# OpenEnterprise™ v3.2

OpenEnterprise v3.2 is Emerson's Supervisory Control and Data Acquisition (SCADA) solution, which targets the requirements of the global Oil & Gas production, transmission, and distribution industries.

OpenEnterprise allows you to implement wide-area SCADA solutions quickly and efficiently, reducing costs and providing an effective solution for managing large, widely distributed data collection networks that include a diverse range of field hardware and equipment. OpenEnterprise has been developed to meet current industry requirements and standards, and incorporates Emerson's experience with previous generations of SCADA over the last 40 years.

## Features

- Full integration with Emerson's ROC, ControlWave® and FloBoss™ products
- Industry standard protocols and interfaces (Modbus, DNP3, OPC, etc.)
- Native AMS Device Manager interface
- DeltaV™ RTU Connect solution
- EFM data export to FLOWCAL and PGAS
- FLOWCAL CFX export for both gas and liquids
- VMWare® virtualization
- Field equipment asset modeling and data abstraction
- Powerful Action Engine automates a wide range of system administration and data management tasks
- Open Database access via SQL, ODBC and OPC supports most business systems
- API 21.1-compliant data storage
- Standard support for distributed wireless SCADA network architecture (*Wireless*HART® and Distributed RTU™ Network)
- Optional integration with Microsoft's Active Directory to centralize access control and improve security

## Key Benefits

- Reduced system management costs and resources
- Reduced maintenance and migration costs with support for a mixture of legacy and current hardware
- Ease of integration with business systems
- Improved business processes and access to data
- Standardization of operational processes (independent of installed field equipment)
- Improved operator efficiency

## Real-time, Object-oriented



## Database

At the core of OpenEnterprise is a 64-bit memory-resident, event-driven database. This database is the repository for all SCADA and configuration data. Internally, the database is entirely "object-oriented," a software design technique in which data and code are combined together ("encapsulated") into individual components known as "objects." This highly-structured approach leads to a product that is easier to maintain, more robust, and operates more efficiently than relational or traditional databases, especially in an event-driven environment such as the typical SCADA system. Many customers have seen continuous up-times (without any shutdown, scheduled or otherwise) of around two years.

The transaction profile encountered on a SCADA system is often very different from one found in a typical large relational database. A SCADA system executes many thousands of small transactions per second, while a typical

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corporate database supports a smaller number of much larger transactions. The OpenEnterprise database engine has been specifically designed to support the type of transaction profile normally encountered in SCADA, while at the same time providing the standard features expected of most business systems. This allows for a close level of integration between OpenEnterprise and off-the-shelf business systems.

The object-oriented methodology also maps very well to the real world of SCADA and process control where the equipment monitored and controlled by the SCADA system is comprised of discrete "objects," such as wells, meters, valves, pumps, compressors, etc.

The compatibility of OpenEnterprise with both field infrastructure and business systems makes it a natural bridge by allowing complete integration of business processes, from the field to the board room.

## Distributed SCADA Installations

OpenEnterprise has been designed to permit the implementation of highly distributed SCADA systems, with multiple redundant servers deployed over large geographic areas, or with servers remote from the field devices.

The flexible design supports a wide range of different architectures, ranging from a single machine HMI to a multi-server, wide-area SCADA system with local and remote users. Whatever the size or complexity of the system, OpenEnterprise appears to operators as a single, integrated platform which can be expanded with additional servers and client machines.

Each server can support up to 1 million database points ("tags"), but options allow for economically priced systems with only a few hundred I/O points.

All communications between OpenEnterprise servers and clients are via TCP/IP and are supported over a wide range of physical and wireless media.

## Field Communications

OpenEnterprise is a true wide-area SCADA platform, designed to meet the challenges of field networks that often include communications channels with a combination of low bandwidth, high latency, and poor reliability. A wide range of communications infrastructure is supported, including licensed and unlicensed radio, satellite, cellular, and hardwired media.

OpenEnterprise supports a wide range of industry standard communications protocols, as well as supporting Emerson's own SCADA protocols (BSAP, ROC, and ROC Plus).

OpenEnterprise provides access to many third-party devices using Modbus and DNP3 protocols and an industry-standard OPC Client interface.

## OpenEnterprise Remote Device Interfaces (RDIs)

OpenEnterprise includes a number of device drivers for access to field equipment. These device drivers are installed on the main OpenEnterprise SCADA servers, and connect with the OpenEnterprise Communications Controller installed on the same server. These interfaces can be used to integrate the majority of RTUs and PLCs used within the oil and gas industries.

OpenEnterprise 3.2 supports the following protocols:

- BSAP (supports ControlWave and Network 3000 ACCOL™-based RTUs)
- ROC and ROC Plus (supports all devices using the ROC and ROC Plus protocols, including FloBoss™ measurement products)
- DNP3 (wide range of 3rd party PLCs and RTUs)
- Modbus (including IP Modbus, ASCII, RTU, Gould, Enron, and SCADA Pack extensions)
- Hex Repeater (for legacy AMOCAMS RTUs and Bristol 3340)
- OPC Data Access (DA) (for all devices with an available OPC DA 2.05 interface)

In addition, ControlWave products can act as data concentrators or virtual terminal servers, feeding data from a wide range of OEM devices into the OpenEnterprise server.

OpenEnterprise supports tight integration with ControlWave, ROC, and FloBoss RTUs and flow computers, using two separate RDIs (ROC RDI for the ROC & FloBoss products and BSAP RDI for the devices that support BSAP).

These RDIs include the ability to build the OpenEnterprise database directly from connected devices (no need to develop intermediate spreadsheets or CSV files to configure the system). Full integration with the configuration and diagnostic tools for these RTUs is supported, so it is possible to view both SCADA and field diagnostics side-by-side on a single screen, either remotely or on the SCADA server.

### ROC RDI

The OpenEnterprise ROC Remote Device Interface (ROC RDI) is a communications driver which allows an OpenEnterprise server to collect data from ROC and FloBoss field devices.

The ROC RDI has been developed to provide an easily

configurable interface between OpenEnterprise and any RTU/flow computer supporting the ROC or ROC Plus communications protocols, with OpenEnterprise acting as the ROC Master device.

The driver is fully configurable, and supports a wide range of functionality, including:

- Read/Write of current values
- Collection of historical data
- Collection of alarms and events
- Time synchronization
- Write individual parameter values
- Write grouped parameter values
- Support for Emerson RTU applications such as Production Manager, Tank Manager, and Gas Control Manager
- Support for Emerson's *Wireless*HART® Interfaces and Distributed RTU™ Networks

All data collected from ROC devices may be incorporated into the OpenEnterprise historical system, and may be "backfilled" following interruptions to field communications.

Standard templates for typical ROC historical configurations are included with OpenEnterprise, and EFM templates are also included for the ROC and FloBoss products.

## BSAP RDI

Bristol Synchronous Asynchronous Protocol (BSAP) is the standard protocol for communication to ControlWave and Network 3000 (33xx) products. Previous versions of OpenEnterprise required the OpenBSI communications suite for communications to these devices. In OpenEnterprise v3.2, the OpenBSI (and the associated RDI3000) have been replaced by an entirely new RDI, which supports many new features. These include:

- Automated database build direct from the RTU
- Read/Write access to lists and recipes
- Collection of EFM audits and historical archives

OpenEnterprise can also collect real-time data from ControlWave and Network 3000 RTUs using polling, Report-By-Exception, and alarm messages. Improvements in the configuration tools allow for additional diagnostics, including built-in data line monitors and communications statistics previously available only in OpenBSI.

# Communications Controllers (CCs)

The Communications Controller is a software package designed to manage multiple communications channels, protocols, and clients concurrently. The Communications Controller manages the interface between the Remote Device Interfaces (RDIs) and the physical network(s) in the field.

The Communications Controller supports multiple communications protocols per channel (for example, ControlWave and Modbus devices can co-exist on a single serial radio channel). It also supports multiple channels per device which allows for triple redundant communications paths. Another important feature is message prioritization, where critical control messages can take priority over less important historical data collection messages on the same channel.

