Modbus-IDA News

the architecture for distributed automation

Modbus on the Move

Since the Modbus protocol was introduced in 1979, it has been adopted in manufacturing applications throughout the world. At this time over 7.2 million Modbus nodes exist in North America and Europe alone. Over the last year, Modbus-IDA has worked with standards organizations across the globe to further the goal of openess and accessibility of Modbus – the most popular industrial protocol in the world.

Recognition in China
Modbus is used extensively in Chinese manufacturing operations. In October 2004, the Standardization Administration of China (SAC) formally launched three standards for industrial automation in the People's Republic of China:

• GB/Z 19582.1-2004 Modbus Industrial Automation Network Specification Part 1 – Modbus Application Protocol,

• GB/Z 19582.2-2004 Modbus Industrial Automation Network Specification Part 2 – Modbus Protocol Implementation Guide over Serial Link, and

• GB/Z 19582.3-2004 Modbus Industrial Automation Network Specification Part 3 – Modbus Protocol Implementation Guide over TCP/IP.

This move heralds even greater proliferation of Modbus in the Pacific rim, especially with the opening of a local protocol conformance test laboratory, currently under development.

IEC Acceptance
Adoption of Modbus TCP in China followed close upon the heels of the IEC acceptance of Modbus as a Publicly Available Specification, putting Modbus TCP on the pre-standard track.

Modbus TCP and a companion protocol known as RTPS were submitted to IEC SC65C as a real-time industrial Ethernet suite. The Modbus-IDA organization was granted a type D liaison status by the IEC, at which time the specification was accepted as a New Work Item by the subcommittee.

Modbus TCP/IP was the first PAS to be approved during the submittal period in September 2004.

At present the organization is working on reformatting the specification, which was requested by several national committees. This will allow it to be better integrated into the revision of IEC-61158 (Ed 4.0 2007), the well-known fieldbus standard.

Modbus Mapping by CiA
In March 2005, Modbus-IDA and CAN in Automation (CiA) announced an agreement, resulting in Specification CiA DSP 309-2: Interfacing CANopen with TCP/IP Part 2: Modbus/TCP Mapping. CiA DSP 309-2 provides a standardized mapping of CANopen data for transport on Modbus TCP networks. In the specification, Modbus Function Code 43/13 is reserved for this purpose.

CiA will maintain the specification, which will be available for CiA members on the CiA website (http://www.can-cia.org) and for Modbus-IDA members upon request (headquarters@can-cia.org).

The specification defines mapping services so that CANopen devices can communicate over a Modbus TCP network via a gateway device or through the incorporation of a local Modbus TCP transport layer. Access to the entries of a CANopen object dictionary is supported on both a read and write basis, along with a variety of device control functions.

For users, this specification increases the options for communicating via Modbus TCP by standardizing the way Modbus communications will be used with CANopen. This also decreases the opportunity for multiple incompatible approaches proliferating.

IAONA Commitment
Last year at Hannover Fair Modbus-IDA was pleased to participate in the signing of a Memorandum of Understanding (MoU) with IAONA, the purpose of which is to help avoid a multitude of "different and partially proprietary solutions." IAONA and its partners seek to bring harmony and standardization where possible to serve both users and suppliers.

In keeping with its commitment to openness and accessibility, Modbus-IDA continues to build relationships that support open standards. Parallel, incompatible paths serve to complicate rather than simplify the work of the industrial control and automation community. Modbus-IDA is pleased to report significant progress in the last year moving toward greater openess to benefit all constituencies.

Modbus-IDA Technical Committee News

The **Conformance Test Policy** Committee is currently reviewing the Modbus TCP test specification, which will be the basis for revising the test software package. This work will also become the foundation for a new specification for testing conformance to the protocol for Modbus over serial line.

The group is using the current specification, developed by the Sensor Bus Laboratory at the the University of Michigan as the starting point for this endeavor.

A policy that includes a strictly monitored self-test option for Modbus-IDA members is also under review. Modbus-IDA will continue to offer nonmember companies and companies that prefer to outsource their device testing an outside laboratory option.

