The Sage Advisor

SCADA, SECURITY & AUTOMATION NEWSLETTER

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Windows XP and the Future of Workbench 6.0

As many of you know, Windows XP will no longer be supported by Microsoft in April 2014. What this means is that Microsoft will no longer issue patches or updates. Some companies are already moving to Windows 7 or higher. For those using Windows XP and IEC61131-3 complaint Workbench 3.X programming software, you have two solutions for the short term. First, you could have a Windows XP computer dedicated for RTU programming and keep this computer off a network and away from unknown data sticks. Second, you could use a Windows 7 (or higher) based computer with a virtual machine running Windows XP.

However, the future is to make the Schneider Electric SCADAPack RTU compatible with the IEC61131-3 compliant Workbench 6 programming software. The good news is that for those that use the SCADAPack E range of RTU's, Workbench 6 is available now!

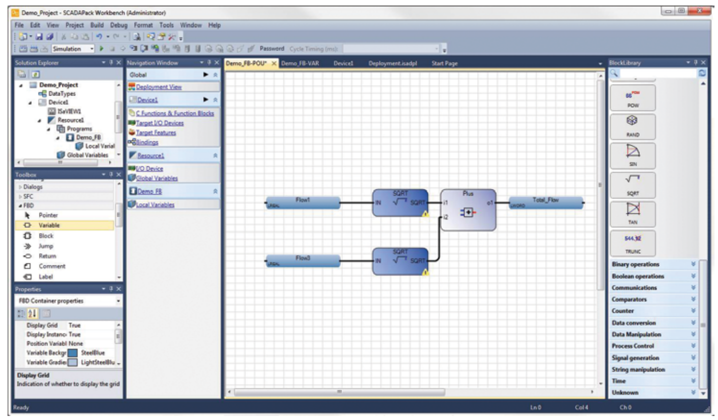
Workbench 6, like its Workbench 3 predecessor, has five programming languages inside. These are Ladder Diagram, Structured Text, Function Block, and Sequential Function block. Also, Instruction List is available on certain controllers.

Workbench 6 is specifically designed for the post Windows XP operating system environment. However, it can be added to installed to existing SCADAPack E controllers simply be updating the firmware.

Workbench 6 has several advancements including a "look and feel" that is more in line with current point and click programming methodology. Also, like other modern programs, you can move windows around and customize it to your working style.

But, it has other advantages too. For instance, you can do online programming. This ability allows for continuous operation of your system while changes are being made. Furthermore, Workbench 6 offers drag and drop features which allow for faster code generation, predefined templates to help you get started, variable names beyond 32 bits, nested function blocks, arrays of variables and structures, and automatic point tag name generation for more maintainable code.

While this is good news for most programmers, some may be comfortable using Workbench 3 and want to continue using it on new SCADAPack E controllers.



The New Workbench 6 offers a more intuitive and familiar look and feel.

We have this concern addressed. The new firmware that supports Workbench 6 can also be set during initial configuration to accept Workbench 3 programs. This way the programmer really does have the best of both worlds; familiarity and innovation.

But what about the situation where programs written in Workbench 3 need to be converted to Workbench 6? Currently, conversion can occur via three different methods. The first is to perform the conversion manually. The second is to use Schneider Electric services team and the third is to use the services of a trusted integrator. Any of these paths provide you with the opportunity to standardize programming and eliminate customization.

Workbench 6 is the next generation of IEC 61131-3 programming software from Schneider Electric. Its compatibility with post Windows XP operating systems makes it the perfect choice for your future programming needs, and will extend the service life of existing controllers.

Remote Communication Network

Remote Communication Network Architecture is an area of remote SCADA design that requires careful consideration. There are various architectures for communication solutions with the possibility of both private and public communication infrastructure being used. Not all architectures suit every application and each case needs to be considered individually to determine the architecture that best suits the application.

Telemetry Protocols

How to Choose a Protocol?

Telemetry and remote SCADA architecture can be impacted by the protocol used in a system with the protocol choice influenced by the industry (in this case W&WW), region of operation, country legislation, and security requirements. Many systems extend or must coexist with legacy systems and protocol choice may be affected by the requirements of integrating with the existing system and the transition strategy. The three most common telemetry protocols worldwide are DNP3, IEC 60870-5 and Modbus.

DNP3 standard – Also known as IEEE1815, DNP3 provides telemetry services optimized for remote communication networks. The key values include the ability to multi-drop devices for efficient use of remote communication links, event handling to optimize volume and accuracy of data, peer to peer inter-site communication, remote configuration management, and the interoperability that standardization brings. DNP3 is defined for operation over serial, TCP/IP, PSTN (dial up) and other remote communication types.

IEC 60870-5 protocols – Similar to DNP3, IEC 60870-5 protocols provide telemetry services optimized for remote communication networks. They are defined for operation over serial and TCP/IP.

Modbus protocols – While not generally regarded as a telemetry protocol by the international community, variants of Modbus with proprietary extensions are used in telemetry applications, though more commonly in the oil and gas sector.

Impact of multiple protocols – A common requirement in remote SCADA systems is to optimize the use of a physical communication channel by simultaneously supporting communication of multiple protocols. This is often required when multiple brands of legacy devices are installed in remote sites within the same system. Attempting to use multiple protocols on the same communication link should be examined carefully as incompatibilities can cause unintended operation.