Each OpenEnterprise server includes a single communications controller that can handle over one thousand field devices, and up to 10 additional Remote Communications Controllers can be installed on other PC servers accessible via LAN or WAN. The use of remote communications controllers allows for larger, more widely distributed systems and reduces the resource load on the main SCADA servers which no longer need to perform low level port/protocol management.

Each Communications Controller handles its own physical communications channels (serial and IP), together with any remote terminal (port) servers it is configured to use. Each Communications Controller can support both serial and Ethernet channels at the same time; using routers, terminal servers, switches, modems, etc. This facilitates communications over networks that use different configurations and/or multiple terminal servers. Each channel can then have different communication properties applied in OpenEnterprise.

The Communications Controllers can also support client applications other than the OpenEnterprise SCADA system. For example, RTU diagnostic tools such as ROCLINK and ControlWave Designer can access the RTU network concurrently, with the communications interleaved with regular data collection requests. These applications can either be installed on the OpenEnterprise Servers or connected remotely on OpenEnterprise Workstations (where it is also possible to perform configuration of the communications controllers).

# AMS Device Manager Interface

The OpenEnterprise v3.2 release adds a native interface to the AMS Device Manager, enabling seamless interaction and remote management and maintenance of HART and *Wireless*Hart® devices in wide area SCADA networks. The native OpenEnterprise v3.2 to AMS Device Manager enables the collection of both wired and *Wireless*Hart device data from Emerson ROC800, ROC800L, FloBoss 107, and ControlWave Micro RTUs without adding the additional expense and complexity of external HART multiplexers.

The OpenEnterprise AMS Device Manager Interface facilitates automatic retrieval of device alerts by the AMS Device Manager alert monitor, as well the ability to drill down to the devices and identify which devices need attention.

OpenEnterprise v3.2, working together with AMS Device Manager, allows users to extend the reach of their predictive maintenance capability out to remote assets, providing a proactive and powerful method of diagnosing potential device problems. As a result, it reduces the amount of trips needed to the field and helps avoid unplanned process shutdowns while improving safety, reliability, and profitability.

The OpenEnterprise AMS Device Manager Interface gives you the functionality to:

### OpenEnterprise 3.2 Server

- Add RTUs with HART devices to the OpenEnterprise database and then build the HART device hierarchy
- Define and control the RTUs and HART transmitters attached to them using RTU Tools
- Collect data from wired HART and *Wireless*Hart® devices

### AMS Device Manager

- Use the AMS Network Configuration utility with the OpenEnterprise HART server
- Request the device hierarchy for HART devices attached to the OpenEnterprise RTU network
- Configure the AMS Alert Monitor to monitor OPENENTERPRISE Alarm (Alerts) for individual HART devices

# DeltaV RTU Connect

Operating and maintaining multiple systems leads to increased costs and lost productivity. OpenEnterprise, through DeltaV RTU Connect, allows you to minimize these shortcomings by enabling Emerson's RTUs and flow computers to seamlessly interface with a DeltaV network. DeltaV RTU Connect provides remote communications, telemetry and connectivity to Emerson RTUs and flow computers, and the DeltaV system.

DeltaV RTU connect gives you the following functionality:

- Seamless bi-directional real-time communication between SCADA and DCS
- Easy-to-use configuration tool that auto-generates the DeltaV FHX file
- Centralizes historical RTU data and alarms with timestamps
- Receives real-time data and alarms, and sends RTU commands
- Propagates RTU alarm configuration (limits and deadband) through to DeltaV
- Communications management with modem, radio, satellite, IP network support
- Real-time database for propagation through DeltaV
- Historian for backfill operation and transfer to DeltaV
- Alarm handling to transfer RTU alarms to DeltaV PEH historian
- Supports Redundancy using OpenEnterprise redundancy and OPC Mirror Redundancy
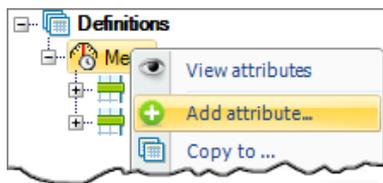
# Asset Models

Many SCADA systems can only provide support for discrete signals; the OpenEnterprise architecture includes graphical tools that allow users to create new tables within the database that model the data and behavior of field equipment. These tables contain records (known as "assets") for each piece of field equipment, and have associated alarms, historical data, and notes. It is also possible to associate reusable graphical symbols and displays with these assets.

Assets have another major benefit: the same assets can be used with different equipment configurations and even different brands of RTUs. A few mouse clicks is all it takes to "map" an asset to new field hardware. This allows for fast deployment of upgraded or replacement field equipment with no changes to the user interface or reporting.

It is also possible to link single display objects to multiple database objects concurrently, a technique used when the objects within the database are collected from different physical locations. It is not necessary for these objects to be contained within the same database or server; they can be distributed across a network of many servers.

In either case, the configuration of the HMI is greatly simplified and more closely reflects the system being controlled. Once the visual representation of a plant component (for example, a compressor) has been created, it can be linked to individual physical plant items without considering the details of the I/O or tags associated with the object. This significantly reduces the engineering cost and complexity in developing applications.

It is also possible to add database attributes to each deployed system to suit the application-specific requirements. For example, the OpenEnterprise system could contain an equipment maintenance database, cross-referenced to tag points, or it could hold geographical data linked to a Geographical Information System (GIS). All of this data is then accessible using operator workstations, or any of the supported communications interfaces.



*Asset Modeling*

## Action Engine

OpenEnterprise incorporates powerful tools which can be used to implement common server-based data management and communications tasks. In previous generations of SCADA these would often be manual tasks, or would require complex script-based programming to implement. The OpenEnterprise Action Engine provides a graphical configuration environment which allows the system administrator to develop "Workflows" – graphical macros that automates these tasks. Workflows reduce the time and resources spent on day-to-day system maintenance tasks, as well as reduce the risk of error involved when performing these tasks manually. Examples might include the uploading and validation of gas chromatograph data, and the transmission of this data to RTUs that require it for flow measurement. Similar examples might include the automated reconfiguration of flow computers after field hardware replacements (where the SCADA system will detect the loss of configuration, and will download the previously validated meter configuration to the new hardware).

Workflows can modify and monitor any data within the

SCADA servers, and can trigger and respond to communications events as well as creating alarms and events. They are typically triggered manually, or by changes in data. OpenEnterprise includes both the graphical configuration tools needed to develop Workflows and real-time debug and trace tools to monitor their performance.

## Calculation Server

The OpenEnterprise Calculation Server is used to perform computational calculations. The inputs to these calculations are values retrieved from the database, normally originating from field devices. The results of calculations are stored in the database, and are available for use within the user interface, reports, or historical storage. It is also possible to write calculation results back to any of the supported field devices.

A wide range of real-time and historical calculations can be performed, with many pre-defined functions included within the system. It is also possible for users to define their own standard functions (referred to as formulae), and to re-use these throughout the system with different parameters.

The calculation server can be used "standalone," where calculations are triggered on a scheduled basis (for example, to perform regular line pack or consolidation calculations). Alternatively, it can be used in conjunction with the Action Engine where calculations are managed and triggered as part of more complex workflows (for example, a workflow may collect gas analysis data from a gas chromatograph, and then use a series of calculations to validate the data).

## OpenEnterprise Reporting Suite

OpenEnterprise includes a powerful set of reporting tools. These allow the user to design and implement reports that include data from the OpenEnterprise historical and real-time databases, as well as third-party databases that are ODBC compliant.

The OpenEnterprise Reporting Suite can be installed and licensed on an OpenEnterprise server or as a "standalone" application on other networked PCs. A single licensed OpenEnterprise Reporting Suite can generate reports from multiple servers.

