Modbus Organization Newsletter, December 2012

Wireless Communications in the Industrial Space

Member company connectBlue brings its expertise in wireless communications to bear every day for its customers. In this issue, connectBlue's chief technology officer, Mats Andersson, offers a bird's eye view of the role of wireless in industrial communications. Links to a longer paper can be found at the end of this article.

Wireless communication has been used in industrial applications for more than 30 years. Among its first applications was the wireless control of Automated Guided Vehicles (AGV) and cranes in warehouses where proprietary radios were used to achieve flexible control of the moving devices. During the last 10 years, standardized radio technologies such as Wireless LAN (IEEE 802.11),

Wishing you all the best in 2013!

Modbus Protocol V1.1b3 Posted on Modbus Web Site

The Modbus Organization has posted a new version of the Modbus protocol specification on the web site. Modbus Protocol v1.1b3 corrects some acronym misnomers and replaces the traditional master/slave language with the more appropriate client/server construct.

Expect similar changes to the implementation guides in short order. Other updates are underway as well.

New Addition to Modbus Resources Page

The Modbus Organization's Technical Resources page list of resources for Modbus developers and users continues to grow.

The newest listing is an open-source multi-platform Modbus library for .Net. Cet Electronics offers a series of open-source Modbus libraries written in C#. They support RTU (binary only), TCP and UDP, both client and server. The libraries target .Net Micro Framework, Windows Phone, and standard .Net (incoming). High abstraction for easy pluggability, and extensibility. Multi-threading and C# 5 are supported. Very easy to use.

News about the World's Most Popular Protocol

Elecsys Corporation provides innovative machine-to-machine (M2M) communication technology solutions, custom electronic equipment and displays for critical industrial applications worldwide. The company's primary markets include energy production and distribution, agriculture, water management, aerospace, military, safety and security systems, and transportation. The company's culture and philosophy place a high emphasis on innovation, quality, reliability, and customer support.

Elecsys Corporation's *Director Industrial Communications Gateway* is a cost-effective remote field data communications device designed for data acquisition and control applications, which communicates via Modbus TCP or Modbus over serial line.

Since 1990, **Hjelmslund Electronics** has been completing industrial automation projects according to customers' specifications. Today the company works with smaller and more complex technologies, using ARM microprocessors (Primarily ARM7), USB, Bluetooth and other technologies in customer-specified projects.

Hjelmslund Electronics' own products include the USB485 family of Modbus RTU-compatible USB-to-RS485 converters — unique because of their isolation barrier and compactness, typically found only in much larger converters.

Toronto-based **Accuenergy** was founded in 1998. The company is a research, design and manufacturing organization, specializing in power measurement meters and software for the distribution, control and management of electric energy and other dynamic processes.

Accuenergy's Acuvim series of energy meters include three-phase multifunction power meters, multi-circuit power and energy meters, multifunctional DC power meters, and single-phase multifunction power meters — used in energy management, industrial automation, wide area power monitoring, power quality analysis, substation automation, and many other applications.

Modbus Newsletter

This is the newsletter of the Modbus Organization, the international nonprofit organization devoted to the evolution and support of the Modbus protocols.

For more information about membership and other services, please refer to our website: www.modbus.org

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The Modbus Organization Mission

The Modbus Organization, Inc. is a group of independent users and suppliers of automation devices that seeks to drive the adoption of the Modbus communication protocol suite and the evolution to address architectures for distributed automation systems across multiple market segments. Modbus Organization also provides the infrastructure to obtain and share information about the protocols, their application, and certification to simplify implementation by users resulting in reduced costs.

Wireless Communications, cont'd...

IEEE 802.15.4 and Bluetooth technology (IEEE 802.15.1) have become the dominant technologies.

Wireless solutions offer several advantages in industrial applications. They are used to increase mobility, eliminate expensive and high-maintenance transmission media (such as flexible cables and swivels), and overcome the problems associated with large or problematic zones, such as public roadways.

Industrial plants typically consist of multiple devices interconnected in different ways. These devices may include simple I/Os, intelligent sensors, single-loop controllers or programmable controllers, and devices for data logging and supervisory control.

The devices may be interconnected using different communication protocols and media types, which, in some cases, can be replaced by wireless technologies.

