Robust Data Comm
Making Industrial Data Flow Like Water ... Safely, Silently, & Sanely

Your Quick Guide to Mixing MODBUS™ , RS-232, RS-485 & Ethernet

RobustDC Application Note #22

Quick Index:

The Ethernet Challenge:

The use of robust Ethernet technologies - such as fiber optics, redundant media, and fast-switching/ATM hubs - is making Ethernet an increasingly popular industrial network back-bone. Either as part of the initial construction or as a later upgrade, end users are increasingly investing in a plant-wide Ethernet "utility" which includes access points in every area on site - possibly even remote sites or neighboring countries too! Our customers are telling us of more and more quotations which include only an Ethernet (via sub-sea cable) to offshore platforms or high-speed leased lines to remote sites. Because this utility investment already exists, ***small-to-medium sized integrators are increasingly being disadvantaged when quoting if they must include the cost of running additional copper or fiber optic or leased lines to support their Modbus or asynchronous serial communications.*** What is required is an effective, easy-to-use method of mixing RS-232/485 and Ethernet. Say! Wouldn't it be great if there was a magic little box which lets your MODBUS or other serial device with a RS-232 or RS-485 port talk across an Ethernet? Well, your wish has come true!

The "CoBox" Solution

CoBox is new & exciting because it is the first RS-232 and RS-485 to Ethernet Converter designed for use by average instrumentation & process engineers who lack a Ph.D. in network LAN management.

Enter your solution - the CoBox. It is state-of-the-art German technology brought straight out of your dreams to solve your industrial RS-232 and RS-485 to Ethernet conversion problems. CoBox is small - as small as 18x60x98mm. CoBox comes in external, DIN-rail, 19" rack and many OEM formats. All CoBox support 10BaseT UTP and some models support AUI mounting transceivers, so fiber optics or coax can also be used. CoBox comes with either 1 or 2 RS-232 ports, at least 1 configurable for 4-wire RS-422 or 2-wire RS-485 multi-drop. Example applications are shown below. The CoBox is configured either by menus accessed through the first RS-232 port, or if you understand some of the rocket science associated with TCP/IP Network LAN Management, you can remotely configure the CoBox

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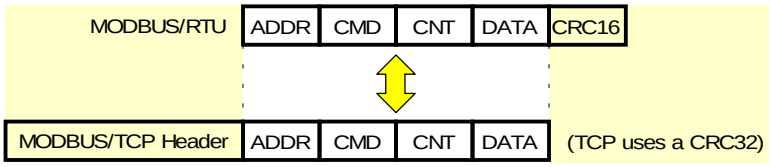
using Telnet. While on the subject of rocket science, the CoBox supports standard TCP/IP protocols (ie: functions) like ARP, UDP, TCP, ICMP, Telnet, TFTP, and SNMP. In fact, it's firmware can even be updated remotely by TFTP! But don't worry, you don't need to understand these for CoBox to solve your industrial automation problems.

● The Exciting New "TCP/IP Rescue Package" - MODBUS/TCP:

Ok, so MODBUS/TCP has been around a while - yet most people have neither heard of it nor have they been introduced to the ***absolute simplicity and brilliance of its use for multi-vendor TCP/IP networks***. True, it is used to talk to Modicon PLC with Ethernet adapters, but it is not an exotic, complex new protocol - merely MODBUS/RTU in a TCP/IP wrapper! So the real beauty of MODBUS/TCP is in how fast it can be implemented. Any company with the following three (3) resources can implement MODBUS/TCP in a few days: ❶ source code for an existing MODBUS/RTU serial driver, ❷ a TCP socket library, and ❸ a competent programmer. So presto, vendors can now have a MODBUS/TCP driver almost instantly, plus all their application programs which already support the data access paradigm of MODBUS/RTU can also support MODBUS/TCP instantly. Plus direct MODBUS/TCP access offers good performance - Modicon's documentation shows that up to 5000 or more registers may be transferred per second. Try that with RS-232 at 9600 baud!



