

CoBox-DR1-MB Device Server

Installation Guide

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1 Introduction

When it comes to planning data communication for open, multi-vendor industrial control systems, Modbus™ is the undisputed first choice of end users and integrators alike. The Modbus/RTU protocol defines how a “master” device polls one or more “slave” devices to read and write data in real-time over RS-232, RS-422, or RS-485 serial data communication. Although it’s not the most powerful protocol available, its rare simplicity allows not only rapid implementation, but remains flexible enough to be applied in virtually all industrial situations. Modbus/TCP is a new extension of Modbus/RTU, which defines how Modbus/RTU messages are encoded within and transported over TCP/IP-based networks. Modbus/TCP is just as simple to implement and flexible to apply as the original Modbus/RTU. You can find the specification for both online at www.modicon.com.

The CoBox-DR1-MB Device Server allows users to integrate new and existing Modbus/RTU and Modbus/ASCII serial devices to newer TCP/IP network-based devices. Section 1.1 describes a system that integrates 4 Modbus/RTU devices with 4 Modbus/TCP devices.

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Extended Modbus System Example

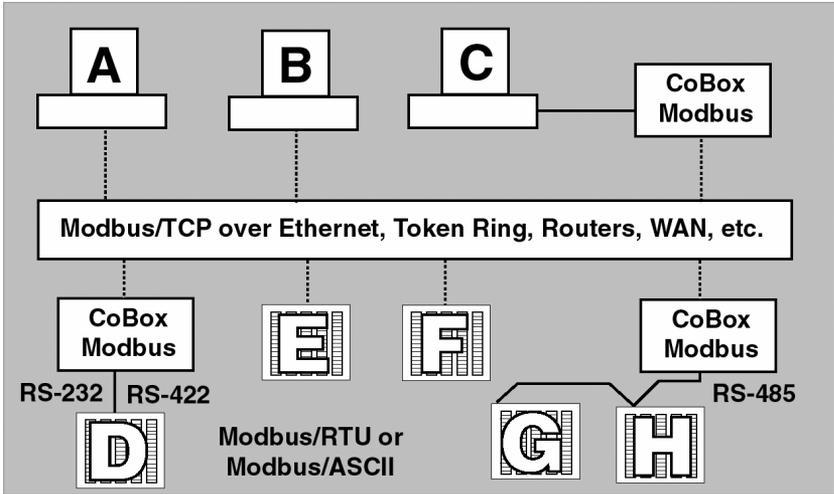


Figure 1-1: Extended Modbus System Example

In figure 1-1, we can see 4 specific styles of Modbus operations. Modbus/RTU devices are traditionally split into 2 groups.

Modbus slave devices generally are the workhorse devices. Often industrially hardened, they tirelessly perform their tasks 24 hours a day, 365 days a year. Tasks such as flow metering, temperature control, batch loading, or even running entire automated assembly lines. The slave devices are not called “slaves” because they work all the time, they are called slaves because as far as the data communications is concerned, they function as passive servers. Modbus slave devices passively sit and wait for a remote Modbus master device to ask them to report existing data values (Read) or accept new data values (Write).

Modbus master devices generally are higher-level computers, devices in which data and software are very important. The most common example of Modbus master devices is the “Human-Machine-Interface” (HMI) computers which allow human operators to monitor, adjust, and maintain the operations of the field devices. Modbus master devices are clients which actively go out and “Read” from and/or “Write” to remote Modbus slave devices to monitor or adjust slave behavior.

Modbus/TCP Master Talking to Modbus/TCP Slave

Devices A, B, E, and F are all new Modbus/TCP devices, which are improved over Modbus/RTU (see more about Modbus/RTU limitations below). All 4 devices can function concurrently as both Modbus master and Modbus slave. Both computers A and B can treat controller E as a slave, polling data in real-time. Yet controller E can also act as a master and poll data from controller F, which can in turn also act as a master to write alarm data directly up to computers A and B to alert the operators to the alarm condition. Traditional Modbus/RTU requires slave devices even with life threatening alarm conditions to sit patiently and wait for a remote master to poll the specific data that caused the alarm condition.

While this new functionality of Modbus/TCP may not impress computer experts, it is really revolutionary for such a simple and flexible protocol as Modbus to offer such functionality. Therefore, Modbus/TCP offers exciting new design options for industrial users, which the Lantronix CoBox-DR1-M extends to traditional Modbus/RTU serial devices.

Modbus/TCP Master Talking to Modbus/RTU Serial Slave

Devices D, G, and H are traditional Modbus/RTU slave devices. Device D uses a point-to-point electrical interface like RS-232. This allows only a single Modbus/RTU master to talk to device D. However, the CoBox-DR1-MB makes device D appear on the Modbus/TCP network as a full Modbus/TCP slave device. All Modbus/TCP enabled devices A, B, E, and F can actively share access to slave device D. A limitation in traditional Modbus/RTU implementation expects devices to be dedicated as either master or slave devices, so device D can only act as a Modbus slave.

Devices G and H are different from device D. They share a single RS-485 “multi-drop” line which strictly limits them to act as slaves to a single Modbus/RTU master. However, a little of the new Modbus/TCP and CoBox-DR1-MB magic still applies—all Modbus/TCP enabled devices A, B, E, and F can actively share access to both slave devices G and H. CoBox-DR1-MB manages and coordinates the shared access. In fact, the CoBox-DR1-MB allows up to 8 concurrent Modbus masters to share access to the slaves.

