Foxboro Evo™
Process Automation

Product Specifications

Foxboro® by Schneider Electric

PSS 31S-2M1

IASCADA Platform

OVERVIEW

IASCADA takes the traditional SCADA Master Station to a new integrated operational environment.

Whether your enterprise manages the transmission or distribution of electricity, oil, gas, water, waste water, or transportation, IASCADA provides a scalable and cost-effective operational solution.

IASCADA provides an open systems real-time control environment for the integrated enterprise. Standard interfaces provide lower risk connectivity for industry-based high level applications and enterprise-wide integrated solution.

INTRODUCTION

IASCADA components are based on a proven, flexible distributed architecture, developed by Foxboro, with a history of more than 40 years of global SCADA project and product engineering.

The modularity and distributed nature of the system components allow system capacity to grow with your enterprise. IASCADA is designed to scale from a single workstation installation to large, high performance enterprise systems.

Sun® SPARC® M10-1 servers and Solaris® operating system technology are used to support client server modules including human machine interface (HMI) and application clients.

The operational environment gives a common look and feel on the operating systems, combined with an "operate from anywhere" network connectivity to the SCADA database.

FUNCTIONAL DESCRIPTION

SCADA system components are arranged redundantly to support very high availability platforms. Redundant components may include:

- Front-End Processor (FEP)
- Database
- Calculations
- History
- Communications
- Networks and workstations

State-of-the-art, real-time object distribution and management provide object level redundancy and load sharing in the Master Station.

Human Machine Interface

The HMI subsystem provides the operator interface and the visualization tools of the system via single or multiple monitor displays. This subsystem also manages system lists, report generation and printing, and logging services.

The "operate from anywhere" architecture uses the Oracle® Secure Global Desktop (OSGD) application to support remote modem access by Windows®/Solaris stations. OSGD helps provide secure remote access to applications and desktops that run on application servers. A typical IASCADA setup has at least one HMI station without a database. Other HMI stations could be using Exceed or OSGD. .

A typical HMI console consists of one or more screens that provide a windowing environment accessible by a single keyboard and mouse.

The HMI provides the following main facilities at the operator console.

Data Visualization

The operator is able to visualize data from a wide range of graphic displays. Complexity can be managed by the use of:

- Layering
- Panning
- Zooming
- Decluttering

Display Navigation

The operator is able to navigate to/from each graphic using:

- Display selection from dynamic objects
- Control and display access from any point value
- Built-in navigational links between displays

Data and Control Presentation

Supervisory control is managed directly from the observed display by presentation of the relevant information. This provides:

- Positive control reserve indication
- Two-step control actions
- Associated point value and quality status display
- System lists (dynamically updated)
- Operator controllable system list filtering/scrolling
- Control interlocking
- System monitoring
- Detection of islanding conditions

Data Representation

Data can be represented by a number of specialized dynamic foreground objects. For example:

- Integers and text
- X/Y plots

- Single and multiple pen trends
- Bar graphs
- Pie charts
- Meters and gauges
- Push buttons
- Sliders
- GIF and X-bitmap images
- Dynamic object coloring
- Object X/Y animation
- Shrink and grow object animation

Front End Processor (FEP)

The Front End Processor (FEP) is the telemetry manager of the system. It comprises software and hardware components.

The FEP manages and controls multiple communication lines for:

- Line health
- Line loading
- Line fail over

Line error statistics are calculated and are available for diagnostic and operational review.

Line fail over can be manually controlled or automatically initiated by the setting of adjustable communication line failure parameters.

“Check before execute” output commands and field time synchronization are coordinated by the FEP using standard protocol facilities.

The FEP has the capability to manage a number of different physical communications interfaces.

The optional Communications Line Server (CLS), a Foxboro® device tightly integrated with the FEP software, provides features not available in commercial terminal servers.

These include:

- Redundant LAN connections
- Physical line fail over switching
- Isochronous protocols
- Direct GPS interface
- High accuracy (millisecond) time synchronization of Remote Terminal Units (RTUs)
- Integrated V.23/Bell 202 modems
- Industrial hardened technology

Refer to PSS 21H-8D2 B4 for further CLS details.

Standard terminal servers may be redundantly configured for multiple RS-232 telemetry connections. The integral RS-232 ports of the FEP servers may also be used.

The FEP can scan RTUs using SCADA protocols over TCP/IP (for example, DNP over TCP/IP).

SCADA protocols are integrated to retrieve data and issue controls to remote devices. Foxboro Evo™ Process Automation Systems track and contribute to a variety of open protocol user groups and committees. The open protocols implemented include:

- DNP3
- IEC 60870-5-101
- IEC 60870-5-104

Core SCADA

Core SCADA provides the core processing of incoming raw data and updates real-time SCADA objects. A 64-bit quality assessment of all data is made and published to services including alarms, events, HMI, application interfaces, and history.

Supervisory controls are securely managed using “check before execute” sequence management.