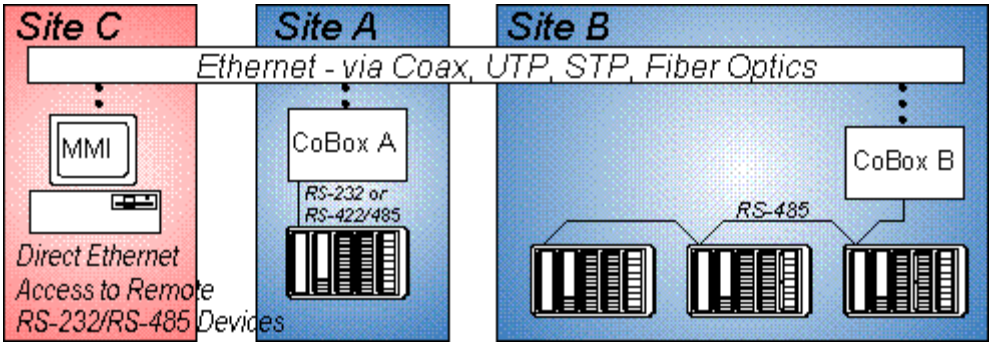
The MODBUS/RTU to MODBUS/TCP Conversion

So why call MODBUS/TCP the "TCP/IP Rescue Package"? Because every week another customer stops by our web site with an impending disaster on their hands. "Someone" (always someone else, you see) specified their new system to have Ethernet TCP/IP throughout, so now they have a half-dozen industrial equipment vendors supplying devices with TCP/IP and ... uhhh ... (overheard from the boss's office) "Simpson! What do you MEAN they CANNOT talk together? Boy, SOMEONE'S neck is on the block here and it ain't MINE!" You get the picture. (For details of the Modbus/TCP specification see **http://www.modicon.com/openmbus** and for information on multi-vendor availability see **http://www.robustdc.com/mbus_tcp.htm**)

So RobustDC is proud to offer the CoBox as all or part of your TCP/IP solution - add MODBUS/TCP and it becomes the "TCP/IP Rescue Package" for your industrial network[†]. Two or more CoBox working together allow any standard serial protocol to work remotely over TCP/IP. With the new CoBox RTU-to-TCP Gateway, you can instantly add any MODBUS/RTU device with an RS-232 or RS-485 port to your TCP/IP network with full MODBUS/TCP support. Most leading MMI and data packages already support MODBUS/TCP - even if their staff doesn't know it yet! Just keep pestering them to "find it" and they will. All standards take time to develop the critical-mass that begets universally availability - MODBUS/TCP is just starting to make that surge to fame ("mark these words!").

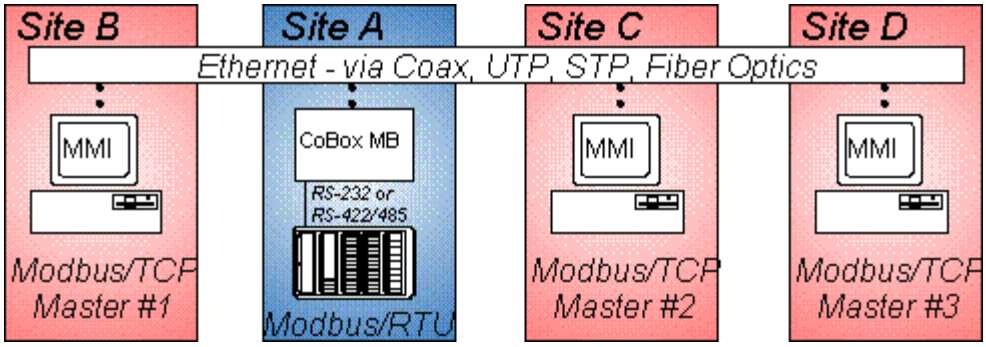
[†] (If you are an Original Equipment Manufacturer, then you will be happy to know that Acola has a very active OEM program to help you add Ethernet and Modbus/TCP support to your existing equipment. Honeywell, Johnson Controls, Westinghouse and others already do it - maybe you should too!)

- **Direct Computer Access by Ethernet to RS-232/RS-485 Devices.**



First we'll show the obvious application most people expect to see. If your computer application supports MODBUS/TCP and your device supports serial MODBUS/RTU, then you can implement this instantly with our CoBox RTU-to-TCP Gateway. Plus, if you can modify your application to use direct WinSock or TCP/IP driver calls, then you can directly communicate remotely via TCP/IP and the CoBox for any protocol. Any binary data sent into the TCP socket will magically emerge from the CoBox serial port and vis-versa. This does require some basic TCP/IP networking skills (plus access to the source code to make the change!), but the functional results can be quite extra-ordinary. Contact us for programming example files.

