Interface(HMI) – from small local displays to centralized control rooms and corporate desktops.

The Industrial<sup>IT</sup> SCADA Vantage system is based on a mixture of Client-Server and Publishing-Subscribing architecture. A single *SCADA Vantage* server may be used in centralized control operations, or several *SCADA Vantage* servers may be used in distributed control operations (refer to Figure 2). Server redundancy may be used when high availability is required. *SCADA Vantage* Client workstations can access multiple servers in a seamless fashion over wired or wireless & dial-up networks. The HMI is compact and may be integrated with common PC desktop applications to work within the corporate environment. Based on Microsoft VB, the HMI screens are highly flexible, allowing an organization to create its own user interface that conforms to existing corporate standards.

*SCADA Vantage* may also serve data consolidation system between other automation systems in an organization – allowing an organization to preserve its existing investments in (legacy) while providing a modern, consistent, user interface. *SCADA Vantage* data is available to other automation systems, data mining applications, optimization tools, business systems, reporting systems, accounting systems, etc. through Open Database Connectivity (ODBC), Object Linking and Embedding–Database (OLEDB), Active-X Data Objects (ADO), and OLE for Process Control (OPC) standards.



**Figure 2 SCADA Vantage System Diagram**

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## Platforms for INDUSTRIAL<sup>IT</sup> SCADA Vantage

INDUSTRIAL<sup>IT</sup> SCADA Vantage server use standard PC and server class hardware depending on the application. SCADA Vantage Client HMI's run on standard PC hardware from laptops to high performance PC's with multiple monitors. Please refer to Appendix A for hardware specifications. INDUSTRIAL<sup>IT</sup> SCADA Vantage server runs on Microsoft Windows 2000 (Professional or Server) or Microsoft Windows NT (Workstation or Server). SCADA Vantage clients may run on any of Microsoft Windows XP (Professional), Microsoft Windows 2000 (Professional or Server), Microsoft Windows NT (Workstation or Server).

The communications platform used by SCADA Vantage is TCP/IP protocol over Ethernet. Any LAN/WAN communication media supporting TCP/IP can be used.

## Software Levels for INDUSTRIAL<sup>IT</sup> SCADA Vantage

SCADA Vantage software is available in two main server packages as well as data collection and client software:

- **SCADA Vantage Field (server):** SCADA Vantage Field interfaces with common PLC's and RTUs and communicates with field devices via remote telemetry (e.g., radio, microwave, satellite, CDPD, etc.) Provides full data collection and storage to serve Client (HMI) needs including graphics , trends, alarm and event information. This includes an integral data historian.**SCADA Vantage Centre (server):** Enables a company to operate control centres and corporate data centres by consolidating multiple SCADA Vantage field servers and third-party SCADA hosts.
- **SCADA Vantage Polling Engine (DVI):** Provides remote data collection and communication capabilities for supplying a SCADA Vantage field Included with SCADA Vantage Field but this option allows to add extra polling nodes for flexible communication architecture.
- **SCADA Vantage Client:** Provides comprehensive view and control features (including graphical displays, trend displays, reports, alarm displays and event displays) when connected to SCADA Vantage Field or SCADA Vantage Centre.

SCADA Vantage offers two kinds of redundancy for Field and Centre :

- **Hot Standby Software Redundancy** – SCADA Vantage hot standby server redundancy allows the system to run with an active/standby configuration. In the event of a hardware or software failure on the active machine, the standby will automatically take control of the system. Client applications will automatically connect to the active server. Administrators may also perform demand fail-over of the system.
- **Warm Standby Redundancy** – This feature allows the warm back-up server located in a different control room (either in the same geographical location or a different location) to take control in case of failure of the primary server. However the failover

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operation is not automatic and manual intervention /initiaition is required.

*SCADA Vantage* applications add specific functionality to *SCADA Vantage* servers and clients. For complete details on available applications, refer to 'Other Features, Tools, and Applications'.

## **Ordering Information**

For ordering information, please contact your local ABB representative and ask for INDUSTRIAL <sup>IT</sup> *SCADA Vantage*.



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# INDUSTRIAL<sup>IT</sup> SCADA VANTAGE SYSTEM ARCHITECTURE

A SCADA Vantage system may consist of multiple servers with multiple clients. Using TCP/IP, SCADA Vantage servers communicate with each other and with redundant servers. SCADA Vantage clients on the network are capable of connecting to multiple servers at the same time; refer to Figure 3 SCADA Vantage Software Architecture. The following components make up a complete INDUSTRIAL<sup>IT</sup> SCADA Vantage system:

- SCADA Vantage Server Databases (including Historian)
- SCADA Vantage Polling Engine(DVI)
- SCADA Vantage Explorer
- SCADA Vantage Client(HMI)
- SCADA Vantage Data Access Applications

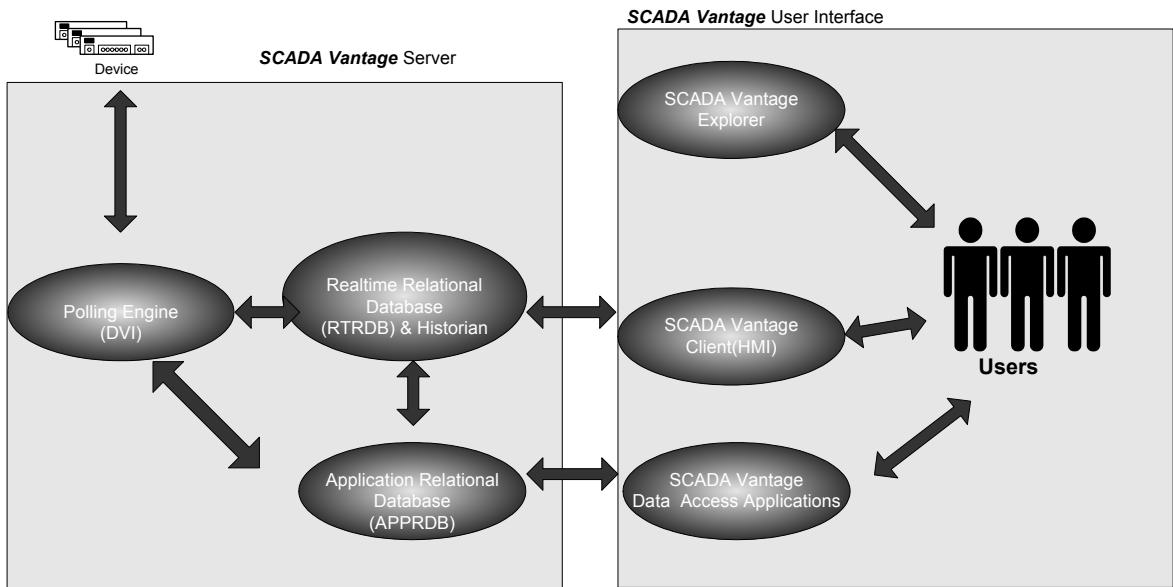


Figure 3 SCADA Vantage Software Architecture

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## **SCADA Vantage Server Databases**

### **Real-time Relational Database (RTRDB)**

The Real-time Relational Database (RTRDB) is the core of *SCADA Vantage* server and exists in the computer's memory for quick access and updates. This database is relational, object-oriented and SQL-compliant; it stores all the realtime values and system configurations.. A key feature of the RTRDB is the active query. The active query works in a report by exception fashion. *SCADA Vantage* Clients use active queries when they talk to the server, and receive updates only when data values change. This results in much lower network traffic and bandwidth utilization than with traditional polling methods, and much faster dial-up access as data is transferred only when required. All configuration changes are made online with *SCADA Vantage Explorer*; there is no need to stop and restart *SCADA Vantage* when changes are made. *SCADA Vantage* is able to immediately process configuration changes that affect a point's value or state without waiting to poll the device.

### **Historian Database (integrated with RTRDB)**

The Historian is closely integrated with the RTRDB. It functions as a high-speed data logger for point value changes (such as analog values and digital states), alarms, system events and communication statistics. For point value changes, the Historian stores data values periodically, by exception, or a combination of both then retrieves those values for trending or data analysis. For system events, the Historian stores information such as configuration changes, user actions, and alarm state changes. Events are available for viewing in a summary screen that also provides filter capabilities. All historian data is also available through direct queries to the RTRDB. All history data can be optionally archived to multiple locations ( i.e writable CD/DVD, file servers) for long term storage and retrieval.

### **Application Relational Database (APPRDB) - (Optional)**

The Application Relational Database (APPRDB) based on MS SQL Server 2002 exists to store large volumes of data that are, by nature, not real-time. The APPRDB is used for *SCADA Vantage* applications such as RTU based Trend Blocks, Dynocards, Compressor Efficiency and Production Data History. The polling engine and RTRDB communicate with the APPRDB to share information. *SCADA Vantage* clients are able to connect seamlessly to any number of APPRDBs. The APPRDB may coexist on the same hardware as the RTRDB or may have separate hardware.

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## **SCADA Vantage Polling Engine (DVI)**

The *SCADA Vantage* Polling Engine also known as device interface(DVI) ) communicates with field devices and sends data to the RTRDB. The polling engine also accepts command requests from the RTRDB and, in turn, commands the field devices. An RTRDB can communicate with many polling engines, and polling engines can run on PCs separate from the RTRDB, thus enhancing the *SCADA Vantage* server performance, communication flexibility and extending the distributed-system concept. The polling engine is capable of connecting to devices using methods such as serial, direct radio control (RTS/CTS), CDPD, dial-up modem, TCP/IP network connections, and protocol-specific connections. In addition, by using the OPC client, *SCADA Vantage* can communicate with many ABB and third party OPC servers. *SCADA Vantage* has an extensive library of industry specific protocols. User specific protocols may be developed on a custom basis.

The polling engine features redundant communication path capabilities. Multiple communication paths may be defined for individual devices and device networks. These physical communication paths are referred to as 'Routes' and each 'Route' has a configurable 'Cost'. This enables the *SCADA Vantage* to select a 'Route' to end-devices either automatically or on demand and provides *SCADA Vantage* with the ability to support redundant communication networks.

The *SCADA* system has two Route selection methods: Automatic and Demand. Automatic Route Selection is based on communication failures rate to the end-devices on a network and the 'Cost' of the 'Route'. The system automatically re-tests the failed 'Route' to a network, subject to configurable criteria, and switches back to the original 'Route' when the criteria is satisfied.

Demand Route Selection is based on a specific user request, via a network, to request that the system handling a network a switch to an alternate 'Route'. This effectively enables the user to override the physical communication path being used to access a particular network.

*SCADA Vantage* polling engine "Listen Mode" simplifies swing over from legacy system. In this scenario, *SCADA Vantage* is connected in parallel with an existing legacy system. *SCADA Vantage* listens passively to the communications of the other system and then processes the data as if *SCADA Vantage* was polling directly. In this way, a *SCADA Vantage* system can be completely tested and commissioned while the existing legacy system continues to operate. Once *SCADA Vantage* is ready to take over, a single switchover is done and the *SCADA Vantage* system is up and running – fully tested and commissioned. Listen Mode is available for many protocols supported by *SCADA Vantage*.

## SCADA Vantage Explorer

SCADA Vantage Explorer combines all server administrative and configuration functions in a single, network-ready tool. It allows a user to view and configure data for any SCADA Vantage server on the network. SCADA Vantage Explorer can connect to many RTRDBs from a single location and provides access for point configuration, alarm and event displays, trends, and system tools such as database import/export, bulk point loaders, SQL Editor, communication analyzer, etc. SCADA Vantage Explorer has an intuitive Windows Explorer-style interface that Windows users easily understand. Figure 4 shows SCADA Vantage Explorer with an analog summary.

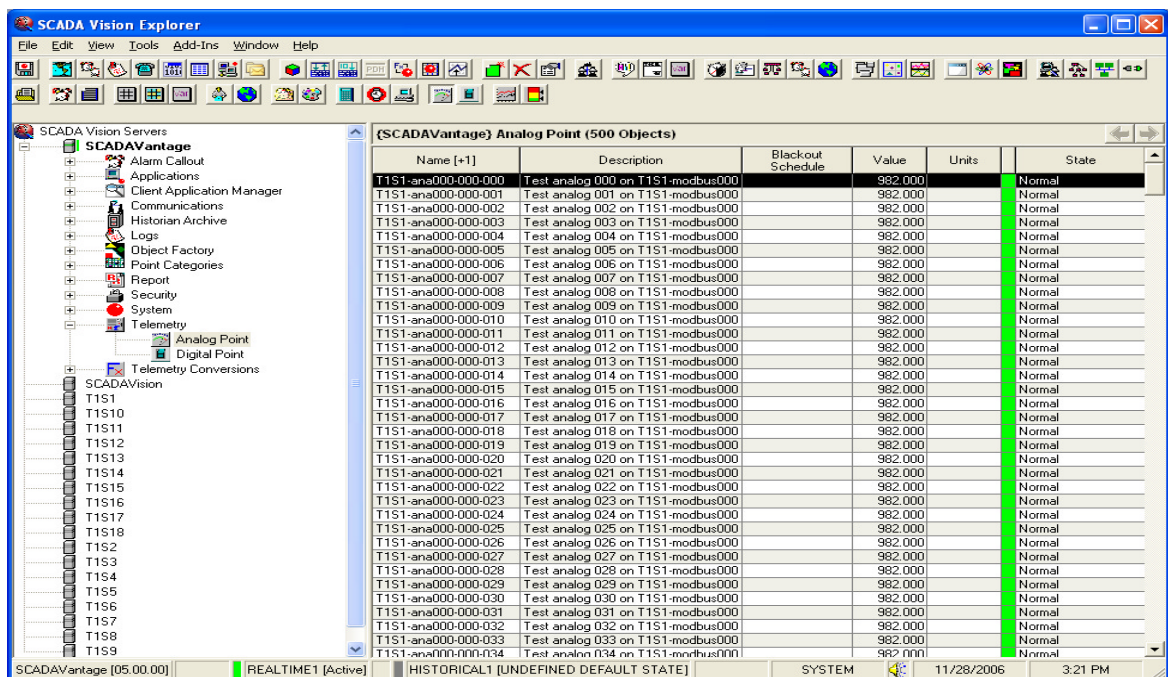


Figure 4 SCADA Vantage Explorer with an analog summary

## SCADA Vantage Client (HMI)

The SCADA Vantage Client(HMI) is built using MS Visual Basic and includes a set of tools that allow the user to create graphical user interfaces (GUIs) for SCADA Vantage. The Client(HMI) supports single and multiple display PCs. The graphic interfaces can be as simple as lists of device names and values or as complicated as alarm displays combined with station graphics, realtime values and trend elements on a single screen. Using SCADA Vantage client, it is easy to define the look and feel of SCADA Vantage to match a company standard. Display builders use Microsoft Visual Basic and the SCADA Vantage data objects to build the client environment. The objects are network-ready and are placed on forms by drag-and-drop methods and property settings. Refer to Figure 5 (Sample SCADA Vantage client Screen). Most objects provide advanced data access and control options when a user employs the right-click and flyover functions (the flyover function displays the point name, value, and other information such as failure reasons). The right-click function ability is dependent on the point type and user access and is similar to the right-click features in Windows Explorer. A client executable is capable of connecting to many SCADA Vantage servers at the same time; system security ensures appropriate access is granted to each server.

