Modicon
TSX Momentum
Modbus to Ethernet Bridge
User Guide

890 USE 155 00   Version 1.0

Merlin Gerin
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Schneider Electric
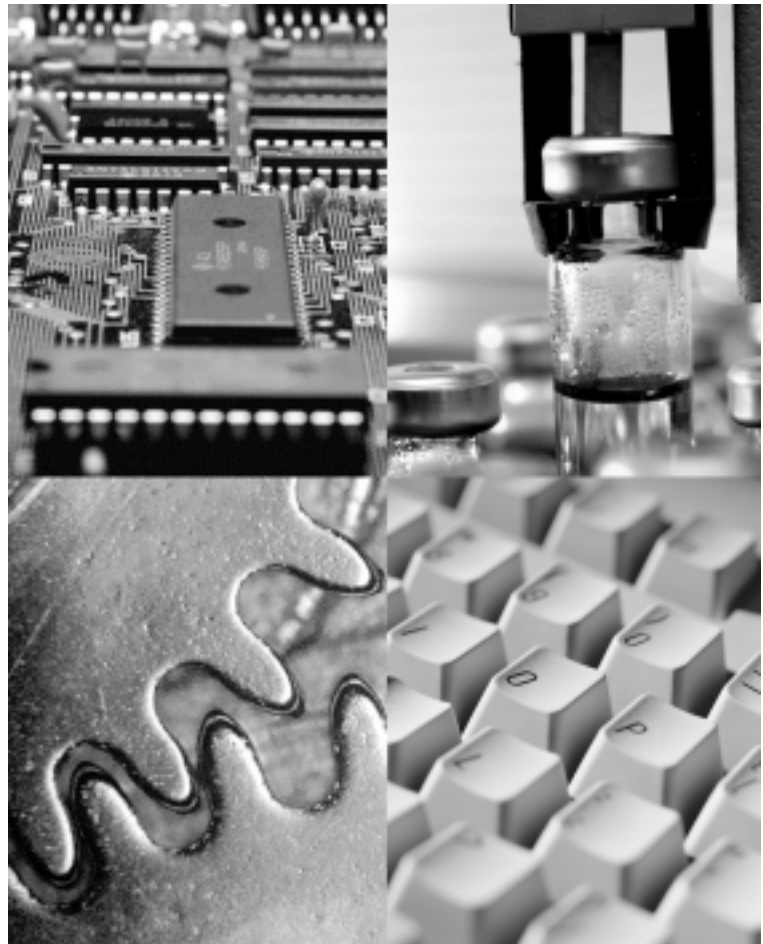
174 CEV 300 10

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Preface

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Modbus to Ethernet Bridge
174 CEV 300 10

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- ■ Introducing the Modbus to Ethernet Bridge
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- ■ Front Panel Layout
- ■ Specifications

1.1   # Introducing the Modbus to Ethernet Bridge

1.1.1   ### Bridge Applications

The Modicon Modbus to Ethernet Bridge provides a means for transacting messages between Ethernet TCP/IP devices and Modbus serial devices. It supports up to eight concurrent transactions between Modbus Master and Slave devices, handling the conversion of TCP/IP and Modbus RTU/ASCII protocols transparently to the user application.

Ethernet nodes using TCP/IP can function as Modbus Masters, originating messages to the Bridge for delivery to Modbus Slave devices connected to the Bridge's Modbus port. The Bridge forwards the messages to the Slave devices using Modbus RTU or ASCII protocol and returns their responses to the Master.

Figure 1 shows a typical application in which a Bridge connects two Modbus Masters on Ethernet to several Modbus Slave serial devices.

Figure 1   Bridging Between Ethernet and Modbus
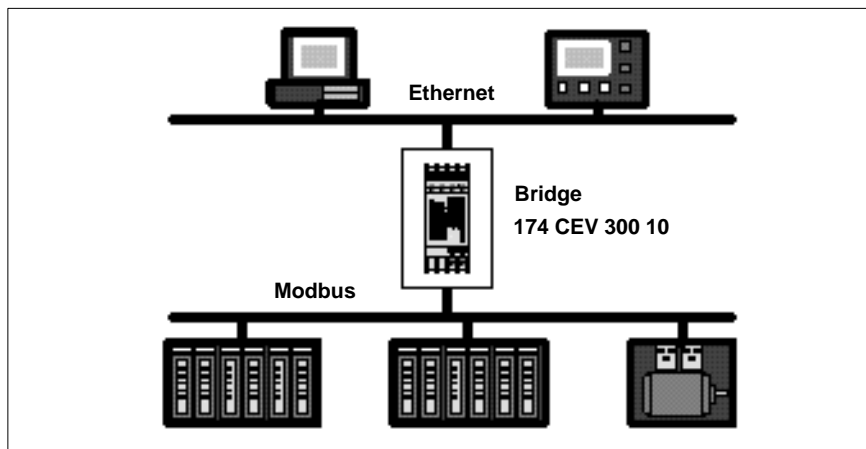
The bridge also allows multiple Modbus networks to be linked together across an Ethernet connection. Multiple Bridges can furnish an Ethernet link between widely separated Modbus networks. This extends the message path beyond the cable lengths allowed for serial connections, and allows a Master on any Modbus network to access Slave devices on another network.

