

Semaphore T-BOX Applications in Data Center Facilities

Introduction

Data centers must reliably provide 24/7/365 operation. For automation and monitoring of the facility, use of a rugged, reliable RTU is essential. Intelligent monitoring and automation functionality provides immediate notification of alarms and live process conditions, reduced risk of downtime, improved preventative maintenance, increased energy efficiency and increased operational efficiency. Key features of Semaphore's T-BOX RTU products for data center facility applications include:

- Local alarm management.
- Intelligent data logging.
- SNMP protocol for systems monitoring and compatibility with IT equipment.
- Push technology that informs multiple recipients of conditions via PDA, lap-top computer, and mobile phone.
- Broad communications protocol support for compatibility with wide area networks and SCADA systems.
- Wide operating temperature range allows RTU installation in outdoor locations such as nearby HVAC equipment.

Semaphore's T-BOX RTU products consolidate the functionality of an alarm notification/dialer product, data logger, programmable controller, and security system for complete monitoring and automation of the entire facility, including:

- Facility monitoring including temperature, humidity, lighting, HVAC system status, smoke/fire alarms.
- Automation of HVAC and lighting systems.
- Monitoring of leak detection sensors.
- Security monitoring and control including intrusion detection, motion detection, IP video, and access control.
- Mains power monitoring including voltage, current, phase and frequency.
- Monitoring of primary and backup generator.
- Generator status and fuel level monitoring.
- UPS monitoring including battery voltage, temperature and charge/discharge monitoring.

T-BOX Communication Operations

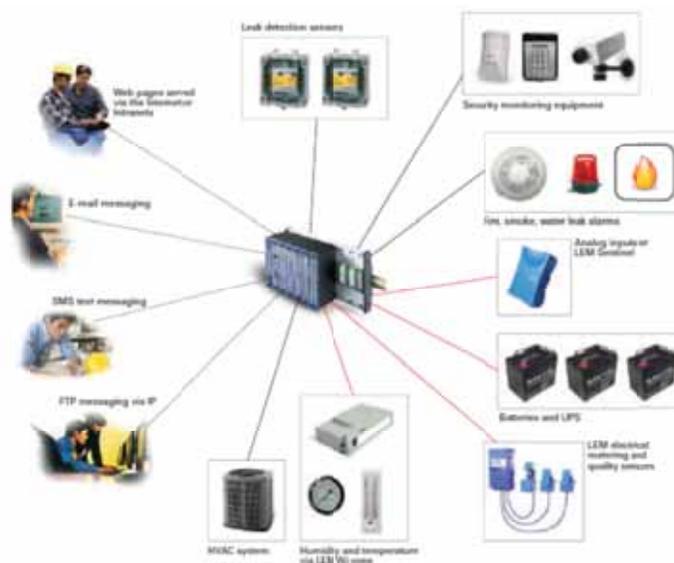
Semaphore's T-BOX line combines alarm notification, data logging, integral web server, IP telemetry, and programmable automation in a single, rugged package that is perfect for decentralized applications. T-BOX offers up to 50% less total installed cost per point versus traditional SCADA and PLC systems.



T-BOX will initiate communications as specified by the user. "Push" communications via e-mail, SMS text or FTP will take place on a periodic basis or when an alarm occurs.

As determined by the user, a periodic call can provide the latest reading, each of the readings since the last call and/or figures from the historical log (please refer to the section, below, for information on the logging capabilities). E-mail and FTP messaging can include files, for example, tabular logs or trend graphs.

T-BOX also includes a number of traditional, SCADA protocols such as IEC 60870-5 and Modbus.



Inputs to the T-BOX RTU can be via analog inputs, discrete inputs, serial connections (RS-232 or RS-485), Ethernet and wireless interfaces. While contact, voltage and current inputs continue to be very common, IP and wireless connections are being employed with increasing frequency.

For example, intelligent sensor products from LEM are popular in facilities management applications. In a data center, a T-BOX MS RTU can interface on a wireless, mesh network with LEM Wi-zone sensors for humidity and temperature monitoring, LEM Sentinel for battery/UPS monitoring and a variety of LEM sensors for electrical metering and quality monitoring.