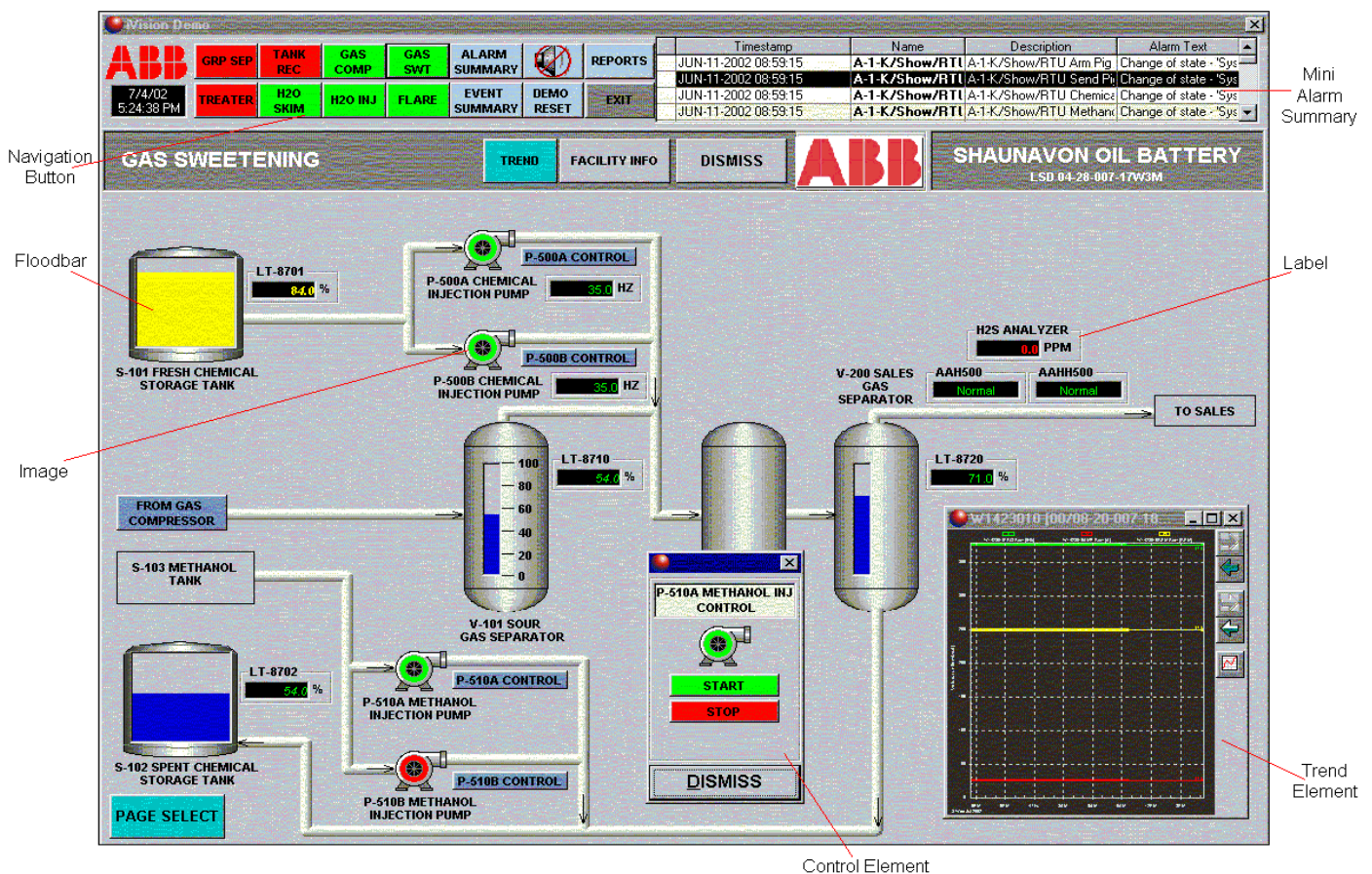
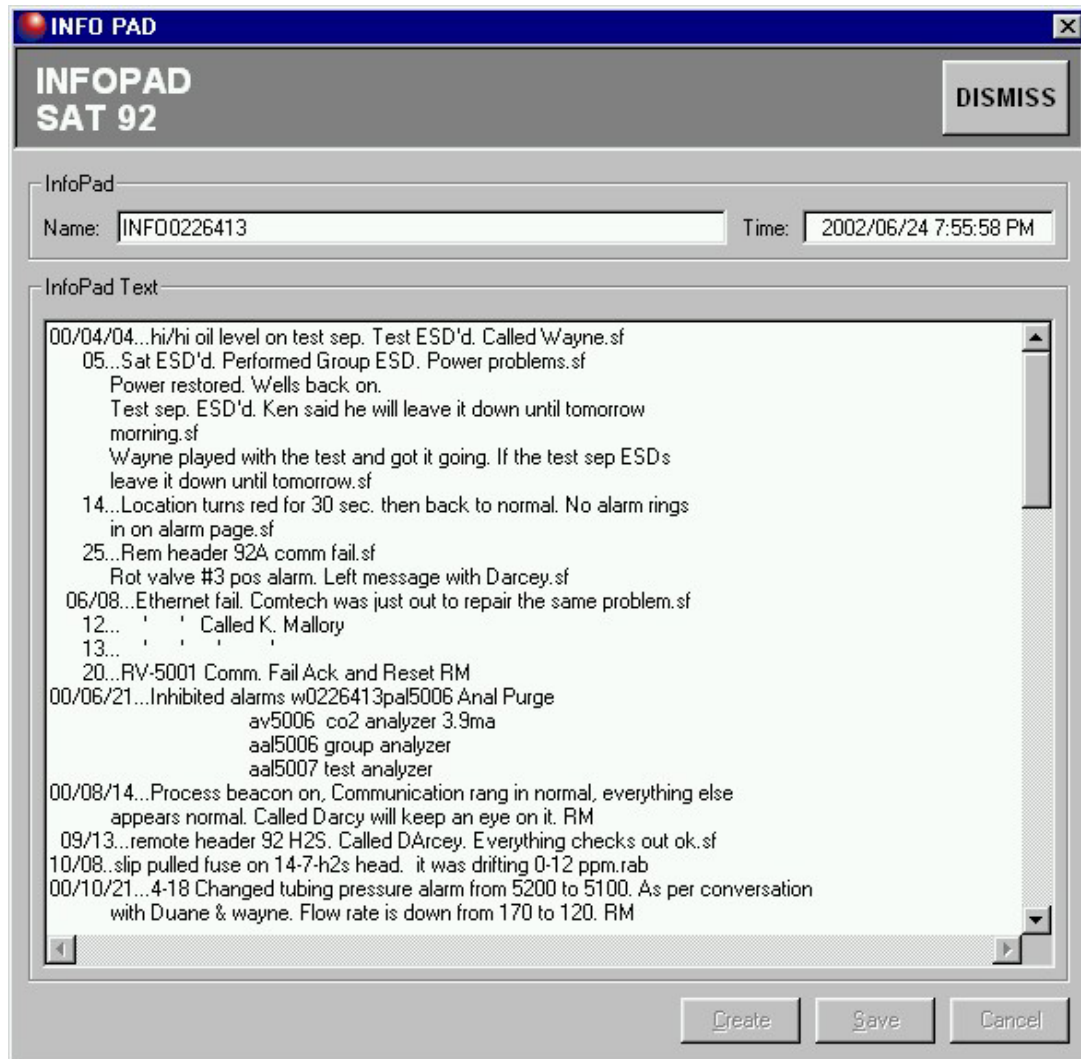


Figure 5 Sample SCADA Vantage Client Screen

The following objects are available in the *SCADA Vantage* client environment :

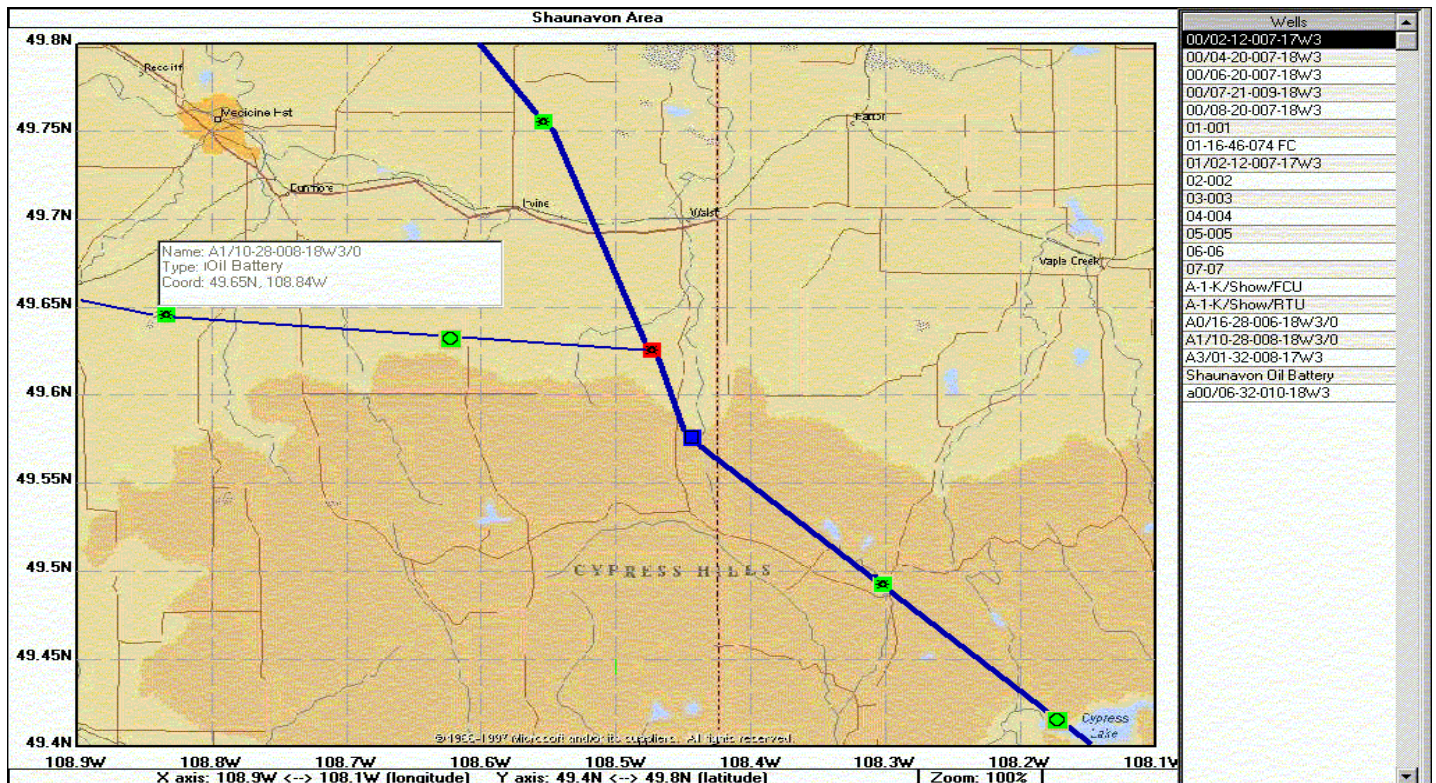
- Alarm Summary – allows access to *SCADA Vantage* alarms. Users can view, acknowledge, and clear alarms.
- Command Button – allows a number of functions such as screen navigation, device commands, access to trend screens, access to reports, etc.
- Transparent Command Button- used to create "hot spots" on graphic displays.
- Event Summary – allows access to *SCADA Vantage* events.
- Flood Bar – fills a rectangle based on an analog value. This often represents the level in tanks or vessels.
- Gauge – represents an analog value in a gauge or speedometer format.
- Grid – displays the tabular results of an SQL query; the grid can use either static or active queries.
- Infopad – provides an electronic notepad that is used by operators to make operational notes.