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Figure 2 shows a typical application in which three Bridges join Modbus networks through a common Ethernet link.

Figure 2   Bridging Between Multiple Modbus Networks
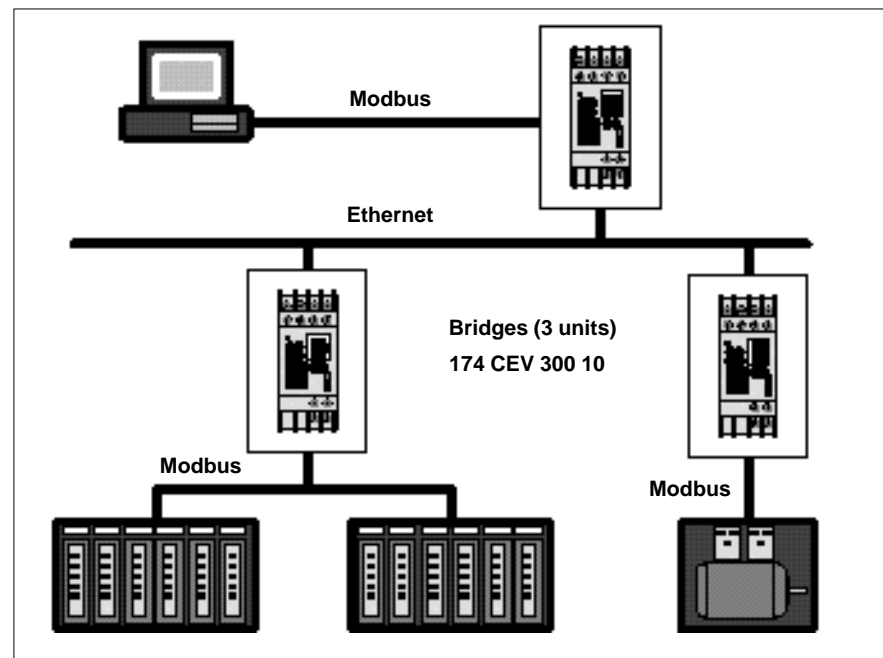
1.1.2   **Overview: Installation and Configuration**

The Bridge is designed for easy 'snap' mounting on a standard DIN rail.

Its front panel has connectors for power, ground, Ethernet and Modbus cables. It has a switch for selecting either an RS–232 or RS–422/485 interface for the Modbus port. Indicators show the status of communication at the Ethernet and Modbus ports.

The Bridge contains a configuraton utility program stored in its non–volatile memory. With this utility you can assign the Bridge's Ethernet and Modbus parameters, using an ASCII terminal at the serial port or a Telnet connection over Ethernet.

The Bridge contains a factory–assigned MAC address that is derived from the serial number printed on the Bridge's label. This allows you to establish an Ethernet connection to the Bridge to assign its IP address and the other parameters for your application.

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1.2 Mapping Modbus and IP Addresses

The Bridge maps messages between Modbus and IP addresses according to the type of device you have configured at its Modbus port.

1.2.1 Mapping for a Modbus Master

When you configure a Modbus Master device at the Bridge's serial port, you can assign up to eight entries into an internal mapping table that is maintained in the Bridge's memory. You enter your intended mapping into the table during your configuration of the Bridge.

Each table entry maps a single Modbus address, or a range of addresses, to a destination IP address.

When the Bridge receives a message from the Master, it searches the mapping table for an entry matching the Modbus address in the message. If one is found, the Bridge sends the message to the IP address for that entry. If a matching entry is not found, the Bridge returns an exception response to the Master application.

Note that the original Modbus address is retained in the message transmitted to the IP destination. If the remote IP node is another Bridge, the message's Modbus address can be used to identify a Slave device at that Bridge's serial port.

1.2.2 Mapping for a Modbus Slave

When you configure a Modbus Slave device or network with multiple Slaves at the Bridge's serial port, you have two options for routing messages to a Slave destination. You assign your choice during your configuration of the Bridge.

Your options are: Message address routing; or, Fixed address routing.

You can specify that the Bridge must route each message to the Slave device that is identified in the Modbus address field of the message. This allows you to address any Slave device in a network of up to 247 devices at the Bridge's Modbus port.

You can specify that the Bridge must route all messages to one fixed Slave address that you define in the Bridge's configuration. With this option the Modbus address field is ignored, and each message is routed to that fixed Slave address only. This limits addressing to a single device at the port.

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Figure 3 shows an example of message address mapping between a Modbus Master and a Modbus Slave using two Bridges with an Ethernet link.