Continued on page 6

Inside This Issue

150 Shoreline Hwy., Suite #8A • Mill Valley, CA 94941-3634 • 1-888-ASK-SAGE (1-888-275-7243) • 1-888-FAX-SAGE • www.SageDesignsInc.com

Schneider Electric Announces a New Hardware and Firmware release to the SCADAPack 300E Smart RTU Range

This innovative RTU range is primarily suited for water and wastewater remote applications. The hardware release introduces 4 new RTU models. These are the 312E, 313E, 333E and 337E. Also, we are introducing two new expansion modules: 5608-24 and 5610-24 for the SCADAPack E Smart RTU. This release extends the I/O mix, scalability, functionality, and cost effectiveness of the SCADAPack E Smart RTU. This permits a wider range of cost effective solutions. All of these units use the IEC-61131 compliant Workbench 6 programming environment. However, the 312E, 313E, and 333E can be initially ordered as non-programmable units with the option of adding programming functionality at a later date. An example of this benefit would be for a water tower level monitoring application where pumps might be added during a future expansion.

The new firmware is for the entire SCADAPack E Smart RTU range. This will allow the user to utilize the existing IEC-61131 Workbench 3 programming environment, or the IEC61131-3 compliant Workbench 6 programming environment. This release of Workbench 6 introduces the new logic program development environment that is compliant with Windows 7. New user interface features include: solution explorer for easy navigation, deployment view with graphical based setup for rapid configuration and drag & drop capabilities for smooth and fast creation of programs. This intuitive environment supports the most popular languages in the IEC 61131-3 suite (Ladder Diagrams, Function Block Diagrams, Structured Text and Sequential Function Chart), and, when combined with the DNP3 Subset Level 4 support in the SCADAPack E RTUs, provides a flexible and cost-effective solution for remote water applications.

For more information visit: http://www.schneider-electric.com/products/us/en/52400-plc-pac-rtu-and-distributed-i-o/53420-remote-application-controllers-rtus-and-flow-computers/61250-scadapack-e/

City of Yerington, Nevada

Arsenic Removal Water Treatment Facility SCADA Design

Sierra Controls is a Nevada-based SCADA integrator that has been serving communities throughout Nevada and California since 1975, when the state-of-the-art control system included handmade circuit boards. Now, in the age of the programmable logic controller (PLC), Sierra Controls remains cutting edge in their solutions for multifaceted municipal water, sewer, and irrigation systems. Sierra Controls was recently acquired by Farr West Engineering (Farr West), another Nevada-based firm. Since 2001, Farr West has been building a reputation as a leader in civil, environmental, and electrical engineering, primarily for utilities and irrigation districts in Nevada and California. Farr West employs over 20 professionals in the Reno, Nevada office, and 10 professionals in the Elko, Nevada office.

One of Sierra Controls' and Farr West's oldest clients, the City of Yerington, recently undertook a utility system SCADA overhaul when they upgraded their water system to include a new arsenic treatment plant and supply well. The new system included design, assembly, programming, security, installation, instrumentation, and integration services. Sierra Controls and Farr West worked together on this project to provide the City with an updated system.

The City's original system was between 10 and 20 years old. The system started out as simple well and tank telemetry, but later included the wastewater treatment plant and other satellite monitoring sites. As the system grew, the facility lacked the building space to accommodate the installation of additional components necessary to achieve the level of security and redundancy needed to make the City's drinking water operation safe for the community. The system monitored and controlled four sewer pump stations (with meters, pump and motor data, etc.) and two treatment plants. The SCADA system controls and monitors the aerators, dissolved oxygen, and effluent pumping. The water system had grown over the years to include three remote tank locations and 4 major wells. The SCADA system controls and monitors these sites to pump water during off peak hours, which resulted in approximately 40% power cost savings. Supervisory control and monitoring at these sites included aquifer levels, system pressure, pump to waste volumes, production volumes, pump run-time, as well as several alarm, warning, and security features.

Sierra Controls' latest project involved expanding the systems to accommodate a new coagulation/ filtration arsenic treatment plant. The plant communicates to the surrounding wells to bring in exact flows of raw water. The plant is an eight vessel pressurized coagulation filtration process with automated backwash and chemical injection system housed in a new treatment building. It includes a new well with variable speed control to balance flows of raw water into the plant. Chemical is automatically dosed according to the flow rate with accommodation for metered bypass flows. Chemical is mixed and flows are directed to various pressure filtration vessels with automated flow control valves. As filters require, they are taken offline again with automated control valves and backwashed with recycled water which comes from a flocculation tank via return pumps. Filter vessels are then brought back online as needed and as the system backwashes the next vessel. Finally, the finish water is continuously monitored with instruments and sent to distribution.

The SCADA upgrade for this process was extensive and complex and led Sierra Controls to redesign the system backbone. The City understood the challenges they were facing with addition of the arsenic treatment plant, and therefore migrated to ClearSCADA, which is ideally suited to expand from a single-node workstation to a server-client system with dedicated servers and client workstations. A new central antenna was placed at the plant site, where the master computer was relocated and all remote telemetry units (RTU's) were redirected to communicate to this location. The central SCADA computer systems were upgraded to include a dedicated server, operations workstation with dual monitors, and an engineering workstation. These computers were housed in a dedicated server rack inside a secure, climate-controlled server room. The entire system was fitted with a UPS uninterruptable power device with enough power to open/close critical automatic valves as needed to put the system into a secure emergency, but operable state in a power outage. The plant's backup power generator was also configured to support the SCADA system in the event of a power failure. Well and tank RTU's that directly supplied or were filled from the new plant were upgraded with modern SCADAPack controllers. The communications architecture for these upgraded sites included Ethernet/ Serial hybrid radios, DNP 3.0 protocol, and full peer-to-peer messaging.