- Template Viewer – facilitates *SCADA Vantage*'s powerful graphical templating

capabilities. This may be used to display templates for wells, compressor stations, valve sites, or any other common display that is reused. Graphic templating saves many hours of display building and testing.

- Smartmap – displays database objects on a map and provides a powerful graphical navigation tool for operators.



**Figure 7 Smart Map Screen**

- Image – displays a bitmap with coloring based on the associated point's state.
- Label – enables the display and input of text and numeric values from the database, for example, a point's units or value.
- Slider Bar – enables numeric data entry into the database. Users can enter a value directly or use the slider to enter a value.
- Status – displays a point's current value and data quality.
- Time – displays the current time and date.

A calculation engine is available in the client environment and is used to manipulate database values and create new values in the client executable. The engine is capable of performing mathematic and logic sequences with numbers as well as manipulating and displaying strings and boolean values.

Multi-language support is available in SCADA Vantage for all the single and double byte character sets with the exception of arabic due to the right-to-left flow of characters. This

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availability stills requires to enter the text of alarms, menu items and messages.

Also display cycling is supported featuring a command list to control cycling between HMI displays.

Reichard Symbol Factory can be used to have additional symbols added to the regular SCADA Vantage symbols.

In addition to the functionality outlined in the previous section, the standard features include:

### **Alarms and Events**

Once *SCADA Vantage* has determined a point's value and state, it determines whether or not a state change has occurred; if so, an alarm and event is generated. When a point is in alarm, the point *flashes* in the client environment and an entry is placed in the alarm summary. The corresponding event is a historical record of the alarm occurrence. *SCADA Vantage* makes the alarms audible (on a priority basis) with user defined sound (WAV) files.

Nuisance alarms can be suppressed with inhibiting functions such as explicit inhibits (on change to either normal or abnormal states), return to normal deadbands, and timer delays on state changes.

SCADA Vantage also supports alarm grouping to summarize the highest priority/severity of them.

Figure 8 is an example Alarm Summary screen which shows all the current alarms in a user's Area of Responsibility. By default, *SCADA Vantage* sorts alarms first by priority and then by time. The Alarm Summary screen is available in the Client Environment and through *SCADA Vantage* Explorer.



V2002.2.10	GRP SLP	TANK REC	GAS COMP	GAS SWT	ALARM SUMMARY	REPORTS	Timestamp [-2]	Name	Description	Alarm Test
ABB	TREATER	H2O SKIM	H2O INJ	FLARE	EVENT SUMMARY	DEMO RESET	NOV-07-2002 20:16:13	Test DDE Device		Change of state - C
							DEC-23-2002 14:09:40	A-1-K/Show/RTU	A-1-K/Show/RTU Flowing	Change of state - N
							NOV-07-2002 20:26:23	W1423141AMP	Pad-DE22_Well-1 Motor C	Fleeting alarm - Shu
							DEC-23-2002 14:08:04	07-07CompTemp	Compressor Station: 07-07	Change of state - A

<b>ALARM SUMMARY</b>		DISMISS	<b>SHAUNAVON OIL BATTERY</b> LSD 04-28-007-17W3M
----------------------	--	---------	---

Timestamp [-2]	Name	Description	Alarm Test
NOV-07-2002 20:16:13	Test DDE Device		Change of state - 'Connection failed'
DEC-23-2002 14:09:40	A-1-K/Show/RTU	A-1-K/Show/RTU Flowing	Change of state - 'voltage high check charger' (158.417 inH2O)
NOV-07-2002 20:26:23	W1423141AMP	Pad-DE22_Well-1 Motor C	Fleeting alarm - Shut off the pump - Above limit '5.0'
JUL-18-2002 10:22:54	07-07SucPress	Compressor Station: 07-07	Change of state - 'voltage high check charger' (1804.6 psi)
JUL-18-2002 10:22:54	07-07CompRPM	Compressor Station: 07-07	Change of state - 'voltage high check charger' (2979.59 rpm)
JUL-18-2002 10:22:51	06-06SucPress	Compressor Station: 06-06	Change of state - 'voltage high check charger' (1806.6 psi)
JUL-18-2002 10:22:51	06-06DisPress	Compressor Station: 06-06	Change of state - 'voltage high check charger' (2708.9 psi)
JUL-18-2002 10:22:51	06-06FCU2Press	Compressor Station: 06-06	Change of state - 'voltage high check charger' (1625.94 psi)
JUL-18-2002 10:22:51	06-06FCU1Flow	Compressor Station: 06-06	Change of state - 'voltage high check charger' (180.66 MSCF/Day)
JUL-18-2002 10:22:51	06-06FCU2Flow	Compressor Station: 06-06	Change of state - 'voltage high check charger' (1625.94 psi)
JUL-18-2002 10:22:51	06-06CompRPM	Compressor Station: 06-06	Change of state - 'voltage high check charger' (2982.89 rpm)
JUL-18-2002 10:22:48	05-005FCU1Press	Compressor Station: 05-005	Change of state - 'voltage high check charger' (1529.0 psi)
JUL-18-2002 10:22:48	05-005FCU2Flow	Compressor Station: 05-005	Change of state - 'voltage high check charger' (181.0 MSCF/Day)
JUL-18-2002 10:22:48	05-005FCU2Press	Compressor Station: 05-005	Change of state - 'voltage high check charger' (1629.0 psi)
JUL-18-2002 10:22:48	05-005CompRPM	Compressor Station: 05-005	Change of state - 'voltage high check charger' (2980.5 rpm)
JUL-18-2002 10:22:48	05-005DisPress	Compressor Station: 05-005	Change of state - 'voltage high check charger' (2715.0 psi)
JUL-18-2002 10:22:48	05-005FCU1Flow	Compressor Station: 05-005	Change of state - 'voltage high check charger' (181.0 MSCF/Day)
JUL-18-2002 10:22:48	05-005SucPress	Compressor Station: 05-005	Change of state - 'voltage high check charger' (1810.0 psi)
JUL-18-2002 10:22:45	04-004DisPress	Compressor Station: 04-004	Change of state - 'voltage high check charger' (2719.2 psi)
JUL-18-2002 10:22:45	04-004FCU1Flow	Compressor Station: 04-004	Change of state - 'voltage high check charger' (181.28 MSCF/Day)
JUL-18-2002 10:22:45	04-004SucPress	Compressor Station: 04-004	Change of state - 'voltage high check charger' (1812.8 psi)
JUL-18-2002 10:22:45	04-004FCU1Pres	Compressor Station: 04-004	Change of state - 'voltage high check charger' (1631.52 psi)

Figure 8 Alarm Summary Screen

The SCADA *Vantage* Event Summary screen shown in Figure 9 illustrates the historical events within a user's Area of Responsibility. By default, SCADA *Vantage* sorts the events by time. A user can switch to different views of the events as well as enable filters to search for specific events. SCADA *Vantage* stores state change events, control events, system events, and maintenance events. The event summary screen is available in the Client Environment and through SCADA *Vantage* Explorer.

Timestamp	Name	Description	Alarm Text
NOV-07-2002 20:16:13	Test DDE Device		Change of state - C
DEC-23-2002 14:12:31	07-07/CompTemp	Compressor Station: 07-07	Change of state - V

Timestamp	Object Name	Description	Event Text
DEC-23-2002 14:12:31.712	07-07/CompTemp	Compressor Station: 07-07	Change of state - 'voltage high check charger' (107.346 Deg F)
DEC-23-2002 14:12:25.897	06-06/CompTemp	Compressor Station: 06-06	Change of state - 'voltage high check charger' (106.891 Deg F)
DEC-23-2002 14:12:22.416	05-005/CompTemp	Compressor Station: 05-005	Change of state - 'voltage high check charger' (106.644 Deg F)
DEC-23-2002 14:12:19.134	04-004/CompTemp	Compressor Station: 04-004	Change of state - 'voltage high check charger' (106.289 Deg F)
DEC-23-2002 14:12:15.962	03-003/CompTemp	Compressor Station: 03-003	Change of state - 'voltage high check charger' (106.002 Deg F)
DEC-23-2002 14:12:12.681	02-002/CompTemp	Compressor Station: 02-002	Change of state - 'voltage high check charger' (105.706 Deg F)
DEC-23-2002 14:09:40.712	A-1-K/ShowRTU	A-1-K/ShowRTU Flowing	Change of state - 'voltage high check charger' (158.417 inH2O)
DEC-23-2002 14:08:04.291	07-07/CompTemp	Compressor Station: 07-07	Change of state - 'Analog Normal' (96.322 Deg F)
DEC-23-2002 14:07:58.275	06-06/CompTemp	Compressor Station: 06-06	Change of state - 'Analog Normal' (96.122 Deg F)
DEC-23-2002 14:07:54.994	05-005/CompTemp	Compressor Station: 05-005	Change of state - 'Analog Normal' (96.537 Deg F)
DEC-23-2002 14:07:51.712	04-004/CompTemp	Compressor Station: 04-004	Change of state - 'Analog Normal' (96.942 Deg F)
DEC-23-2002 14:07:48.431	03-003/CompTemp	Compressor Station: 03-003	Change of state - 'Analog Normal' (97.367 Deg F)
DEC-23-2002 14:07:45.15	02-002/CompTemp	Compressor Station: 02-002	Change of state - 'Analog Normal' (97.820 Deg F)
DEC-23-2002 14:06:40.712	A-1-K/ShowRTU	A-1-K/ShowRTU Flowing	Change of state - 'Analog Normal' (26.794 inH2O)
DEC-23-2002 14:05:45.166	SYSTEM	System user with all privileg	Logged off
DEC-23-2002 14:05:42.4	SYSTEM	System user with all privileg	Logged off

Figure 9 Event Summary Screen

## Security

SCADA Vantage Security features are used to limit the data that users may view, and the actions that they may perform on that data. To access data from a SCADA Vantage server, users must first log on to SCADA Vantage with a unique name and password combination. The SCADA Vantage Area of Responsibility is used to limit the view and modification of SCADA Vantage data to given users. With these capabilities, the system administrator can define users, user profiles, zones, and zone groups. Once these are defined, the system administrator is able to determine exactly who can do what, and in what area.

Once logged on to a server, the user may only view and control data that is within assigned Areas of Responsibility. SCADA Vantage Non-covered alarm detection feature enables the system to detect alarms that belong in zones for which there is no user currently monitoring. Non-covered alarms are automatically 're-routed' to users who have privilege to view and acknowledge non-covered alarms. All user control actions are logged in the event summary.

## Control

SCADA Vantage uses the Control component to allow users to send commands to field devices. Users can issue commands only if they have been granted control privileges for the device or point they wish to command.

It is possible to either fully inhibit commands for points or cause the display of a command warning message. When a user attempts to command a point that has a command warning, SCADA Vantage displays the command warning message and the user has the option of overriding the command warning. SCADA Vantage has standard commands for devices, analog points, and digital points.

---

## Historical Trending

Trending in INDUSTRIAL <sup>IT</sup> *SCADA Vantage* is easy to use and flexible. The system stores data values for points on a periodic exception or a combination of periodic and exception basis. Once data is collected, the historical values are available for direct query (via ODBC and OLEDB), or for analysis in reports and on trend displays.

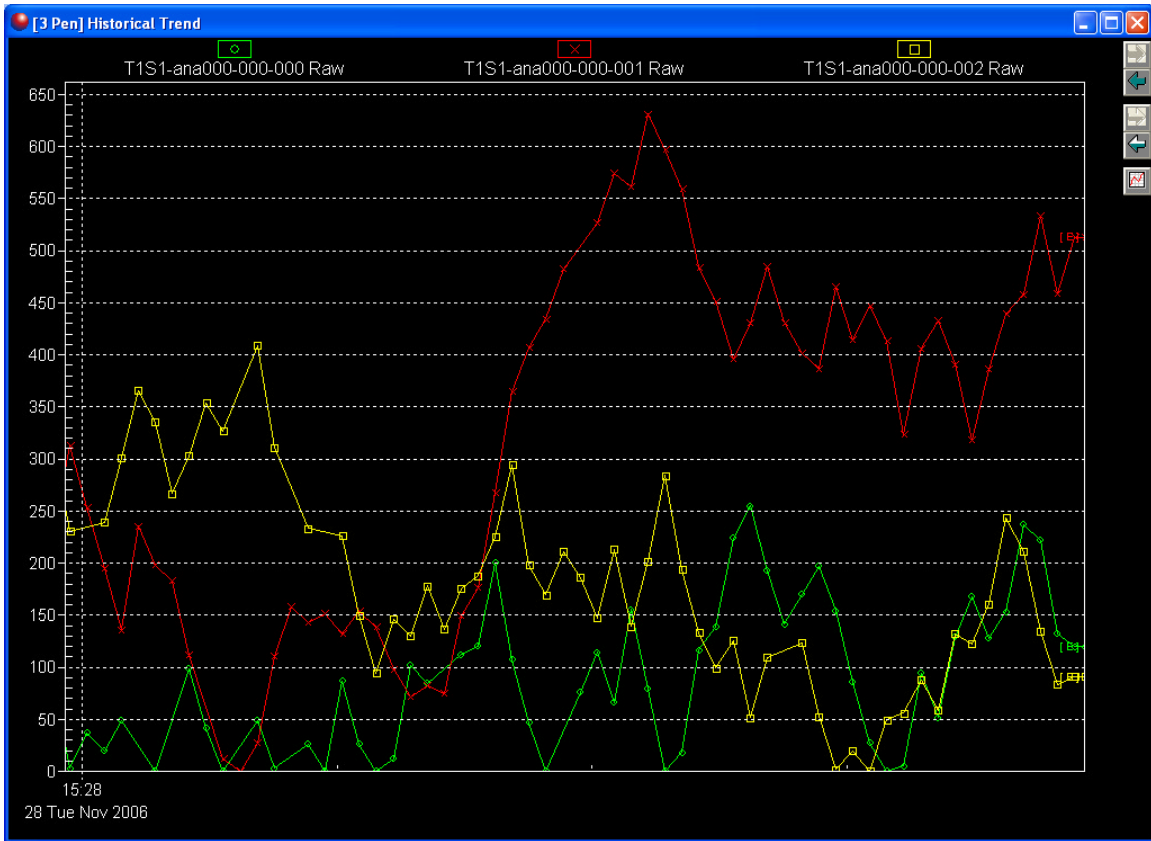
## Enhanced Historical Trend Data Feature

When enabled, this feature provides complete hourly or daily rollup traces by repeating the last recorded value for a time period where an inconsistent number of trend data rollups are present

In addition to the raw collected values, rollups are available for each hour and day. *SCADA Vantage* calculates the minimum, maximum, and average values for the rollup period. Standard deviation is also supported in all trends.

