A Pre-SCADA System Assessment

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Turn this . . .

Into This!

A properly designed SCADA system saves time and money . . .

INTRODUCTION

Supervisory Control and Data Acquisition (SCADA) is a process control system that enables a site operator to monitor and control processes that are distributed among various remote sites.

A properly designed SCADA system saves time and money by eliminating the need for service personnel to visit each site for inspection, data collection/logging or make adjustments. Real-time monitoring, system modifications, troubleshooting, increased equipment life, automatic report generating . . . these are just a few of the benefits that come with today's SCADA system.

As technology continues to advance, SCADA systems will be the operating standard for any processing site. But from the hundreds of system providers available today, which one will you choose to partner with and why?

Choosing a SCADA system provider that will design a system applicable to your needs can be an overwhelming, confusing task. With little or no knowledge of SCADA and telemetry systems and an incomplete pre-system assessment, decisions made can be costly mistakes. Too often the decisions are based on . . .

Price:

The quality of system components and workmanship may suffer when vendors "low bid" to win the contract. The vendor may then indiscriminately cut costs to make a profit.

Proprietary Equipment:

If proprietary, closed-protocol equipment is installed as "standard" for the system, the customer can be forced to pay inflated prices and face the possibility of future equipment integration problems due to obsolete or irreplaceable components, company shutdowns and a lack of support.

Excessively Complex or Customized Equipment:

If the SCADA system installed is too complex to understand, operate and support, the only recourse is to purchase expensive training and/or service contracts, which do not always guarantee prompt and professional service. Keep it simple wherever possible.

Don't be lured or pressured; be equipped and make a sound decision . . .

Years of Experience or Knowledgeable Expertise:

Be careful! There are a host of reputable SCADA providers with years of experience and knowledgeable expertise who have designed systems that are too broad or expensive. Experience and knowledge are important but only as a starting point when determining what vendor is right for you.

Sales People and/or Flashy Marketing:

Effective sales and marketing strategies are meant to produce "top-of-mind" results. Don't be lured or pressured; be equipped and make a sound decision based on all factors that affect optimum system performance.

These and other costly mistakes can be avoided through knowing, understanding, and carefully assessing your particular needs. For some, that may mean skimming through this article and then focusing on Table A and B at the end of this article. For others, with little or no SCADA knowledge, you should read and become familiar with the following background information.

A BRIEF HISTORY

SCADA began in the early sixties as an electronic system operating as Input/Output (I/O) transmissions between a master station and a remote station. The master station would receive data through a telemetry network and then store the data on mainframe computers.

SCADA began in the early sixties . . .

In the early seventies, Distributed Control Systems (DCS) were developed to control separate remote subsystems and in the eighties, with the development of the microcomputer, process control could be distributed among remote sites. Further development enabled the DCS to use Programmable Logic Controllers (PLC), which have the ability to control sites without taking direction from a master.

In the late nineties, SCADA systems were built with DCS capabilities and systems were customized based on certain proprietary control features built in by the designer. Now with the Internet being utilized more as a communication tool, SCADA and telemetry systems are using automated software with certain portals to download information or control a process.

Good SCADA systems today not only control processes but are also used for measuring, forecasting, billing, analyzing and planning. Today's SCADA system must meet a whole new level of control automation, interfacing with yesterday's obsolete equipment yet flexible enough to adapt to tomorrow's changes.

. . . it is important to know the system components . . .

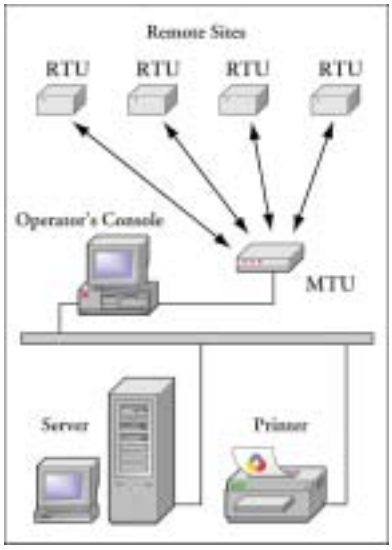
Whether you need a new system or are upgrading an older one, it is important to know the system components before you decide on who to talk with and what equipment you will need for your particular application.

SYSTEM COMPONENTS

The four major SCADA system components include the Master Terminal Unit (MTU), the Remote Terminal Unit (RTU), Communication Equipment and SCADA Software.