Figure 3   Mapping Modbus and IP Addresses
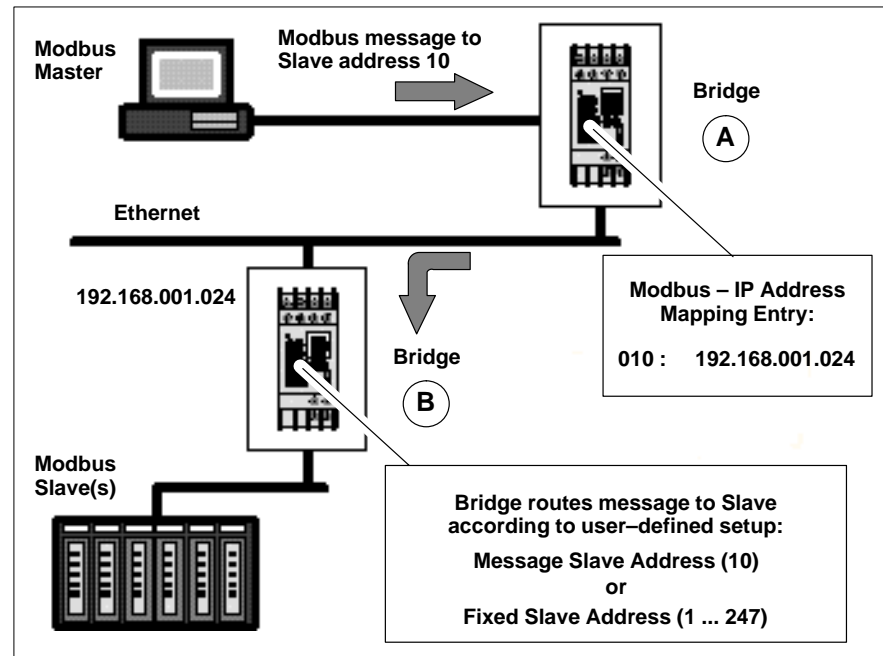
These are the events in the message routing:

- ■ The Modbus Master sends its message containing address 10 decimal to Bridge A.

- ■ You have set an entry in the mapping table in Bridge A. Your entry specifies that messages with address 10 are to be mapped to IP address 192.168.001.024.

- ■ Bridge B has that IP address and receives the message.

- ■ Depending on the option you set in Bridge B, the message is routed either to the Modbus Slave device at address 10 as specified in the message, or to a fixed Slave address in the range 1 ... 247.

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1.3 **Front Panel Layout**

Figure 4 Front Panel Layout
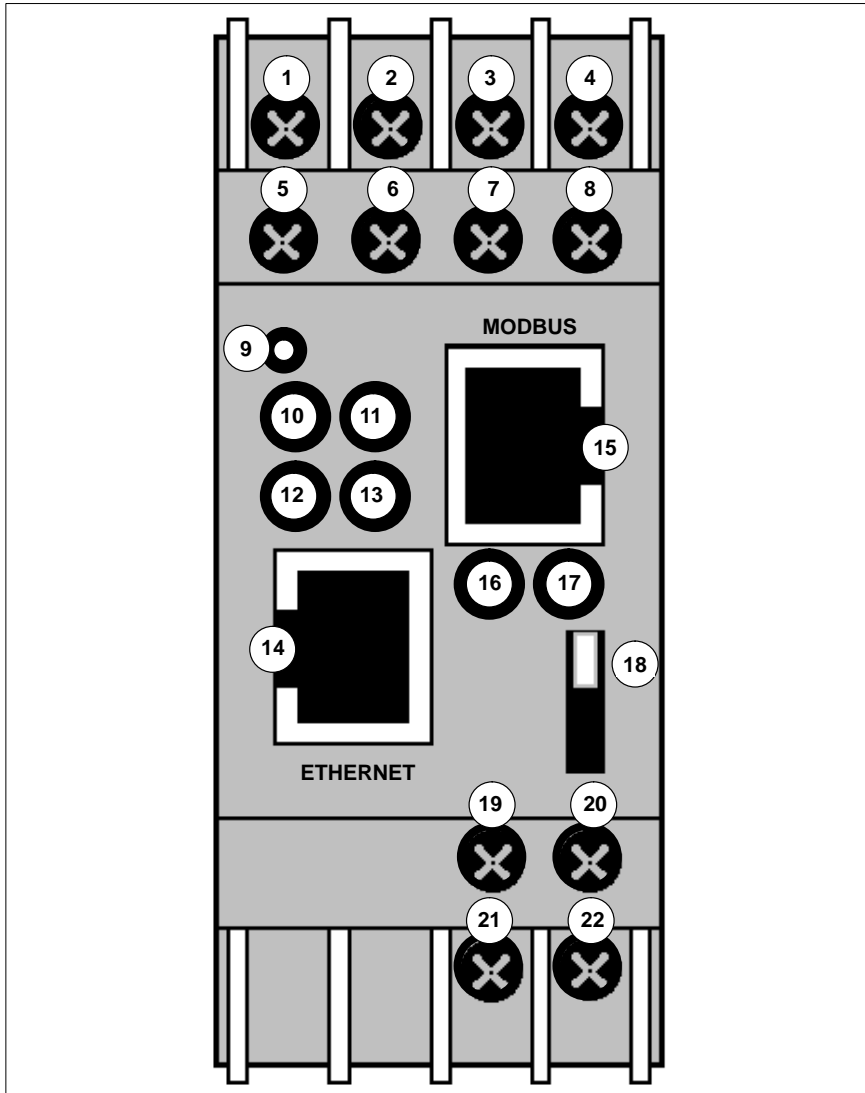
Table 1 Front Panel Components (See Figure 4)