*Create customized reports in a variety of formats.*

The Reporting Suite contains three separate components:

- **Configuration Plug-in** – Configures the actual report's data content and appearance
- **Configuration Tool** – Creates new reports, schedules their production, and specifies how they are published
- **Scheduler** – Produces the final reports automatically based on the defined configuration

Reports can be created in a variety of formats, including:

- Paper (printed)
- Microsoft Excel
- Adobe Acrobat (PDF)
- Comma Separated Variable (as import to other systems)
- Tab Separated Variable
- XML
- HTML

Reports can also be published (distributed) in several ways:

- Email attachments (using POP3 or IMAP)
- File copy (to another machine)
- FTP (to a Web server)

Reports can contain any mixture of historical, real-time, or alarm and event data from multiple OpenEnterprise servers.

OpenEnterprise Workstation includes a Report viewer tool. This tool allows operators to select a date and time from a calendar, and to view (or publish) selected reports for that date. It is even possible to select an existing report and re-run it for pre-existing data, perhaps running a newly-developed report to compare current conditions with those several years ago.

## Electronic Flow Measurement (EFM) Package

OpenEnterprise Metering is an EFM package that combines historical and real-time configuration and event data from gas and liquids meters into consistent data structures for presentation and export to external EFM packages.

The product includes standard EFM templates for the ROC and FloBoss products, and allows for custom templates to be created for all other supported field devices (including 3rd party devices supporting Enron Modbus).

Once a template is created, you simply create a new meter instance from the template, specify which field device is supplying the data, and select which meter (in multi-meter devices) is to be used. Once the meter instance is created, you can schedule OpenEnterprise Metering to generate EFM reports/exports at regular intervals or create manual reports on demand.

OpenEnterprise EFM supports the following third-party packages:

- Flow-Cal versions 5 and 7 (CFX file export)
- PGAS version 4.2

## Alarm/Event Management

The real-time database maintains a record of all alarms, and logs all alarms and events to the historical database, as well as (optionally) to a simple text file. All alarms and events are accessible via the database access tools provided within OpenEnterprise. Assuming sufficient disk storage is available, the alarm and event history may be maintained indefinitely, and is accessible within seconds even when the events of interest may have occurred years ago. As an alternative, alarm storage can be configured to be cyclical. Cyclical alarm storage reduces the disk space required for long-term storage, but results in the eventual loss of the oldest records in the alarm/event history.

In addition, important OpenEnterprise system events (but not process alarms or events) are also logged to the Windows™ Event log.

OpenEnterprise includes a powerful Alarm and Event viewer component, which is normally used to provide a standard "alarm line" at the bottom of an operator's screen, as well as alarm and event summaries. All notable system events are logged to the alarm and event system, even if they may not be considered "alarms" (an example may be a user logging onto the system or modifying a signal value).
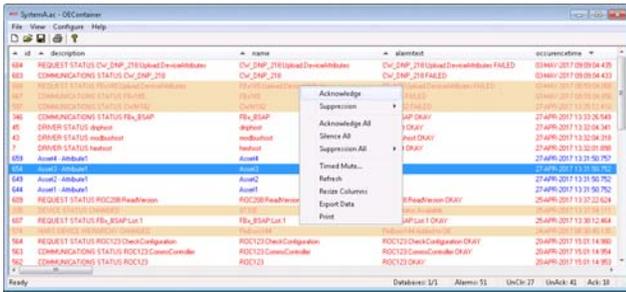
*Alarm client shows all current and unacknowledged alarms in real-time.*

## Categorization of Alarms

All OpenEnterprise alarms and events may be categorized in several ways:

- **Access Areas** – All objects in the system belong to access areas. The system can be configured such that individual operators (or groups of operators) only have access to certain areas of the plant. Each signal (and any alarms generated from it) can be allocated to a specific access area, and therefore is only visible to those users granted access to the area.
- **Plant area** – Each signal and alarm can be associated with a plant area, normally used to represent a physical split of the plant equipment.
- **Priorities** – Each alarm is assigned a priority. Typically this is used to indicate the severity of the alarm, but within the system it is also used to indicate how the alarm should be processed (that is, on which printers it should appear, which alarm summaries should show it; whether it should be auto-acknowledged or auto-cleared; which colors it should be presented in, or which sound should be issued at the workstation when it occurs). Each priority of alarm can be configured separately to determine its behavior.

OpenEnterprise incorporates full support for the remote alarming facilities within the range of ControlWave and ROC RTUs. This allows for alarms to be generated in the RTU, and (if necessary) buffered until they can be transmitted to the server. This ensures that no alarms are lost or events missed during periods of time when the server may not be in operation or communications outages are experienced.

All alarms may be "inhibited" to prevent alarm checking as if there were no alarm defined for the tag. Alternatively, alarms may be "suppressed." In this case, the alarm is still generated and logged to the database, but (optionally) is not displayed on the operator console. This reduces the visual "clutter" associated with nuisance alarms.

Alarms can be suppressed indefinitely, or for absolute or relative periods of time (perhaps allowing for maintenance to occur).

For alarms the following conditions are available, although not all are applicable to both digital and analog alarms:

- Greater than or equal (High and High-High)
- Greater than
- Less than
- Less than or equal (Low and Low-Low)
- Equal to
- Rate of change
- ON (changed true)
- OFF (changed false)
- Delayed ON
- Delayed OFF
- Toggle (changed)

Both external and internal alarm conditions can be in one of four possible states:

- Not In Alarm
- In Alarm Not Acknowledged
- In Alarm Acknowledged
- Cleared Not Acknowledged

Each state is represented by a different alarm color combination of foreground, background, and blink attributes within the Alarm Summaries. OpenEnterprise can mimic the behavior of most other competing SCADA systems, an important consideration when considering an upgrade where staff is already familiar with a standardized way of representing alarm conditions.

## Alarm Escalation

When an alarm remains unacknowledged for more than a pre-configured period of time, alarm escalation actions occur. Various escalation actions are supported, including changing the priority of the alarm; generating a new alarm; or changing the occurrence time (causing the alarm to return to the top of the current alarm summary). It is also possible to trigger a workflow when an alarm is escalated, or move the alarm to a different plant area (perhaps to attract the attention of a different group of operators). Note that this functionality is in addition to the supported Alarm Messaging Escalation.

## Alarm Viewer

Alarms and event lists can be displayed at the workstations in scrollable "Alarm Summaries," using the Alarm Viewer

component. The attributes of the alarm messages viewed within the displays can be selected from any of the attributes within the alarm or event list (over 60 are available), including:

- Alarm/Event priority
- Time and date of occurrence
- Alarm/Event description
- Name of Point (or object) in alarm
- Alarm Description
- Value causing alarm/event

Within the alarm summary window, it is possible to use selection criteria to filter the alarms/events to be viewed. Multiple selection criteria and wild cards can be used, and saved for later use:

- By Access Area
- By Asset
- By Plant Area (Site Name)
- By Priority
- By Operator responsibility
- By Alarm State
- By Point/Object Name (including wildcards)
- By Description
- By Date/Time

The Alarm Viewer also permits you to view a sorted history of all alarms and events that have occurred on the system.

From the Alarm Summary window it is also possible to export selected alarms to Microsoft Excel® with a single mouse click. This can be useful in constructing reports or emails.

OpenEnterprise allows alarms to be individually (or by priority) configured as "audible." If so, alarms sound with either the default Windows "beep" at the workstations where they display or using a custom audio file configured for the alarm priority. In this way, each alarm can be associated with a different sound at the workstation, with different sounds alerting operators to more serious problems. These can even include spoken announcements or warnings. The system also supports an external I/O driven "klaxon" output, which may be used to drive a plant wide audio alert system, in addition to the local workstation alert.

## Alarm Banner

The "Alarm Banner" component allows you to configure displays showing the quantity of outstanding alarms of various states (in/out of alarm, acknowledged/ unacknowledged) per plant area (note that, unlike the Alarm Viewer, it only shows quantities of alarms per Plant Area, not the actual alarms).

The Alarm Banner immediately indicates alarm activity anywhere in the system either on a local or system basis, while viewing other displays. Typically, it is used as an alternative to having a more traditional Alarm Viewer on display at all times.

## Alarm Messaging

OpenEnterprise supports the transmission of alarms to cell phones and email accounts. This feature means it is no longer necessary to purchase third-party packages or hardware to be assured that the operations staff is alerted to critical alarms when away from the control room environment. Simple filters can be constructed to handle specific alarm situations. For example, all "level" alarms can be sent to a particular group of operators while all "fault" alarms are sent to the maintenance department.