Operator Assignable Trend Groups allow ad-hoc creation of trend displays. Each user may create their own trend displays combining values that are of interest at the time. These displays may be kept either private to a specific user, or made public for all users.

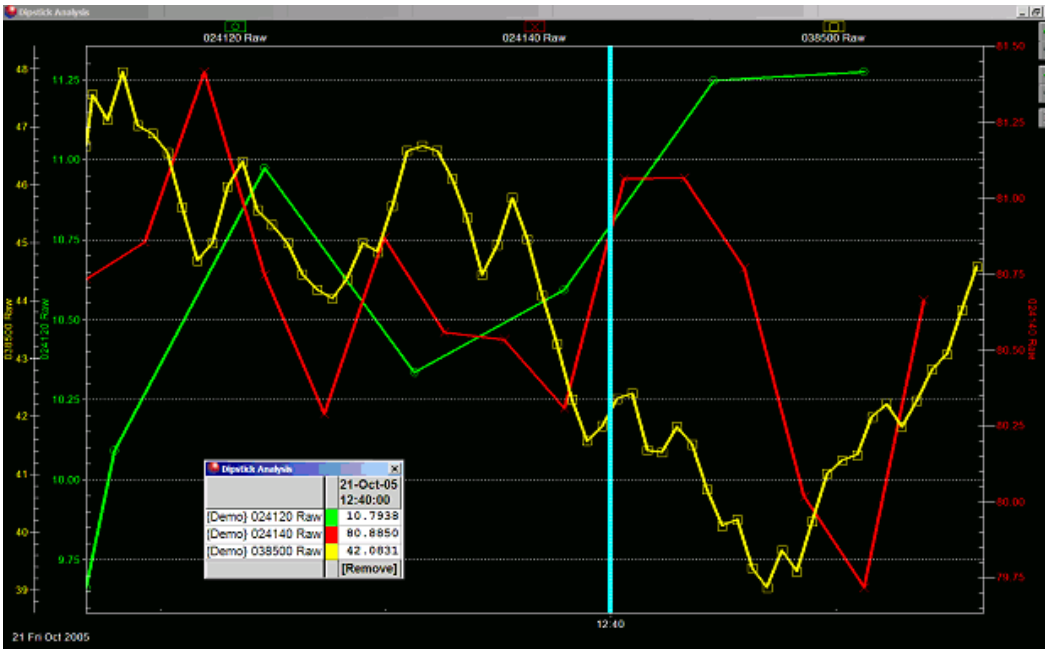
Figure 10 is an example of a Trend Screen. The screen is available in the Client Environment and through *SCADA Vantage* Explorer. The trend screen can show the real-time or historical trend for any point or group of points. Pan, zoom, dipstick and many other features are also included.



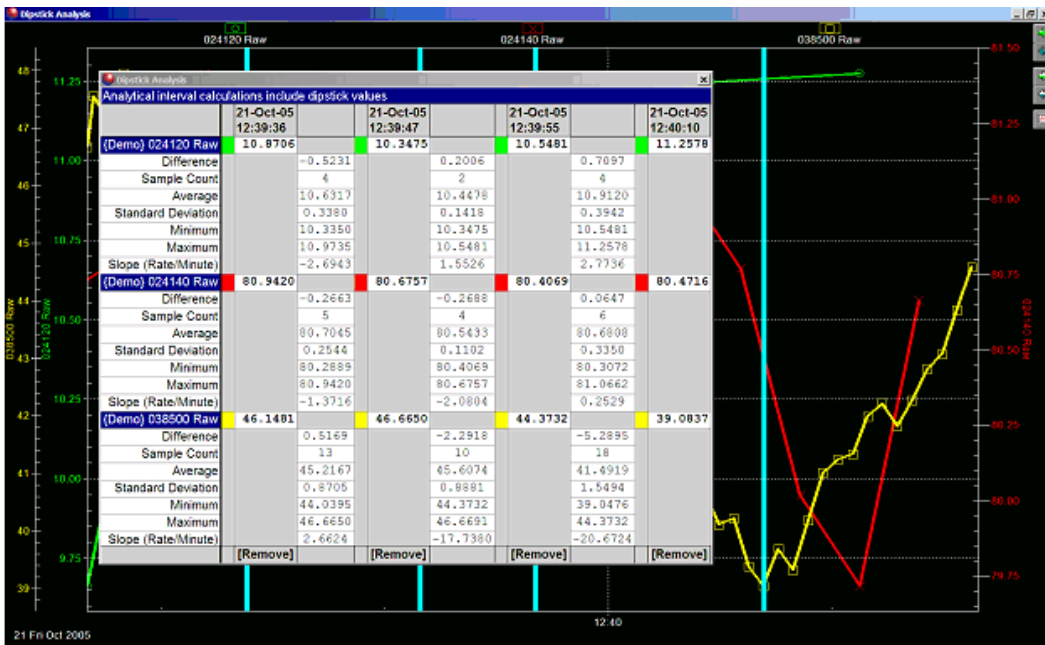
**Figure 10 Trend Screen**

### Using Dipsticks

SCADA Vantage's trending facility provides for detailed analysis of graphical representations of historical and/or realtime data. This analysis is possible via a mechanism known as a dipstick, which is a vertical line created on the trend graphic area at a date/time of interest. This vertical line is positioned via a single left-click on the trend background and is accompanied by a popup window that contains the data analysis values. The following image shows a simplified view of dipstick analysis:



An enhancement has been introduced, prior to this enhancement, data analysis was restricted to obtaining the value of a given set of pen traces at a given date/time as shown above. While this feature still exists, it has been extended to allow for concurrent analysis of multiple values at different date/times. Additionally, analytical data services have been introduced to allow for calculations on values defined by the intervals created by multiple dipsticks. The following image shows the type of analysis possible as a result of this enhancement:



In the image shown above, four dipsticks have been added to the trending display, yielding three intervals of samples. The calculations pertaining to these intervals are displayed as a column of data between each respective dipstick.

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## SCADA Vantage Data Access Applications

SCADA Vantage supports standard interfaces such as ODBC, OLEDB, and ADO. Any language or tool that supports these standard interfaces may be used to configure and maintain the data access Applications. An example is the SCADA Vantage Reporting System, which uses Microsoft Excel to read and manipulate both real-time and historical data from servers, and present the information in the form of a polished report. Other applications which extract data and perform analysis and optimization may be easily linked.

## Alarm Printing

# FEATURES ,TOOLS, AND APPLICATIONS

SCADA Vantage's features, tools, and applications add functionality to the basic SCADA Vantage platform. Note that the Application Database (APPRDB) described earlier in this document is required to run a number of the SCADA Vantage applications. Check with your ABB representative if there are any questions regarding a specific application. The following table outlines the features, tools, and applications available with SCADA Vantage. The features and tools which are included with SCADA Vantage base software and the applications which are optional are also shown in Table 1.

Features and Tools		Applications	
Name	Included in Base	Name	Included in Base
Client Application Manager	Yes	Communication Analysis	Yes
Object Factory	Yes	Compressor Efficiency*	No
Graphic Templates	Yes	Rod Pump Analysis and Monitoring (Dynocards)*	No
Reports	Yes	Software Point Calculation and Control	No

---

SQL Editor	Yes	Production Data History*	No
Class Import/Export	Yes	Alarm Call out	No
Variable Frequency Drive Calculation	Yes	Data and configuration replication	No
Inferred Production	Yes	Production Allocation*	No
Point Calculations	Yes		
Task Scheduler	Yes		
Control sequences	Yes		

\*Indicates requirement for APPRDB

**Table 1 Features, Tools and Applications**

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## Communication Protocols

. The protocols listed below are available for addition to a **SCADA Vantage** system:

- Modbus ASCII, RTU, Enron and TCP/IP
- Totalflow
- OPC Client and server (OPC interfaces with most available PLCs and some devices)
- Allen-Bradley PLC5 DF1 (DH+)
- Adept (Barton)
- HP48000 (Hewlett Packard)
- Toshiba G2+
- Kimray
- Hex Repeater (Amocam)
- BSAP (Bristol)
- IEC 870-5 101 and 104
- ROCTalk and ROCTalk plus

Other protocols can be developed on a custom basis.

## Client Application Manager(CAM)

The Client Application Manager (CAM) simplifies the process of installing *SCADA Vantage* software on client PCs and keeping it up to date. This is especially useful as a *SCADA Vantage* system grows to include multiple servers and multiple clients or when clients are spread across a region or area. The Client Application Manager ensures lower start-up and maintenance costs for users of *SCADA Vantage* by automatically distributing updated client Client Environment files (typically executables and library files) to client PCs over the network.

## Communication Statistics

The **Communications Summary** is a useful monitoring and diagnostics tool to help analyze SCADA Vantage communications.

The **Communications Summary** is available from a command button such as



or other object built into your companies SCADA Vantage HMI. The Communication Summary (three views) are shown below.

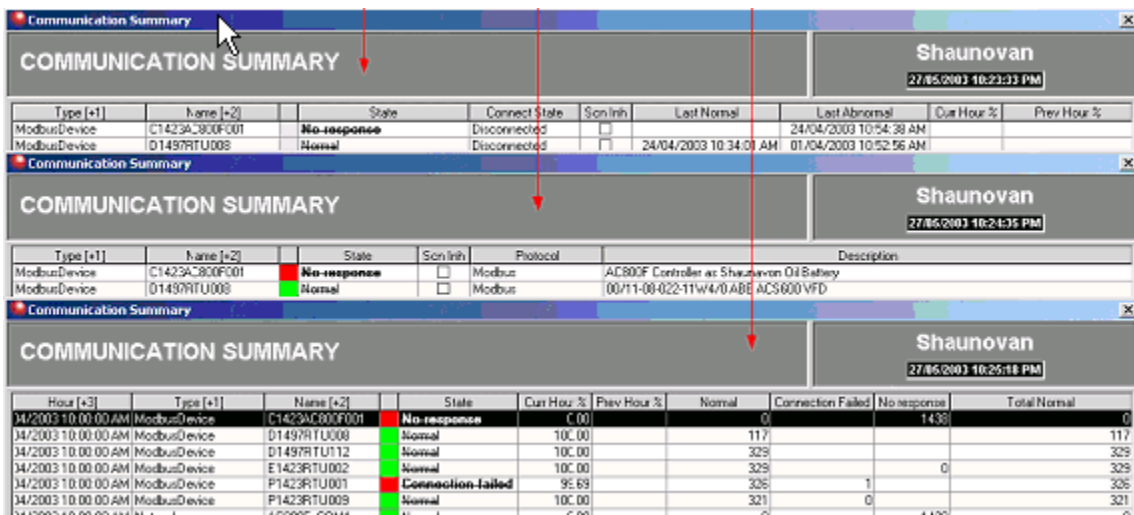
The Communication Summary Menu will pop-up with a right click while the mouse is on any Communication Summary.



The Communications Summary has three different views that are selectable from the Communications Summary Menu shown above:

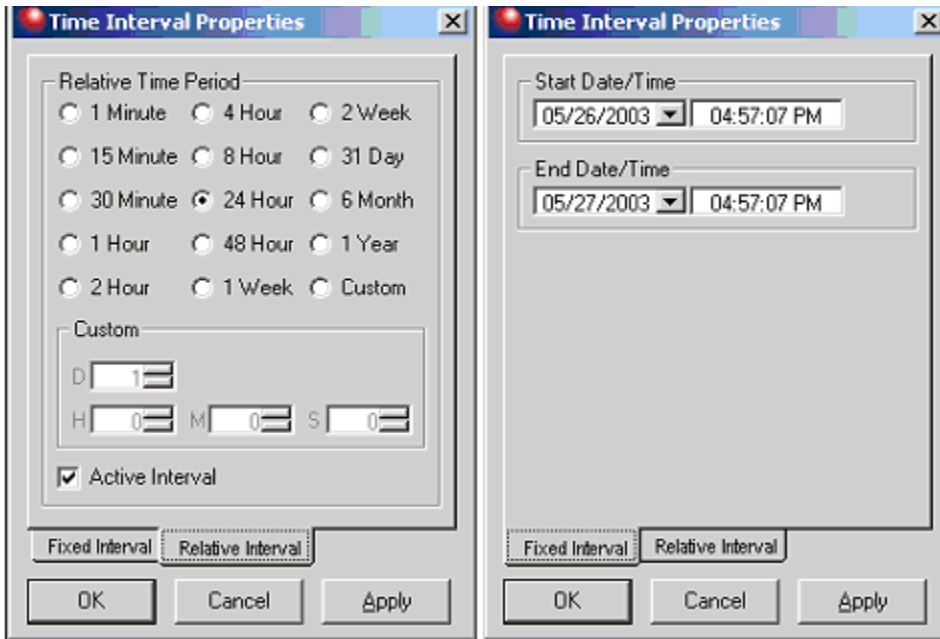
- The **REAL TIME VIEW** shows the current communications status of each channel including time of Last Normal and Last Abnormal communication.
- The **CONFIGURATION VIEW** shows the configuration details of each configured channel.
- The **STATISTICS VIEW** shows detailed statistics including percentage of communication during the current hour and the previous hour for each channel. The three Communications Summary views are shown in the illustration below.