Modbus/RTU Serial Master Talking to Modbus/TCP Slave

Device C is a traditional Modbus/RTU master device. Yet the CoBox-DR1-MB makes device C appear to the TCP/IP network as a Modbus/TCP master—plus all of the Modbus/TCP slaves on the TCP/IP network (A, B, D, E, F, G, & H) appear as traditional Modbus/RTU slave devices. The only limitation is the traditional Modbus/RTU assumption that device C is dedicated as a master only. Therefore Modbus/TCP master devices A, B, E, and F cannot treat device C as a Modbus/TCP slave.

Modbus/RTU Serial Master Talking to Modbus/RTU Serial Slave

Finally, master device C can poll traditional Modbus/RTU slave devices D, G, and H as if they were directly multi-dropped on an attached RS-485 line. The CoBox-DR1-MB transparently bridges traditional Modbus/RTU devices across any TCP/IP network. This means users can start implementing for Modbus/TCP long before all of their required products exist with Modbus/TCP and network interfaces.

2 CoBox-DR1-MB's Interfaces

Serial Interface

CoBox-DR1-MB has RJ45 and screw block serial ports. Both the RJ45 port and the screw block port supports RS232 and RS485/422.

NOTE: CoBox-DR1-MB is a single serial port device, meaning that only one port can be used at a time. In the configuration menu, channel one refers to either one of the ports being used. Channel two should be disregarded (this channel applies to another type of product.)

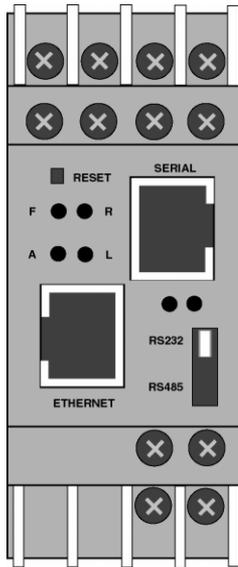


Figure 2-1: CoBox-DR1-MB Front Panel

Network Interface

CoBox-DR1-MB supports 10 Mbit Ethernet through its RJ45 (10BaseT) connector.

Hardware Address

The first three bytes are fixed, and read 00-20-4A. The fourth, fifth, and sixth bytes represents the type of the product and the serial number in Hex notation.

Power Requirements

The CoBox-DR1-MB is not shipped with a power supply. The required input voltage can vary between 9VDC and 30VDC with a maximum of 3 Watts.

3 Network Protocols

The CoBox-DR1-MB product uses TCP/IP protocols for network communication. The supported standards are: ARP, UDP, TCP, ICMP, Telnet, TFTP, DHCP, and SNMP. For transparent connections, TCP/IP (binary stream) or Telnet protocols are used. Firmware upgrades can be made with the TFTP protocol.

The IP protocol defines addressing, routing and data block handling over the network. The TCP (transmission control protocol) assures that no data is lost or duplicated, and that everything sent into the connection on one side arrives at the target exactly as it was sent.

For typical datagram applications where devices interact with others without maintaining a point to point connection, UDP datagram is used.

Packing Algorithm

Traditional Modbus/RTU requires a “character time-out” to signal the end of a Modbus/RTU packet. This stretches out the overall response cycle. Fortunately, the CoBox-DR1-MB uses an intelligent length-predictive algorithm to detect the end of standard Modbus messages. This allows better performance plus the CoBox-DR1-MB falls back to using a user definable “character time-out” to manage non-standard or user-defined Modbus functions.

IP Address

Every device connected to the TCP/IP network including the CoBox-DR1-MB must have a unique IP address. When multiple Modbus devices share a single IP, then Modbus/TCP includes an additional address called the Unit ID. See Appendix B for a complete description of IP Addressing.

When the CoBox-DR1-MB is receiving Modbus/TCP messages from remote masters, the Unit ID is converted to use in the Modbus/RTU message as the slave address.

When the CoBox-DR1-MB is receiving Modbus/RTU messages from local serial masters, a user-defined lookup table is used to match the 8-bit Modbus slave address to a remote IP address. The Modbus slave address received is used as the Unit ID.

4 Configuration

The CoBox-DR1-MB can be configured using remote or local methods. Either use an ASCII terminal or a terminal emulation program to locally access the serial port, or use a Telnet connection to configure the unit over the network.

The CoBox-DR1-MB configuration is stored in nonvolatile memory and is retained without power. The configuration can be changed any time. The CoBox-DR1-MB performs a reset after the configuration has been changed and stored.

Network Configuration

To configure over the network, a Telnet connection to port 9999 must be established.

If you know the assigned IP address you can establish a Telnet connection to port 9999. Under Windows 95/98/NT, open an MS-DOS command window and type the command "telnet x.x.x.x 9999", where x.x.x.x is an IP address already configured in the CoBox-DR1-MB and 9999 is the desired TCP/IP port. Make sure you put a space between the x.x.x.x and 9999.

CoBox-DR1-MB's IP Address

The CoBox-DR1-MB is shipped with a default IP address of 0.0.0.0, which automatically enables the DHCP within the CoBox-DR1-MB.