Some of the features provided by the alarm system are:

- High and low limits
- Severity zones (refers to Analog alarm zones) on analog alarms
- Alarm priority
- Alarm filtering
- Audible annunciation
- Audible acknowledgement
- Alarm list line and page-based acknowledgment
- Better and worse analog alarm tracking

Database

The Database subsystem manages all objects instantiated in memory and on disk in the system for read, write, install, redundancy, and data persistence. The database used to achieve this is the commercially available Versant® Object Oriented Database Management System (OODBMS).

Examples of system objects include:

- Host stations
- Scanned devices (for example, RTUs)
- Communication channels
- Point data
- Scan rates
- Points

Point data can be associated with multiple operational regions, a particular alarm group and category. These associations are used later for list filtering and permission for control access.

History

The history subsystem provides distributed redundant storage of SCADA data samples for up to one year on-line.

All change-based data samples are recorded for later retrieval. Data samples arriving late or out of sequence due to communications failures are retrospectively merged with the stored data sequence for each point.

Older data can be automatically compressed to optimize storage space. Disturbance triggers can be assigned to help prevent subsequent compression of data associated with a plant disturbance.

The history subsystem also manages the transfer and retrieval of data to optical archive.

The history system supports the trend display, tabular list display, and structured query language (SQL) queries. User specified transformations on historical data such as Max/Min/Avg can be calculated as data and retrieved for either display or query.

You can archive history data on Oracle Solaris Zones using the Zone Archiving feature.

Calculations

IASCADA allows user defined calculations using IEC 61131-3 programming language. When a calculation is initiated, object data is read, the calculations performed, and the results written back to database objects. Digital event triggering, periodic execution, or real-time triggering can initiate calculation execution.

Application Programming Interface

The application programming interface provides an Object Interface Library (OIL) for integrating OEM process applications, user-developed application packages and real-time data interfaces using C/C++ programming language.