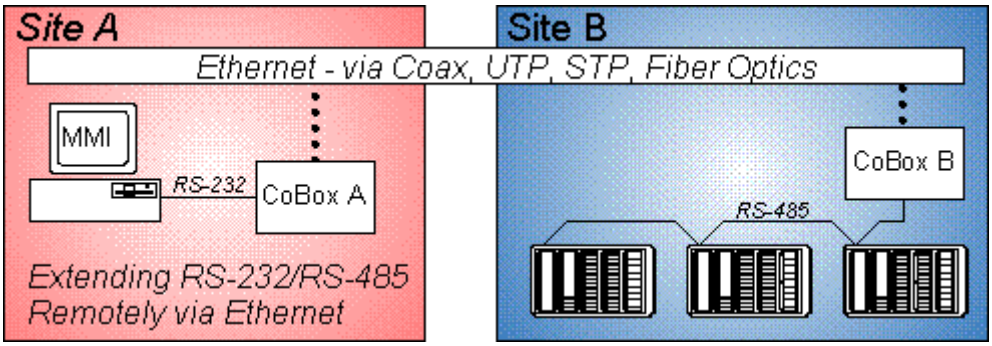
- **Multi-Master Sharing of Modbus Slave Devices.**



One super benefit of adding the CoBox RTU-to-TCP Gateway to your single or dual port RS-232 Modbus/RTU slave device is that you gain a natural multi-master capability. Up to 8 Modbus/TCP Master devices can now access your slave at the same time. No more messy "Bridge/Mux" solutions with lots of RS-232 cables, complex ASCII table set-up, and long added time delays.

● Two Converters to extend/bridge RS-232/RS-485 lines.

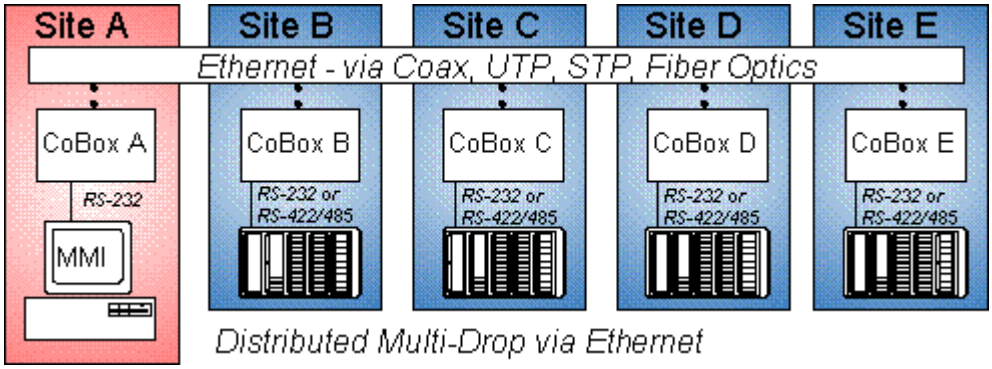
Not so lucky? What if you cannot modify your computer application? Well, the CoBox allows you to still have TCP/IP solutions without requiring you to be a rocket scientist (or LAN Specialist).



A pair of CoBox extend (or bridge or "tunnel") a standard async serial protocol like MODBUS/RTU between 2 sites. When the Master sends out a poll, CoBox A packs the request into a TCP/IP data packet. This is sent via Ethernet to CoBox B, which unpacks the request and sends it out the RS-485 multi-drop. Magic - the Slave devices don't even know TCP/IP was used to transport the request. When the appropriate Slave responds, this is packed back into TCP/IP by CoBox B, sent to CoBox A, and returned to Master. Really so very simple - honest!

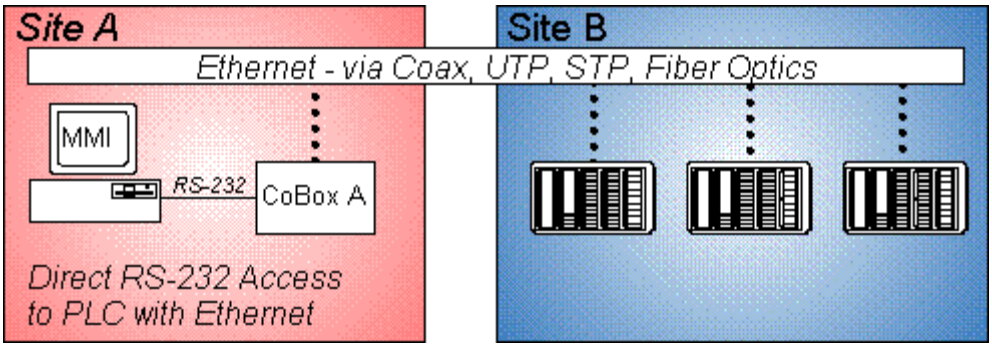
Since the CoBox works independent of protocol, any standard async protocol using RS-232 or RS-485 can be extended this way. Other than the slightly more unpredictable "rubber time" of Ethernet, the CoBox connection is completely transparent to your products. The CoBox is easy to configure and set-up using just a note-book computer running any terminal emulation program like HyperTerminal or ProComm. The CoBox uses a built-in menu system, allowing rapid configuration by even beginners. For example, to setup this simple bridge application, all you must do is ❶ in CoBox A, set the RS-232 port speed & settings, tell A it's IP address and the IP address of CoBox B, then ❷ in CoBox B, set the RS-485 port speed & settings, tell B it's IP address and the IP address of CoBox A. The 2 serial ports don't even need to be the same speed, so the computer can still buzz along at 115K even if your devices require a more leisurely 9600 baud. It's that easy - you don't have to locate your own rocket scientist (ie: Network LAN Specialist) to make use of an existing Ethernet! And if you already are a network LAN specialist, then SHHHH! Don't let your boss know how easy this is becoming or you won't be able to extort that next big pay raise out of management!