With DHCP-enabled CoBox-DR1-MB, If there is a DHCP server to respond to CoBox-DR1-MB's request when it's booting up, the CoBox-DR1-MB will then get an IP address, a gateway address, and a subnet mask from the DHCP server. These addresses will not be shown in the CoBox-DR1-MB's configuration screens (you will still see 0.0.0.0), however if you enter the "monitor mode" (see Section 5.1) and from 0> prompt type NC (upper case) you will be able to see the IP configuration of the CoBox-DR1-MB.

NOTE: Using the ARP command (see below) you can always override the IP address given to the CoBox-DR1-MB by your DHCP server.

With DHCP enabled CoBox-DR1-MB, If there is no DHCP server on the network, then the CoBox-DR1-MB's request will eventually time out and the unit will boot up with no IP address. As soon as a static IP address is assigned to the CoBox-DR1-MB, the DHCP support will be disabled within the product. To re-enable DHCP support, the IP address should be set back to 0.0.0.0.

Assigning a New IP Address

If the IP Address of the CoBox-DR1-MB is unknown or undefined, the following steps outline how to assign a temporary IP address over the network.

Set a static ARP with the desired IP address using the hardware address of the CoBox-DR1-MB, which is printed on the product label. The following example shows the use of ARP in Win95/98/NT, (from the DOS prompt) and UNIX environments when the hardware address of the CoBox-DR1-MB is 00-20-4A-01-64-0B.

NOTE: In order for the ARP command to work in Windows, the ARP table on the PC must have at least one IP address defined other than its own. Type “ARP -A” at the DOS command prompt to verify that there is at least one entry in the ARP table. If there is no other entry beside the local machine, ping another IP machine on your network to build the ARP table. This has to be a host other than the machine on which you are working. Once there is at least one entry in the ARP table, use the following commands to ARP an IP address to the CoBox-DR1-MB.

arp -s 191.12.3.77 00-20-4A-01-64-0B

The command example for most Unix systems is:

arp -s 191.12.3.77 00:20:4A:01:64:0B

- b) Open a Telnet connection to port number 1. This connection will fail, but the CoBox-DR1-MB will change its IP address to the one designated in the arp command line.

telnet 191.12.3.77 1

- c) Open a Telnet connection to port 9999 and set all required parameters.

telnet 191.12.3.77 9999

NOTE: The temporary IP address by arp is reverted after every power reset of the CoBox-DR1-MB. Be sure to log into CoBox-DR1-MB and store the parameters to make the changes permanent.

Serial Configuration

An ASCII terminal or a PC with a terminal emulation program can be connected to one of the serial ports on the CoBox-DR1-MB. The terminal (or PC) should be configured for 9600 baud, no parity, 8-bit, and 1 stop bit.

To enter configuration mode, the power on the CoBox-DR1-MB must be cycled (powered off and back on). After power-up, the self-test begins. About

a second later, three lowercase ‘x’ characters must be sent to the CoBox-DR1-MB. These characters must all be sent within approximately one second to start the configuration mode.

NOTE: The easiest way to enter the configuration is to hold down the ‘x’ key at the terminal (emulation) and then power up the CoBox-DR1-MB. This will ensure that the x characters will arrive in time.

Configuration Parameters

After configuration mode is entered (confirm with <ENTER>), the parameters can be changed; default values can be confirmed with the ENTER key. The parameters must be stored, and the CoBox-DR1-MB performs a power reset.

```
Lantronix, Inc. CoBox-DR1-MB
Serial Number 204-041 Software Version V01.1 (990709)
Press Enter to go into Setup Mode, wait to close
CoBox MB Setup, Lantronix, Inc.
  Resetting to factory defaults
1) Network/IP Settings:
  Ethernet Interface TPI
  IP Address ..... 194.039.078.254
  Default Gateway ..... --- not set ---
  Netmask ..... --- not set ---
2) Serial & Mode Settings:
  Protocol ..... Modbus/RTU,Slave(s) attached
  Serial Interface ..... 9600,8,E,1,RS232,DB25
3) Modem Control Settings:
  DCD Output ..... Fixed High/Active
  CTS Output ..... Fixed High/Active
4) Advanced Modbus Protocol settings:
  Slave Addr/Unit ID Source .. Modbus/TCP header
  Modbus Serial Broadcasts ... Disabled
  Character, Message Timeout.. 00050 ms,05000 ms

D)efault settings, S)ave, Q)uit without save
Select Command or parameter set (1..4) to change:
```

Basic Commands (D/S/Q)

The main CoBox-DR1-MB configuration menu is shown in figure 4-1. The CoBox-DR1-MB offers 3 basic options.

Default Settings (D)

Entering “D” resets all parameters to the factory default as shown above. Only the IP address is not changed.

Save (S)

Entering “S” saves the currently displayed parameter settings into non-volatile memory and exits configuration mode. It will trigger a reset.

Quit Without Saving (Q)

Entering “Q” throws away any parameter changes you have made and exits configuration mode. It will trigger a reset.

Network/IP Settings

To change the basic network parameters, press “1”. The following values can be set/changed.

IP Address

The IP address must be set to a unique value on your network. If you are not familiar with IP addressing on your network, please consult your system administrator. Please refer to Appendix B for more details about IP addresses.

If the CoBox-DR1-MB is set to an address already in use, it will display an error code with the LEDs and it will not operate properly. If you understand and plan to use DHCP, set the IP to 0.0.0.0 to activate DHCP (see section 4.3).

