PRACTICAL TROUBLESHOOTING AND PROBLEM SOLVING OF ETHERNET TCP/IP AND MODBUS PROTOCOLS

YOU WILL LEARN HOW TO:

- Gain a practical understanding of what TCP/IP is and how to apply it

- Identify, prevent and troubleshoot Modbus protocol communications problems

- Gain a practical toolkit of skills for working with Modbus

- Work competently with Modbus and RS-232, RS-485, wireless and Ethernet

- Gain skills to fault find your Modbus based Ethernet, RS-232/485, wireless, Ethernet and TCP/IP network problems

WHO SHOULD ATTEND:

Anyone working with or required to troubleshoot Modbus systems; or anyone designing, installing, commissioning, maintaining or troubleshooting TCP/IP and intra/internet sites will benefit, including:

- Consulting engineers
- Design engineers
- Designers
- Electrical engineers
- Electronic technicians
- Engineering managers
- Instrumentation and control engineers/technicians
- Instrumentation engineers
- Network engineers
- Network planners
- Network system administrators
- Plant managers
- Process control engineers
- Shift electricians
- System integrators
- Systems engineers
- Technicians
- Test engineers

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The Workshop

One of the great protocols inherited from the internet is TCP/IP, which is used by most present-day automation and process control systems. SCADA systems, Programmable Logic Controllers and even low level instruments are using TCP/IP and Ethernet to transfer information. TCP/IP and Ethernet are truly open standards.

Modbus is one of the few (if not the only) industrial messaging protocols recognised by the internet world, using port number 502. It has one of the largest installed bases world-wide with more than 7.2 million installed nodes. The Modbus TCP/IP profile has recently been accepted by the International Electro-technical Commission (IEC) as a Publicly Available Specification (IEC PAS 62030) and is now eligible to become part of future editions of the International Standards IEC 61158 and IEC 61784-2. So it enjoys the status of a widely available open standard available to everyone, hence its popularity.

Whilst detractors will say the Modbus protocol lacks some of the refinements of the newer offerings on the market, there is no doubt that it is one of the most popular standards available in the industrial world today.

This two-day workshop focuses on the main issues of troubleshooting Modbus serial (i.e. Modbus over RS-232, RS-485) and Modbus/TCP (i.e. Modbus over TCP/IP and Ethernet) installations.

Practical Sessions

This is a practical, hands-on workshop enabling you to work through practical exercises which reinforce the concepts discussed.

Practical sessions include:

- RS-485 basics
- Logging and protocol analysis on serial (RS-232/RS-485) communications system
- Modbus serial operation: RTU mode
- Modbus serial operation: ASCII mode
- Setting up a basic Ethernet network
- IP configuration
- Protocol analysis on Ethernet network
- Modbus/TCP
- Construct simple Ethernet LAN
- Configure IP addresses and subnet ,ask
- Analysis of ARP/ICMP/IP/UDP/TCP protocols with protocol analyser
- Ping, Arp, Netstat, Tracert and route commands
- Set up and analyse FTP/HTTP sessions
- Interconnect networks with bridge or router
- Modbus (serial) over IEEE802.11 wireless
- Installation and configuration of Modbus/TCP to serial communication gateway

To gain full value from this workshop, please bring your laptop/notebook computer.

The Program

INTRODUCTION
- What is Modbus?
- Overview of the Modbus standards
- Modbus and IDA
- How Modbus relates to the RS-232, RS-485, Ethernet and TCP/IP standards

OVERALL TROUBLESHOOTING METHODOLOGY
- Common symptoms, problems and solutions
- How to quickly identify likely causes
- Basic steps
- Communications issues
- Grounding, shielding and noise

BASIC SERIAL COMMUNICATIONS STANDARDS
- RS-232
  - Fundamentals
  - Problems: UART settings (Baud rate, parity, etc.), cabling, DTE/DCE, handshaking, voltage levels, noise

RS-232 practical troubleshooting session
- RS-485
  - Fundamentals
  - Problems: cabling, common mode voltage, voltage levels, transient protection, biasing, termination, control (hardware/software), noise

RS-485 practical troubleshooting session

INTRODUCTION
- LANs, WANs, VLANs and VPNs
- OSI and ARPA models

ETHERNET
- 10Mbps (half-duplex) Ethernet
- Fast and gigabit Ethernet
- Full-duplex, deterministic and dual redundant Ethernet

THE MODBUS SERIAL STANDARD
- Fundamentals: overall concept, protocol stack, client/server interaction, PDU and ADU
- Modbus RTU vs. Modbus ASCII: frame structures and timing considerations
- Problems: timeouts, checksums (CRC/LRC), incorrect function codes/data parameters, exception responses

Modbus serial troubleshooting session

MODBUS PLUS
- Fundamentals
- Problems: cabling, grounding, shielding, terminators, token passing

INDUSTRIAL ETHERNET
- Fundamentals
- Protocol analysis
- Problems: noise, connectors, cabling, wire types, jabber, excessive broadcasting, bad frames, faulty auto-negotiation, network loading, component failure

Ethernet practical troubleshooting session

TCP/IP
- Fundamentals
- Software utilities (ipconfig, ping, arp, tracert, netstat)
- Protocol analysis
- Problems: IP addresses, subnet masks, default gateways, TCP connections

TCP/IP practical troubleshooting session

MODBUS/TCP (MODBUS OVER TCP/IP)
- Fundamentals: overall concept, protocol stack
- Packet structure: PDU, ADU, MBAP header
- TCP connectivity issues
- Protocol analysis
- Modbus/TCP to Modbus serial gateways
- Problems: TCP connection problems, timing issues

Practical session with Modbus over TCP/IP

RADIO AND WIRELESS COMMUNICATIONS
- Fundamentals
- Problems: noise, interference, power, distance, channel separation, encryption

Practical session with Modbus/TCP over IEEE802.11

TROUBLESHOOTING TIPS AND TRICKS
- Summary of all the problems faced
- Further troubleshooting tips

SUMMARY, OPEN FORUM AND CLOSING

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