OpenEnterprise Messaging also supports alarm notification escalation, so that if the individuals primarily responsible for resolving a problem are unavailable or do not respond to their pages, responsibility can be escalated to alternative or expanded groups of individuals. The same alarm can be transmitted to different users in different pre-configured formats, to support the different physical devices capable of receiving the messages.

It is also possible to (optionally) allow remote users to acknowledge alarms from their mobile device, after entering a secure PIN number.

# OpenEnterprise Historical System

The OpenEnterprise Historian provides long-term storage of data and events sourced from the real-time database. It provides profiles of past manufacturing or process activity by capturing the data from the process and retaining it in an accessible format.

This data can be made available across the corporate network for use with common desktop spreadsheet, reporting, and database packages.

In addition to the powerful trending tools provided with the OpenEnterprise workstation, the OpenEnterprise Reporting package allows historical data to be published in a wide range of textual and graphical reports. Support for ODBC allows most third-party reporting and historical data analysis packages to work well with OpenEnterprise, either locally or across the network.

The Historian combines object and relational technologies, and is configured through a set of control tables that inform

the Historian what data objects to log and how to log them. This approach allows the Historian to log any information held in the real-time database, rather than being limited to the more typical logging of signal values against time.

Data objects required for long-term storage and analysis are allocated to historical "control groups." These groups specify the frequency of storage (logging can also be configured to occur on exception), the source of the data objects, and the "compression" types (if applicable). The group of data objects is then captured from the source and transparently passed to a raw historical data stream. The data objects within the historical data stream can then be fed into additional compressed data streams to produce (for example) hourly averages or daily minima.

As well as incorporating real-time data from the OpenEnterprise server, the historical system can be configured to save historical data collected from ROC and ControlWave RTUs. This allows the RTU to buffer historical data before transfer to the server, a common requirement where communications to the server are either poor or intermittent. Following a communication failure, the server's historical database is "backfilled" with the missing data.

The data objects collected for each stream are saved to a unique historical log file, which users can access using the OpenEnterprise trending tools or other tools using ODBC or SQL.

The system manager defines the basic rules governing the way sampled data is stored to the raw historical data stream. The system can sample data by polling at a defined rate and save this data in a compressed data stream; or, if preferred, the system can be tasked to perform continuous data sampling and save to the raw historical stream only on an exception basis when values change.

Within each compression stream, data objects are time compressed (to reduce the stored data volume) using a comprehensive list of Boolean and/or analog compression routines such as maximum, minimum, average, total, integral, standard deviation, on count, on percent etc.

Configuration and management of the Historian has been designed to be simple and secure. The historical configuration tool is a "wizard" utility that allows authorized users to add/delete objects online from the Historian data stream and create new compression groups of data.

It is also possible to configure the system using pre-configured SQL scripts. Although more suited to the "power user," this approach provides additional flexibility. It is

possible to export the historical configuration from one OpenEnterprise system, and import it to another – thus allowing for the offline development and test of the historian.

For long-term data storage, the Historical data streams can be configured to automatically archive data to disk for future online historical queries. These archive files can be moved to Network Attached Storage (NAS) devices as required. There is no limit (beyond available physical storage) as to the volume or age of data that may be stored for later retrieval. Users of the data need not be aware of the physical location of the data, or the file structures in which it is stored. All access is via industry standard tools and interfaces (typically SQL or ODBC).
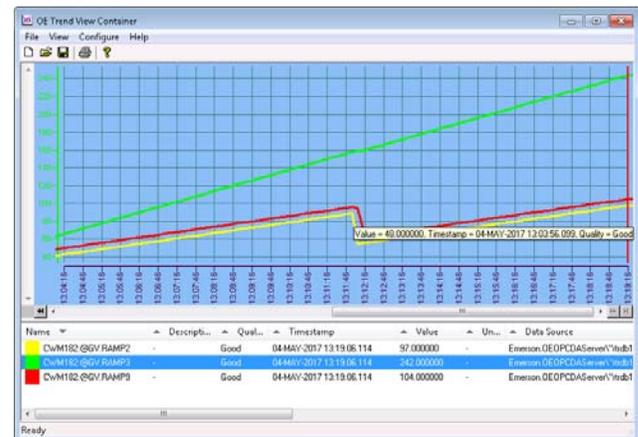


*Users can display all historical data at Workstations using the OpenEnterprise Trending package.*

Each user accesses the database and performs local analysis of process data via the desktop package that best matches their abilities and requirements. OpenEnterprise Terminal Services Workstation brings this data to the remote web browser. The OpenEnterprise Reporting Suite allows historical data to be distributed even further, using email and external web servers.

In order to simplify data access further for casual users who may be less experienced in the use of SQL, the system administrator can create SQL "views" on the server, which provide filtered data more suitable for end users. For example, you can create a view named Yesterday to show the previous day's hourly average, minimum, and maximum values for a set of signals. This would effectively be a "canned" set of data, available across the network for all users.

The Historian is normally configured for automatic archiving

of data to hard disk. System users may hold a number of archive files "online" for immediate access, with older archive files brought back online with only a few clicks of the mouse. The Historian creates an automated catalog for the system, logging the names and contents of all archive files created since system installation, and where they are currently stored. A user need only enter the signal name and time period for data they are interested in, and the system can locate it, even if it has been archived.

Redundant OpenEnterprise systems maintain two separate copies of all historical data, to provide an additional level of protection of critical data.

# Server Management and Configuration

OpenEnterprise provides a set of tools that allows the user to configure and monitor the SCADA system hardware and software components. OpenEnterprise security can be used to limit access to these tools. Many of these OpenEnterprise tools are available at all operator workstations.

## Project Explorer

OpenEnterprise server configuration is performed using the Project Explorer. This provides a graphical tree view of the communications networks associated with the SCADA system. Context sensitive links to OpenEnterprise and RTU configuration tools provide access to utilities that can be used to monitor and modify the communications infrastructure.

Project Explorer also contains all the tools needed to configure other aspects of the system, and can be used to monitor and configure both local and remote servers – it is the dashboard for configuring and monitoring your network of OpenEnterprise servers.

## Security System

The Project Explorer is where OpenEnterprise Security is configured, using the Security Administration tools.

OpenEnterprise System administrators may create and modify users, define groups of users, and grant or revoke privileges for individual users or groups. Privileges such as viewing trends or displays can be based on functional groups or can be very specific, such as not permitting the addition of pens to trend or the acknowledgement of alarms.

It is possible to prevent operators from modifying values of specific tags or groups of tags; and read/write access can be specified down to the individual attribute of any signal or

asset, or by using filters (for example, all operators and technicians may modify setpoints, but not alarm limits). The configuration tools include a "test component," which allows an administrator to very quickly determine if a user (or group of users) has the privileges to access an individual tag or OPC Item. This feature can significantly reduce the time needed to resolve security configuration issues. As shipped, the system includes a default security configuration, intended to meet typical industry requirements. This includes five levels of users, from Administrator through Operator to "Guest." This can be easily modified to add more levels, each with individually-defined functions and privileges.

It is possible to configure the system for multiple servers to share the same security configuration, and to act as backup security servers, in a similar manner to Windows Domain Controllers. This improves system management in distributed systems with multiple servers.

In addition to the token-based security which is used primarily to control the privileges of authorized users, there is a standard SQL grant/revoke privilege based security system implemented at the database level. Typically, this security will be implemented by those more familiar with database technology, with the primary purpose being to provide protection for the SCADA database from unauthorized intrusion via the SQL or ODBC interfaces.

Optional integration with Microsoft's Active Directory allows you to associate an Active Directory user account with an OpenEnterprise user account, enabling the AD user to automatically log into OpenEnterprise just by logging into Windows. This improves overall security.