The new policy will include guidelines for in-house testing, outside laboratory work, re-testing requirements, and test result publication. The program will

Join one of Modbus-IDA's technical groups:

IT Infrastructure

Conformance Test Policy

Device Description

Safety Layer

Real Time

expand options for testing and make it easier for members and non-members to certify the conformance of their devices to the Modbus protocol.

The Modbus-IDA Newsletter

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

For more information about membership and other services of Modbus-IDA, please refer to our website: www.modbus-ida.org

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The Modbus-IDA Mission

Modbus-IDA 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-IDA will also provide the infrastructure to obtain and share information about the protocols, their application and certification to simplify implementation by users resulting in reduced costs.

Q&A

From the Modbus User's and Modbus Developer's Forums...

Advanced/Hidden Modbus Protocol...

Jeff wrote to the Forum:

Modbus is supposed to be an open protocol, but why can't I get the entire list of commands that I can issue? For example, I'd like the ability to stop the PLC and issue the write program to flash command from our MMI. Is there a way to get this information?

Bud Buyer responded:

Modbus ASCII, RTU and TCP are open protocols. The instruction set includes read and write instructions.

It's up to the device manufacturer to supply the the specifics of the implementation of the registers, addressing and the associated word format used in any given device.

It is unlikely that you are missing instructions, but you might be missing certain registers that will do what you want to accomplish. Or maybe your device doesn't offer Modbus access to control features that you need.

In any event, you need to direct your inquiry to the device manufacturer for specifics.

Curt Wuollet added:

That is, no doubt, a proprietary extension to the protocol as it would be specific (hopefully) to a particular vendor. I would suggest a serial protocol analyzer.

Max Power's comment:

I use the manufacturer's reserved commands with my own proprietary data within the Modbus packet. The command numbers are listed in the spec but there are reserved commands for other uses and future uses. Some of these uses could be for network routing and relaying and other special devices

Q&A continued...

besides special programming and other commands for Modicon equipment.

From Lynn A. Linse:

The info you want is VERY product specific, thus to do this you'll need to first query the device and confirm which product and firmware rev it is. Then generate a large list of devices that behave as you expect. This is one reason you WON'T find this info in the public space - it is too complex to describe and support. Each new gen of PLC adds "new" functions, so these commands are a moving target.

You may be better off with a DOS utility from SE (if there is one) that you can run in an OS child shell to reflash a PLC.

SE uses function 0x7E as a "catch all" for things like this (at least on newer equipment). The form is just SA 0x7E LN SF ???, where SA is server address, LN is byte count of remaining command, SF is some function code (such as start or stop PLC), and ??? is up to 249 bytes of data per the function.

The start/stop PLC would be easy to reverse engineer. The reflash of the program will be harder and you'll need to work this out repeatedly for different PLC generations.

Building Modbus TCP Server...

Gibbi wrote to the Developer's Forum:

I am new to Modbus TCP. I did a lot of tests and think I understand the messages, which I have to send between client and server. But, the main problem I am working around is to understand how the Modbus server defines its registers. I am trying to implement this server with labview - a tool where I can't influence memory allocation, memory addresses and so on.

Is there some kind of guideline where I could read how to create a Modbus TCP server? How do I have to define the registers?

I already checked out the *Modbus messaging on TCP/IP Implementation Guide* from Modbus-IDA, but there was nothing said about this task.

Curt Wuollet replied:

The registers are virtual. They can be pointed at hard memory addresses, an array abstraction, hardware, anything addressable. Why couldn't you simply use an array or two? Even the least flexible visual tools must support some sort of array. Probably not the best for efficiency, but with hundreds of megabytes of RAM the point is moot.

Fred Daniali suggested:

Creating a Modbus TCP server is simple... you must know the address registers of the information that you wish to poll from the controller. I recommend that you contact quark communications (www.quarkcommunications.com). They could help you out with things.

Lynn A. Linse added:
See my white paper on creating multi-vendor Modbus/TCP servers (www.iatips.com/modbus.html).