When the Statistics View is selected, the STATISTICS GRANULARITY item in the Communication Summary Menu becomes active. When the cursor is positioned over an active STATISTICS GRANULARITY item, the menu shown here will appear and allow selection of HOURLY, DAILY or MONTHLY.

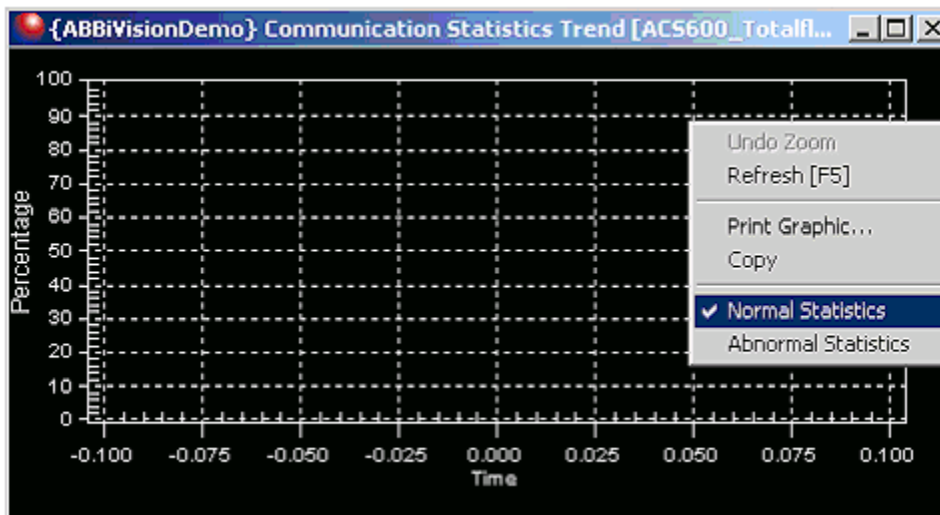


The **VIEW STATISTIC HISTORY** item in the **Communication Summary** Menu will pop-up a screen as illustrated below. This presents information similar to the **Statistics View** of the **Communication Summary** but only for the selected communication level.

Once **VIEW STATISTIC HISTORY** has been selected, the **TIME INTERVAL PROPERTIES** and **VIEW STATISTICS TREND** items become active. The **Time Interval Properties** are illustrated below. This allows selection of the time period during which the statistic history is shown.



The **VIEW STATISTIC TREND** item will produce a trend element as illustrated below. This is a trend of the Communication Statistics for the Communication Level selected with the View Statistic History. Normal Zoom functionality applies to the Statistic Trend. A right-click within the Statistics Trend will pop up the menu shown at the right edge of the illustration. The **Statistic Trend Menu** allows selection of **UNDO ZOOM**, **REFRESH**, **PRINT GRAPHIC**, **COPY** and view of **NORMAL STATISTICS** or **ABNORMAL STATISTICS** for the selected Communication Level.



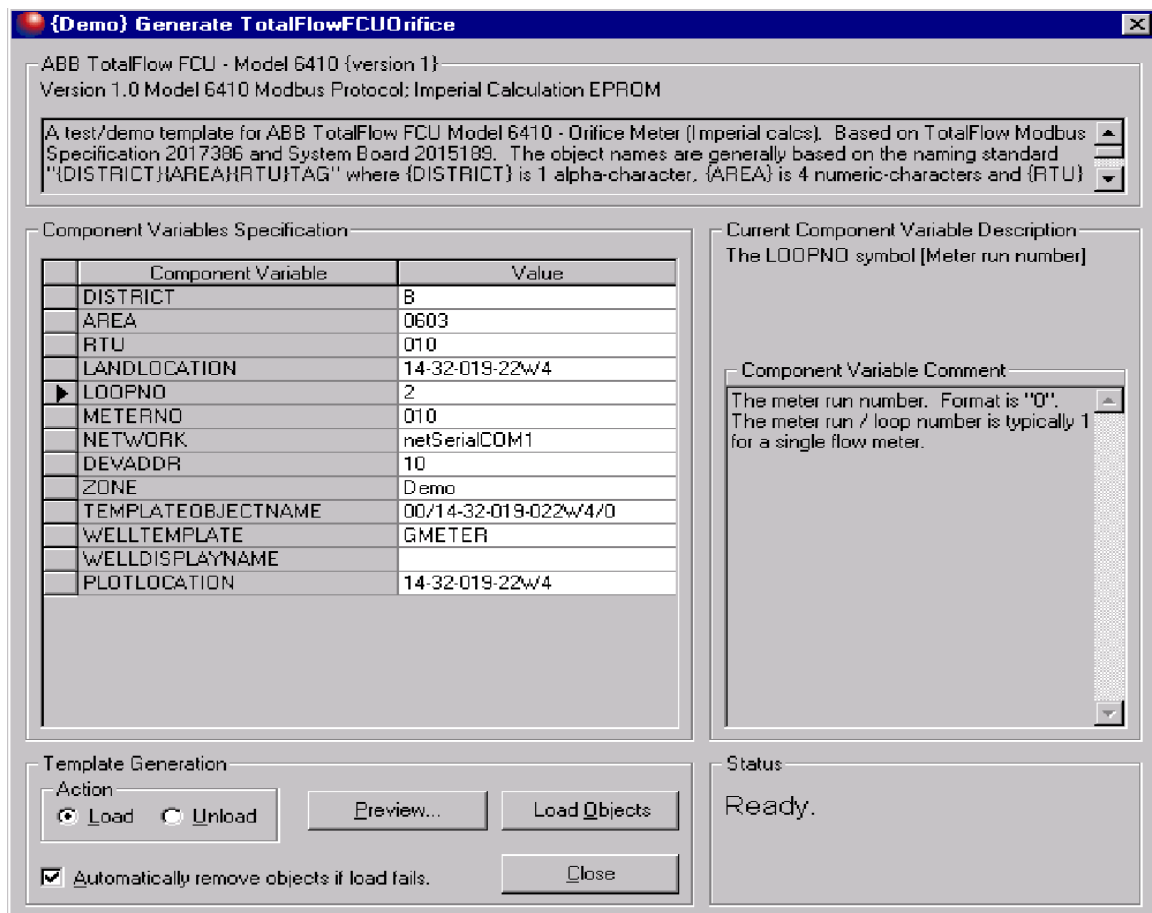
Pre-configured filters may be applied to the Communication Summary using the **SHOW COMMUNICATION POINTS** item in the **Communication Summary Menu**. Position the cursor over the **SHOW COMMUNICATION POINTS** item and the menu shown below will appear adjacent to the **Communication Summary Menu**. Select an individual Communication level (**DEVICE**, **MODEM**, etc) to narrow the view, or **ALL** to view all Communication levels in the Summary.

## Object Factory

The Object Factory enables *SCADA Vantage* administrators and users to configure the *SCADA Vantage* database quickly, easily and accurately. With the Object Factory, administrators are able to build templates (Business Object Template) of database objects that are frequently used (Figure 11). The template may correspond to something as simple as a typical user profile, or as complicated as a device with hundreds of analog and digital points. Once the template has been created, it is possible to create the new objects (either single or in bulk) at the click of a button. For example:

A production field with 50 wells consists of several business-object templates (variations in well configuration such as equipment, available input/output (I/O) and control points, etc.). If users employ the provided business-object templates or construct their own for each variation, they can load the configuration for the 50 wells into *SCADA Vantage's* database in a matter of minutes.

With the *SCADA Vantage* Object Factory, users save configuration time, commissioning time, and troubleshooting effort.



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**Figure 11 Business Object Template**

## **Graphic Templates**

Graphic Templates are closely related to the Object Factory. Users employ templates to create the client environment graphics required to display objects. Graphic Templates greatly simplify display development in that users only need draw the graphic template once. Graphic templates may be as complex or simple as standard screens. After a graphic template has been incorporated into the client environment, it is accessed with an object name. The template then displays all information that is applicable to that object.

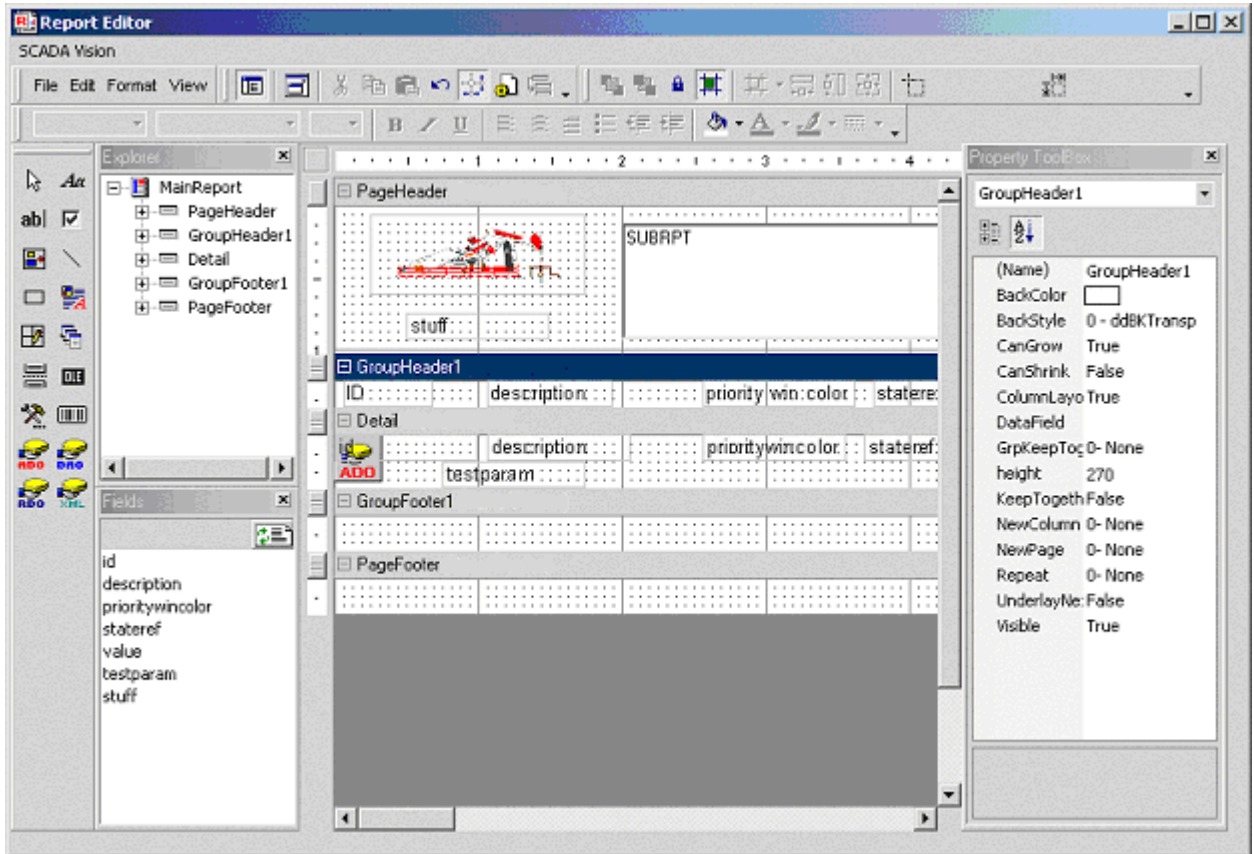
In addition to saving time by not building similar screens many times, the Graphic Templates save time in distributing screens. Once a client PC has a specific graphic template, users can employ that template immediately for new database objects as soon as the database points exist.

## **Reports**

The Reporting Engine (RE) is a set of controls and services meant to allow the creation, distribution, and execution of user defined reports in a quick and seamless manner.

Reports are first constructed in the SCADA Vantage Explorer (configuration tool), then destinations can be defined for any reports. Reports are then scheduled and routed to

selected destinations, with any given parameters for the report being designated at configuration time, but provided at run time.



The Report Editor, displayed above, allows a user to edit/create a report. A visual query designer is included with the Report Editor, and can be used to edit/create the SQL statement used to designate the fields to be included in the report. Sub Reports can also be linked from this screen.

## SQL Editor

The SQL Editor is an enhanced interface for issuing SQL commands to *SCADA Vantage* servers. The editor is a tool within *SCADA Vantage Explorer*. The SQL Editor features:

- Standard Windows features such as cut and paste, print, copy and export
- A recorded command history with the ability to repeat commands
- An active query update (with the active query, the result set continually updates, thus ensuring that data is accurate. Users can modify the result set and save it to the database making the SQL Editor an active tool for maintaining the database.)

## Class Import/Export

The Class Import/Export tool is a means of exporting the *SCADA Vantage* database to text files for manipulation with a tool such as Microsoft Excel. These files can be

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imported back into the *SCADA Vantage* database resulting in a convenient method for creating or modifying points in bulk.

Users can select the classes to import or export, and use an SQL query to specify the data to export within *SCADA Vantage Explorer*.