Item	Component	Name	Purpose
1	Wire terminal	RxD or Rx –	Modbus signal: RS–232: RxD (Receive Data) RS–422.485: RxD– (Receive Data –)
2	Wire terminal	CTS or Rx +	Modbus signal: RS–232: CTS (Clear to Send) RS–422/485: RxD+ (Receive Data +)
3	Wire terminal	RTS or Tx +	Modbus signal: RS–232: RTS (Request to Send) RS–422/485: TxD– (Transmit Data +)
4	Wire terminal	TxD or Tx –	Modbus signal: RS–232: TxD (Transmit Data) RS–422/485: TxD– (Transmit Data –)
5, 6, 7	Wire terminal	NC	No connection
8	Wire terminal	GND	Modbus signal ground
9	Reset switch	RST	Push to reset and initialize Bridge
10	LED (Red)	Fault or Configuration	ON: Fault in Bridge communication (or) Bridge is in Configuration Menu
11	LED (Green)	Ready	ON: Bridge is ready for communication on both ports
12	LED (Yellow)	Active Ethernet	Flashing: Indicates activity at Bridge's Ethernet port
13	LED (Green)	Link Good	ON: Bridge has good connection at Ethernet port
14	Connector (RJ45)	Ethernet port	RJ45 connector for Ethernet 10BaseT cable
15	Connector (RJ45)	Modbus port	RJ45 connector for Modbus RS–232 or RS–485 cable
16	LED (Yellow)	Modbus Tx	Flashing: Indicates transmission or upload at Modbus port
17	LED (Yellow)	Modbus Rx	Flashing: Indicates reception at Modbus port
18	Switch	Modbus interface selection	UP: Modbus port is RS–232 DOWN: Modbus port is RS–422/485
19	Wire terminal	DC +	Operating power, positive
20	Wire terminal	Ground	Earth ground
21	Wire terminal	DC –	Operating power, negative
22	Wire terminal	Ground	Earth ground

1.4 Specifications

Table 2   Power

Parameter	Specification
Operating Power, Nominal	12 or 24 V dc
Operating Power Range	9 ... 30 V dc
Maximum Power Drain	3 W
Connection	Screw terminals
Fuse	External, supplied by customer. Fuse value according to supply voltage (see Maximum Power Drain)
Grounding	Screw terminals provided for power ground and safety (Earth) ground

Table 3   Environmental

Parameter	Reference	Limits
Temperature, Operating	IEC 68–2–14	0...60° C ambient
Humidity, Operating	IEC 68–2–3	20 ... 90% RH, non–condensing

Table 4   Ethernet Interface

Parameter	Specification
Protocol	Ethernet v2 encapsulation TCP/IP Version 4
Connector	RJ45 connector for 10baseT cable

Table 5   Serial Interface

Parameter	Specification
Modbus Protocol	RTU or ASCII
Serial Protocol	Switch selectable, RS–232 or RS–485 Supports RS–232 RTS/CTS handshaking RS–485 setting supports RS–422 devices Supports 2–wire and 4–wire RS–485 Supports up to 16 RS–485 devices
Baud Rate	300 ... 38400 +/– 2%
Connector	RJ45 connector, screw terminals RJ45 port connects to Modicon M1, Compact, 984 Slot Mount controllers by direct cable. Cable adapters and adapter kits are available for other products.

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Table 6 Packaging

Parameter	Description
Dimensions	35 x 95 x 60 mm (1.4 x 3.7 x 2.4 in)
Enclosure Material	High–impact plastic
Weight, Product	0.5 kg (1.0 lb)
Weight, Shipping	0.9 kg (2.0 lb)
Mounting Method	DIN rail: DIN EN S0 022 (35 mm)

Table 7 Agency Approval

Parameter	Specification
UL, CSA, CE	Approved
FM	Pending

Installing the Bridge Hardware

<div style="float:right">

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- Mounting the Bridge on the DIN Rail
- Connecting the Power Wiring
- Connecting the Serial Cable (RJ45 Port)
- Compatible Modbus Devices and Cables
- Modbus Cable Pinouts
- Connecting the Serial Cable (Wiring Terminals)
- Setting the Serial Port Switch
- Connecting the Ethernet Cable

2.1   Mounting the Bridge on the DIN Rail

2.1.1   Before You Install the Bridge

The Bridge has an Ethernet MAC address printed on the label on its side panel. The address is required for your Ethernet network administrator to configure the Bridge.