## Database Explorer

The OpenEnterprise Database Explorer is an easy-to-use tool, installed on OpenEnterprise Workstations, but used for interacting with the OpenEnterprise servers. It has the look and feel of Microsoft Windows Explorer and provides the user with the capability from any OpenEnterprise workstation or server to:

- Connect to any OpenEnterprise database via LAN or WAN.
- Display database table definitions and structure ("schema") and the objects within those tables using drag, drop, point and click methods.
- Allow free format SQL data access.
- Permit – through user-extensible OEMenus – the addition of application-specific functionality to the

tabular views (Database Object Views) used to show data. For example, the end user can add the ability to modify any data directly from the database, to add "notes" directly to the data, or to edit the database contents. For large systems, these queries can be used as context sensitive navigation tools.

Database Explorer includes full online documentation of the standard database tables and attributes, which is available by right-clicking on any table or attribute and selecting **Help** from the pop-up menu. This provides advanced users with full access to the entire database schema documentation from within the product. Use of Database Explorer, like all other OpenEnterprise configuration tools, is controlled by security.

## Flexible Fault-Tolerant Solutions

OpenEnterprise supports system designs that offer a high degree of system availability. Some example configurations include:

### Redundancy

In this arrangement, two physical servers are configured as OpenEnterprise servers. At any moment in time, one of the two machines is "master" and one is "standby." The master server provides a continuous update of all data changes (on exception) to the standby server on a dedicated TCP/IP network segment.

If the master server fails, the standby machine automatically becomes the master server with its database up-to-date with the status of the field equipment. A changeover to the standby machine may be initiated by any of the following mechanisms:

- Soft switch (manual intervention)
- Critical software process failure
- Detected hardware failure

The switch over between master and standby is normally automatic, following a failure.

An important feature of the OpenEnterprise redundancy system is that it automatically synchronizes the contents of the historical and real-time databases on the two servers, including system configuration data.

### Distributed Systems

OpenEnterprise server components can be distributed over a local or wide-area network. In large SCADA applications, this allows components to be distributed on separate hardware platforms.

Typically, this is used where – either for reasons of economy or robustness – multiple plants must be controlled from either a single or multiple locations. For example:

- A large production asset may be split into separate geographical regions, each with its own server (to provide some degree of fault tolerance – loss of a single SCADA system will only affect part of the asset). Although the system contains multiple servers, each operator workstation (and a single control room) can interact with all servers and RTUs concurrently.
- OpenEnterprise is ideally suited to distributed SCADA configurations where multiple plants or facilities are linked together but each still requires its own local control, monitoring, and data storage. OpenEnterprise allows operators at any facility to monitor and control either local or remote equipment, independently of their current location. Each RTU or PLC can supply data to a local OpenEnterprise server (or redundant pair of servers), which manage and archive historical and alarm data. If workstations or other servers require this data, it is supplied to those locations on an "as required" basis without impacting local communications to the RTUs and PLCs. This approach adds significantly to performance, especially in the case where RTUs are remotely located on radio or other low-bandwidth connections.
- A separate backup server may be configured identically to the server located on site, but be located remotely. In the case of a disaster scenario (such as fire) at the primary control center, the backup control center would take over from the primary control center.

## Standard Communications Technology

One of the most important features of OpenEnterprise is that it supports client/server architectures, with support for multiple clients and servers within any configuration. All the individual software components communicate via TCP/IP rather than using complex proprietary transport mechanisms such as DCOM. As a result, OpenEnterprise:

- Supports distributed client/server architectures using

TCP/IP for communication between processes on the same physical machine or between processes on separate CPUs or machines (perhaps physically separated by thousands of miles). It is possible to support both OpenEnterprise Server and Workstation on a single machine or distribute the processes across a number of separate machines. This provides a high degree of system scalability, fault tolerance, and flexible network topologies.

- Provides compatibility with the most common network connections available today (including CDMA, GPRS, Wi-Fi®, wireless radio, and the Internet). OpenEnterprise components can communicate via any communications layer or device that supports the TCP/IP protocol and permits socket-to-socket connections. Firewalls and VPNs are also supported.

- Supports OEM communications hardware available for a very wide range of physical communications media, including copper, satellite, radio, and fiber. There is generally an off-the-shelf TCP/IP solution available for almost any communications requirement encountered within the SCADA industry.

# Data Access from OEM Applications

As previously mentioned, OpenEnterprise contains a high-speed, object-oriented database engine, optimized for the SCADA environment. In contrast, most business systems are still heavily reliant on the relational model for data access and manipulation.

In order to ensure complete integration with OpenEnterprise and existing MIS/IS and desktop applications, OpenEnterprise supports a wide range of traditional relational database access tools and interfaces.

## Structured Query Language (SQL)

An ANSI-compliant (ISO 9075, 1989) SQL Client is provided on all OpenEnterprise Servers to permit command line SQL access to the OpenEnterprise Server database contents. This can also be used for running SQL scripts (simple text files containing SQL commands), or simple data import/export utilities, often used to provide compatibility with legacy systems. The SQL Client can also be used for configuration of the system, and modification of the database schema.

OpenEnterprise also includes an ActiveX® component, the Database Object Viewer (DOV), which allows SQL queries to be displayed within other applications.

Standard SQL only supports snapshot queries where the data

is returned to the client when the query is issued, and is only changed if the client re-requests the data. A unique feature of Database Object Viewer is that clients can request that the SQL query remains active. After the data is initially returned to the client, a copy of the query is kept at the server, and any subsequent changes in the result set are immediately sent, by exception, to the initiating client.



*In a powerful extension to SQL, OpenEnterprise provides the ability to issue "Active Queries" against the OpenEnterprise server.*

This functionality allows the construction of tabular displays using SQL, where the output is the real-time results of an SQL Query. Using this technique, it is possible to build displays that show information that would previously have required custom programming – for example, a list of all the currently Control Inhibited (forced) signals on the entire system, a list of failed RTUs, or a list of users connected to the server. It is also possible to configure Active SQL Query Windows to permit the user to modify the database (and RTU information, where appropriate) from a simple right-click menu.

## Open Database Connectivity (ODBC)

Almost all of the spreadsheets, database, reporting packages, and development environments within the PC environment provide easy-to-use graphical tools which use Microsoft's Open Database Connectivity (ODBC) to provide connectivity to a wide range of databases, including OpenEnterprise.

ODBC access to all data/configuration information on an OpenEnterprise installation is possibly the most useful feature of the product, allowing real-time or historical data to be incorporated into almost any ODBC Compliant desktop application with a minimum of effort.

## Object Linking and Embedding for Process Control (OPC DA & AE)

OPC is not normally considered a relational database access tool. It was originally developed as a standard to provide HMIs with access to a wide range of proprietary RTUs and PLCs. OpenEnterprise supports this functionality with the OPC Remote Device Interface.

In addition, OpenEnterprise supports 3rd Party OPC DA (Data Access) and AE (Alarm and Event) clients accessing real-time data held within the SCADA database.

The OPC DA interface also provides data to the OpenEnterprise Workstation displays, and is highly optimized for transfer of large amounts of rapidly changing data from server to client.

There is a wide range of 3rd party applications available that use OPC to collect data; all such applications are able to access the process and configuration data held within the OpenEnterprise server. Packages are available for plant and system modeling, historical data analysis, and web server interfaces. Most of the other available SCADA HMI packages are also able to display data from OpenEnterprise servers using the OPC interface.

The Alarm & Events OPC Server can be used to feed alarm related information to 3rd party alarm management packages, such as Iconics AlarmWorX®.

OpenEnterprise's ability to provide data to third-party OPC Clients and collect data from third-party OPC servers makes it the ideal product to select when looking for a solution to integrate a wide range of third-party hardware and software products.

# OpenEnterprise Workstation

OpenEnterprise Workstation is a software package that provides operators, technicians, and management with full access to all the real-time, historical, and diagnostic data gathered by the OpenEnterprise servers. The easy-to-use Human Machine Interface (HMI) integrates all aspects of SCADA management into a single package that is compatible with Microsoft Windows (see the end of this document for full details of supported platforms).

For remote access, OpenEnterprise Workstation functionality is supported for remote users within Internet Explorer® or Microsoft Windows Remote Desktop, without the need to develop new displays or change the application configuration.