Set Gateway IP Address (Y/N)

Most users could choose “N” for this case. You only need to choose “Y” if your CoBox-DR1-MB must communicate to remote TCP/IP networks through a router or gateway. If you select “Y”, you must also enter the IP address of the default gateway within your local network. If in doubt, consult your network administrator.

Set Netmask (N for default)

Most users could select “N”, which causes the CoBox-DR1-MB to automatically use the standard netmask appropriate for the IP address you’ve entered. Users who want a non-standard netmask need to enter the number of host bits in the IP address. Appendix B covers the calculation of non-standard netmasks in detail.

Telnet Configuration Password

The telnet configuration password can be set to disable unauthorized access to the setup menu via a Telnet connection to port 9999. To access the setup menu through the serial port, it is not necessary to enter the password.

Serial & Mode Settings

To change the basic serial parameters, press “2”. The following values can be set/changed.

Attached Device (1=Slave, 2=Master)

As mentioned in the introduction, Modbus/RTU devices are defined as either slave or master devices. Enter “1” if the attached device is a slave (such as controller or PLC) or “2” if the attached device is a master (such as a computer running graphical human-machine-interface (HMI) software).

Serial Protocol (1=Modbus/RTU, 2=Modbus/ASCII)

Serial Modbus comes in two flavors. Modbus/RTU uses 8-bit data bytes to send binary information. However, some devices cannot handle 8-bit data bytes, so Modbus/ASCII is used, which is a slower protocol where each 8-bit data byte is converted to 2, 8-bit ASCII characters. Since CoBox-DR1-MB converts both to/from Modbus/TCP fully, you can mix any combination of RTU and ASCII devices on a Modbus/TCP network.

Serial Connector

The CoBox-DR1-MB hardware includes 2 physical serial ports. It allows you to choose either RJ45 (RS232 only) or Screw Block (RS232/422/485).

Interface Type (1=RS-232, 2=RS-422, 3=RS-485)

This applies allows the CoBox to deal with the software-related details of using RS-232, RS-422, and RS-485.

Enter Serial Parameters (B,D,P,S)

Enter the baud rate (300/ 600/ 1200/ 2400/ 4800/ 9600/ 19,200 or 38,400), data bits (7/8), parity (N/O/E), and stop bits (1/2) in the classic “DOS Mode Command” style. Examples are: 9600,8,E,1 or 1200,7,O,2.

This setting must match the setting on the attached Modbus device.

NOTE: Regardless of this setting, CoBox-DR1-MB configuration is always done on CH1 with RS-232 and a setting of 9600,8,N,1.

Modem Control Settings

When using RS-232, CoBox-DR1-MB has a number of user-definable “Modem Control” parameters to manage RTS/CTS handshaking for half-duplex radio modems.

DCD Mode (1=Fixed 2=Variable)

Answer “1” and the CoBox-DR1-MB DCD output is fixed high. Answer “2” and it is only high if there is at least 1 active TCP connection. For a CoBox with attached slave, this means at least 1 Modbus/TCP master is interested in our data. For a CoBox with attached master, this means at least 1 slave Modbus/TCP device accepted a connection.

RTS/CTS Mode (1=Fixed 2=Variable)

Answer “1” and the CoBox RTS/CTS output is fixed high. Answer “2” and it acts as modem handshaking.

Delay after Output of RTS (0-1275 msec, 5ms resolution)

Only asked if RTS/CTS mode is variable. After the CoBox asserts the RTS/CTS signal, it delays from 0 to 1275 msec before continuing. Normally this is set to 0. Only set a value here if your device, modem or cable is non-standard.

Wait for CTS to Go Active (N/Y)

Only asked if RTS/CTS mode is variable. Answering “N” causes the CoBox-DR1-MB to ignore the RTS/CTS response from the modem. Answering “Y” causes the CoBox-DR1-MB to wait for the RTS/CTS response from the modem. Don’t answer “Y” unless you know that the cable is wired properly to support this signal.

Delay after CTS Going Active (0-1275 msec, 5ms resolution)

Only asked if RTS/CTS mode is variable and set to wait for CTS to go active. After the CoBox sees the modem assert an RTS/CTS response input, it delays from 0 to 1275 msec before transmitting. If the CoBox waits without seeing a valid response from the modem, it will return the Modbus exception response 0x0B (hex) to the Modbus/TCP requesting master.

Delay Dropping RTS After Transmitting (0-1275 msec, 5ms resolution)

Only asked if RTS/CTS mode is variable. After the CoBox completes transmission, it delays from 0 to 1275 msec before dropping the RTS/CTS output.

Advanced Modbus Protocol Settings

Changing these parameters takes a bit of thought and planning.

Slave Address (0 for auto, or 1..255 fixed otherwise)

Modbus/TCP includes a “Unit ID” field, which is used to address multiple Modbus slaves at a single IP address. Unfortunately, some first generation software drivers assumed a single slave at each IP and always set the Unit ID field to 0. This causes the CoBox-DR1-MB problems because it requires the Unit ID for the Modbus/RTU “Slave Address”. To support these older applications, the CoBox allows you to force a fixed address for Modbus/RTU and Modbus/ASCII, but note that this restricts you to a single serial slave device per CoBox-DR1-MB.

Setting this value to 0 causes the CoBox to use the Modbus/TCP Unit ID as received. Setting it to any other address causes the CoBox to always use the set value as a fixed address.