No one wireless technology offers all the features and strengths that fit the various industrial application requirements; therefore, standardized wireless technologies Wireless LAN, Bluetooth technology and IEEE 802.15.4, as well as number of proprietary technologies, are all used. The main requirement could be high data throughput, robustness or low power (the latter especially for battery-operated devices).

Wireless LAN is often used for production planning and data acquisition, as well as

Applications where rapid roaming is required. Bluetooth technology is used for Human Machine Interfaces (HMI), programming, service/maintenance as well as real-time control tasks.

During the last few years, other technologies such as IEEE 802.15.4 (ZigBee, Wireless Hart, etc.) and Bluetooth low-energy technology have become increasingly used for sensors, actuators and other small devices.

The adoption of wireless in an industrial environment is typically a gradual process. Initial requirements include the creation of islands of wireless enabled devices connected to an existing wired network. The wired network may be a standard IP-based network or a fieldbus network, such as Modbus TCP, Profinet, Devicenet, Controlnet or Interbus-S.

connectBlue's white paper describes some of the specific requirements for wireless communication technology in industrial applications. The paper considers the following topics in more detail:

- Serial cable replacement
- Ethernet cable replacement and Ethernet infrastructure
- Seamless roaming
- Fieldbus cable replacement
- Smart phone/other mobile device applications
- Wireless sensors and actuators network
- Industrial requirements for wireless technologies
- Coexistence of multiple wireless technologies.

Moxa's new Profibus-to-Modbus TCP gateway

Moxa recently released its MGate 5101-PBM-MN Profibus-to-Modbus TCP gateways series with PI certification. The MGate 5101-PBM-MN gateway features enable bridging Profibus devices (Profibus drives or clients) to Modbus TCP clients (SCADA or PLCs) with ease.

Its rugged design with optional built-in optical isolation, and -40 to 75°C wide-temperature operation, ensure reliable performance for use in industrial applications such as oil/gas, power, process automation and factory automation.

With a little help from our friends...

Modbus member company Acromag, recently pointed out a **helpful Wiki page** with explicit instructions for taking raw Modbus data and uploading it to iDigi as "Dia Data" for access by Web services.

Many thanks to Lynn Linse at Digi for his continuous support to the Modbus community. A frequent contributor to the Modbus discussion forums, he seems to always be there with useful advice for those with Modbus questions and quandaries.

Q&A from the Modbus Discussion Forum...

Using Modbus data packets and setting up the registers to be read from a Modbus client...

New user posted this message to the forum:

I'm new using Modbus and would like some help, if possible. I have an application where I need to output data in Modbus format over Ethernet to Experion Software. I believe Automation Direct's H2-ECOM 100 module is all I need, but not sure.

Once the PLC process is done, I need to download all my user inputs (recipe data) to Experion. It appears all I need is to use a conversion sheet that targets V memory. Specifically, I just enter the V memory into the spreadsheet and it tells me the Modbus number to use.

I have not worked with Experion, but am assuming this Modbus "number" is what the Client needs to pull that data. From a PLC ladder logic point of view I don't have to write any additional logic beside the Load and Output for assigning user inputs to re-ceipt V memory. Correct?

William Sturm replied:

Sounds to me like you have the overall right idea...

Steve Myres concurred:

Correct. With the 205 PLC, Modbus/TCP comms to an H2-ECOM100 (or Modbus RTU comms to Port 2) target the same block of V-Memory you address in ladder, so you don't have to move the data you're interested in to a special location or anything like that.

To make it even easier, the addresses (for Modbus FCs 3 and 16) are even the same, once you allow for the fact that ADC memory addresses are in octal. V2000 is Modbus 1024, for example (you might see it as 1025, depending on Experion's implementation of Modbus).
Coils are almost as easy. Convert the "C" address to decimal and add 3072, IIRC.
You don't even need to use ADC's spreadsheet if you don't want to.

Excel has the DEC2OCT() function in the Analysis Toolkit, and between that and drag-and-fill, you pretty much have everything you need.

Read more or add your comments to this thread.

Modbus comms & total time scan...

VSS asked:

Both analog and discrete values are fetched from a PLC via RS485 2W Modbus. How much time does it take to read value for analog (numeric) value and digital (holding register) value till the values are displayed in DCS system?

I read somewhere that it takes 5 sec for numeric and 1 sec for discrete value.

What effect it will have if several devices are put using multi-drop?

Can anyone confirm this?