Communication via the Simple Network Management Protocol (SNMP)

Since information technology (IT) equipment commonly supports SNMP, the Semaphore implementation of this protocol provides powerful functionality for monitoring remote systems. Semaphore has implemented the SNMP protocol in the T-BOX MS RTU product using the MS-CPU32 processor. The protocol implementation is in three parts:

- SNMP Trap Protocol Implementation.
- SNMP Daemon Protocol Implementation.
- SNMP Client Protocol Implementation.

SNMP Trap Protocol

The SNMP trap protocol implementation allows Semaphore RTUs to send and receive SNMP trap messages. In this manner, the RTUs may be used to monitor system health and alarm states for information technology or broadcast equipment where the trap functionality associated with SNMP is widely used to provide a mechanism to monitor equipment of different models and from different manufacturers in a unified manner.

Alternatively, using the ability to generate SNMP traps, the RTUs may be integrated in such network environments in a manner that alleviates the requirement for a separate supervisory system.

SNMP Daemon Protocol

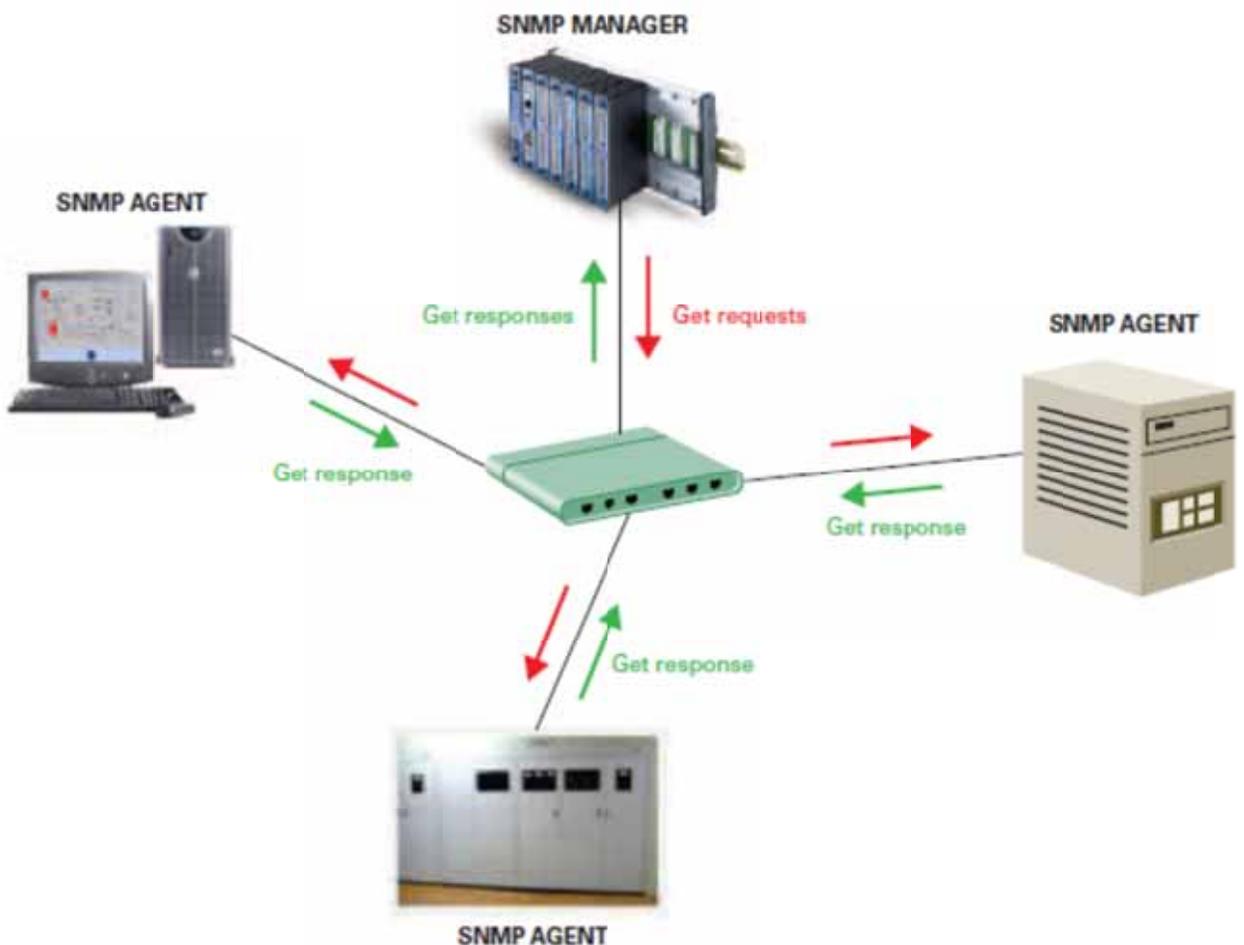
The SNMP daemon protocol implementation provides a server (or slave) SNMP implementation which allows configuration and state information about RTUs to be set, queried or retrieved by remote agents using SNMP. This functionality allows the RTUs to be integrated within network environments where SNMP is employed and administered using existing SNMP management tools. The configuration and state information about the RTUs exposed through this interface include:

- RTU network address and system identifier.
- RTU hardware modules and I/O states.
- Event log information.
- Network interface and traffic information.

The Semaphore MIB defines those elements of RTU hardware and software configuration available for query and manipulation through the SNMP agent interface provided by the SNMP daemon protocol implementation. The Semaphore RTUs also support the Management Information Base for Network Management of TCP/IP based internets (MIB-II) as defined in RFC document 1213 which describes SNMP objects that expose information about system configuration, network interfaces and connection and protocol information.

SNMP Client Protocol

The SNMP client protocol implementation provides a client (or master) SNMP implementation that allows the RTUs to be used to query, retrieve and set information associated with remote devices using SNMP. In this manner this protocol implementation may be used to extend the scope of monitoring of the RTUs beyond traditional SCADA applications and physical I/O to incorporate the monitoring of SNMP enabled network equipment.



Alarm Management

T-BOX uses an alarm management system that not only detects and reports alarms but can be configured to require alarm acknowledgement and escalate unacknowledged alarms.

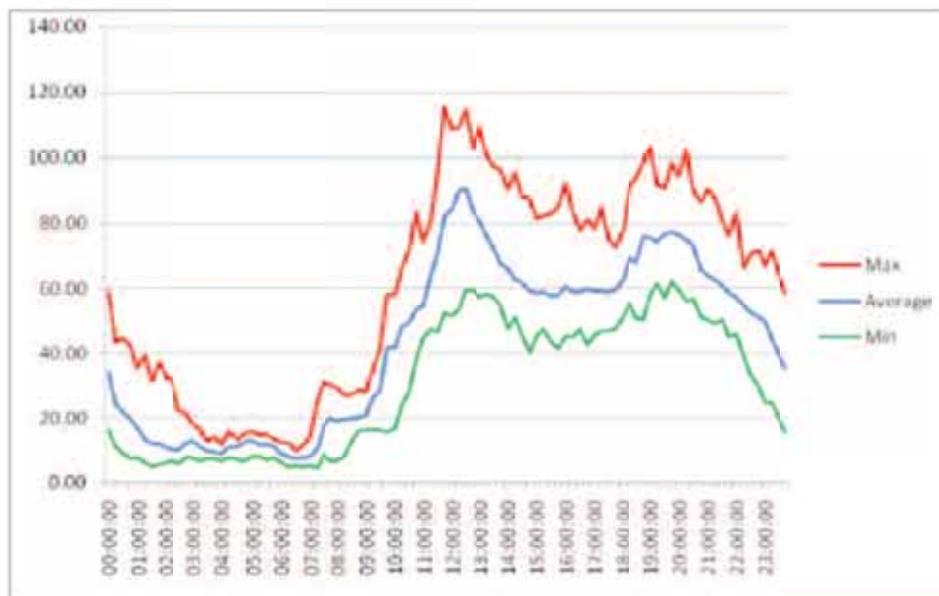
If configured to do so, an alarm transition will initiate communications. Messaging can be to multiple recipients while escalation can be to multiple groups, each including multiple recipients. Alarm acknowledgement is performed by users via a PC, PDA or even a cellular phone. Using a phone, the user sends a text message to acknowledge the alarm. T-BOX will not only clear the alarm, internally, but can initiate programmable logic functions in response to a text message.

T-BOX also maintains an alarm history, which can be displayed as a web page and attached, as a file, to email and FTP messages. Each message includes a time and date stamp, signal i.d. and text description.

Historical Data Logging and Trending

Unlike remote I/O devices, T-BOX provides sophisticated, data logging capabilities. On user-defined intervals, T-BOX will perform statistical calculations on measured inputs and update the historical data base. Averages, totals, minima and maxima can be run over intervals such as hourly, daily, monthly, etc.