Allow Modbus Broadcasts (1=Yes 2=No)

This actually relates to the previous issue. The default is 2/No, in which case CoBox-DR1-MB always assumes a Modbus/TCP “Unit ID” of 0 really means Modbus slave address 1. Answering “No” here is like setting a fixed address of 1 (parameter above), except the fixed address is only used if the Modbus/TCP “Unit ID” is 0.

NOTE: In the current software version for CoBox-DR1-MB, a true Modbus broadcast is only supported when a serial slave device is attached. A Modbus broadcast from a serial master device is discarded regardless of this parameter setting.

Character Timeout (10-1275 msec, 5ms resolution)

This sets the timeout between characters received. Official Modbus/RTU defines a 3.5 character time-out, but complex devices have various interrupts which can cause 5 to 10 character “pauses” during transmission. A safe value for general use with Modbus/RTU is 50msec and this is fixed to 1000msec for Modbus/ASCII.

NOTE: Setting this value lower than 50msec will not improve performance and may even make it worse. CoBox-DR1-MB uses an intelligent length-predicting algorithm to detect end-of-message in Modbus/RTU. This “character timeout” is only used with user-defined or non-standard Modbus functions.

Message Timeout (500-60000 msec, 250ms resolution)

This sets the timeout for a response from a connected slave.

Unit ID to IP Address Lookup Table

These parameters only apply when a serial Modbus master device is attached. Since traditional Modbus uses 8-bit slave addresses and a TCP/IP network requires 32-bit IP addresses, CoBox-DR1-MB uses this table to map an 8-bit address into an IP/Unit ID combination. The 8-bit address is used to both select the desired IP and as the Unit ID sent. The table holds 8 entries, and any Modbus slave address not found in the table returns an exception response to the master. Below is an example of adding an entry.

```
A)dd, D)elete, E)xit - select function: A
Modbus addr from (191) 220
Modbus addr to (191) 255
Slave IP address (192) .(168) .(000) .(000) 32

1): 001-009: 192.168.000.030
2): 010-190: 192.168.000.031
3): 220-255: 192.168.000.032
```

Select Function A)dd, D)elete, E)xit

You can either add or delete entries in the IP address table. They are automatically sorted into increasing order. Enter “E” when you are satisfied with the table to return to the main menu.

Modbus Address From/To

This is the minimum/maximum Modbus slave address (inclusive) to forward to this IP address.

Slave IP Address

This is the IP address of the remote Modbus/TCP slave.

Exit Configuration Mode

To leave the configuration program and save all changes, press ‘9’. All values will be stored in nonvolatile (E²PROM) memory, and CoBox-DR1-MB will reset.

Factory Default Settings

By selecting this option all the serial port settings within the CoBox-DR1-MB will be changed back to factory default values (the “Server Configurations” stay unchanged).

5 Monitor Mode and Firmware Upgrade

To enter monitor mode, the same principal as setting the parameters is used (see Section 4.3) Instead of entering three “x” keys, key in “xx1”. Within one second of power-up, the CoBox-DR1-MB will respond with a special prompt. To start the monitor mode without network functions (no network connections), enter “xx2”. To enter the monitor mode, in addition to “xx1” and “xx2” you can also type “yyy” and log in.

To enter the monitor mode using a Telnet connection, after the Telnet session is established, you will see the following messages:

Lantronix UTS Snr 222-195 V3.5

Press Enter to go into Setup Mode

At this point, type M (upper case.) If you see O> prompt, it means that you have entered the monitor mode successfully.

Monitor Commands

The following commands are available in the monitor mode. Many commands have an IP address as an optional parameter (x.x.x.x). If it is given, the command is applied to another CoBox-DR1-MB with that IP address. If no IP address is given, the command is executed locally.

All commands must be given in capital letters; only blanks (spaces) are accepted between parameters.

DL	Firmware download to the CoBox-DR1-MB
SF x.x.x.x	Send firmware to CoBox-DR1-MB with IP x.x.x.x
VS x.x.x.x	Query software header record (16-byte)
GC x.x.x.x	Get configuration as HEX records
SC x.x.x.x	Set configuration from HEX records
PI x.x.x.x	Check with Ping if x.x.x.x is alive and reachable
AT	Show the CoBox-DR1-MB’s ARP table entries
TT	Shows all the incoming and outgoing TCP connections (used only with “monitor mode” from Telnet)

- NC** Shows the IP configuration of the CoBox-DR1-MB
- RS** Resets the power on the CoBox-DR1-MB
- SI x.x.x.x:n.n.n.n** With this command, you can remotely assign an IP address to another CoBox-DR1-MB, where x.x.x.x is the new IP address and n.n.n.n is the remote CoBox-DR1-MB serial number written twice. For example:
- SI194.39.78.234:146.138.146.138
- IP address = 194.39.78.234
- Remote CoBox serial # (146-138) = 146.138.146.138

NOTE: Since this is obtained by sending broadcast packets, this IP assignment cannot be done over the routers.

QU Quit - exit diagnostics mode

Command result codes:

- 0** OK, no error
- 1** No answer from remote device
- 2** Cannot reach remote device or does not answer
- 8** Wrong parameter(s)
- 9** Invalid command

Firmware Download Using Serial Port

Downloading is done in monitor mode. Once the CoBox-DR1-MB is in monitor mode, by using “DL” command, the CoBox-DR1-MB will wait for the firmware image in Intel Hex format. This must only be sent through the serial interface. When the end record is received, the CoBox-DR1-MB checks the integrity of the firmware image and then programs the new firmware in the flash ROM. Do not switch off the power supply at this time. A loss of power while reprogramming will result in a corrupt program image and a nonfunctional CoBox-DR1-MB.