IBM responded:

You need to provide a more information! Biggest factor in determining the update time is the communications speed (baud rate). Modbus RTU is a reasonably compact protocol; you can request up to 127 consecutive registers of data using an eight (8) byte command; the response could be up to 259 bytes long. At 19,200, 8, N, 1 that string would take less than 2 seconds to transmit.

VSS added:

Here is more information:
Baud rate: 9600
Request: 32
Data:8
Parity: None
Stop Bit: 1
Length of cable around 1km
Client: Honeywell DCS through SI card Server: IVT OilMist System

Patrick Lansdorf suggested:

I would actually say that [the] most influential factor is/can be the response time of the server. In some cases up to 300ms.

I have an excel sheet, that calculates the line times for Modbus RTU.

Read more or add your comments to this thread.

We're with you. The Modbus Organization is there to help suppliers and users of the Modbus protocol succeed. Our members range from Modbus device suppliers, to system integrators, end users, and educational institutions.

The common link? They all value the information and services provided by the Modbus Organization, and they all play a role in determining the future of the world's most broadly applied protocol.

Designing with Modbus

Modbus developers rely on the Modbus Organization for valued assistance with their projects:

- Start by downloading specifications and other design documents from the modbus.org website.
- To save time, purchase the Modbus TCP Toolkit CD (FREE to general members); it contains source code and a myriad of other resources.
- If you come across technical issues that have you stumped, post your question on the modbus.org forum. One of the many experienced Modbus implementers who frequent this forum will likely have your answer.

Conformance Testing

When your project's done, how do you know it really conforms to the Modbus specification? How do your users know?

The answer starts with running the conformance test suite included with your Modbus TCP Toolkit. This self-test helps you check your design assumptions and catch the subtle "gotchas" that might otherwise slip through your design review.

Then submit your product for testing to the Modbus Organization for conformance testing. We'll certify your product as compliant, and post that information on the Modbus website for the world to see.

Visibility: Your Company & Your Products

Your membership in the Modbus Organization also opens the door to a powerful range of visibility options to highlight your company as a supplier of Modbus-based products.

Exposure on our website, our newsletter, and through our various trade show appearances are all options that allow you to make the most of your Modbus Organization membership.

Your company will also value the opportunity to participate in our technical committees. There, your company's knowledge, experience and technology can help guide future enhancements, extensions, and adaptations of Modbus to keep it the world's leader for decades to come.

Time to Apply

When it comes time to get your Modbus network up and running, it's comforting to know that hundreds of thousands of applications have preceded yours. But what if things don't go as planned?

Again, the modbus.org forum is ready to answer your questions and provide guidance. Thousands of users from diverse backgrounds participate in the forum, giving you a powerful base of experience from which to draw.
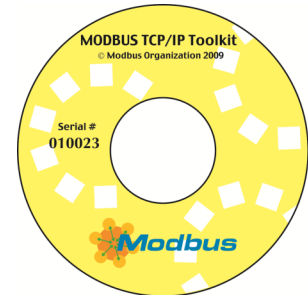
The Future is Yours

Whatever your role in the use of Modbus, consider joining the Modbus Organization. You'll get the support you need today, and have opportunities to help guide Modbus to a dynamic future.

Download the Modbus Organization Membership Application to learn about the different membership levels and their associated benefits.

Modbus TCP Toolkit v3.0

The Modbus TCP Toolkit provides all the necessary pieces to develop a Modbus-compliant device, including documentation, diagnostic tools, sample source code, and pre-test software to prepare for Modbus conformance certification.

The toolkit is available as a benefit of corporate-level membership in the Modbus Organization or can be purchased separately for US$500 plus shipping and handling. The toolkit contains the following items:

Modbus Documentation

- Modbus Application Protocol Specification, v1.1b
- Modbus Messaging on TCP Implementation Guide, v1.0b

Tools

- Modbus TCP Client & Server Diagnostic Tools

Sample Source Code

- Modbus TCP Sample Client Code for Visual Basic Win32
- Modbus TCP Sample Client Code for C/C++ Win32
- Modbus TCP Sample Server Code for C/C++ Win32
- Modbus TCP Sample Server Code for C VxWorks
- Modbus TCP Sample Server Code for C++ VxWorks

Modbus Conformance Testing

- Conformance Test Tool v3.0
- Conformance Test Tool v2.1

Additional Resources