The register design is up to you - but be aware that many MB/TCP clients do NOT like ranges with holes (i.e.: 4x00100 & 4x00110 both exist, but reading 11 registers starting at 4x00100 causes error because 4x00109 does NOT exist). Write-Only registers are another no-no since some DCS demand to write-then-readback the value to confirm correct behavior.

And so on - my paper covers such details.

Key thing to avoid: just reading the Modbus/TCP spec won't create a 100% troublefree device. You need to take into account ASSUMPTIONS existing products will make about your device.

Curt Wuollet replied:

I would add that it's a fine thing you are doing sharing your real world experience. It will save countless hours and aggrevation dealing with the non-standard standard. Just think of the enormous amounts of time wasted across the automation realm with everyone discovering the same problems and reinventing the wheel because they labor in isolation. If ever there was a need for a cooperating community it's here. This list is a small step. If we could get people working on an open platform where information is a given rather than a product we would advance far more quickly. It's crippling working with closed systems.

Technical Committees Work on Modbus' Future

**Contact
Ken Crater
ken@modbus-ida.org
for more information
or to join a
Modbus-IDA
committee or
technical group.**

Modbus Products and Innovations

Bluetooth Web Enabler by connectBlue

Using a standard Web browser, the BLUETOOTH WEB ENABLER™ allows users to control and exchange information, storing it as Web pages on the device's internal Web server. Web pages can be customized with standard HTML tools or a text editor, and the user interface can be modified to control everything from industrial devices to parking meters. The Bluetooth Web Enabler provides several options to access your device: locally using Bluetooth, remotely using Ethernet/Internet, and globally using GSM/GPRS.

The WEB ENABLER™:

- Adds a Web user interface to your device, which is controlled using a regular Web browser.
- Gives flexible access through Bluetooth or an Ethernet interface.
- Communicates using standard products (PC/PDA/mobile phone).
- Allows you to change the user interface on the embedded Web server without affecting the client.
- Supports RS232/422/485 communication as well as several industrial fieldbus protocols such as Modbus.
- Offers wireless Internet access using the BWE as a Bluetooth access point.
- Can be used as a data logger for local data acquisition.

For more information about the BLUETOOTH WEB ENABLER™ visit connectBlue's website, www.connectblue.com.

BLUETOOTH is a trademark owned by the Bluetooth SIG Inc.

Phoenix Contact's I/O Modules with Modbus/TCP

Phoenix Contact's new Inline Block I/O modules for Modbus/TCP enable simple and fast integration of I/O modules in Ethernet systems. Connection is established by mounting the modules onto a DIN rail, connecting the power supply and network cable, and assigning an IP address.

Equipped with 16 fixed inputs and 16 assignable inputs/outputs, and with all the flexibility of a modular I/O system, the modules are adaptable for use in many applications. The function of each I/O channel is assigned by connecting an actuator or sensor. The modules do not have software and/or parameters that need to be set. Web-based management for simple configuration, SNMP services, and the possibility of getting firmware updates on site round off the product range.

One new feature of the Ethernet-capable I/O modules is the integrated three-port switch. This makes it possible to attach more Ethernet appliances to the devices using the second RJ45 socket, thereby saving costs and leaving ports on the structural elements free. Installation is made more flexible and it is possible to set up a linear topology.

The modules are well suited for use in particularly small terminal boxes thanks to their flat design and a height of just 55 mm.

With the bus coupler for the Inline Modular System, the FL IL 24 BK, the Modbus/TCP user can take complete advantage of Inline functionality. The seamless connectivity of the Inline system reduces adaptation time between the systems to a minimum.

Modbus Products and Innovations

Eaton's Modbus Network Adapter Certified

Eaton Electrical, Inc.
(www.eatonelectrical.com) With a direct focus on speed, productivity, diagnostics and system design, the D77D-EMA Ethernet Modbus Network Adapter provides superior integration of IT, motor control and D77 IO products. Three powerful features are combined into one module: Modbus TCP, RS-485 serial Modbus, and a Modbus Pass-Through from Modbus TCP to serial Modbus.