The following figure displays a typical screen while programming the new firmware. After a complete reprogramming, the CoBox-DR1-MB restarts.

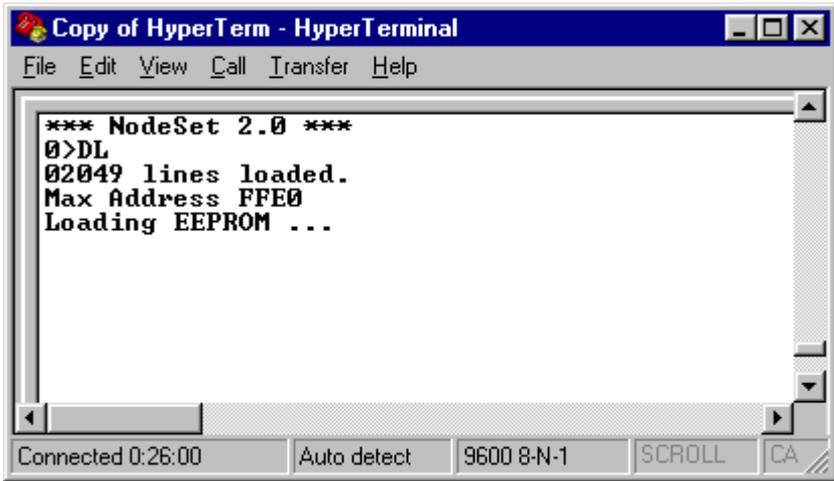


Figure 5-1: HyperTerminal Dialog Box

Firmware Distribution

To distribute the firmware of one CoBox-DR1-MB to others, the “SF” command is used. After entering monitor mode on the CoBox-DR1-MB, simply send the firmware with the “SF” command to the other devices.

Firmware Download Using a Network Host

To download new firmware from a computer to a CoBox-DR1-MB, it is necessary to have a TFTP client sending a binary file. The parameters to send the binary firmware are shown in figure 5-2.

NOTE: The file to be downloaded must be the .ROM (binary) image and not the .HEX (ASCII) version.

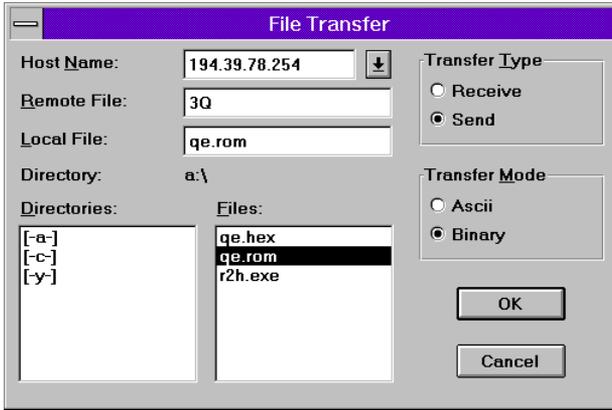


Figure 5-2: TFTP Dialog Box

6 Configuring Third Party Software

Modsoft v2.6 or later

Modsoft is the traditional tool used to program and configure Modicon equipment. To support Modbus/TCP you require Modsoft version 2.6 or later. Set the Communications Parameters as follows:

- **Protocol** : TCP/IP
- **Dest_Port** : 502
- **Dest_Index** : Modbus/RTU slave address
- **TCP/IP Address** : as required

NOTE: Modsoft's "Dest_Index" is the Modbus/TCP "Unit ID" parameter, therefore you do not have to use the "Fixed Slave Address" setting in the CoBox-DR1-MB and RS-485 multi-drop is supported.

Win-Tech ModScan32

Wintech (at www.win-tech.com) puts out a number of useful tools for general purpose Modbus support. Of greatest interest is ModScan32, which allows you to select and poll coils and registers from various Modbus/RTU, Modbus/ASCII, and Modbus/TCP slave devices. This is a good tool for troubleshooting.

NOTE: Wintech properly supports the Modbus/TCP "Unit ID" parameter, therefore you do not have to use the "Fixed Slave Address" setting in the CoBox-DR1-MB and RS-485 multi-drop is supported.

IO-Server OPC Server

IOServer (at www.ioserver.com) makes a general purpose OPC server which properly supports Modbus/TCP. This OPC server can be accessed by Intellution, Genesis, Wonderware, and most other commercial HMI products.

NOTE: IOServer properly supports the Modbus/TCP "Unit ID" parameter, therefore you do not have to use the "Fixed Slave Address" setting in the CoBox-DR1-MB and RS-485 multi-drop is supported.

Intellution FIX HMI

The CoBox MB allows Windows workstations with FIX to access Modbus/RTU devices by TCP/IP over Ethernet. To configure, just enter the CoBox-DR1-MB's IP address.

NOTE: At the time of this writing, Intellution does not properly support the Modbus/TCP "Unit ID" parameter, therefore you may have to use the "Fixed Slave Address" setting in the CoBox-DR1-MB and only a single slave device is supported.