In T-BOX, historical logs can be displayed as web pages on a PC and transmitted, as files, with e-mail and FTP messaging. Logs can be maintained in tabular as well as trend graph format. To simplify configuration, Semaphore offers a software tool, Report Studio, which provides powerful trending capabilities.

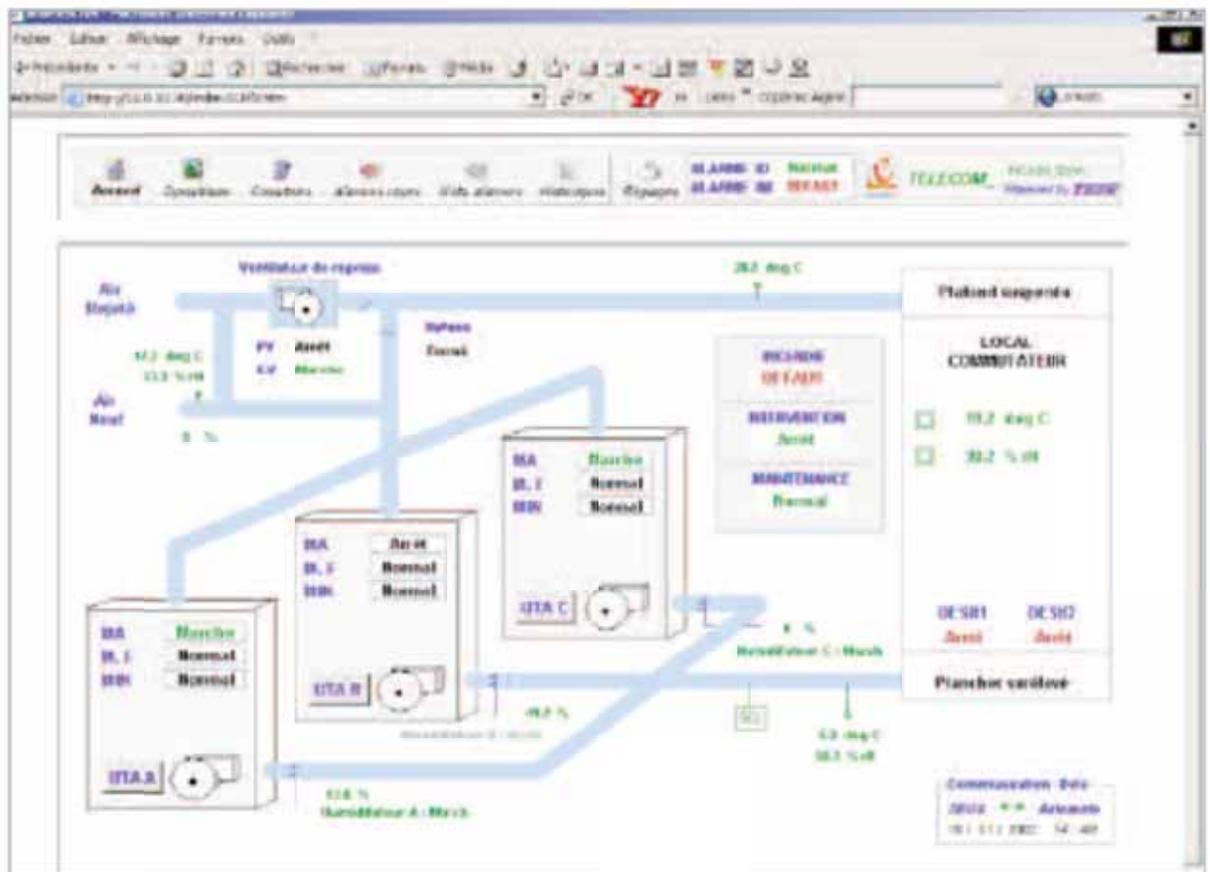


Web Server

The integral web server in T-BOX provides an HMI capability, which can offer significant cost savings versus expensive licensing for SCADA software. Web pages can be accessed by users, anywhere in the world, via the Internet or an intranet.

For data center applications, web pages also comprise an inexpensive HMI for local technicians. Not only is process information provided but system diagnostic information is available in the T-BOX data base.