The device also features Quick Connect Port (QCPort) connectivity.

The D77D-EMA was certified through Modbus-IDA's device conformance test program, to test policy version 2.0.

Ethernet Modbus Network Adapter D77D-EMA

Dataforth Announces the isoLynx™ SLX100

Dataforth Corporation
(www.dataforth.com) introduced its new isoLynx™ SLX100 data acquisition system. An intelligent, high-speed, fully isolated distributed system, the isoLynx offers maximum flexibility for analog and digital I/O selection.

The system is comprised of a 12-channel base system including an I/O controller module and optional 8- or 16-channel expansion backplanes, all of which can be panel or DIN rail mounted. The system accepts single-

isoLynx Data Acquisition System

channel digital or analog I/O modules, and all I/O is channel-to-channel isolated. The company's SCM5B signal conditioning module family is used for analog I/O, and its SCMD miniature digital modules provide digital I/O. One I/O controller module can operate up to 60 channels of differential analog I/O and 128 channels of digital I/O.

The I/O controller module contains a powerful high-speed microcontroller, A/D and D/A subsystem, communication interface, system memory and status LEDs. The system is modular in design and all wiring remains connected to the system when accessing I/O modules, making field service and upgrades easy.

The isoLynx SLX100 can interface to a broad spectrum of analog signals, including millivolt, volt, milliamp, amp, thermocouple, RTD, potentiometer, slidewire, strain gage, AC to true RMS output, frequency, two-wire transmitter, and transducers requiring DC excitation.

The user can mix and match any I/O module type on a per-channel basis to reduce wasted I/O channels and save costs.

The isoLynx SLX100 communicates on RS-232/485 serial links up to 115.2 kbps or 10Base-T Ethernet with TCP/IP protocol and, in the near future, fieldbus protocols such as Profibus, DeviceNet, Modbus, and others. Up to 16 systems can be multi-dropped on the RS-485 serial link. Optional fieldbus protocol communication boards are factory installed, but are field replaceable or upgradeable without processor re-configuration.

Control Solutions' BabelBuster™ 10/100

Based in White Bear Lake, Minnesota, **Control Solutions, Inc.** (www.csimn.com) offers the Babel Buster™ 10/100, a fully configurable universal LonWorks® to Modbus/TCP gateway. The Modbus client is used to make Modbus/TCP devices accessible on a LonWorks network. The Modbus server is used to make LonWorks devices accessible on a Modbus/TCP network.

The Babel Buster 10/100 gateway is also available in a wireless version using IEEE 802.11b.

A Modbus client, Babel Buster 10/100 can poll a single Modbus server IP address, and can be bound to any number of LonWorks devices. A Modbus server Babel Buster 10/100 responds to a single IP address, and may be bound to any number of LonWorks devices. LonWorks network variable data is translated to Modbus register data, and vice versa. Modbus polling rates and LonWorks network update rates are fully configurable. Register mapping and network variable types (SNVT) are also fully configurable.

BabelBuster 10/100

Meet Some of Our Members...

MOXA Technologies, Inc. was founded in 1987 and is a major manufacturer of Industrial Ethernet and serial communication infrastructure in Asia. Moxa's main product categories include Industrial Ethernet Switches, Modbus-to-Modbus/TCP Gateways, IP-based video servers, industrial media converters, and multiport serial boards. Moxa serves customers in many different fields, including industrial automation, point of sale/retail, telecommunications, financial services, security systems, traffic automation, and building automation. In 1997, the company opened its first branch office in China, establishing a worldwide marketing and sales strategy that now includes offices in Germany and the United States. Visit Moxa's website: www.moxa.com for more information.