Integration challenges included working with multiple manufactures of equipment, monitors, variable frequency drives (VFD's), and human machine interfaces (HMI's). The new site well had to have a variable drive and power filters to make up for the variations in the other wells without VFD's. The City required an extensive real-time integrated trend analysis and data package that could be utilized by their off-site consultant in their operation optimization efforts. The City also required an automated reporting tool that would automatically prepare monthly reports for submission to their regulators. Sierra Controls designed, built, and integrated the entire SCADA system from concept to completion. Throughout integration, the treatment plant supplier realized the depth of programming capabilities offered by Sierra Controls and utilized that to eliminate on-site trips by the manufacturer, saving the City money during start-up.

SCADA retrofit projects often overlook key compatibility issues, cost saving opportunities, and operational requirements such as keeping key facilities online during construction. The excellent communication and relationship between the plant designers and the SCADA integrators on this project kept these key issues from being overlooked. New equipment was selected that would maximize the use of the existing equipment and programming, which lead to cost savings and minimum down-time. The contractor involved the integrator from the beginning of the project, which then led to a seamless startup and transition to the operations staff. We attribute this success to the selection of an experienced project team and selection of the right SCADA equipment for the City's needs.

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ClearSCADA Level 1 Training Course

Nov 4-7, 2013 — Mill Valley, CA
Feb 24-27, 2014 — Mill Valley, CA
May 12-15, 2014 — Buena Park, CA

Day 1 (8AM– 4PM)	Installing ClearSCADA, Introduction to ClearSCADA, Components, Using ViewX, Using WebX, ClearSCADA Help
Day 2 (8AM - 4PM)	Configuring using ViewX, Database Organization, Basic Telemetry Configuration, Creating Mimics, Creating Trends
Day 3 (8AM - 4PM)	Configuring using ViewX, Templates & Instances, Logic Languages, Security, Communications Diagnostics
Day 4 (8AM - 4PM)	Reports, System Configuration, System Architecture, Questions

Cost: ClearSCADA Training Course $2,200

This course has been certified by the California Department of Public Health as courses qualifying for contact hour credit for Water Operator Certification for Drinking Water Treatment or Distribution in the State of CA.

(28 Contact Hours)

Telepace Studio Training Course

Oct 29-31, 2013 — Mill Valley, CA
Feb 11-13, 20143 — Mill Valley, CA
May 6-8, 2014 — Buena Park, CA

Day 1 (8AM - 4PM)	SCADAPack controller operation, Series 5000 I/O, Telepace Studio introduction
Day 2 (8AM - 4PM)	Telepace Studio advanced programming techniques and advanced functions
Day 3 (8AM - 2PM)	Controller communications, Modbus Master/Slave protocol, Diagnostics, Modems

Cost: SCADAPack Telepace Studio Course $1,650*

* You must have a licensed copy of Telepace Studio installed on your computer for this course. If you do not have a licensed copy, you will be given a temporary license, or you may purchase one with the class. Course price for Telepace Studio: $510 + applicable CA sales taxes

This course has been certified by the California Department of Public Health as courses qualifying for contact hour credit for Water Operator Certification for Drinking Water Treatment or Distribution in the State of CA.

(20 Contact Hours)

ClearSCADA Level 2 Training Course

Nov 12-14-2013 — North Houston, TX
Spring 2014 — California (TBA)

Day 1 (8AM– 4PM)	Installation, Understanding the Architecture of ClearSCADA, Application Design Considerations, Server Automation Interface, ClearSCADA Logic Engine, Using ODBC and SQL with ClearSCADA
Day 2 (8AM - 4PM)	Advanced Mimic Design and Techniques, Data Grids and Data Tables.
Day 3 (8AM - 1PM)	Accessing Historical Data, Ad Hoc trends, Archiving

Prerequisite: ClearSCADA Level 1 Training Course

Cost: ClearSCADA Level 2 Training Course $1,650

Instructor: Schneider Electric | Telemetry & Remote SCADA Systems factory trainer.

Instructors: ClearSCADA Level 1 & Telepace classes will be taught by Tony Sannellla, Sage Designs, a Factory-Certified Instructor. The ClearSCADA Level 2 class will be taught by a SEUSA training instructor. The ClearSCADA Test drives will be conducted by Sage Designs or a factory representative.

Location: See individual course registration form. Those requiring overnight accommodations should call the hotel directly for reservations.

What should I bring? Laptop computer with minimum requirements as shown on the specific course registration forms, plus necessary permissions to install software on your computer.

***You must have a licensed copy of Telepace Studio to take the Telepace course. We offer a course price for a license or you may purchase through your local Schneider Electric TRSS representative.**

What is provided? Course manual, daily continental breakfast, lunch & beverages.

Schedule Your Own

ClearSCADA Test Drive

Free Hands-On Test Drive

Call to Schedule a Test Drive

Call 1-888-ASK-SAGE

email: info@scadawise.com

SAGE DESIGNS, INC.
SCADA & Security Products

Download the Registration form at: http://www.sagedesignsinc.com/events/index.htm

*** * * Registration Deadline: 3 weeks before 1st day of course * * ***

All registrations are subject to cancellation fees. A confirmation notice will be sent to all registrants on or before the deadline date.