Semaphore's software tools greatly simplify configuration of web pages and eliminate software integration problems. No programming is required. Using WebForm Studio, dynamic objects, entry fields, tables, trends, and links to other pages are simply added with a few clicks.



Programmable Automation

Since T-BOX is an automation controller, not simply a data logger or remote I/O device, it performs full, local, standalone control of all processes in the data center facility.

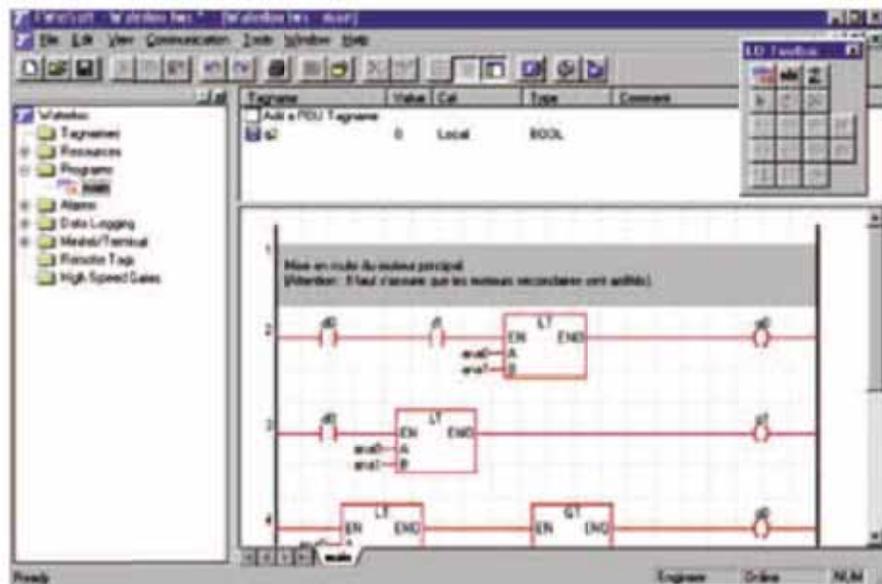
The TWinSoft Suite programmable automation environment consists of programming tools, a real-time execution engine, and personalized development tools for equipment manufacturers and systems integrators. In TWinSoft, a user-friendly and interactive Ladder Diagram editor that complies with the IEC 61131-3 standard facilitates design and testing of the control program.

The editor is immediately familiar to the LD programmer and intuitive for the novice programmer. A simple combination of mouse and keyboard commands is all that is needed to complete development.

TWinSoft contains a complete set of tools, including an editor, debugger, code generator, documentation generator, library manager, archiver, and online control. It is very easy to add lines or comments, duplicate entire parts of the program, or create new variables, modules, and macros.

Using TWinSoft, users minimize design time by directly using libraries of predefined functions and subprograms, which include control, mathematical functions and conversions, and Boolean functions. Dynamic analytical tools allow programmers to rapidly perfect their applications and include online ladder display, states of timers, meters and internal registers, locally or remotely in complete security.

For programmers who are more at ease with high-level languages, programming in BASIC is also available.



Conclusion

Data center facility management applications take full advantage of the features offered by Semaphore's T-BOX product line:

- Simple Network Management Protocol (SNMP) — Since IT equipment commonly supports SNMP, Semaphore products are able to take full advantage of their capabilities for reporting purposes.
- Alarm management — The RTU alarm system detects alarm conditions and reports them using push technology. Alarm management ensures that un-acknowledged alarms will be escalated. Even cellular phone users can acknowledge alarms and send text commands to a T-BOX.
- Data logging — T-BOX data logging capability retains historical information and allows users to adapt operations for the highest efficiency. Trends can also assist in maintenance management and continuous improvement.
- Push technology — Using T-BOX, end user operations personnel are immediately notified of alarms and important events without the need for polling. This takes best advantage of inexpensive data communications plans on public networks.
- Integral Web server — This T-BOX feature provides significant savings vs. SCADA/HMI software licensing. Web pages are accessible to users, anywhere, anytime. PC-based Web pages also provide all, local HMI operations when maintenance personnel visit the sites, thus saving the cost of additional software.
- Programmable automation — A choice of programming in two languages in T-BOX (IEC 61131-3 Ladder Diagram and Basic, plus Microsoft Automation) provides calculation functions as well as control outputs for automation. These capabilities are not available in data loggers, remote I/O and other products that are intended for monitoring, only.