Before you install the Bridge on the DIN rail, write down the MAC address and give it to your network administrator. The label may not be visible after you install the Bridge.

STOP

Warning
COMMUNICATION DISRUPTION HAZARD   Connecting any device to an active Ethernet network can disrupt communication on the network. Before you connect the Bridge to your network, and before you apply power to the Bridge, heed the steps in Chapter 3 for configuring the Bridge in your application. Failure to observe this precaution can result in injury or equipment damage.

2.1.2   Mounting the Bridge

The Bridge is designed for mounting on a standard DIN rail. Figure 5 shows how to mount the Bridge

1. Note the slot on the Bridge's rear panel. Position the top edge of the slot over the top edge of the DIN rail.

2. Snap the Bridge into place on the lower edge of the rail.

Figure 5   Mounting the Bridge on the DIN Rail

Mounting   Completed

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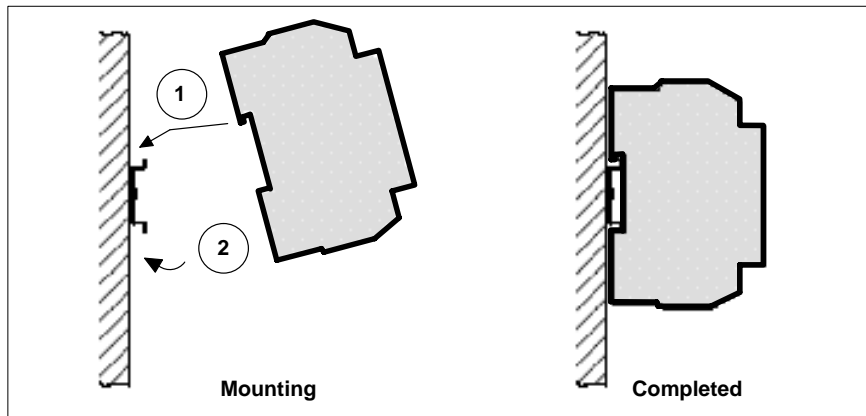
2.2   # Connecting the Power Wiring

Figure 6 shows the connections for operating power and ground.

Operating power must be fused externally to the Bridge. The Bridge draws 3W maximum (9 ... 30 V dc). Select a fuse value according to the supply voltage.

Figure 6   Connecting the Power Wiring
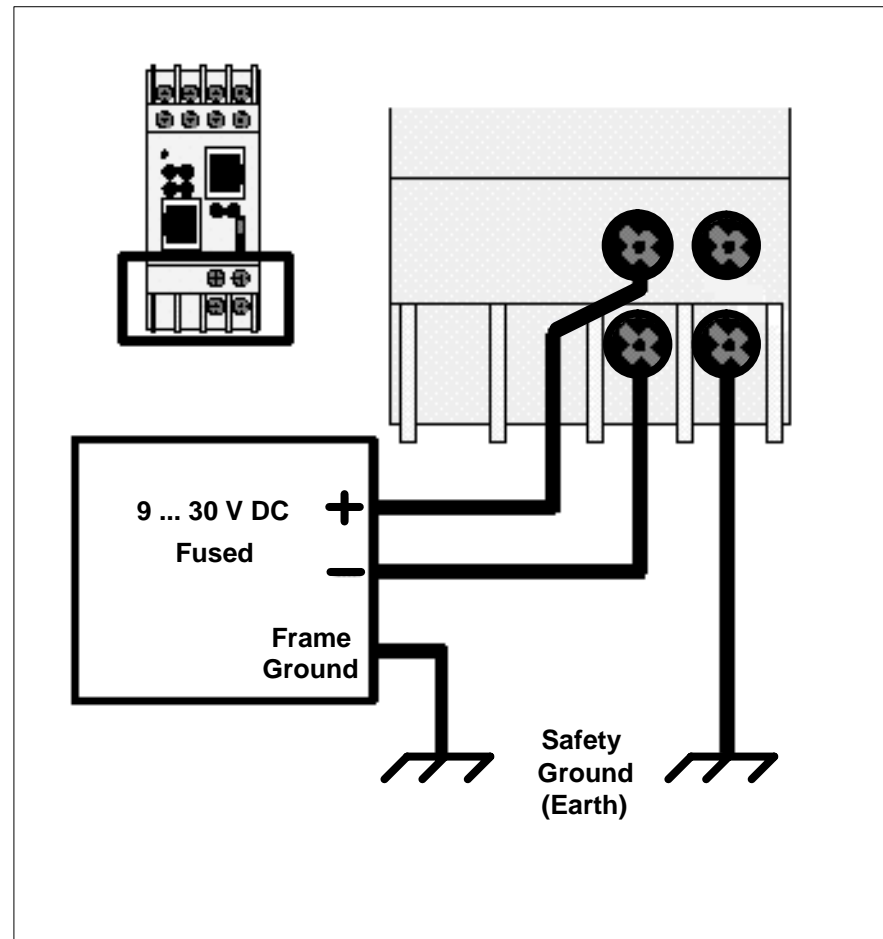
2.3   # Connecting the Serial Cable (RJ45 Port)

Figure 7 shows serial cable connections for several Modicon CPUs for operation as Modbus Master or Slave devices. The figure also shows a typical connection to a standard PC 9–pin serial port for setting up the Bridge configuration.