Building a Scalable Network Backbone

The process of managing a SCADA network, combined with the expanding requirements to protect critical infrastructure from theft/vandalism, can pose a significant problem for water system operators. The expansion of existing 900 MHz systems may not offer the necessary bandwidth, while the use of dedicated T1 or cellular systems continues to increases in price leaving operators with the need to examine alternatives and "scale" their system to meet increasing requirements.

The use of a hybrid wireless/wire line system has been deployed by many operators to meet this and future expansion needs with great success. But what are the requirements for such systems and how best to determine if this solution is appropriate for your operations? The key consideration here is the examination of both present and anticipated future communication needs. Too many operators have been sold systems that, within a short period of time, no longer meet their existing needs and cannot be scaled to expand to future requirements. This "future proofing" of a SCADA and communications system that can provide the intrusion detection and video surveillance systems requirements, but not at the sacrifice of critical SCADA systems, is critical. It is also necessary to understand the integration of wired and wireless systems and the limitations of both. Operators need to be able to separate, prioritize and secure the network, not only to meet Homeland Security mandates, but also to provide that peace of mind you, as the operator need with a reliability factor that matches or exceeds that of copper and fiber installations.

The Firetide redundant wireless system has provided many water system operators the peace of mind and future proofing they seek for combined network systems and allowed them to systemically grow their SCADA and network system on their schedule and as funding permits. While each operators specific needs are unique, the Firetide solution has been deployed in both large and smaller water systems, each representing challenges that had delayed the expansion of operations and management systems. A combination of software selectable 900 MHz, 4.9 GHz and 5 GHz solutions can provide the flexibility needed to overcome terrain and obstacle issues and maintain critical communication systems. Please contact Sage for more information and see if Firetide can be that critical missing piece to your existing systems to tie together and enhance the reliability, increased bandwidth, and scalability needs of your SCADA and network systems.

— Alan Gatlin, Regional Sales Manager, Western U.S. | Firetide, Inc.

8 CAMERA TIPS FOR PROTECTING WATER FACILITIES, PART 3 of 3

6. Create a Camera Location Worksheet and keep it updated – Hopefully by now you realize that there are lots of little details that can get overlooked when planning to secure your facilities with video. What better way to capture all that info than in a simple Camera Location Worksheet? What is the objective of the camera? Where is it to be located? How far does it need to detect? How will it be illuminated at night? It doesn't need to be overly complex, but it can save you hours of headaches by insuring you have all the pertinent details for each camera location. Don't have a camera layout worksheet? Feel free to use the downloaded example excel worksheet located below (Figure 4).

Figure 5 - Camera Layout Tool

Camera number	Camera type	Lens Type	Camera Height	Viewing Distance (feet)	Blindspot of next camera (feet)	Total Viewing Distance (feet)	Camera Location	Field of View / Objective
1	Brand A	25MM	20Ft.	285.4	0	285.4	30°00'00.00"N 85°00'00.00"W	Intrusion Detection From Camera 1 to Gate house area
2	Brand B	25MM	20Ft.	110	29.52	139.52	30°00'00.00"N 85°00'00.00"W	Intrusion Detection From From Camera 2 to Camera 3
3	Brand A	25MM	20Ft.	110	0	110	30°00'00.00"N 85°00'00.00"W	Intrusion Detection From From Camera 3 to Camera 2
4	Brand B	25MM	20Ft.	354	49.2	403.2	30°00'00.00"N 85°00'00.00"W	Intrusion Detection From From Camera 4 to Camera 5
5	Brand A	25MM	20Ft.	261	49.2	310.2	30°00'00.00"N 85°00'00.00"W	Intrusion Detection From From Camera 5 to Camera 6
6	Brand B	25MM	20Ft.	416	0	416	30°00'00.00"N 85°00'00.00"W	Intrusion Detection From From Camera 6 to Camera 7

Figure 4 - Downloadable Camera Location Worksheet

7. Use a Camera Layout Tool: There are lots of different approaches to actually creating the final layout. The old T-square and triangle method, placing polygons on Google Earth, PowerPoint, and vendor specific tools. In all cases the objective is to get a visual of the protection to be provided by a particular camera and by an entire perimeter layout. This layout can then be used as a visual tool to facilitate responses to bids, discussions on budget, sensor selection, installation trade-off considerations and ultimately, peace of mind that intended areas are fully covered. The key to a good camera layout tool is one that takes into account the various aspects of the design (Lens size, camera sensor, cameras locations, blind zones), gives a good visual of the final design and allows for easy modification as plans change (Figure 5). Taking the time to find a layout tool that works for you can save you a vast amount of time during all phases of a perimeter protection project. There are many security product suppliers that have access to these tools and are very willing to provide you layout advice at no charge, in exchange for an opportunity to win your business.

At first glance, the idea of using cameras to protect a perimeter, facility or other asset seems pretty easy. Hopefully, this white paper has helped you realize that it is in fact a task that has many details to consider and many aspects that can impact the effectiveness of the final design. Several key considerations have been highlighted in this discussion, but this list should not be considered exhaustive. If it sounds a little daunting, don't be afraid to ask for help. There are lots of resources available to help you meet your security needs.