The OpenEnterprise Workstation package includes a powerful set of tools in an object-oriented HMI development environment that enables an engineer to quickly create intuitive windows-based graphical front ends for the control and management of industrial processes. No programming knowledge is required to create very powerful user interfaces.

The two main tools are OEDesktop and OEGraphics. These, combined with a number of other components, are used to construct the installed system's HMI.

Once assigned the required security privileges, a user of any OpenEnterprise Workstation can create and edit display mimic files. The process of display creation is discussed in detail later in this document. There is no need to purchase additional packages or licenses to permit display editing. No compilation or "release" process is required – all workstation displays and other components can be changed and viewed in real-time without interruption to normal operations.



*Easy to use Graphics engine enables the rapid development of attractive mimics.*

## OEDesktop

The OEDesktop is a "container" application used to manage the other windows and applications within the Workstation environment. The user can control the position and location of Windows (including third party applications supporting the Microsoft ActiveDocument standard).

Within the OEDesktop, each window can be one of three types: a standard Multiple Document Interface (MDI) window; a docked window (effectively fastened to one edge of the screen); or a floating window (windows which float above all the MDI and docked windows on the screen).

A desktop window can either contain a Mimic Display, Data Object Viewer, Alarm Banner, Alarm Summary, Trend Window, OEM Active Document, Notes Viewer, Web View or ActiveX® Control. Many windows can open concurrently –

only system resources and physical screen space limit the number. Once a layout of multiple windows has been configured, it can be saved and recalled later, allowing individual users of the system to configure their own operator environments or save different environments for different operating scenarios.

The OEDesktop also provides facilities for building custom menus, both "dockable" menu bars and "right-click" menus. In general, these menus can be attached to objects within any of the supported window types. Most of the systems deployed use these menus to make the system intuitive to use; no piece of information is ever more than a few mouse clicks away, and operators use the keyboard only when they have a value to type.

An extremely powerful feature of the custom menus is the ability to transfer information from window to window while simultaneously implementing commands. For example, it is possible to implement an interface where the operator observes, in an Alarm Banner, that a "critical" alarm has occurred in an area of the plant. They would right click on the affected plant area, and select the "show alarm list" option. This brings up a list of the alarms in the affected area, and seeing an alarm; they can then select that alarm and launch a trend of the signal, showing its value over the last few hours.

Similarly, an operator may call up an overview display from the alarm summary for the specific alarm, and from there take the actions required to make the plant safe while the problem is investigated. All of these links between applications are created using the custom menu tool (OEMenus) within the OEDesktop, and do not require programming or scripting to implement.

A single OpenEnterprise Workstation can host multiple OEDesktops concurrently. Typically, this feature is used when multiple monitors are attached to a single PC. A single OpenEnterprise desktop is normally used per monitor, using the window management tools to manage the windows on that monitor. For example, one monitor may be configured for various alarm management screens, while another may include a map overview, and another may show process displays.

## Display Builder (OEGraphics)

The OEGraphics display builder tool enables display (mimic) designers to configure object-oriented high resolution, vector-based process mimics for data sourced from the OpenEnterprise servers.

OEGraphics is used to:

- Develop new mimics in a Microsoft "look-and-feel" environment, similar to PowerPoint®.
- Add/delete/save new mimics online.
- Define mimic backgrounds (solid color, shading, or bitmaps).
- Import BMP, JPG, GIF; Microsoft Clipart, and AutoCad®.
- Create and save in a user-defined symbol library both static and dynamic graphical objects that can be displayed within a process mimic.
- Define security access to objects, including displays.
- Assign foreground, background, line, and shadow colors to all objects.
- Assign and display any attribute of any process database point. All numeric data can optionally display a quality tag along with other tags to indicate whether it is in Alarm Inhibit/Enable, Manual Inhibit/Enable, and Control Inhibit/Enable. It is important to realize that almost any attribute of any object within the OpenEnterprise server database can be displayed within the workstation environment, including objects in tables or assets created by the user.
- Display data as animated objects, such as graphical bar-graph format, irregular fill vessel, or rotating pump impellers.
- Position an object anywhere on a graphic background using standard windows select, drag, drop, and re-sizing with the mouse.
- Embed ActiveX components within displays – either supplied by Emerson or those from other vendors.
- Define links that, when selected, call up other displays in a pre-defined position and size, or replace the existing mimic in the current window. Links can also be used to enable "pop-ups" (reduced size or inset mimics) which can be displayed while maintaining the current mimic on display. These are typically used for the implementation of features like auto/manual control panels.
- Print mimics.
- Define layers within the display, used to determine which objects will be visible at which zoom levels. This provides significant flexibility in supporting "declutter," reducing the level of detail visible on the display when shown at low magnification.

In addition to these tools, standard editing tools facilitate mimic creation within the Display Builder, namely:

- Cut, paste, copy, duplicate, multi-level undo, redo, and

select all
- Snap to grid, toolbars, zoom factor, alignment, re-size, group/ungroup, back, front, flip, mirror
- Drawing utilities:
    o Object Rotation
    o Object Reshape
    o Zoom
    o Line
    o Style of Line
    o Square
    o Fill
    o Rectangle
    o Oval
    o Circle
    o Arc
    o Polygon
    o Freeform
    o Text

## Display Object Re-use

In SCADA systems there is often a high degree of replication of the same object types and mimics. OpenEnterprise uses object-oriented design methods to minimize the design and testing process. Subsequent changes to these objects can be made globally (across all displays), thus reducing maintenance effort further.

OEGraphics (like all other OpenEnterprise Workstation components) incorporates a powerful function called "aliasing," in which all or part of a name tag may be replaced at run time, changing the links between the display and the database. This facility allows a single display object to be re-used many times, significantly reducing development effort.

OEGraphics is an ActiveX container. This facility allows the "embedding" of ActiveX controls supplied by Emerson and others within displays. Every attempt has been made to ensure that OEGraphics is compatible with the widest range of these products. However, it is strongly recommended that tests are conducted of any such OEM components for compatibility with the OpenEnterprise system before committing to their use within installed systems.
All OEGraphics displays incorporate support for Microsoft's Visual Basic for Applications (VBA), VB Script (VBS) and Java Script (Jscript). These industry standard programming languages provide access to the data and functionality within the OpenEnterprise displays, and can also be used to communicate with external OEM applications, or manipulate data within displays. In general, most systems can be built without using the included scripting engines, but having them

available provides additional flexibility.

## WebView

WebView allows operators to access web pages from within the OEDesktop, just as if they were another display. This allows integration of data from both Emerson and third-party web-based applications without giving operators access to a standard web browser. Possible uses are for access to mapping systems, maintenance packages, or weather data. Aliases can be passed to the WebView as part of the URL, and the OpenEnterprise Security System is used to control operator access to the remote system.

## Trend Viewer

OpenEnterprise incorporates a flexible trending system, which can trend any real-time or historical data stored in the OpenEnterprise server(s) within an installed system. No server configuration (beyond ensuring the value is logged) is required; all configurations are performed at the OpenEnterprise workstation using the OETrend window.

OpenEnterprise makes it very easy for operators to add their own trends to the system. It is possible to simply drag values from real-time displays into a trend to create a historical or real-time trend of the point. It is also possible to configure the system so that operators can right-click on alarms or tables of data, and trend the selected point and associated variables. As an example, clicking on a low pressure alarm might trend the pressure, flow, and set point for that location with a single action. These trends can then be saved for later re-use by the operator.

All windows may be re-configured, moved, and re-sized within the workspace. Within a trend window, a user can customize the appearance of the trend. Users, subject to security, are able to configure the following at runtime:

- Assign style and color of pen plot
- Assign multiple signals to a trend base, with common or independent Y-axis
- Enable/inhibit the display of signal attributes (such as tag name, units, current value, and Engineering units)
- Change the color of a pen based on the quality of data, or any other historical or real-time parameter
- Move a cursor to determine value and time of intersection with the plot(s)
- Zoom both value and time axis, using select and zoom functionality
- Assign points from a configured historical data stream for trending

- Add or delete pens to/from the trend window
- Define time period and compression type for historical data retrieval (including different historical periods for each pen for comparing different time periods)
- Print the graphical trend
- Change the appearance of the grids and axes within the trend window
- Change the appearance of the trend background (either a solid color, graduated shading, or graphic file can be displayed)

A powerful feature of the trend system is the ability to export the visible data to a Microsoft Excel file (effectively providing a tabular trend) or to BMP or JPG files (typically for emailing or use in other documents).