Table 8 lists other compatible devices and cables.

Figure 7   Connecting the Serial Cable (RJ45 Port)

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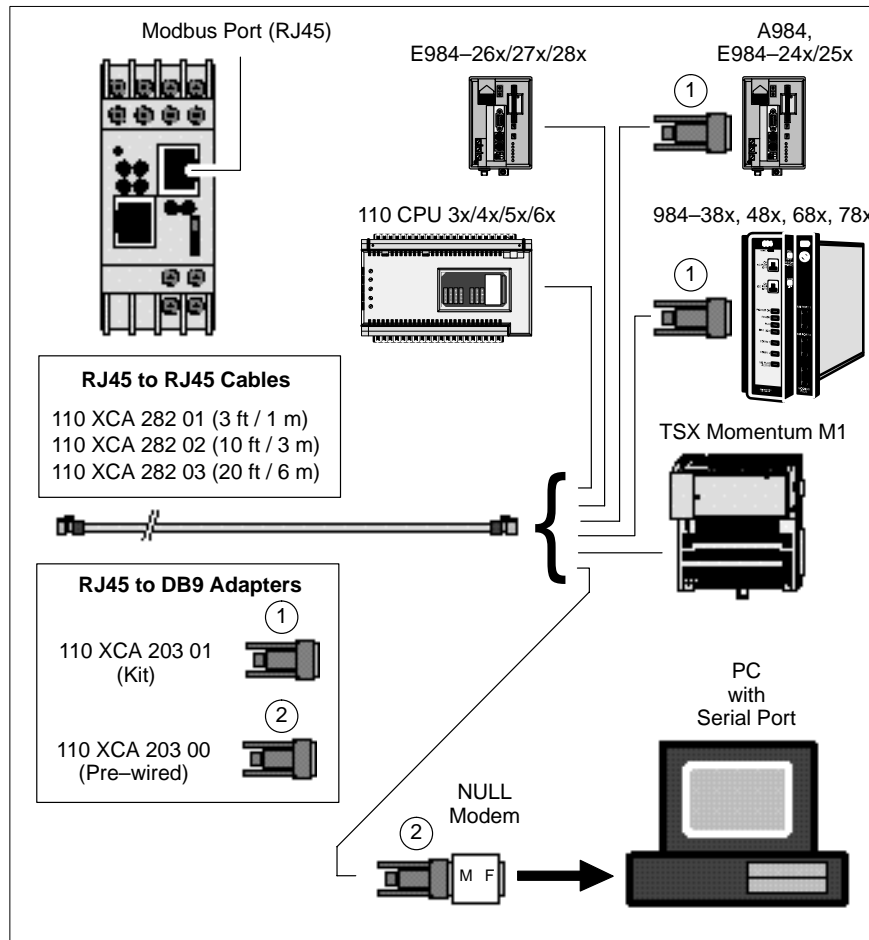
2.4   # Compatible Modbus Devices and Cables

The Bridge connects directly by RJ45 cable to various products shown in Figure 7.

Table 8 below lists other Modbus devices and their cable connections to the Bridge. Connections are RS–232 unless indicated otherwise.

Cable pinout references are to the diagrams in Figure 8 on page 24.

Table 8   Compatible Modbus Devices and Cables

| Device Part Number	Device Description	Cable Pinout (Figure 8)
MM–PM10–2xx	PanelMate Plus 1000 (RS232)	A
MM–PM10–2xx	PanelMate Plus 1000 (RS422)	B
AS–J478–000	Modbus Modem, Fixed Modem Control	C
AS–J478–000	Modbus Modem, Variable Modem Control	D
AS–J347–001	184/384 Controller Modbus Interface	E
AS–J375–000	Micro 84 Controller Modbus Interface	E
AS–P190–xxx	P190 Programming Panel	E
AS–884A–xxx	884 Controller	E
AS–984x–xxx	984A, B, X Controller	E
– –	PC Serial Port, 9–Pin	F
AS–P892–000	ASCII/RIO Interface	G
140 CPU 424 xx	Quantum Controller, 486	G
140 CPU 534 xx	Quantum Controller, 586	G
PC–0984–xxx	984 Controller, 38x/48x/68x/78x Slot Mount	G
PC–A984–xxx	984 Controller, Compact	G
PC–E984–24x/25x	984 Controller, Compact	G
PC–E984–455	984 Controller, 484 Replacement	G
PC–M984–xxx	Micro–984 Controller	G
NW–BM85xxxx	BM85 Bridge Multiplexer	G
– –	Generic Modbus Serial Device, 9–Pin	G
110 VPU 192 00	Programmer, Handheld	H
AS–A584–xxx	584A, L, M Controller	See 584 Note
TSX SCx	TSX Controllers, Modbus Interface	See TSX Note

584 Note
Use cable AS–W192–XXX with Adapter 110 XCA 204 02, pinouts in Figure 8 cable E.

TSX Note
TSX Controller products offer multiple options for cable connection to the Bridge. Refer to your product guidebook for more information.