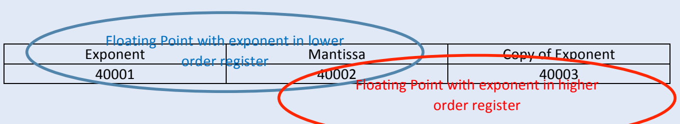
8. Look to the Future – This may seem silly, but plan for growth. In this case, it's not about adding more cameras, increasing bandwidth or drive space; it's about real growth. That cute little sapling may not impact the perimeter today, but in a few years how is it going to impact your design? Will the tree obscure the camera's field of view thereby creating safe passage for an intruder? You are thinking it's just a tree. If it grows and becomes a problem just cut it down or keep it trimmed. Although that sounds logical, landscaping services are recurring costs, which are often harder to get approved versus the fixed cost of purchasing the perimeter system in the first place. Additionally, some locations are very restricted about destroying trees after they reach a certain size. At that point the decision to remove it may be out of the hands of the site owner, but he will have to bear the cost of modifying his security system to accommodate the tree.

Sometimes looking to the future is just about asking the correct question. If the current design includes the protection of an open space or makeshift storage yard, take the time to inquire about the future use of the area. Using one or two cameras with a wide field of view to cover an open space won't be a very effective solution after new storage buildings are placed in that same location during the next fiscal year.

A Backwards Bit of Sage Advice

One of the unfortunate truths that many of have faced when working with the “Standard” Modbus protocol is that there is little “Standard” about it. Since its release by Modicon into the public domain several decades ago, there has not been a standards committee to recommend enhancements, certify compliance or move the protocol forward. As a result, it is pretty much the Wild West when it comes to products that support “Standard” Modbus simply because there is no “Standard”.

One of the problems that technicians and integrators face when trying to interface two Modbus devices is that there are different schools of thought in how to make use of registers when using them in any other way than as I/O. For example, some implementations of floating point math, which uses two consecutive holding registers, puts the Mantissa in the lower order register and the exponent in the higher order register. Other implementations do it the opposite way. Fortunately, this is relatively easy to deal with as all you need to do is copy one register and put the copy at the other end of the set to switch their order.



A more difficult problem arises when you wish to pack discrete bits into holding registers for more efficient polling of your system and one manufacturer wants to pack them in from lower order bit to higher and the other wants to pack the opposite way.

Manufacturer A
1111111100000000

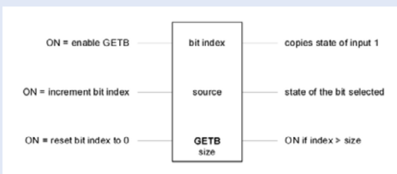
Manufacturer B
0000000011111111

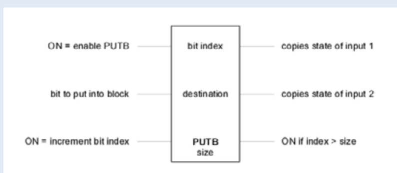
This requires a little more thought. Luckily, TelePACE Studio has a good set of tools for register manipulation and I was able to come up with a solution which involves reading the bits in the input register from left to right and writing them to the output register right to left.

Input
1111111100000000

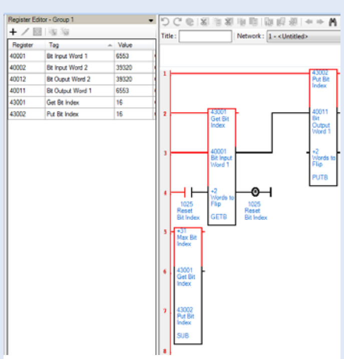
Output
0000000011111111

I connected the Increment input of the GETB block to the Power Rail of the ladders so that it will increment with each scan of the program, a One Shot coil and a normally open contact to reset it when it reaches the Size. The Size is in 16-bit registers, so with the first bit being 0, 1 word is 0 – 15, 2 words are 0 – 31, etc. I then subtract the Get Bit Index from 31 (two word example) and use this as the Put Bit Index. The GETB block outputs the state of the bit at the index number which is used to set the bit value for the PUTB block, which then puts the value in the Bit Output Word at the opposite end of the register.



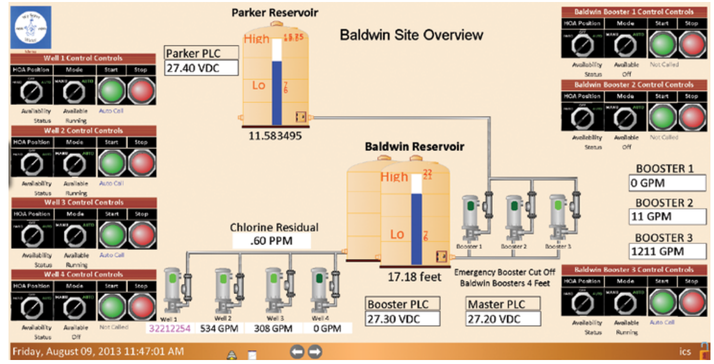


This program will scale to up to 600 (max value for size in the GETB function) consecutive registers by simply increasing the Words to Flip and Max Bit Index values.



For a copy of this program, contact Tony@scadawise.com

Turnkey Ethernet DNP3 SCADA System With Licensed Wireless Remote Telemetry



In Ojai, CA lies a small sleepy community with a state of the art control system for their drinking water, served by Ventura River County Water District. I was contracted to update an aging, ailing and unsupported system. With the help of Sage Designs and an engineer’s vision and design by WREA, we were able to implement a state of the art system which will be around and supported for decades to come.