## Variable Frequency Drive Calculation

The Variable Frequency Drive (VFD) Calculation feature calculates the revolutions per minute (rpm), current, and torque for VFDs that do not natively contain this information. *SCADA Vantage* stores the calculated values as analogs, which a user can view or employ to draw graphs of trends, as with any other analog point in *SCADA Vantage*. If operators prefer to send speed setpoints in RPM (revolutions per minute) as opposed to frequencies in Hz, the feature takes the setpoint in RPM, converts the value to Hz, and sends that value to the VFD. Calculations are available for standard, rodless, and ESP pumps. This feature may be used to assess the performance of a well with respect to inflow and torque problems.

## Inferred Production

The Inferred Production Application is a convenient and practical application focused on heavy oil production using Progressive Cavity (Screw) Pumps. The intent of the application is to calculate the daily production rate for screw pumps.

Once configured, the Inferred Production calculation runs every time the associated device is polled. The calculation result (which represents the flow rate per day based on the most recent RPM reading) is stored in *SCADA Vantage* and may be viewed by system users. Setup of this application is through the *SCADA Vantage* explorer.

## Point Calculations

The *SCADA Vantage* Point Calculations are intended to provide users with mechanisms to have the *SCADA Vantage* real-time database maintain and calculate a number of frequently used values over various rolling time windows. Each calculation is performed for each of the current/previous time periods: hour, day, month, year, and two user-defined time periods. The calculations available include:

- Time Weighted Average – calculation of a point's time weighted average.
- State Time – calculation of the amount of time a point has spent in each state.
- State Transition Count – calculation of the number of times a point has changed into each state.
- Totalizers – calculation of the summation of positive deltas for a point.

- 
- Integrations - calculation and storage of the calculated accumulation (integration) for a rate point.
  - Software rate/accumulators – given a telemetered rate, the system is capable of calculating a software accumulation; conversely, if given a telemetered accumulation, the system is capable of calculating a software rate. The system is also capable of detecting and handling accumulator resets and rollovers.

## Task Scheduler

The SCADA Vantage Task Scheduler controls the execution of system-defined and user-defined tasks as well as operator alarms. An example of a system-defined task is saving the database to disk on an hourly or daily basis. An example of a user-defined task is synchronizing the time of all field devices on a daily basis, or uploading meter readings on an hourly basis. Operator alarms provide users with the ability to generate a configurable alarm message at a specific time (often used as reminders especially during shift operations).

## Replication

ScadaVantage replication enables separate ScadaVantage systems to share configuration and real-time data. Analogs and digitals configured at one system may be automatically replicated to another system. The polled values are also replicated from one system to another. Setpoints and digital out commands may then be commanded at either system and the commands are sent to the physical device via the system actively polling the device.

Data consistency between systems is maintained via integrity updates on connect, update by exception, and periodic integrity updates, or a subset of the three. The number of realtime exception updates may be reduced by deadbanding or only sending values periodically.

ScadaVantage replication supports a variety of topographies. Replicated systems may be peers sharing some or all data, master/sub-master systems concentrating data to a single point, or even backup offsite systems ready to take over control in the event of a failure (on-site backup is usually performed via ScadaVantage redundancy which provides more automatic failover). Replicated systems may form complete circles without causing an endless chain of replicated updates. Also, replicated systems may replicate data from a nearby system rather than the original source system in order to reduce bandwidth requirements (data hopping).

Data may be selectively replicated to remote systems by either limiting which points (e.g. analogs and digitals) are replicated to a remote system, or by limiting the type of data replicated to a remote system (e.g. configuration, operator configuration, or real-time data).

The replication data stream may be compressed for additional efficiency in low bandwidth environments.

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## Tag Calculation and Control Sequences

The Tag Calculation package of SCADA Vantage is design to cover extensive calculation and conversion of data. It consists in the following major components:

- Averages and digital runtimes
- Conversions extensions
- Calculated tags
- Control Sequences

The Analog Averages and the Digital runtimes are intended to provide users with a mechanism to have the SCADA Vantage real-time database maintain and calculate time-weighted averages of real-time values over various rolling time windows.

A Conversion object contains the parameters and setting necessary to perform a conversion of a raw data value into a process data value suitable for an application. By default, conversion function is a simple linear equation:  $y = mx + b$

The SCADA Vantage Rate Calculations & Integrations Application is intended to provide users with mechanisms to have the SCADA Vantage real-time database maintain and calculate rates and accumulators and their respective totalizers over various rolling time windows.

The 'Integrations' and 'Totalizers' tables in the SCADA Vantage real-time maintain integrated and accumulated values for Analog Points with the 'Integration' and 'Totalize' calculation enabled. The current and previous period values are calculated and maintained for the following Time Windows:

- Hour
- Day
- Month
- Year
- User 1
- User 2
- Unlimited

When designing a Control Sequence it is possible to implement either a process oriented sequence or an event driven sequence. They allow the system to evaluate a complex expression taking action under certain predicted results



## Communication Analysis Application

The Communication Analysis Application (refer to Figure 12 ) is used to analyze and troubleshoot communications between *SCADA Vantage* and its configured devices. By using this application through *SCADA Vantage Explorer*, it is possible to view communications data from any location on the network. This application enables the analysis of the communications for one or more devices, or an entire network, simultaneously. Many users can look at the same or different devices at the same time.

Other features of this application include:

- a screen with the device name, time stamp, data bytes, and ASCII conversion
- clearly distinguishable messages with configurable color options
- a detail window that allows a user to select bytes and see the conversion to integer and floating point values
- the ability to save selected messages to disk or the Windows clipboard
- the ability to record an entire session to disk
- the ability to print selected messages.

The screenshot shows the 'Communication Analysis' window for 'T1S1-network000, 10 of 10 [Network...]'. The window contains a table with the following columns: Device, Time, Typ, Message, and ASCII. The messages are color-coded by type: blue for queries and green for replies.

Device	Time	Typ	Message	ASCII
T1S1-modbus000-002	NOV-28-2006 15:30:16.187	Quer	03 03 00 00 00 14 44 27	.....D'
T1S1-modbus000-002	NOV-28-2006 15:30:16.656	Repl	03 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 28 3F 2A E1 29 35 29 CC 15 11 10 DB 1D 12 40 8A 23 C9 4D	.. (.A.B.C.D.E.F.G.H.I.J(?*)S).....6 #M2..
T1S1-modbus000-007	NOV-28-2006 15:30:17.265	Quer	08 03 00 00 00 14 45 5C	.....E\
T1S1-modbus000-007	NOV-28-2006 15:30:17.718	Repl	08 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 28 31 2A C9 29 0C 2A 02 15 2C 10 C1 1C BC 40 C6 24 3C 4D	.. (.A.B.C.D.E.F.G.H.I.J(1*).*.....6 \$<ML..
T1S1-modbus000-000	NOV-28-2006 15:30:18.328	Quer	01 03 00 00 00 14 45 C5	.....E.
T1S1-modbus000-000	NOV-28-2006 15:30:18.781	Repl	01 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 28 23 2A B0 28 E3 2A 38 15 48 10 A9 1C 67 41 00 24 AF 4D	.. (.A.B.C.D.E.F.G.H.I.J(#*. (*8.H...g)h \$Me.W
T1S1-modbus000-005	NOV-28-2006 15:30:19.39	Quer	06 03 00 00 00 14 44 72	.....Dr
T1S1-modbus000-005	NOV-28-2006 15:30:19.843	Repl	06 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 28 16 2A 97 28 BA 2A 6E 15 64 10 92 1C 13 41 3A 25 23 4D	.. (.A.B.C.D.E.F.G.H.I.J(*.*n.d....)h \$#M)..
T1S1-modbus000-003	NOV-28-2006 15:30:21.515	Quer	04 03 00 00 00 14 45 90	.....E.
T1S1-modbus000-003	NOV-28-2006 15:30:21.968	Repl	04 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 27 FA 2A 64 28 67 2A D8 15 9F 10 67 1B 6B 41 A9 26 09 4D	.. (.A.B.C.D.E.F.G.H.I.J'. *d(g*....g.k)h 6.M..
T1S1-modbus000-008	NOV-28-2006 15:30:22.578	Quer	09 03 00 00 00 14 44 8D	.....D.
T1S1-modbus000-008	NOV-28-2006 15:30:23.031	Repl	09 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 27 EC 2A 4A 28 3E 2B 0D 15 BE 10 53 1B 18 41 DF 26 7D 4D	.. (.A.B.C.D.E.F.G.H.I.J'. *J(>+....S...h )H.d.
T1S1-modbus000-001	NOV-28-2006 15:30:24.656	Quer	02 03 00 00 00 14 45 F6	.....E.
T1S1-modbus000-001	NOV-28-2006 15:30:25.109	Repl	02 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 27 D0 2A 17 27 EB 2B 77 15 FE 10 2F 1A 73 42 48 27 63 4D	.. (.A.B.C.D.E.F.G.H.I.J'. *+w.../.sE 'cM..
T1S1-modbus000-006	NOV-28-2006 15:30:25.718	Quer	07 03 00 00 00 14 45 A3	.....E.
T1S1-modbus000-006	NOV-28-2006 15:30:26.171	Repl	07 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 27 C2 29 FD 27 C1 2B AB 16 1F 10 1E 1A 22 42 7A 27 D7 4D	.. (.A.B.C.D.E.F.G.H.I.J'. )'+....."E 'H.E.
T1S1-modbus000-004	NOV-28-2006 15:30:26.796	Quer	05 03 00 00 00 14 44 41	.....DA
T1S1-modbus000-004	NOV-28-2006 15:30:27.25	Repl	05 03 28 9C 41 9C 42 9C 43 9C 44 9C 45 9C 46 9C 47 9C 48 9C 49 9C 4A 27 B4 29 E3 27 98 2B 80 16 41 10 0E 19 D1 42 AB 28 4A 4D	.. (.A.B.C.D.E.F.G.H.I.J'. )'+...A...E (JM..

Figure 12 Communication Analysis Screen

## Compressor Efficiency Application

The Compressor Efficiency Application provides a real-time view of the operating characteristics of compressors. A Compressor Efficiency Diagram is used to view the efficiency at which a compressor, or a number of parallel compressors, is operating. The Compressor Efficiency Diagram shows various characteristic/flow capacity curves of the compressor(s) (based on reference curves as supplied by the compressor manufacturer) adjusted to the current operating condition of the compressor(s). The Compressor Diagram (Figure 13) includes a plot of the current net flow produced by the compressor(s) as well as the maximum capacity and ultimate maximum capacity curves for the compressor(s). This illustrates not only the current capacity of the compressor(s), but also the potential maximum capacity that could be expected from the compressor(s)

under different operating conditions.

The Compressor Diagram is very flexible in that the capacity

characteristic curves shown on the diagram are adjusted on demand according to the real-time operating parameters of the compressor(s). Thus, as the operating conditions such as speed, discharge pressure and suction pressure change,

the Compressor Diagram is able to present the revised operating

capacity of the compressor(s) in real-time. This is advantageous to Engineering and Operations personnel as the Compressor Diagram enables them to quickly assess the production capacity of the compressor(s) and determine what changes (i.e. pocket settings, speed changes, etc.) could be used to maximize the production. Furthermore, the Compressor Diagram is capable of showing numerous capacity curves for an individual compressor, allowing the Engineer/Operator to easily view “what-if” scenarios.

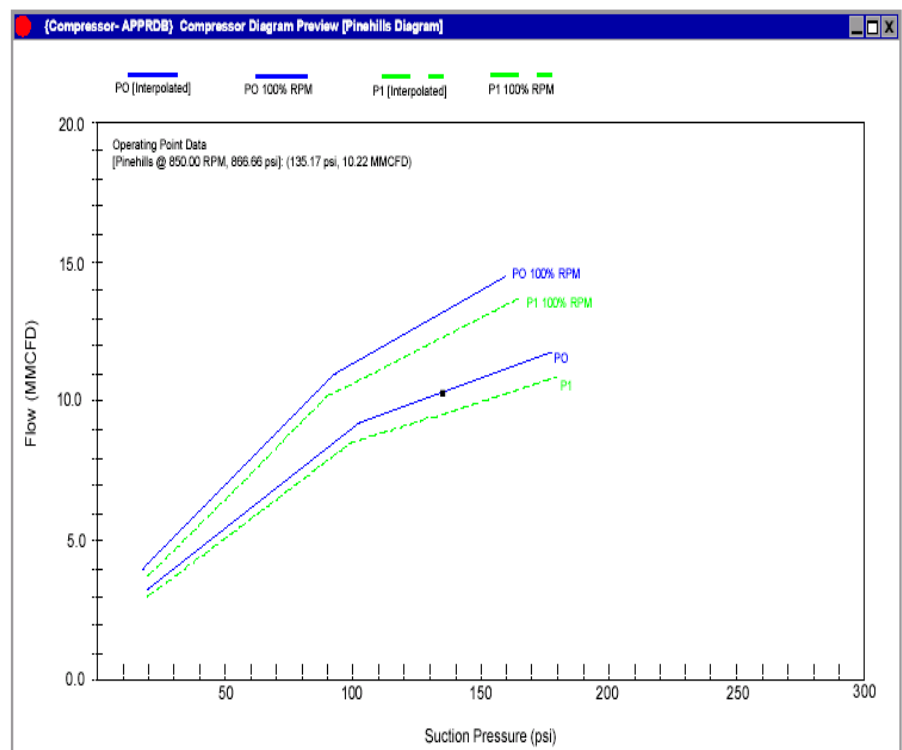


Figure 13 Compressor Diagram

## Rod Pump Analysis & Monitoring Application - DynoCards

The Rod Pump Analysis and Monitoring Application collects, analyzes, and reports information generated by Rod Pump Controllers. *SCADA Vantage* uploads and stores rod pump controller data, such as load vs. position, and presents dynamometer plots (DynoPlots) to operations and engineering personnel for analysis and diagnostics. When incorporated with an operational philosophy of well visits by exception, this software application is a key factor in reducing equipment failure, analyzing production problems, and increasing production.