2.5   Modbus Cable Pinouts

References in this figure are to the devices listed in Table 8 on page 23.

Figure 8   Modbus Cable Pinouts

(A) Adapter Kit: 110 XCA 203 01

DB9M	Wire	RJ45
2	Red	4
3	Black	3
5	Green	5
Shield	White	8

(B) Adapter Kit: 110 XCA 203 01

DB9M	Wire	RJ45
1	Black	3
4	Red	4
5	Green	5
6	Yellow	6
9	Brown	7
Shield	White	8

(C) Adapter Kit: 110 XCA 204 01

DB25M	Wire	RJ45
1	White	8
2	Red	4
3	Black	3
7	Green	5
4		
6		
20		

(D) Adapter Kit: 110 XCA 204 01

DB25M	Wire	RJ45
2	Red	4
3	Black	3
6	Blue	1
7	Green	5
20	Orange	2
5	Yellow	6
4	Brown	7
1	White	8

(E) Adapter Kit: 110 XCA 204 01

DB25M	Wire	RJ45
3	Red	4
2	Black	3
20	Blue	1
7	Green	5
6	Orange	2
4	Yellow	6
5	Brown	7
1	White	8

(F) Adapter Kit: 110 XCA 203 02

DB9F	Wire	RJ45
2	Red	4
3	Black	3
4		
6	Orange	2
5	Green	5
7		6
8		7
Shield	White	8

(G) Adapter Kit: 110 XCA 203 01

DB9M	Wire	RJ45
2	Red	4
3	Black	3
5	Green	5
6	Orange	2
7	Yellow	6
8	Brown	7
Shield	White	8

(H) Adapter: None

RJ45 (Prog)	RJ45 (Bridge)
1	2
2	1
3	4
4	3
5	5
6	6
7	7
8	8

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Figure 9 shows the layout of DB9–RJ45 and DB25–RJ45 Adapter Kits available from Schneider Automation. Each kit contains three jumper wires and a pin insertion tool. Follow the pinout diagrams in Figure 8 for assembling the adapter for your product.

Figure 9   DB to RJ45 Adapter Kits

DB9M (110 XCA 203 01)
Pin 1

Pin 1

Pin 1

DB9F (110 XCA 203 02)

DB25M (110 XCA 204 01)
Pin 1

Pin 1

Pin 1

DB25F (110 XCA 204 02)

25
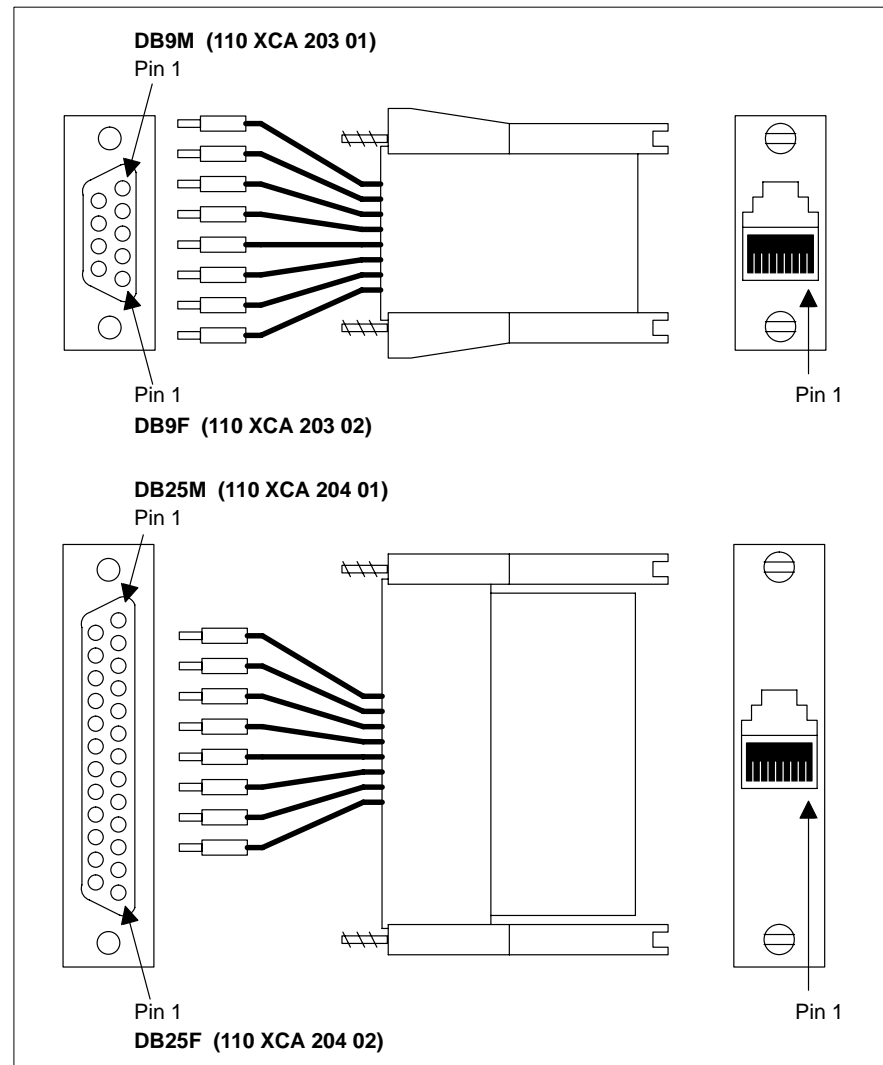
Connecting the Serial Cable (Wiring Terminals)