For the hardware aspect we chose to use the Schneider Electric SCADAPack 350E Smart series RTU with the Function Block Program developed using ISaGRAF. For security and absolute consistency of communication, we chose the distributed network protocol 3 or DNP3. This was accomplished entirely over Ethernet. We used TRIO licensed Ethernet Radios for the remote telemetry sites at the reservoirs and pump stations.

At the front end of the system, we used Schneider Electric’s ClearSCADA 2012 and WIN-911 Alarm Notification Software with a USB modem. The Software runs on a Dell OPTIPLEX commercial computer running Windows 7 Ultimate. The computer has a RAID1 Configuration for seamless Data backup and integrity, utilizing redundant hard drives.

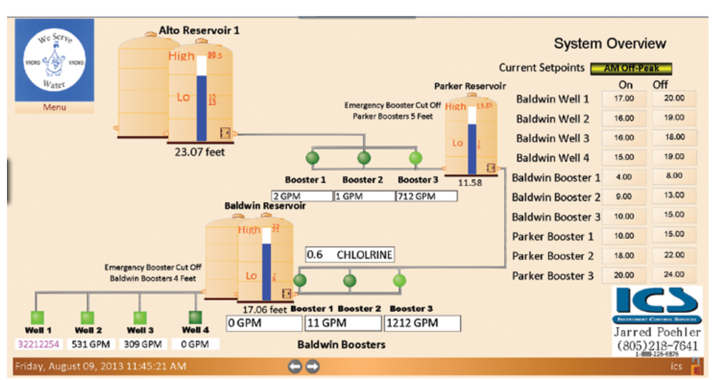
The programming utilizes a pumping strategy that fills the tanks at a time when utility power is at the lowest cost. The tank levels replenish themselves at night, when electricity is cheap, and avoid running the pumps during the day, when the power is expensive. This saves money and balances the utility demand for the entire area. If a problem arises, the operators are alerted via cell phone and the operators can access the VPN to the SCADA using the same smart phone. This saves the district money in callouts and costly overtime, while holding an operator accountable at all times.

This package allows for a very easy to use, simple graphic user interface, which the operators can use and monitor to keep the water system reliable and continuously operating. In the background The ClearSCADA server and application is logging everything, giving this small water district the ability to track, report, trend and forecast anything they want to. The ability of this data to be modeled is only limited by their imaginations. This design also makes it easier for a small water district to absorb some of the budgetary expenses of a new system. Only one model of radio was used, one model of RTU was used. This cuts down on the hardware that needs to be stocked as spare parts.

A system such as this is very cost conscience and effective. All of the applications are developed using simple, easy to follow methods. The products chosen are new proven technology that will be around as well as supported for years to come. I thank WREA, Sage Designs and the Employees at Ventura River County Water District for a successful system that I am proud to have implemented.

— Jarred Poehler, Senior System Integrator , Instrument Control Services

www.instrumentcontrol.com



Remote Communication Network, cont.

Remote System Topology Considerations

The topology of a remote communication network can affect how remote devices interact with the SCADA master station and with each other. Particularly in a system with widely dispersed remote sites, the design of the network needs to consider if there are requirements for multiple communication initiators, aggregation of data, separation of communication and interaction between remote sites.

Several aspects of remote system communication need to be considered in the design of a remote communication network.

Polling – Polling is the standard strategy for acquiring data from remote sites and should be used to provide the balance between information updates and the bandwidth consumed on the remote communication network. Since most remote assets yield few changes from one poll to the next, efficiencies can be gained where the majority of communication requests from the master station to the RTUs are event polls with integrity polls enacted at larger time intervals. Where multiple classes of events are supported, such as in DNP3, a high priority data class containing alarms and more important point changes can be polled more frequently, with lower priority data classes polled less frequently.

Polling for remote SCADA requires careful consideration. There is high value in being able to have other communication traffic inserted in the remote communication data stream in addition to the polling. Non-polling data that can operate on a remote communication network, if sufficient “free time” is made available between polls, includes peer-to-peer communication between remote sites, file transfer for remote configuration changes, and headroom provided for system expansion.

A well-tuned polling regime for remote SCADA can support up to hundreds of remote sites on a single communications link without compromising data integrity or responsiveness to critical events.

Unsolicited responses – Unsolicited reporting allows an RTU to send DNP3 data to a master without having to wait for an event or integrity poll. It is typically used for transmission of high priority data such as alarm conditions. Unsolicited responses can improve system response time, but in general should be restricted to sending data that is considered critical.

Routing – Message routing in a remote SCADA system allows communication across interconnections in a hierarchical architecture, including situations where there are multiple remote communication network links or multiple types of networks to interconnect (e.g. serial, Ethernet, PSTN). DNP3 supports message routing because its messages carry both a source and a destination address.

DNP3 peer-to-peer – RTUs with DNP3 protocol allow the user’s IEC 61131-3 logic application to request reading of the current value of specific data items across the remote communication network from another RTU. Similarly, an RTU can send a control request to change data in a remote RTU. There is a wide range of applications to which this functionality can be applied. In water distribution systems, a pumping station can be notified of the level of a tank that it is filling. It can periodically receive or request the level of the tank to determine when to start and stop its pumps.