### OpenEnterprise Notes System

OpenEnterprise incorporates a facility for attaching "notes" to objects within the database. Operators would typically use these to pass messages to other system users regarding specific items of equipment. For example, a note could be added to the system explaining why a specific signal was control-inhibited. The notes are "attached" to plant objects as if they were virtual "sticky notes."

In addition, it is possible for system users to send message notes directly to other users. This is similar to email except that all such messages are logged within the server. Optionally, such messages can also be configured to generate alarms, drawing operators' attention to high-priority notes.

### Thin Client Access

OpenEnterprise supports Microsoft Remote Desktop for remote or "thin client" access to the system. This allows remote users to use Internet Explorer or a supported Microsoft Remote Desktop client to access the full range of OpenEnterprise Workstation functionality.

To use OpenEnterprise Remote Desktop (OERD), install the standard OpenEnterprise Workstation package on a Windows 2008 or 2012 server running Microsoft's Remote Desktop Services, and install a multi-user OERD license on the server.

Depending on the performance of the Windows server, approximately 25 remote users can concurrently access a single Remote Desktop Server. Multiple servers can be deployed to increase this number. OERD is ideal for the customer who has already developed an operator HMI using the OpenEnterprise Workstation product. No re-engineering

of displays, trends, or other desktop components is required to provide a web-based user interface. It is a true operator workstation.

### Workstation Localization

Workstation Localization enables your operators to use their OpenEnterprise workstations in their native language. Using the Translation Manager utility, a system administrator configures localization using a language pack file which contains translated content for the standard OpenEnterprise product (product translations) as well as any customer-specific translated content (project translations). For further installation and configuration information, see the *OpenEnterprise Workstation Localization Reference Guide (D301807X012)*.

## In Summary

OpenEnterprise has been designed to meet the needs of the customer looking to make SCADA and process data available throughout the organization via a consistent and standard user interface.

Support for a wide range of field infrastructure allows the best use of installed equipment. Data abstraction allows the complexity (and diversity) of the field equipment to be hidden from operators and corporate users, reducing the training and resources needed to fully benefit from the information supplied by the system.

OpenEnterprise incorporates the experience Emerson has gained in a wide range of industries over several decades and generations of SCADA products. It is the ideal solution for the user who wants to make their SCADA solution a part of the business process, and incorporates many features to substantially reduce both the timescales and initial installation costs, as well as lifetime cost-of-ownership.

## OpenEnterprise SCADA Suite

| Operating System Requirements | |
|---|---|
| Server | Microsoft® Windows® 10 SP1 (64-bit) |
| | Microsoft Windows 7 SP2 (64-bit) |
| | Microsoft Windows Server 2008 R2 SP1 (64-bit) |
| | Microsoft Windows Server 2012 R2 (64-bit) |
| Workstation | Microsoft Windows 10 SP1 (64-bit) |
| | Microsoft Windows 7 SP2 (64-bit) |
| | Microsoft Windows 7 SP2 (32-bit) |
| Single Box Solution | Microsoft Windows 10 SP1 (64-bit) |
| | Microsoft Windows 7 SP2 (64-bit) |
| | Microsoft Windows Server 2008 R2 SP1 (64-bit) |
| | Microsoft Windows Server 2012 R2 (64-bit) |
| Workstation Terminal Server | Microsoft Windows Server 2008 R2 SP1 |
| | Microsoft Windows 2012 R2 |
| Remote Communications Controller | Microsoft Windows 7 SP2 (32-bit) |
| | Microsoft Windows 7 SP2 (64-bit) |
| | Microsoft Windows Server 2008 R2 SP1 |
| | Microsoft Windows Server 2012 R2 |
| Standalone OPC Standalone ODBC | Microsoft Windows 7 SP2 (32-bit) |
| | Microsoft Windows 7 SP2 (64-bit) |
| | Microsoft Window Server 2008 R2 SP1 |
| | Microsoft Windows Server 2012 R2 |
| Reporting Server | Microsoft Windows 7 SP2 (64-bit) |
| | Microsoft Windows Server 2008 R2 SP1 |
| | Microsoft Windows Server 2012 R2 |
| | Microsoft Office 2010 (32-bit application) |
| | Microsoft Office 2013 (32-bit application) |
| Messaging Server | Microsoft Windows Server 2008 R2 SP1 |
| | Microsoft Windows Server 2012 R2 |
| | Microsoft Exchange 2007 |

**Notes:**

- Microsoft Server 2012 Remote Communications Manager requires 1 Device CAL.
- Microsoft Server 2012 Workstation requires 1 User CAL.
- Microsoft Server 2012 Terminal Services Server requires 1 Remote Desktop CAL per concurrent user or client.
- Emerson Automation Solutions does not provide the Microsoft CALs (purchase it directly from Microsoft).
- Microsoft Operating System (OS) running English Base Language is required.

| Hardware Requirements (Minimum) | | |
| --- | --- | --- |
| OpenEnterprise Server **Simplex** (50 RTUs) OESL1 | Processor | Intel® Xeon® 4C/8T 3.40 GHz, 8 MB Cache or better |
| | Memory | 16 GB or better |
| | Hard Drive | 120 GB (*see HDD sizing note*) |
| | I/O | Specific to deployment |
| | RAID Controller | RAID 5 (*see HDD sizing note*) |
| | Communications | Ethernet: 2 NICs (LAN + Redundancy) Serial: Specific to deployment |
| | Video requirements | SVGA or better (If Server/Workstation DirectX® 9 compatible) |
| | Video RAM | 32 MB or better |
| | Preferred/suggested hardware manufacturer | Dell |
| OpenEnterprise Server **Pro** (250 RTUs) OESL2 | Processor | Intel Xeon 4C/8T 3.40 GHz, 8 MB Cache or better |
| | Memory | 16 GB or better |
| | Hard Drive | 120 GB (*see HDD sizing note*) |
| | I/O | Specific to deployment |
| | RAID Controller | RAID 5 (*see HDD sizing note*) |
| | Communications | Ethernet: 2 NICs (LAN + Redundancy) Serial: Specific to deployment |
| | Video requirements | SVGA or better (If Server/Workstation DirectX 9 compatible) |
| | Video RAM | 32 MB or better |
| | Preferred/suggested hardware manufacturer | Dell |
| OpenEnterprise Server **Max** (Unlimited RTUs) OESL3 | Processor | Intel Xeon 4C/8T 3.50 GHz, 8 MB Cache or better |
| | Memory | 24 GB or better |
| | Hard Drive | 120 GB (*see HDD sizing note*) |
| | I/O | Specific to deployment |
| | RAID Controller | RAID 5 (*see HDD sizing note*) |
| | Communications | Ethernet: 2 NICs (LAN + Redundancy) Serial: Specific to deployment |
| | Video requirements | SVGA or better (If Server/Workstation DirectX 9 compatible) |
| | Video RAM | 32 MB or better |
| | Preferred/suggested hardware manufacturer | Dell |
| **HDD Sizing Note:** | | Microsoft's recommended hard drive size for Windows® Server is 120GB. In addition to the operating system and installed software, an additional 8 GB plus 25 bytes for each historical sample is required. All server hard drives should be RAID 5 (which requires a minimum of 3 drives) or similar fault-tolerant solution. |
| | | For example, assume 1,000 signals or tags stored for 1 year on a local hard drive with logging occurring every minute: 1,000 x 25 x 1,440 x 365 = 13,140,000,000 bytes (or 12.24 GB) plus 8 GB overhead = 20.24 GB. |
| | | For larger servers, contact your OpenEnterprise sales representative. |