Based in Joplin, Missouri, **Niobrara Research & Development Corporation** manufatures industrial communication equipment including protocol translation modules, network interfaces, I/O bus interfaces, specialty modems, smart cables, and accessories for programmable controllers and other industrial automation equipment. NR&D has distributors in Germany, Denmark, Israel, the United States, and Canada. Membership in Schneider Electric's Collaborative Automation Partner Program gives the company a worldwide reach. (www.niobrara.com)

FieldServer Technologies gateways and protocol translators connect building automation systems, fire alarm panels, process controls, and other devices and networks to Modbus networks and systems. FieldServer also has over 75 different drivers, which interface to over 350 different devices. When an integrator needs to interface LonWorks, BACnet, Metasys, DH+, Ethernet/IP, Profibus or a wide range of other protocols to a Modbus system, FieldServer has a solution. In addition to stand-alone gateways, FieldServer offers ProtoCessor, an embedded protocol coprocessor, for device design engineers to use to provide proven Modbus output (serial or TCP) from their devices. (www.fieldserver.com)

Jetter AG is a manufacturer of industrial control systems, with headquarters in Ludwigsburg, Germany. As a system provider, the company sells complete solutions or individual components. Controllers, drive systems, user interfaces, remote I/O, industrial PCs and automation software are included in the scope of supply. Jetter technology distinguishes itself by optimum integration of all functions, such as motion control, communication over Ethernet, Web technologies and clear plain-text programming (www.jetter.de).

HMS Industrial Networks AB
HMS Industrial Networks AB was founded in 1988. From its headquarters in Sweden, HMS has expanded its operations with offices and support centers in the United States, Japan, Germany and a distributor network covering five continents. HMS develops, produces and markets intelligent communication technology for automation devices. Its technology, services, and products bring value and flexibility to manufacturers and users of automation products. HMS's AnyBus product line includes embedded solutions, serial and Ethernet bridges, gateways, and switches, as well as a full set of development tools. (www.anybus.com)

Join
Modbus-IDA
see back cover for details...

Modbus Device Database Grows

As Modbus-IDA enters its third year, one important focus is building the organization's database of Modbus products. This serves Modbus-IDA's supplier constituency by promoting Modbus devices and provides users an easy way to identify the products they need.

As of this newsletter printing, the database contained 236 devices, ranging from simple connectors, trip relays, and I/O modules to gateways, protocol translators, and PLCs.

The goal is to build a comprehensive listing that is easily accessible on the Modbus-IDA website. Eventually, we will also publish an annual catalogue.

Check out the Modbus-IDA website for product listings that showcase member's products and highlight Modbus conformance-tested products, making it easy to find the best Modbus device for your application.

To get your products listed, e-mail info@modbus-ida.org with the following information:

1. Company name, address, phone, fax
2. Contact name and e-mail address
3. One-paragraph description of company, especially as it relates to Modbus
4. Company logo (150x150 pixels in JPEG or GIF format)
5. URL for company home page
6. URL for company's Modbus product(s)
7. Image of the product (150x150 pixels JPEG or GIF)
8. Spec sheet (1-3 pages in pdf format)
9. Product name and model number
10. One-paragraph product description
11. One-line product description
12. Summary of standard features (list)
13. Summary of specifications (list)
15. Connectivity: Modbus, Modbus TCP/IP or both
16. Type of product, e.g. device driver, gateway, I/O module.

ARC's Ninth Annual Forum
Over 650 Industry Executives Gather to Explore "Performance Driven Manufacturing"

Modbus-IDA was a *Silver Sponsor* for the well attended event in February 2005. Modbus-IDA President, Ken Crater attended the conference, accompanied by member companies, Harting USA, Control Technology Corporation, and ProSoft Technology.

As a participant in the Tabletop Exhibition, Modbus-IDA and its member companies displayed literature and discussed their Modbus devices with users from some of the largest manufacturers in the world.

Exhibitors attended all the conference sessions and met with other attendees throughout the event, which focused on the "optimization of physical and human assets, including increased throughput, reduced engineering and commissioning costs, reduced maintenance cost, and increased customer satisfaction."

Modbus-IDA to Show at ISA EXPO 2005

Modbus-IDA is already planning its exhibit for ISA EXPO 2005. This year's show will be at the McCormick Place Lakeside Center October 25 - 27.