In a wastewater collection system, a lift station at an environmentally sensitive location can instruct upstream (in-flow) stations to stop pumping in order to avoid a local overflow. Upstream stations can also periodically check operational conditions in their surrounding network, determining when it is appropriate to resume normal operating conditions.

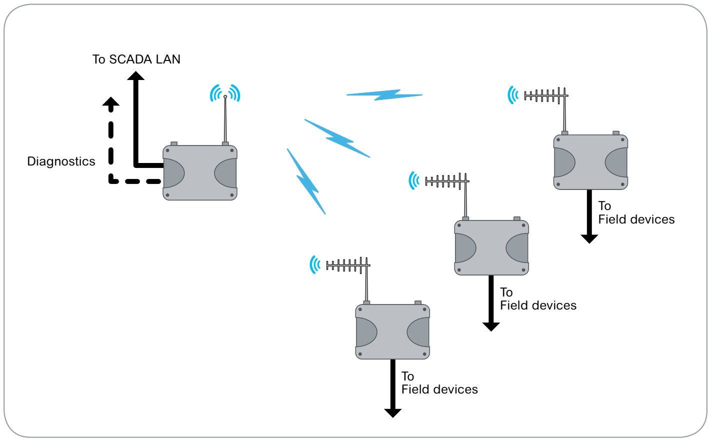
Data concentrator (sub-master) – Data concentrating is a part of an architecture where a sub-master is used to collect and aggregate data from multiple remote devices. The data concentrator presents the concentrated data (along with data it has collected or derived in its role as an RTU device) to the SCADA master station. When concentrating data from downstream remote devices using DNP3 and IEC 60870-5, the RTU preserves the original sequence of event ordering, event time stamps and point quality information when it presents its data upstream.

Multiple masters – In some system architectures there are two or more independent masters. An example of a multiple master system is where a local master communicates with an RTU as well as a central master, or where two separate business entities have independent control rooms with separate communications to the same RTU devices, e.g., a flood management system that crosses international borders. RTUs supporting multiple masters manage events independently for each master connection.

Network Architecture

The choices made when establishing the communication system architecture will influence capital expenditures, operating expenses, and the required bandwidth. Careful consideration needs to be given to each selection.

Wireless Communication – Data radio solutions solve a number of challenges in remote applications including: ease of deployment, high reliability and ease of maintenance. The radio architecture can provide collision avoidance in multi-point systems that is ideal for DNP3, IEC



Optimized wireless network (point-to-multipoint model)

60870-5 and Modbus remote SCADA networks.

In general, serial communication is a simpler approach to communication where a single protocol provides the services necessary for remote SCADA communication. It is efficient, allowing optimization of communications to a large number of systems on the same communication link.

Ethernet wireless communication is well suited to applications where IP connectivity is a critical part of the communications or SCADA solution. Multiple protocols and multiple applications are possible, although careful consideration of security issues, bandwidth and the management of unnecessary Ethernet network traffic should be considered.

Optimized wireless network (point-to-multipoint model)

A typical point-to-multipoint architecture for remote SCADA networks uses a radio as an entry point (sometimes called a base or access point) to communicate with multiple remote radios. This type of network is applicable to licensed and unlicensed radio systems.

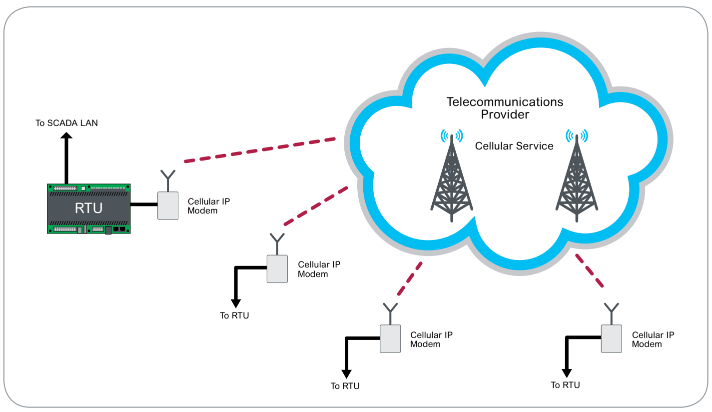
Wide area wireless network (point-to-multipoint with repeater)

This architecture utilizes a radio repeater (a remote radio as a bridge / access point). It is particularly useful where the entry point radio does not have good RF coverage to the rest of the system. Repeaters are typically located at a site of high elevation (water tank, mountain top and so on) which offers maximum RF coverage over the target area of remotes.

Wide area wireless network (hierarchical model)

An integrated radio system is designed to cover challenging terrain, and over very wide areas, with a radio backbone and/or RTU routers, Ethernet switches and so on. In such systems, point-to-point links are commonly used for interlinking multiple point-to-multipoint systems.

Cellular IP Network – Cellular IP communication relies on public infrastructure networks from a telecommunications provider. System availability requirements for an application should be carefully



Cellular IP netowrk (small)

analyzed when considering using public infrastructure communication systems.

Cellular communication, for example, may not give the level of service needed to provide network access when required. Events such as storms and other severe weather activity, civil emergencies and so on can impact the availability of public communication networks. For critical infrastructure applications, system availability, particularly at these times, may be a key requirement. A number of telecommunication network standards are in use for cellular IP networks. These include GPRS, EDGE, HSPA, and LTE.