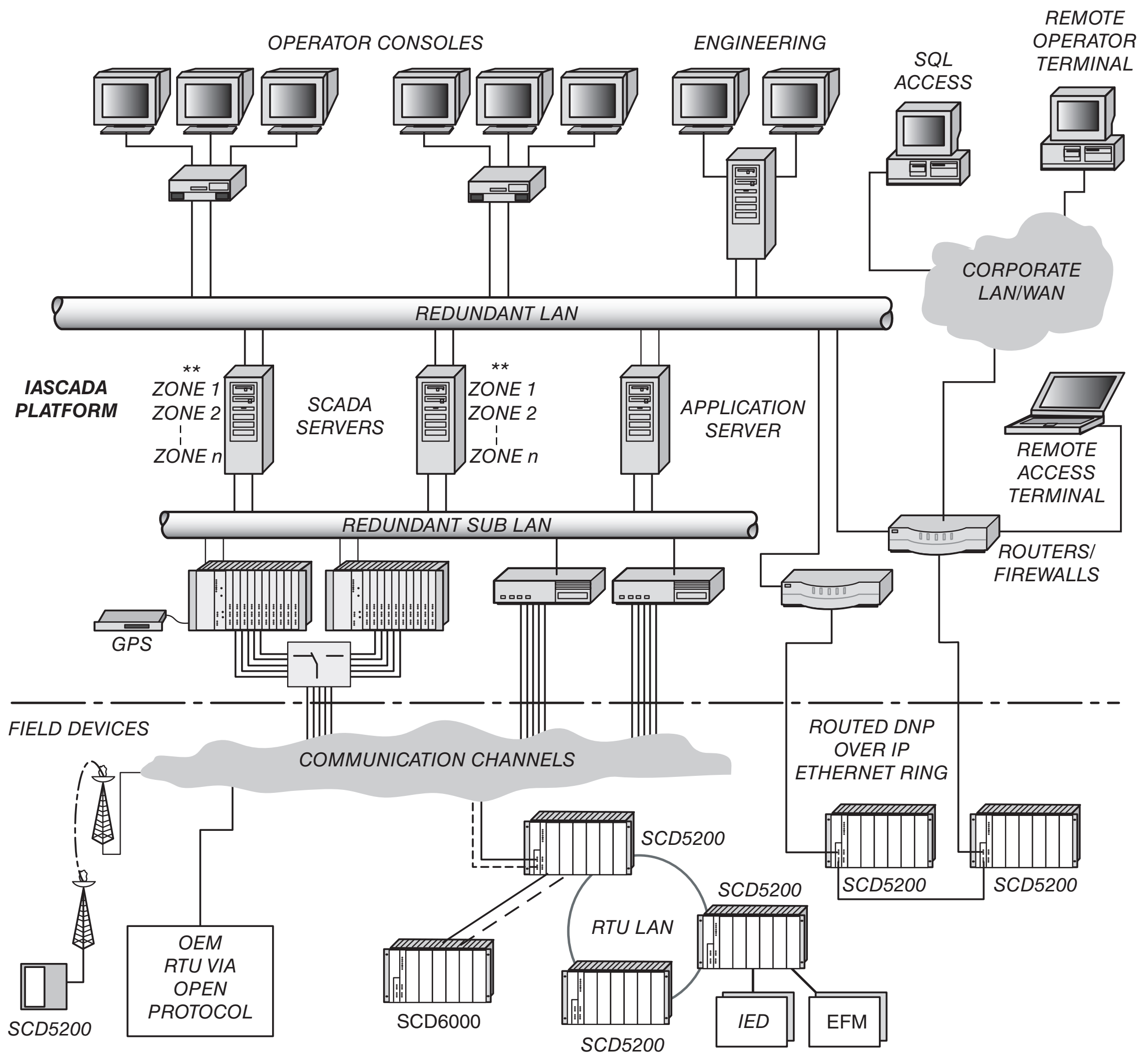
Structured Query Language

Structured query language enables open database connectivity (ODBC) to enterprise databases for corporate data exchange and personal computer desktop applications access.

Supervisory

A SCADA process monitor runs in each UNIX® workstation to supervise and report on the state of the SCADA subsystems running in each machine.

Network Time Protocol (NTP) is used to synchronize time between the NTP time master and the other LAN connected UNIX servers.



*** **Note**: "Zone 1-Zone n" refers to the number of Oracle Solaris Zones. The configuration depends on the server.*

Figure 1. Typical IASCADA System

Figure 1 shows the major units of the system built around a redundant Ethernet backbone LAN. The redundant CLS chassis are connected on a communications subLAN, keeping communications traffic off the main LAN. The SCADA servers in this case are running all the SCADA subsystems. This configuration is typical for systems of up to 60,000 points. As the systems scale up, typical enhancements are to distribute the subsystems by adding dedicated servers for tasks such as History, Calculations, Applications with API and to simply add more operator positions. The operator positions can be upgraded to an applications workstation functionality allowing extra tasks such as, Calculation or Archive to be included making use of idle CPU time typically observed at an operator position.

The proposed hardware supports Oracle Solaris Zones, which provide a way to virtualize operating system services to create an isolated environment. This isolation helps prevent processes that are running in one Zone from monitoring or affecting processes running in other Zones. IASCADA can be installed on multiple Oracle Solaris Zones and each Zone can be used as a SCADA server.

Performance and Capacity

Performance is dependent on the hardware platform chosen to operate the system, other configurable functions that run on the same station, and general system load. The product is validated on Fujitsu Oracle SPARC M10-1 (SPARC64 X and X+ processor based) server. M10-1 is capable of handling up to 50,000 telemetry and 10,000 manual points per station.

The stated general capacity and performance is based on the following assumptions:

- M10 servers are used.
- The bandwidth of the LAN is 100 Mbps.
- Each station has a maximum of 50,000 telemetry and 10,000 manual objects.

Table 1. IASCADA General Capacity

Item	Maximum Number (a)
DOMAIN	
Stations per domain	32
Objects per domain	180,000
Redundant copies (total number) per object	3 (b)
Total redundant objects per domain	60,000
Open databases	Limited by hardware resources (c)
STATION	
Points per station	60,000
Telemetered points per FEP station	50,000
Alarms per station	50,000
Active off-normals per station	50,000
Active tags per station	50,000
Active channels per FEP station	200

(a) Performance is measured on M10 server Oracle Solaris Zones.
(b) The base system has been optimized to suit a single redundant server.
(c) When the user opens a non-distributed database, the full database is served from the workstation where the database is kept. This requires memory and/or swap space resources to hold the database, and CPU resources to serve clients. Though there is no software limit on the number of open databases in a workstation, too many reduces the performance of the workstation for real-time work (for example, scanning and serving real-time data).

Table 2. IASCADA System Performance

Item	Maximum Number [a]
FEP/CORE SCADA	
FEP throughput, as a total of data retrieved from all remote devices [b]	138 kilobytes of data per second
FEP throughput, as a total of data retrieved from all remote devices [c]	240 kilobytes of data per second
Average data retrieved per remote device [b]	200 point values per second [c]
Maximum publication rate, of changes in point data, for a database node to the network	250 points per second (normal) 1,000 points per second (burst load)
Maximum alarm rate	1,000 alarms per second
Maximum event rate [d]	1,000 events per second
CALCULATIONS	
Maximum calculations configurator compile time	250 lines per minute
Maximum number of calculated results for simple expressions (for example, x = y + z) [e]	500 results per second

(a) Performance is measured on M10 server Oracle Solaris Zones.
(b) The throughput of FEP is calculated as a function of the number of telemetered points retrieved by a single FEP station. Calculations are based on an FEP with the maximum of 24 channels at 9,600 baud and a data efficiency of 60%. Assuming the TCP/IP (Ethernet interface) allows a maximum of 200 packets per second.
(c) For example, 40 point values retrieved per scan request, with 5 scan requests per second per channel (assuming 50% analog and 50% digital).
(d) The HMI performance is based on the assumption that the History software is not in the same station as the HMI software, although this is a valid combination.
(e) Performance is directly related to the complexity of calculations, the distribution and location of data objects used in the calculations, and general system load.

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