7 Serial Line Interfaces

CoBox-DR1-MB has RJ45 and screw block serial ports. Both ports support RS-232 and RS-485/422. By setting the switch located on the face of the CoBox-DR1-MB, RS-232 or RS-485/422 can be selected.

Pin	Direction	Function
1	Not Connected	None
2	Hard-wired output	DSR Data Set Ready
3	To CoBox-DR1-MB	RXD Received data
4	From DR1-MB	TXD Transmitted Data
5		Ground
6	To DR1-MB	CTS Clear to Send
7	From DR1-MB	RTS Ready to Send
8	Not Connected	None

Figure 7-1: RJ45 Connector RS-232 Pinout

Pin	Function
1	None
2	None
3	RX -
4	TX -
5	Ground
6	RX +
7	TX +
8	None

Figure 7-2: RJ45 Connector RS-485 Pinout

NOTE: Pin number 1 of the RJ45 serial connector is the first pin from the bottom.

Screw Block Connector Pinouts and Other Components

The following figures illustrate and describe the screw block connector pinouts and other components of the CoBox-DR1-MB.

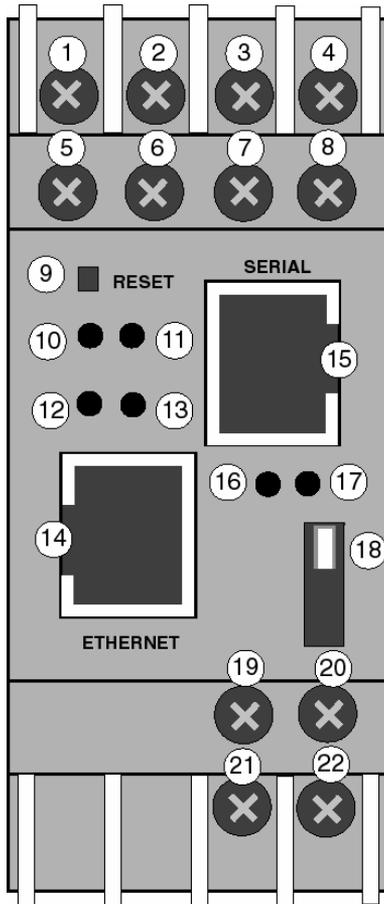


Figure 7-3: Front Panel Layout

Serial Line Interfaces

Item	Component	Name	Purpose
1	Screw terminal	RXD or RXA	RS-232: RXD (Received Data) RS-422/485:RXA (Received Data -)
2	Screw terminal	CTS or RXB	RS-232: CTS (Clear to Send) RS-422/485: RXB (Received Data +)
3	Screw terminal	RTS or TXB	RS-232: RTS (Request to Send) RS-422/485: TXB (Transmit Data +)
4	Screw terminal	TXD or TXA	RS-232: TXD (Transmit Data) RS-422/485: TXA (Transmit Data -)
5,6,7	Screw terminal	NC	No connection
8	Screw terminal	GND	Signal ground
9	Reset switch	RESET	Push to power reset and initialize
10	LED (Red)	Fault or Configuration	SOLID: Fault in CoBox-DR1-MB communication (read error) or CoBox-DR1-MB is in Configuration Mode
11	LED (Green)	Ready	SOLID: Connection to network host established
12	LED (Yellow)	Activity	FLASHING: Network traffic
13	LED (Green)	Link	SOLID: CoBox-DR1-MB has good Ethernet link
14	Connector (RJ45)	Ethernet port	RJ45 connector for Ethernet 10BaseT
15	Connector (RJ45)	Serial port	RJ45 connector for RS-232
16	LED (Yellow)	Serial TXD	FLASHING: Indicates transmission from the serial port
17	LED (Yellow)	Serial RXD	FLASHING: Indicates reception to the serial port
18	Switch	Switch for screw block	UP: Serial RS-232 DOWN: Serial RS-422/485
19	Screw terminal	DC +	Operating power, positive
20	Screw terminal	Ground	Earth ground
21	Screw terminal	DC -	Operating power, negative
22	Screw terminal	Ground	Earth ground

Figure 7-4: Front Panel Components

NOTE: For RS-485 2-wire functionality, pins 1 & 4 and 2 & 3 of the screw terminals must be connected together.

8 Technical Data

CPU, Memory Controllers

V.40 CPU, 10MHz clock

National Semiconductor DP839xx Ethernet Controller

128kByte RAM, 128 kByte Flash EPROM

256 Byte E²PROM for parameter storage

Serial Interface

RJ45 connector for RS232 interface

Screw terminals for RS232 or RS422/485 interface

Speed software selectable 300 to 38.4k baud

Switch selectable RS-232C or RS-422/485 – screw terminal connector only

Network Interface

Integrated 10BaseT port (RJ45 connector)

Power Supply (not included)

Screw terminals for 9-30 Volt DC

Power Consumption

Maximum 3 Watt

Operating Temperature

0-60 degrees C (32-140 degrees F)

LEDs

Four LEDs for Ethernet channel, link, activities, and error

Two LEDs for serial channel status

Case

Plastic case for DIN rail mounting

Dimensions

90 x 60 x 36 mm

Weight

Approx. 150g (0.33 lb)

A IP Addresses, Netmask etc.

IP Addressing

An IP address is a 32-bit value, divided into four octets of eight bits each. The standard representation is four decimal numbers (in the range of 0..255), divided by dots.