The MTU . . . enables operator interface . . .

The MTU is located at the operator's central control facility and enables two-way data communication and control of remote field devices.



The RTU . . . gathers data from field devices (pumps, valves, alarms, etc.) in memory until the MTU initiates a send command.

The RTU, located at the remote site, gathers data from field devices (pumps, valves, alarms, etc.) in memory until the MTU initiates a send command. The central processing unit (CPU) within the RTU receives a data stream via hardware equipment protocol. When the RTU sees its specific address embedded in the protocol, data is interpreted and the CPU directs the specified action to take. The protocol used can be open like Modbus, Transmission Control Protocol and Internet Protocol (TCP/IP) or a proprietary closed protocol. Some RTUs, called "smart PLCs" or Remote Access PLCs (RAPLC) provide remote programmable functionality while retaining the communications capability of an RTU. These devices are designed to perform control, check site conditions, re-program anytime from anywhere and have any alarm or event trigger a call to your personal computer without any direction from the MTU.

The way the MTU/RTU transmission network (topology) is set up can vary but they must have uninterrupted, bi-directional communication for the system to function properly. Methods to accomplish this include Private Medium, where the end user owns, operates, licenses and services the medium and/or Public Medium, where the customer pays for a monthly, per time or volume use.

The first method for private media transmission includes wire lines or buried cable and modems, and is usually limited to low bandwidth. When it makes sense to string or bury your own communication cable between sites, consider the staffing requirements necessary to support the technical/maintenance aspects of the system. The second method to consider is wireless transmission and includes Spread Spectrum, Microwave or VHF/UHF radios.

Spread Spectrum is license-free and available to the public in the 900 MHz and 5.8GHz bands. Some Spread Spectrum radios have the ability to re-strengthen signals for the next radio in line. These "repeater" radios are used to span distances and generally have built in error correction, encryption and other features, making them a reliable, secure and long-lasting solution for network communication.

Microwave radio transmits at high frequencies through parabolic dishes mounted on towers or on top of buildings. This media uses point-to-point, line-of-sight technology and communication may become interrupted at times due to misalignment and/or atmospheric conditions.

VHF/UHF radio (good for up to 30 miles) is an electromagnetic transmission with frequencies of 175MHz-450MGz-900MHz received by special antennas. A license from the FCC must be obtained and coverage is limited to special geographical boundaries.

Public media transmission includes services offered by your local telephone or cable company and in some systems and/or subsystems may provide a more suitable method for data transfer. The Public Switch Telephone Network (PSTN), Generally Switched Telephone network (GSTN) and the Cellular network are dial-up services suitable for occasional use. If you need a 24-hour permanent connection for analog (continuously varying signal) data transmission between two or more locations, the Private Leased Line (PLL) should be considered. The Digital Data Service (DDS) with the Digital Subscriber Lines (DSL) and Integrated Service Digital Network (ISDN) should be considered for high speed/low error rate, computer-to-computer applications. WiFi equipment utilizes broadband as well, but on a "time-share" basis when it makes sense to use the infrastructure of another company. PCS/CDPD service, provided by cellular companies, and Low Earth Orbit (LEO) or Geosynchronous satellites can also be used for continuous communication.

The HMI allows the operator to view virtually all system alerts, warnings and functions . . .

Finally, the use of an easy-to-use SCADA software package, commonly know as the Human Machine Interface (HMI), installed on PC hardware provides a reliable representation of the real system at work. The HMI allows the operator to view virtually all system alerts, warnings, and functions as well as change set points, analyze, archive or present data trends.

Common HMI software packages include Cimplicity (GE-Fanuc), RSView (Rockwell Automation), IFIX (Intellution) and InTouch (Wonderware). Most of these software packages use standard data manipulation/presentation tools for reporting and archiving and integrate well with Microsoft Excel, Access and Word. Collected data can also be sent to web servers that dynamically generate HTML pages to be viewed on the operator's Local Area Network (LAN) or published to the Internet.

MPs, like MTUs, can continuously collect, process and store data . . .

EPG 2551 microprocessor-based level meter

Managers/operators can be informed 24 hours a day through automatic email. .

SM800 Series MP PLC
Communications Controller

The Microprocessor Option

Now that you have a basic understanding of the SCADA system components, you may want to consider utilizing a microprocessor (MP) and/or a PLC-based SCADA system over a basic RTU or a proprietary system for the following reasons:

MPs, like MTUs, can continuously collect, process and store data, operating independently from the MTU through "intelligent" programming. In addition, by utilizing the EPG 2551 microprocessor-based level meter (pictured), you can have a robust SCADA system with both a master and local display that automatically gathers, processes, and reports data necessary to comply with local, state and federal regulations in formats that integrate well will Microsoft Excel, Access and Word.