The DynoPlot Diagram (see Figure 14) is capable of presenting more than one Dynocard (i.e. pump stroke) at a time and thus a Dynocard presented on a DynoPlot can provide significant insight into the operation and behavior of the well for engineering and operating personnel.

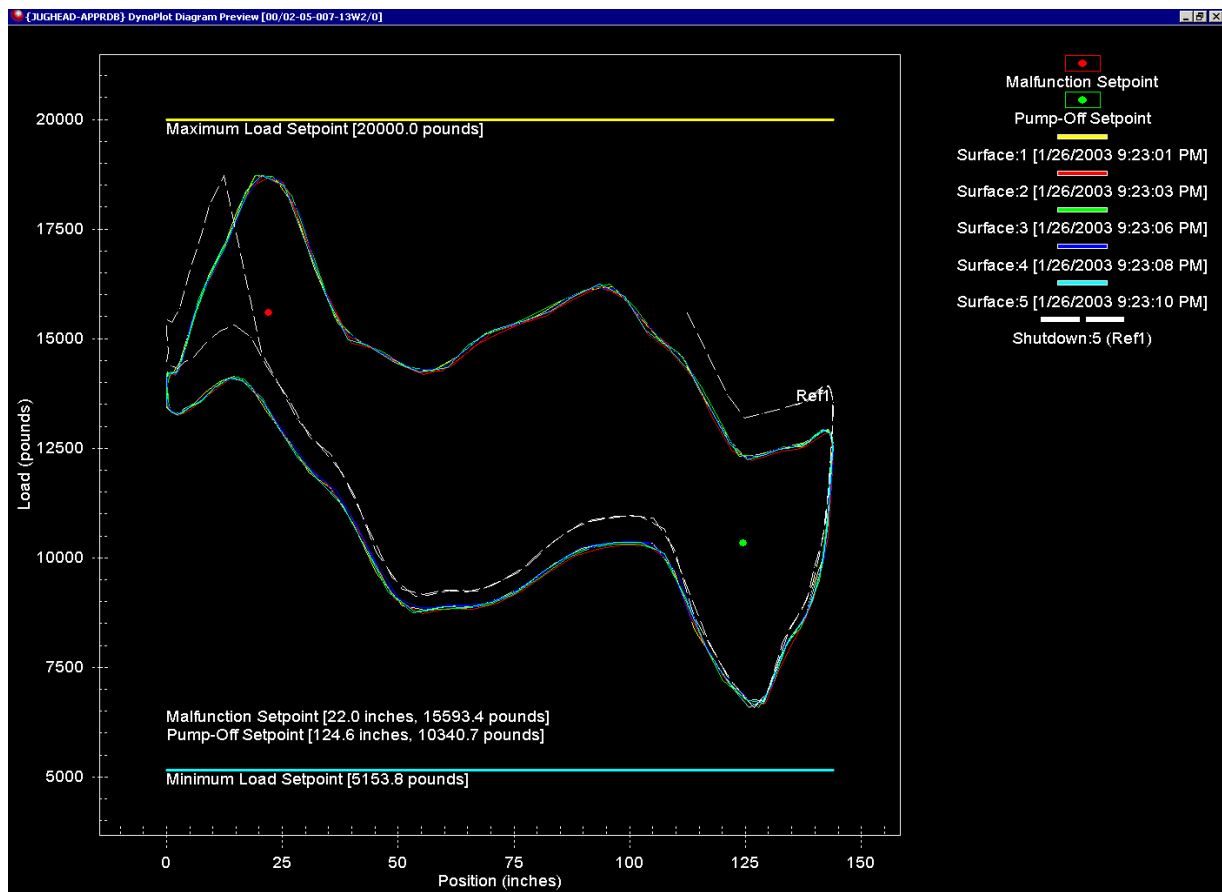


Figure 14 Dynoplot

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## Software Point Calculation and Control

This tool enables a user to create analog and digital software points, and make those points available within *SCADA Vantage*. *SCADA Vantage* receives the point values from calculations performed in Microsoft Excel or Visual Basic; users can base the calculations on constants, real-time point values, or other software point values. Because Microsoft Excel or Visual Basic is the calculation engine, the range of supported calculation types is extensive. The calculations are triggered automatically as underlying data values change.

The control component allows users to define control strategies based on point values. For example, if an analog value goes to a high alarm, *SCADA Vantage* may automatically command a digital point to correct the situation.

## SCADA Vantage Alarm Call Out

SCADA Vantage Alarm Call Out application is an integrated telephony and messaging system within SCADA Vantage and offers real time intelligent alarm notification. It allows users remote access to critical specific alarms & events via telephone voice (PSTN or cellular), radio, pager (numeric and alpha-numeric) and e-mail (Figure 15). The Alarm call out application enables users to reduce their operational costs by allowing them to remotely monitor critical alarms and dial in to acknowledge a call out. Users can listen to and acknowledge alarms, hear exact value of variables via telephone from remote locations saving valuable time and money.

Alarm call out can be configured to generate a call out based on a defined escalation list that defines a number of SCADA Vantage system users who are to be contacted by any of the above call out methods (telephone, pager, e-mail etc) in case the call out is not acknowledged within a configurable period of time.

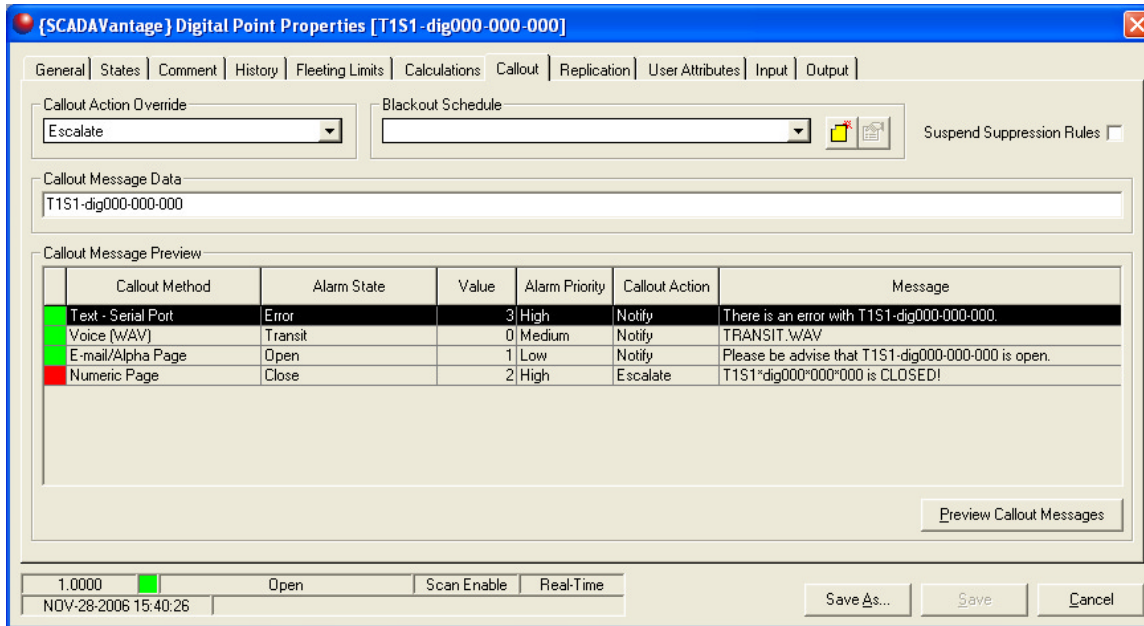


Figure 15 Alarm Call Out

## Production Data History (PDH)

SCADA Vantage Production Data History based on Microsoft SQL Server is designed to be the source of production data for oil and gas companies. PDH is tightly coupled with the SCADA Vantage real time database so that hourly and daily production data upload from the RTU's or flow computers is automated complying with API 21.1 recommendations. Gas composition, and parameters such as orifice plate size can be uploaded and downloaded directly from PDH. PDH supports trending for any entity that can be numerically defined and tracked over time for e.g daily values, time on production, gas-oil ratios etc. A reporting tool is built into PDH to display reports either in SCADA Vantage clients or the reports can be saved in HTML format. PDH supports redundancy at the software level providing a hot-standby environment with automatic failover for systems requiring high availability.

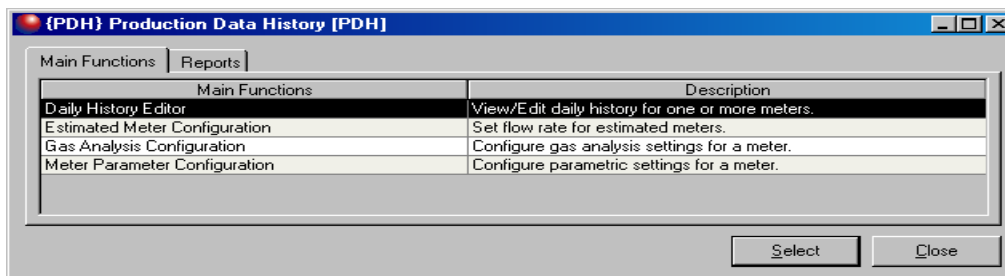


Figure 16 Production Data History

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## Production Allocation

The production allocation application will govern the calculation and management of production allocation on a well-by-well basis. In coarse terms, this is achieved by using the product metered at the a group level (outlet of a testing faciliti group line or outlet of a cluster or inlet of a plant) and allocating production back to source wells based upon well test information and time on production

On a daily basis, well-specific allocated production is calculated using last accepted<sup>1</sup> well test and combined product daily volume information. The Production Allocation application consists of two main requirements areas – one to configure the logical objects representing the real-world entities (such as wells, meters, etc.) and one to compute the allocated production as necessary.

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<sup>1</sup> Accepted well test refers to a well test that in the operator's opinion is accurate

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## **SCADA VANTAGE CONNECTIVITY**

*SCADA Vantage* was built as an open system to interact with other systems. It can interact with other applications or users can build applications that interact with it. *SCADA Vantage* uses the mechanisms in this section to interface (e.g., read, import, export) with other systems.

### **Open Database Connectivity**

Many commercially available relational databases use the ODBC interface. Designed by Microsoft and other database vendors as a cross-platform, database-independent method, ODBC uses API calls for universal data access.

### **Object Linking & Embedding & Component Object Model/ Distributed COM**

OLE and COM/DCOM are standard technologies on Windows platforms that enable users to implement support for object-oriented interaction between software components. These technologies enable users to access functions within one component from another software component.

### **Active-X Data Objects**

ADO is a set of Active-X controls that provide programming access to Microsoft's underlying data access technologies. This can be accomplished through most programming or scripting languages, as long as the languages can create and use Active-X controls, which are effectively COM objects.

### **OLE for Process Control**

OPC is an open standard for sharing data from remote devices and other systems with computer applications. It allows applications to read and write process values, and enables a computer network to share data.

Currently *SCADA Vantage* supports OPC DA V3.0, OPC AE V1.0 and OPC HDA V1.0 in the server and client versions.

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## INTERFACES WITH OTHER PRODUCTS

*SCADA Vantage* is specifically adapted to interact with the products listed in this section. ABB Inc. will be adding other interfaces in the future.

### **Production Volume Reporting (PVR) by CGI**

Production Volume Reporting is a suite of software for managing historical (daily) production information. By means of an API, *SCADA Vantage* is able to transfer information to PVR. However, since oil companies have different setup for this system customization of this interface is likely required.

### **Field Data Capture by Slumberger**

Field Data Capture is a software for managing historical (daily) production information. By means of an API, *SCADA Vantage* is able to transfer information to FDC. However, since oil companies have different setup for this system, customization of this interface is likely required.

### **PI by OSI**

PI Historian fully automates the storage and presentation of data, allowing users to perform in-depth data analysis, manipulation and aggregation. *SCADA Vantage* can interface with PI through OPC in real-time.

### **Computerized Maintenance Management System by Davison**

This CMMS system keeps track of maintenance record per device plus is able to generate work orders for maintenance. *SCADA Vantage* can interface with the Davison CMMS through an API which carries the runtimes for field equipment.

### **Asset Master by ABB**

The Asset Master is an ABB product designed to interface with Foundation Fieldbus, Hart and Profibus field instrumentation for remote diagnostics and configuration. *SCADA Vantage* can interface with Asset Master through OPC FF in real-time. Asset Master can also interface with Maximo CMMS at the corporate level.

### **Enterprise Connectivity Solution (ECS) by ABB**

Enterprise Connectivity Solutions is a suite of software capable to provide connectivity and validation to any relational database and it is also a certified SAP connector for the enterprise accounting. *SCADA Vantage* can interface with ECS through OPC in real-time.