Security Note: Where a public infrastructure communication network (including Internet as well as other infrastructure) is used to interconnect parts of a remote SCADA system, careful attention should be paid to system reliability and security. It is generally accepted as best practice not to use public infrastructure for critical applications and defense-in-depth security measures should be deployed.

Cellular IP (small model)

Cellular IP modems at each remote site can connect to an RTU device to provide communication connectivity for remote SCADA. This architecture is suitable where there are a small number of remote systems. The cellular IP modem is operating in a "1-to-many" topology and may be constrained to providing a total system throughput equivalent to that of one remote device.

Cellular IP (large model) – In the large model architecture for cellular IP networks, the connection of the network to the SCADA LAN is by way of a "backhaul link" from the telecommunication provider's network. This is a common architecture for medium to large systems, where volumes of data coming from remote sites can be anticipated to be higher under certain operational conditions, or where network data usage is expected to expand over time.

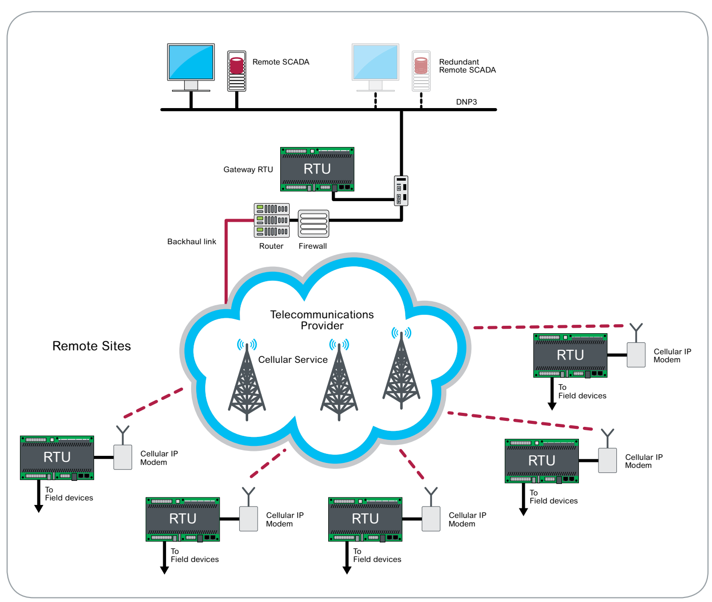
Static vs. Dynamic cellular IP addressing – While dynamic IP addressing in a cellular IP system can be used in remote SCADA architectures, in general an offer that provides static IP addresses is better suited to remote SCADA. Remote SCADA architecture results in a large number of small distributed servers. Typically, each system has only one (or a very small number) of clients. Static IP better suits this remote SCADA architecture by allowing lower cost and simpler modem devices to be used at remote sites.

IP communication infrastructure – Remote SCADA can utilize conventional IT communication services to remote sites, though this will only be available for remote sites in a small number of cases. One aspect to consider when sharing IT infrastructure with SCADA operations is availability; IT networks may not be available at all times when required for remote SCADA operations.

Landline / PSTN network – Landline and PSTN communication generally rely on public infrastructure networks from a telecommunications provider. Data speed across classic wire-line services is typically slow and, while a minimum line quality can be expected, it can be variable. Availability requirements for the communication system should be considered.

High availability Remote Network – A number of the communication methods described can be used to provide communication for remote SCADA. Small systems may only use a single method, while medium and large systems may use multiple methods in the same system such as a remote wireless network with coverage to the majority of remote sites and cellular IP to the few outlying sites not within the wireless coverage area or with marginal signal to the remote wireless network. Some remote sites may be determined to be more crucial to business and system operation than others. Despite a dependable primary communication link, it may be appropriate to provide an additional (fall-back) communication link to a critical site for remote communication system availability either through PSTN or cellular IP.

— Philip Aubin, Senior Systems Architect, Schneider Electric | Telemetry & Remote SCADA Systems



Architecture for remote network using cellular dynamic IP addressing

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Calendar of Events

September 10-12, 2013	**CWEA 2013 Northern Regional Training Conference,** Modesto, CA
September 24-26, 2013	**Tri-State Seminar on the River,** South Point, NV
October 1-2, 2013	**CA-NV AWWA 2013 Fall Conference,** Sacramento, CA
October 5-9, 2013	**WEFTEC 13,** Chicao, IL - visit our manufacturers' exhibits.
Oct 22-25, 2013	**USCID Water Management Conference,** Denver, CO
October 29-31, 2013	**Telepace Studio Ladder Logic Training Course*,** Mill Valley, CA
November 4-7, 2013	**ClearSCADA Level 1 Training Course*,** Mill Valley, CA
January 23-24, 2014	**California Irrigation Institute 52nd Annual Conference**
February 11-13, 2014	**Telepace Studio Ladder Logic Training Course*,** Mill Valley, CA
February 24-17, 2014	**ClearSCADA Level 1 Training Course*,** Mill Valley, CA
March 4-7, 2014	**USCID Groundwater Issues & Water Management Conference,** Sacramento, CA
March 24-27, 2014	**CA-NV AWWA 2014 Spring Conference,** Anaheim, CA
April 28 – May 2, 2014	**CWEA 2014 Annual Conference,** Santa Clara, CA
May 6-8, 2014	**Telepace Studio Ladder Logic Training Course*,** Buena Park, CA
May 12-15, 2014	**ClearSCADA Level 1 Training Course*,** Buena Park, CA

* Download the registration form from our website or call for more information.

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