MPs can provide security and monitoring of door switches, heat and motion detectors. Managers/operators can be informed 24 hours a day through automatic email, paging and dial-up call features. Multiple users can easily be added and if open architecture protocol is used, future equipment can easily be integrated. Since MPs have no moving parts, they are extremely reliable and can be designed to be repairable with components that any local electrical distributor supplies.

MP-based SCADA system can reduce the number of man-hours needed for on-site visual inspections, adjustments, data collection and logging. Continually monitoring and troubleshooting potential problems increases equipment life, reduces service calls, reduces customer complaints and increases system efficiency. Simply put, open-architecture, MP-based SCADA systems are an excellent means for process control facilities to save time and money.

IN REVIEW

The ROI (return on investment) and benefits produced by a properly engineered MP-based SCADA system far outweigh the initial investment if the right equipment is chosen and installed correctly. But from the hundreds of SCADA system providers to choose from, one poor decision may lead you down the path to countless frustrations, inefficiencies and unnecessary expenses. Hopefully this pre-SCADA system assessment will help you avoid such a decision. Begin by answering the questions in Table A and consider the principles offered in Table B below. If you do, you will be further equipped to purchase an appropriate SCADA system that will provide years of cost-effective, dependable process control while leaving you open for tomorrow's options.

Table A – Questions to Consider

General SCADA System

1. What features/benefits will SCADA perform at the master/remote site?
1. What type of SCADA system/hardware is presently installed? (proprietary, outdated, etc.)
1. How many sites, stations and dependant users does your present/future system require?
1. Will remote station collect data independently from master station?
1. Will master station control local input/output and back up operations?
1. Will the present/future system communicate with additional (LAN, Internet, etc.) points?
1. Considering the present/future software used, is it fully documented, easy to learn/use and likely to have future support?
1. Does present/future budget need to change for higher ROI?
1. What aspect of SCADA requires further investigation?

The Field Equipment

1. Rate the performance standards of each site and all field equipment. Are they reliable and cost-effective?
1. What present equipment needs replacing?
1. What present/future process needs expansion, monitoring and control?
1. What are the future equipment/expansion needs?
1. Can new equipment integrate well with the present system?
1. What is the present/future maintenance and service arrangement? Will it change with new equipment? Will you assign your own maintenance personnel or contract out?
1. What are your present costs for operation, personnel, field inspection, maintenance, repair, travel time, gas, report generating, etc? Is it cost-effective? How will it change with a new SCADA system?

The Communication Path

1. What telemetry network or communication path is presently installed?
    a. Topology: (Point-to-Point, Point-to-Multipoint, Multipoint-to-Multipoint)
    a. Transmission Mode: (Hardwire, Telephone, Fiber Optics, Radio/Microwave)
1. What are the transmission modes available and if changes are made, how will that affect vendor service charges - at each site?
1. What topology and transmission mode is best suited and cost-effective for present/future application?
1. What are the distances and obstacles to span between the control center and each present/future site?

The Protocol (Encoding/Decoding)

1. What protocol (open, closed) is used (present/future) and will it integrate well with future equipment?
1. Is there complete documentation?
1. Do you need multi-vendor software to communicate with a variety of manufacturer's equipment?
1. What protection and safeguards are needed/used to keep out hacking, tampering, sabotage, and other unauthorized use. (Consider security issues)

Table B - SCADA Equipment Purchasing Principles

1. Must be supplied by a reputable, established, customer-focused manufacturer.
2. Must use open architecture, (Modbus) protocol to keep future integration options open.
3. Must be non-proprietary, proven technology that integrates well with existing/future equipment.
4. Must be cost-effective, easy to learn/use, reliable and not cause disruptions to the every day business operation.
5. Must be supportable, well documented and designed to use locally supplied electrical components.

EPG equipment uses the open architecture Modbus protocol, is well documented, and will integrate into any existing system. For over 20 years we've been manufacturing dependable, cost-effective process control solutions for thousands of industry professionals. If you have any questions or would like to talk to a Data Acquisition, SCADA or Telemetry hardware specialist, please give us a call at 800-443-7426. We look forward to partnering with you.