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## GLOSSARY

ADO	Active-X Data Object
API	Application Programming Interface
APPRDB	Application Relational Database
ASCII	American Standard Code for Information Interchange
CAM	Client Application Manager
CDPD	Dellular Digital Packet Data
client	A PC running the software that a person uses to run the <i>SCADA Vantage</i> applications, Client and Explorer.
COM	Component Object Model
CSV	Comma-Separated Value (a file type commonly used by Microsoft Excel)
CTS	Clear To Send
DCOM	Cistributed Component Object Model
DVI	Device Interface
ESP	Electric Submersible Pump
flyover	The text, with brief information about a tool bar icon, that appears when you hold the cursor on the icon; also known as a <i>tool tip</i> .
GUI	Graphical User Interface
Hz	Herz (frequency unit)
I/O	Input / Output
IP	Internet Protocol
ODBC	Open Database Connectivity
OLE	Object Linking and Embedding
OLE-DB	Object Linking and Embedding–Database
OPC	OLE for Process Control
PC	Personal Computer
PLC	Programmable Logic Controller
RPM	Revolutions Per Minute
RTRDB	Real-time Relational Database
RTS	Request To Send
server	The PC that is running the <i>SCADA Vantage</i> database.
SP	Service Pack
TCP	Transport Control Protocol
user	The person who is running the <i>SCADA Vantage</i> software.
VFD	Variable Frequency Drive
WAV	A format for a PC sound file.

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## APPENDIX A – SIZING CALCULATION

ABB recommends hyper-threading be disabled on any CPU that supports it.

### 30 Well Configuration

1 CPU 2.8 GHz or higher  
1 GB RAM  
100 GB Hard Disk or higher

### 300 Well Configuration

1 CPU 2.8 GHz or higher  
2 GB RAM  
250 GB Hard Disk or higher

### 3000 Well Configuration

2 CPUs 2.8 GHz or higher  
4 GB RAM  
500 GB Hard Disk or higher

It is important to mention that SCADA Vantage real-time database can be physically split, if performance requirements demand it, in which case data from several databases running on different physical servers can be combined in one screen display.

Currently there are 85,000-point systems in operation and SCADA Vantage has been tested in the lab with a simulated load of 100,000 points. Also the number of simultaneous client machines actively exchanging data with a server has been lab tested at 300 workstations. For real conditions there is a company running in excess to 100 workstations.

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Finally SCADA Vantage has been deployed as a simple HMI of 100 tags all the way to enterprise systems, the software licenses allow increments of as little as 100 tags to 50,000 tags.

### Data Flow and Link Bandwidth Requirements

The following describes the various data flows associated with SCADA Vantage.

Where data flows across WAN links, a calculation methodology for that portion of the bandwidth is described. Some of these bandwidth requirements are very minimal and/or infrequent so are not detailed, but are allowed for in the spare bandwidth allowance to be included with each link.

For data flow restricted to the local LAN at 10/100Mb no detailed calculations are provided unless very large data transfers are anticipated as the available bandwidth far exceeds the demands of this SCADA system.

Since much of the data communications in this system are done by exception, only changes in field IO values generate data traffic. Bandwidth calculation parameters are based on experience with similar systems, advice from developers regarding typical data record sizes, and empirical testing of specific features. Note that SCADA Vantage uses variable length text fields so there is no fixed size for data records but instead depends on the typical tag names, descriptions, device names, comment etc text length so need to be estimated.

Digital values are usually associated with status of such devices as motors, valves and rarely change. Calculations based on each point changing 1/hour are typically very conservative. Analog points are more active but within a 0.5% deadband values could be expected to be reported once every 1-15 minutes. (Note that levels and temperatures are typically very steady at about 5 minutes per change. Flows tend to report frequently <1 minute and pressures depend on the application but every 2 minutes is reasonable). Estimates for loading will be based on the RateofChange value being computed as follows.

$$\text{RateofChange/sec} = (\% \text{ Digital})/3600\text{sec} + (\% \text{ Analog})/60\text{sec}$$

Initial estimates are 60% Digital and 40% Analog points giving a RateofChange of 0.00677

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The calculations below also include a BurstFactor to de-rate the normal communications loading (i.e. Burst Factor=1) to allow for process upsets that may cause spikes in the normal exception reported data flow. BurstFactors ranging from 1.5-3 would be reasonable but given the types of measurements expected, large bursts are not anticipated. A BurstFactor of 1.5 will be used for all calculations to follow.

Finally, all calculations to follow include only the raw data transfer requirements and do not include the TCP/IP overheads or any "safety factors". TCP/IP overheads of 5% should be applied (40 Bytes of TCP/IP protocol in 576-1504 Bytes total message) and a 25% safety factor to allow for communications delays and additional data overheads.

These calculations will be used to compute communications loading for each site as part of the Communications Bandwidth Document typically to be completed in detailed engineering. Note that bandwidth is usually expressed n-kilo Baud or kilo-bits-per second (kbps) where as data quantities are expressed in Bytes. We use an approximation of 10 bits/Byte (to account for normal serial start/stop/parity bits) so the factor from Bytes per second to kbps is 1000/10=100

#### RTU to SCADA server

##### Average RTUs

SCADA Vantage will use the ABB AC800F controller as an RTU and will communicate to the associated gas level 1 SCADA Host via OPC DA protocol for data collection and command outputs. However, since the OPC server will reside in the SCADA Server, the external communications loading is related to the native AC800F protocol over TCP/IP – not OPC. This communication will be continuous and significant but is dependant on the rate data is changing in the RTU, as data is exchanged by exception. This includes average protocol overheads but does not include TCP/IP protocol overheads..

$$\text{Load (kbps)} * 100 = (\# \text{ of Points}) * (10 \text{ Bytes/Point}) * (\text{RateofChange/sec}) * \text{BurstFactor}$$

##### Bristol RTUs

SCADA Vantage will directly communicate with the Bristol RTU's via serial radio where low power RTU's are requested. This data communication is polled, however the available solar power usually limits the polling rate. The following calculation assumes all the required data is in two contiguous register ranges

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$$\text{Load (kbps)} * 100 = (2 * 15 \text{ Bytes data request} + 2 * 15 \text{ Bytes data reply} + 4 \text{ Bytes /Point} * (\# \text{ of Points}))$$

Including radio delays, a system will typically poll real-time data for 1 device every 2.5 seconds and transfers about 60 Bytes + 4 Bytes per point = approx 64 / 2.5 Bytes/sec = 256bps. As this communications will be a dedicated 19.2 communications channel, the communications channel usage is approximately  $256/19200 = 1.3\%$  loading at peak loading (RTUs on fast scan). Note that the RTUs are sized for polling once per minute under normal conditions.

#### OPC linked to other systems or external applications

Third-party OPC Server will communicate to the associated SCADA Vantage Host via OPC DA protocol to transfer all the real-time process control parameters from the third-party OPC server to the SCADA Host and control commands from the SCADA Host to the third-party OPC server. The third-party OPC Server is not required to communicate across any of the Level-to-Level links. In this case the OPC servers will exist on other computers distant from the SCADA Vantage server. Hence the communications loading is for the OPC DA protocol. This includes average OPC/DCOM protocol overheads but does not include TCP/IP protocol overheads.

$$\text{Load (kbps)} * 100 = (\# \text{ of Points}) * (15 \text{ Bytes/Point}) * (\text{RateofChange/sec}) * \text{BurstFactor}$$

#### Server Replication

The Level 1 SCADA Vantage can communicate to the Level 2 SCADA Vantage via ABB's SCADA Vantage replication protocol over TCP/IP for the replication of the real-time and historical data, and host configuration to the Level 2 SCADA Vantage and control commands from the Level 2 SCADA Vantage. The Level-to-Level data replication works in the following modes; normal data synchronization, integrity updates and historical data synchronization.

#### Normal Data Replication

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The normal data synchronization process is continuously transferring data from the Level 1 SCADA Vantage server to its associated Level 2 SCADA Vantage server based on the rate of change of the data from the RTU. The bandwidth requirement for this mode of replication is calculated based on the number of points and the rate at which the host is receiving the data from the RTU or OPC Server. Also note that the replicated data can be optionally compressed prior to transfer with the compression ratio dependent on the quantity of update messages and content of tag configurations. Compression ratios of 50%-15% are common for real time data transfers.

### The Level 1 to Level 2 Normal Data Synchronization

Communication Link Loading calculations will be based on the following formulas:

$$\text{Load (kbps)} * 100 = (\# \text{ of Points}) * (64 \text{ Bytes/Point}) * (\text{RateofChange/sec}) * \text{BurstFactor} * \text{CompressionRatio}$$

*For example:*

100 pressure transmitter values are changing more than 1% of its current value at an average rate of once every 60 seconds and the Burst Factor is 150%, assume compression is disabled due to limited points and no data buffering, therefore the communication link loading for this point would be:

$$((100) * (64 \text{ Bytes/Point}) * (1/60 \text{ sec}) * 150% * 100%) / 100 = 1.6 \text{ kbps}$$

For the overall SCADA Vantage server normal data synchronization replication communication link loading for 500 tags with RateofChange considering a mix of analogs/digitals and normal 20% compression

$$((500) * (64 \text{ Bytes/Point}) * (.00677/\text{sec}) * 150% * 20%) / 100 = .65 \text{ kbps}$$

### Integrity Updates

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When the Level 1 and Level 2 servers initially connect (or reconnect after a communications failure) an integrity updates process ensures that the two servers are initially synchronized prior to exchanging data by exception as described above.

This Integrity Update function is also typically scheduled to occur once a day or on demand. The feature has built-in settings to manage bandwidth by restricting the number of integrity update messages per second for various update reasons. It also can do an incremental update for short communications outages where only the changes occurring during the outage are transferred.

Finally, replication includes a data compression features which can be very effective for integrity updates since much of the tag data is repetitive and transferred in groups of multiple tags – hence compression ratios of 20-15% are achievable. Hence the following is based on normal WAN link settings for scheduled updates of 1 update per second. The integrity update exchanges check-sum type data for each data record and only synchronizes data records, which are not synchronized.

The integrity update message sizes associated with any object are very dependent upon the configuration. For instance, an empty Analog object without a description can be transferred in approximately 220 bytes (about 160 for configuration and 60 for operator configuration). For the test typical tag description is 100 characters, tag comment of 50 characters, tag name of 23 characters, device name of 15 characters and allowing for normal configurations options and a fully configured analog is 300 to 500 bytes. The actual size of the original message should not be overly important since compression will remove redundancy and reduce the messages to compact sizes.

The Level 1 to Level 2 Integrity Update Communication Link Loading calculation will be based on the following formula:

$$\text{Load (kbps)} * 100 = (500 \text{ Bytes/Point}) * (\text{IntegrityUpdate/second}) * \text{CompressionRatio}$$

$$\text{Duration of Load} = (\# \text{ Points}) / (\text{IntegrityUpdate/second}) * 150\%$$

Note that the duration of the integrity update is scaled by 150% to allow for transfer other SCADA configuration, which is related to the total point count but not strictly associated with the tag count.

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For example:

A Level 1 Server with 500 replicated tags, with a complete integrity update scheduled to occurring once every day and set to update 10 values every 10 seconds, the total loading would be:

$$(500 \text{ Bytes/Point}) * (1 \text{ Update/second}) * 20\% = 1 \text{ kbps/Update}$$

$$(500 \text{ Points}) / 1(\text{Update/second}) * 1.5 = 750 \text{ seconds} = 12.5 \text{ minutes}$$

Note that the integrity update process can occur more quickly simply by increasing the update rate and increasing the bandwidth required. However the Integrity Update process occurs in the background and is normally just a validation of the system configuration so there is no urgency to complete it. The update that occurs upon initial connection typically is set to almost 10x this update rate and is done incrementally, so it would consume 10x the bandwidth but last less than a minute.

#### Historical Data Synchronization

Each SCADA Vantage server replicating data is responsible to historize the real time data locally – hence under normal circumstances, there is no need to transfer history data to Level 2. However in the case of a communications failure between Level 1 and Level 2, the Level 2 server is no longer receiving real time data so local historization cannot occur. In this case, once communications are restored, the Level 1 server must send the history data it collected up to Level 2. Transferring a file containing the missing data between servers does this.

The Level 1 to Level 2 Historical Data Synchronization Communication Link Loading calculation will be based on the following formula:

$$\text{Load (kbps)} * 100 = (\# \text{ Points}) * (\text{HoursofMissingData}) * (2610 \text{ Bytes/Point/Hour}) / (\text{RequiredUpdateTime sec})$$

The Bytes/Point/Hour is based on the Historical Data Log containing 64 Bytes per entry and the Historical Event Log containing 256 Bytes per entry and the assumption that on average a Level 1 SCADA Host database is comprised of 60% Analog points and 40% Digital points and that Analog points are



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historized at an average rate of 6 entries per hour and Digital points are historized at a rate of 1 entry per hour. Also, one event per every 50 points is historized per hour.

The average Bytes/Point/Hour is calculated as follows:

$60\% * (6 \text{ Entries/hour}) * (64 \text{ Bytes/Entry/Point}) + 40\% * (1 \text{ Entries/hour}) * (64 \text{ Bytes/Entry/Point}) + (1 \text{ Entry/hour/Every } 50 \text{ Points}) * (256 \text{ Bytes/Entry/Point}) = 261 \text{ Bytes/Point/hour}$

For example:

A Level 2 Server with 24 hours of missing historical data for 500 replicated tags and requires 600 seconds (10 min) to complete the update, the total loading would be:

$((500 \text{ Points}) * (24 \text{ hours}) * (261 \text{ Bytes/Point/Hour}) / (600 \text{ sec})) / 100 = 52 \text{ kbps}$

The total maximum bandwidth requirement for Level 1 to Level 2 replication based on 500 points is:

*Total Maximum Loading = Normal Data Synchronization + Data Integrity + Historical Data Synchronization*

$2.64 \text{ kbps} + 1.0 \text{ kbps} + 52 \text{ kbps} = 56 \text{ kbps}$

Note that where 52kbps is only necessary for Historical Data Catch-up which would be an infrequent requirement and which could be set to update more slowly to conserve bandwidth. Normal bandwidth would be 4kbps.