Example: 192.2.1.123

This is called decimal-dot notation.

The IP address is divided in two parts: network and host. To support different needs, three "network classes" have been defined. Depending on the network class, the last one, two or three bytes define the host, while the remaining part defines the network. In the following, 'x' stands for the host part of the IP address:

Class A Network

IP address 1.x.x.x to 127.x.x.x

Only 127 different networks of this class exist. These have a very large number of potential connected devices (up to 16,777,216)

Example: 10.0.0.1, (network 10, host 0.0.1)

Class B Network

IP address 128.0.x.x to 191.255.xxx.xxx

These networks are used for large company networks. Every network can consist of up to 65,534 devices.

Example: 172.1.3.2 (network 172.1, host 3.2)

Class C Network

IP address 192.0.0.xxx to 223.255.255.xxx

These network addresses are most common and are often used in small companies. These networks can consist of a maximum number of 254 hosts.

Example: 192.7.1.9 (network 192.7.1, host 9)

The remaining addresses 224.x.x.x - 239.x.x.x are defined as "class D" and are used as a multicast addresses.

The addresses 240.x.x.x. - 254.x.x.x are defined as "class E" and are reserved addresses.

Network Address

The host address with all host bits set to "0" is used to address the network as a whole (in routing entries, for example).

Broadcast Address

The address with the host part bits set to '1' is the broadcast address, meaning "for every station".

Network and Broadcast addresses must not be used as a host address (e.g. 192.168.0.0 identifies the entire network, 192.168.0.255 identifies the broadcast address).

IP Netmask

The netmask is used to divide the IP address differently from the standard defined by the classes A, B, C. A netmask defines how many bits from the IP address are to be taken as the network section and how many bits are to be taken as the host section. When the number of host bits is entered, the CoBox-DR1-MB calculates the netmask. The netmask is displayed in standard decimal-dot notation.

	Network Bits	Host Bits	Netmask
Class A	8	24	255.0.0.0
Class B	16	16	255.255.0.0
Class C	24	8	255.255.255.0

Figure A-1: Standard IP Network Netmask

Netmask	Host bits
255.255.255.252	2
255.255.255.248	3
255.255.255.240	4
255.255.255.224	5
255.255.255.192	6
255.255.255.128	7
255.255.255.0	8
255.255.254.0	9
255.255.252.0	10
255.255.248.0	11
.	.
.	.
255.128.0.0	23
255.0.0.0	24

Figure A-2: Netmask Examples

Private IP Networks and the Internet

If your network is not connected to the Internet and there are no plans to make such a connection you may use any IP address you wish.

If you are not connected to the Internet and have plans to connect, or you are connected to the Internet and want to operate your CoBox-DR1-MBs on an Intranet you should use one of the sub-networks below. These network numbers have been reserved for such networks. If you have any questions about IP assignment consult your Network Administrator.

- Class A 10.x.x.x
- Class B 172.16.x.x
- Class C 192.168.0.x

Network RFC's

For more information regarding IP addressing see the following documents. These can be located on the World Wide Web using one of the directories or indices:

RFC 950	Internet Standard Subnetting Procedure
RFC 1700	Assigned Numbers
RFC 1117	Internet Numbers
RFC 1597	Address Allocation for Private Internets

B Binary to Hex Conversion

Hexadecimal digits have values from 0..15, represented as 0...9, A (for 10), B (for 11) ... F (for 15). The following table can serve as a conversion chart binary-to-decimal-to-hex:

Decim	Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

Figure B-1: Binary to Hex Conversion

To convert a binary value to a hexadecimal representation, the upper and lower four bits are treated separately, resulting in a two-digit hexadecimal number.

Warranty Statement

Lantronix warrants for a period of FIVE YEARS from the date of shipment that each CoBox-DR1-MB server supplied shall be free from defects in material and workmanship. During this period, if the customer experiences difficulties with a product and is unable to resolve the problem by phone with Lantronix Technical Support, a Return Material Authorization (RMA) will be issued. Following receipt of a RMA number, the customer is responsible for returning the product to Lantronix, freight prepaid. Lantronix, upon verification of warranty will, at its option, repair or replace the product in question, and return it to the customer freight prepaid. No services are handled at the customer's site under this warranty.

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Lantronix shall have no obligation to make repairs or to cause replacement required through normal wear and tear of necessitated in whole or in part by catastrophe, fault or negligence of the user, improper or unauthorized use of the Product, or use of the Product in such a manner for which it was not designed, or by causes external to the Product, such as, but not limited to, power or failure of air conditioning.

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Declaration of Conformity

according to ISO/IEC Guide 22 and BS 7514

Manufacturer's Name: Lantronix
Manufacturer's Address: 15353 Barranca Parkway
Irvine, CA 92618
USA

The manufacturer hereby declares that the product:

Product Name: CoBox-DR1-MB
Product Number(s): CoBox-DR1-MB-0x

Conforms to the following standards or other normative documents:

Electromagnetic Emissions: C1SPR22: 1993 Class "A"
EN55022, 1995 Class "A"
Electromagnetic Immunity: EN50082-1, 1992
Product Safety: EN60950, 1988 +A1, A2, A3, A4

Supplementary Information:

This product has been verified as being compliant within the class A limits of the FCC Radio Frequency Devices Rules (FCC Part 15, Subpart B), revised as of October 1993.

"The product complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/E