We keep listening and keep improving exhibition opportunities for our members. What better way to promote your company's Modbus products than exhibiting with Modbus-IDA? Once again show partners will have premium exhibition space with lockable kiosks, signage, and wireless connectivity.

Look for upcoming information about opportunities to exhibit with Modbus-IDA's **Show Partner** and **Show Visibility** Programs.
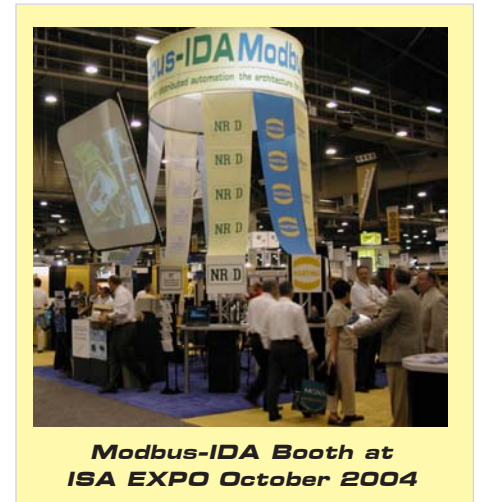
Modbus-IDA Booth at ISA EXPO October 2004

Modbus-IDA

Join the Modbus-IDA Marketing Committee and help us help you!

Participate by e-mail!
info@modbus-ida.org

Join! Design! Test! Promote! Apply!

We're with you. Modbus-IDA exists to help suppliers and users of Modbus protocols succeed. Our members range from suppliers of Modbus-compliant products, to system integrators, to end users and educational institutions and even individuals.

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

Designing with Modbus

Each day, Modbus developers turn to Modbus-IDA for valued assistance with their projects:

• Start with downloading specifications and other design documents from the modbus-ida.org website.

• To really save time, purchase the Modbus TCP Toolkit CD (hint: it's FREE with membership), which contains source code and a myriad of other resources.

• Then, if you come across technical issues that have you stumped, post your question on our highly active developer's forum. One of the many experienced Modbus implementers who frequent this forum will likely have your answer.

Conformance Testing

When your project's done, what then? How do you know it really conforms to Modbus specifications? 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.

But to make the definitive statement of your company's commitment to open protocols, submit your product for testing to the independent Modbus-IDA Conformance Test Lab. We'll certify your product as compliant, and post that information on the Modbus-IDA website for the world to see.

Visibility for You and Your Products

And, speaking of the world seeing your products, your membership in Modbus-IDA 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, in our newsletter, and through our various trade show appearances are all options that allow you to make the most of your Modbus-IDA membership.

If your company is truly on the cutting edge of new technology, you'll likely 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?

The modbus-ida.org users forum is ready to answer your questions and provide guidance. Thousands of users from diverse backgrounds read the forum, giving you a powerful base of experience from which to draw.

The Future is Yours

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

The Modbus TCP Toolkit CD

The Modbus 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-IDA conformance certification. The toolkit is available as a benefit of membership in Modbus-IDA or can be purchased separately for US$500 plus shipping and handling.
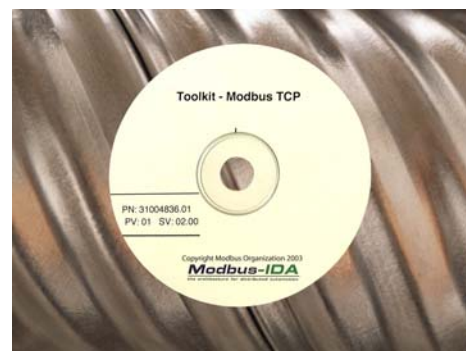
Toolkit Contents

Modbus Documentation

• Modbus Application Protocol Specification, V 1.0

• Modbus Messaging on TCP Implementation Guide, Rev. 1.0

Tools

• Modbus/TCP Client Diagnostic Tool

• Modbus/TCP Server Diagnostic Tool

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

Conformance Testing

• Modbus/TCP Conformance Test Software