| | | |
|---|---|---|
| OpenEnterprise Workstation | Processor | Dual-core (3.1 GHz, 3M Cache) or better |
| | Memory | 4 GB or better applies when using Windows 64-bit versions |
| | Hard Drive | 80 GB |
| | I/O | USB for OpenEnterprise Graphics |
| | Video Requirement | DirectX® 9 compatible (minimum Windows® 7 Requirement) |
| | Preferred/suggested hardware manufacturer | Dell |
| OpenEnterprise Terminal Server - Deployment Scale (25 Pack Concurrent User Pack) | Processor | Intel® Xeon® 4C/8T 3.50 GHz, 8 MB Cache or better |
| | Memory | 16 GB or better |
| | Hard Drive | 120 GB or better |
| | RAID Controller | N/A |
| | Communications | Ethernet: 2 NICs (LAN + Redundancy) Serial: N/A |
| | Video resolution | SVGA or better |
| | Video RAM | 32 MB or better |
| | Preferred/suggested hardware manufacturer | Dell |
| Remote Communications Controller, Standalone Reporting, Standalone Messaging, and Standalone ODBC | Processor | Dual-core (3.1 GHz, 3 MB Cache) or better |
| | Memory | 4 GB or better |
| | Hard Drive | 80GB |
| | I/O | N/A |
| | Video Requirements | If Windows Server, SVGA or better If Windows 7, DirectX 9 compatible |
| | Preferred/suggested hardware manufacturer | Dell |
| **Database Sizing** | | |
| SCADA Points / Tags | 1.5 million (number of items in the database) | |
| Memory/tag | Average is 4k per tag (1.5m tags = 6GB) | |
| Tag collection | 10,000/s at the database | |
| History logging rate | 1 s (maximum) | |

| Database interfaces | |
| --- | --- |
| OPC  DA Client | 50,000 Tags (maximum) |
| OPC DA | Version 2.05a |
| OPC A&E | Version 1.1 |
| SQL | |
| OSISoft Pi | Version 2012 |
| **Number of RTUs or Flow Computers** | |
| Number of RTUs | 3,000 (BSAP/Hex) <br> 1,000 (ROC) <br> 500 (DNP3) <br> 1,500 (Modbus) |
| Number of RTUs per Remote Communications Controller | 600 (maximum) |
| **Communications Controller (CC)** | |
| Serial Channels | 10 |
| Terminal server ports | 16 |
| IP Channels | 20 |
| **Remote Communications Controller (RCC)** | |
| Number of RCCs connected to OpenEnterprise Server | 10 (maximum) |
| Serial Channels | 10 |
| Terminal server ports | 16 |
| RTUs per RCC | 600 (note – See RTU Grid above) |
| IP Channels | 1 |
| **DeltaV RTU Connect** | |
| DeltaV | Version 12.3.1 |
| OSISoft PI | Version 2012 |
| OpenEnterprise | v3.2 |
| **Meters** | |
| Maximum number of Meters | 2,000 (Assuming 1:1 with RTUs) |
| Average time to publish | 8 seconds per meter file <br> Containing 35 days (Assuming 1 record an hour) |

| Historian | |
|---|---|
| Size of log file | 500 MB (maximum)<br>50 MB (maximum) buffer size |
| Supported online historical data | 1,000,000 tags per hour stored for 3 years<br>**Note:** Although OpenEnterprise can manage up to 3 years of 1,000,000 tags per hour, the total size of the archive files stored depends on the hard drive capacity of your server. Refer to the *HDD Sizing Note* on page 18. |
| Disk Space Required | 25 bytes per historical sample (under 10K signal, with 1 minute collection) |

| Supported RTUs and Flow Computers | | |
|---|---|---|
| ROC and ROC Plus | DL8000 | Firmware v2.31 and newer |
| | FB103/104 | Firmware v2.15 and newer |
| | FB107 | Firmware v1.61 and newer |
| | FB407 | Firmware v1.08a |
| | FB503 | Firmware v2.15 |
| | FB504 | Firmware v2.48 |
| | ROC300 FP | Firmware v2.2 and newer |
| | ROC800L | Firmware v1.31 and newer |
| | ROC800 Series 1 | Firmware v2.16 and newer |
| | ROC800 Series 2 | Firmware v3.52 and newer |
| BSAP | 33XX | Firmware v4.45 and newer |
| | ControlWave (EFM, Micro, PAC, RED) | Firmware v5.5 and newer |
| | TeleRTU | |
| | TeleFlow | |
| Modbus | ControlWave (EFM, Micro, PAC, RED) | Firmware v5.5 and newer |
| | ROC800 | Firmware v3.5 and newer |
| | S600 | Firmware v6.21 |
| | S600+ | Firmware v6.21 and newer |
| | FB1000-Series | Firmware v1.00 and newer |
| | FB2000-Series | Firmware v1.00 and newer |
| DNP3 | ControlWave (EFM, Micro, PAC, RED) | Firmware v5.5 |
| HEX | 3340 | |

| Supported Emerson SmartProcess Oil & Gas Applications | | |
|---|---|---|
| ROC800 (Firmware v3.71) | ROC Plus Protocol | AGA 3, AGA 7, AGA 8 |
| | | Daniel Gas Chromatograph Interface |
| | | V-Cone®-User Program |
| | | Production Manager Series |
| | | Cause & Effect |
| | | FOUNDATION™ Fieldbus |
| ROC800L (Firmware v1.51) | Liquids Protocol | AGA 3, AGA 7, AGA 8 |
| | | Daniel Gas Chromatograph Interface |
| | | V-Cone®-User Program |
| | | Cause & Effect |
| | | Micro Motion Coriolis Interface |
| | | Liquid Calcs_800L |
| | | Batching_800L |
| | | BatchQueue_800L |
| | | Proving_800L |
| | | Reporting 800L |
| | | Gas Chromatograph Interface |
| DL8000 (Firmware v2.41) | Preset Protocol | AGA 3, AGA 7, AGA 8 |
| FloBoss 107 (Firmware v1.81) | ROC Protocol | AGA 3, AGA 7, AGA 8 |
| | | Gas Chromatograph Software Interface Program |
| | | V-Cone®-User Program |
| | | Linear Meter  Flow Calculation Program |
| | | Steam and Water Properties Program (IAPWSD-IF-97) |
| | | Continuous Liquid Allocation Program |
| | | DS800 Runtime |
| | | Daniel Net Oil Calculation Program |
| | | Cause and Effect Program |
| | | Micro Motion Coriolis Interface |
| | | Auto Adjust Turbine Meter Program |
| | | Params UsrC |
| | | FOUNDATION Fieldbus |
| ControlWave EFM | BSAP Protocol | Station Manager 4.0 |

| **OpenEnterprise AMS Device Manager Interface Requirements** | |
| --- | --- |
| Software | OpenEnterprise v3.2 |
| | AMS Device Manager v13 w/SP1 and newer |
| Number of HART Devices connected to OpenEnterprise Server | 4,000 |
| **Supported Devices per RTU** | |
| FloBoss 107 | Up to 5 wired multidrop devices per HART channel, or up to 20 WirelessHART devices per RTU at a burst rate of 2 seconds |
| ROC800-Series | Up to 5 wired multidrop devices per HART channel, or up to 60 WirelessHART devices per RTU at a burst rate of 4 seconds |
| ControlWave Micro | Up to 5 wired multidrop devices per HART channel, or up to 100 WirelessHART devices per RTU at a burst rate of 8 seconds |
| **Supported RTU Compatibility** | |
| FloBoss 107 | Firmware version 1.70 and newer |
| ROC800-Series | Firmware version 3.20 and newer |
| ROC800L | Firmware version 1.40 and newer |
| ControlWave Micro | Firmware version 5.76 and newer |
| IEC62591 Module | Firmware version 1.12 and newer |
| Distributed RTU Network Bundle | Firmware version 1.00 and newer |
| **Supported *Wireless*HART® Devices** | |

**Note:** Testing with the Emerson CSI 9420 Wireless Vibration transmitter indicates that Rev3 of this device is currently incompatible with OpenEnterprise. Please use Rev4 or higher.

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