- **Multiple Converters to Create a Distributed Multi-drop.**



CoBox A acts as Master, while CoBox B to E notify CoBox A of their interest in the data. When the MMI sends out a poll, CoBox A packs the request into a TCP/IP data packet and sends it to slave CoBox B through E. This mimics an RS-485 multi-drop. When the appropriate Slave responds, the attached Co-Box replies to Master CoBox A, which in turn responds to the MMI. Since the CoBox works independent of protocol, any standard protocol which works across an RS-485 multi-drop can be distributed this way. Although we show only 1 slave device per site, each and every site could also have a full multi-drop of RS-485 devices!

- **RS-232 Master Access to PLC with Ethernet**



The CoBox RTU-to-TCP Gateway also enables master devices without an Ethernet port to access and program PLC and other slave devices with Ethernet. For example, maybe you want to run Modsoft on a notebook computer with only an RS-232 port, but your PLC all have Ethernet ports.

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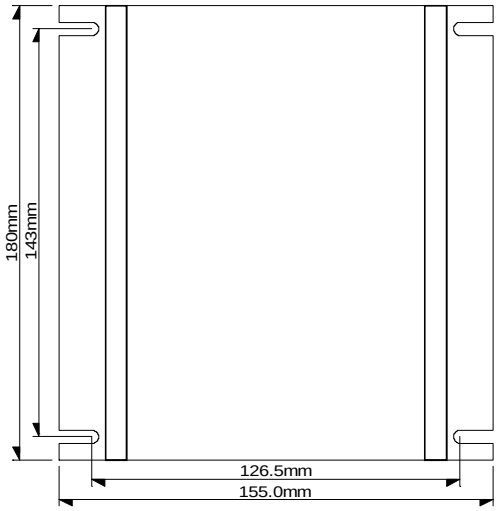
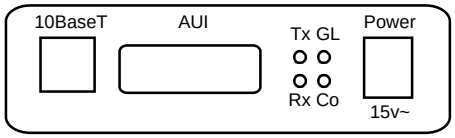
Technical Data.

The Cobox allows 2 serial ports to send/receive data across a standard TCP/IP Ethernet. The Cobox is precision engineered in Germany for reliable, year-round use. It's rugged aluminum case allows easy plate mounting - or the side brackets can be removed for free-standing use. DIN-rail mount and DeviceNet models will be available shortly. The internal firmware can be upgraded via Ethernet TFTP or the serial port, so future functional enhancements can be added as required.

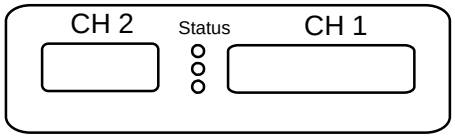
Serial Channel 1	RS-232/RS-485 software selectable (25-pin DCE/Modem port for RS-232)
Serial Channel 2	RS-232 (9-pin DCE-like port - see the manual)
Serial Settings	Up to 115kbps, 7 or 8 data bits, O/E/N Parity, 1 or 2 stop bits - supports 8 data bits with parity (commonly used for Modbus)
Network	10mbps Ethernet, AUI (15-pin) or 10BaseT (UTP with RJ-45)
Power Supply	15v AC or DC, 800mA max (110 or 230vac wall transformer available)
Case Dimensions	180 x 155 x 35 mm max, Aluminum case with removable mounting bracket.
Parameters	Configurable: IP address, gateway, net mask, port number for each channel, serial speed & character settings, interface type, flow control, Ethernet connection/disconnection method.
LED Indicators	For Ethernet: Good Link, Tx/Rx, Collision For Serial: Remote Link Active



Foot Print



Ethernet End View



Async End View

For More Information

Robust DataComm can truly make your data flow like water - safely, sanely, and silently.

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