Figure 10 shows the connection for serial cables at the Bridge's wiring terminals.

Figure 10   Connecting the Serial Cable (Wiring Terminals)
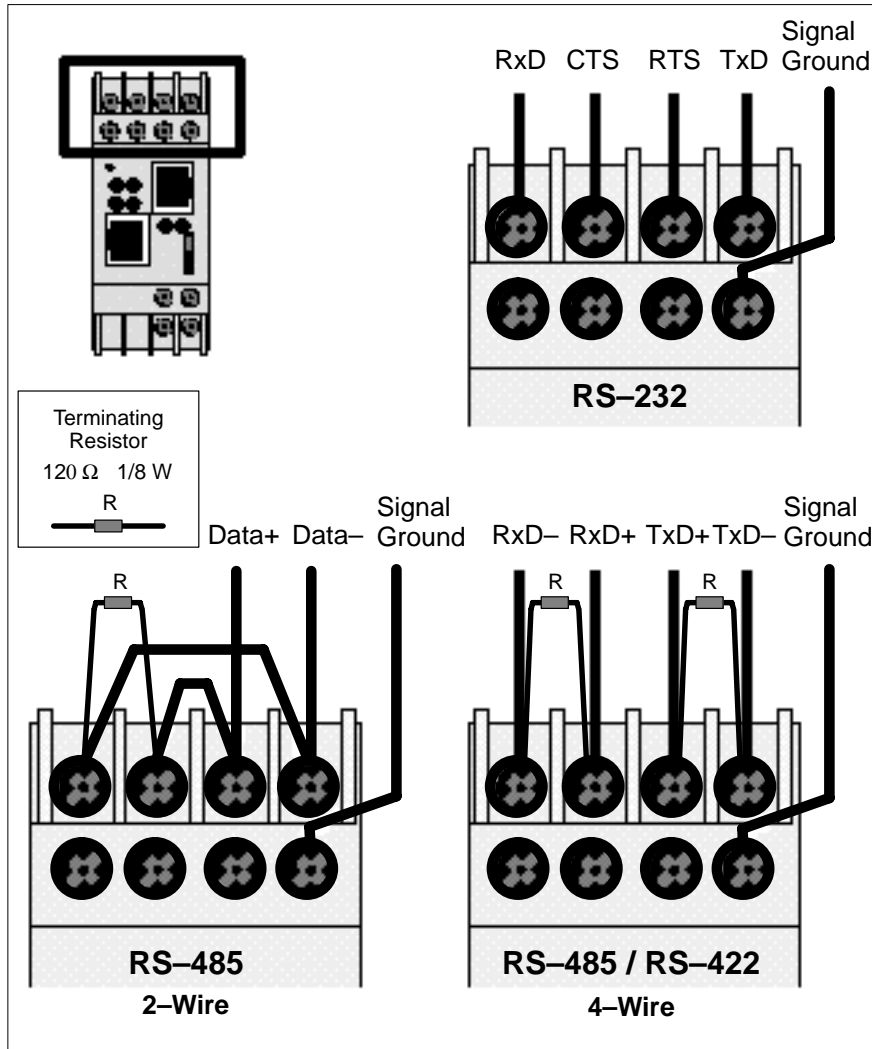
2.7   # Setting the Serial Port Switch

Figure 11 shows the front panel switch for setting the Bridge's serial port interface.

Before you place the Bridge into service, set the switch for the type of interface used in your application:

- UP: RS–232 interface.
- DOWN: RS–422 or RS–485 interface.

Figure 11   Setting the Serial Port Switch

Serial Port Switch
UP: RS–232
DOWN: RS–422 or RS–485

STOP
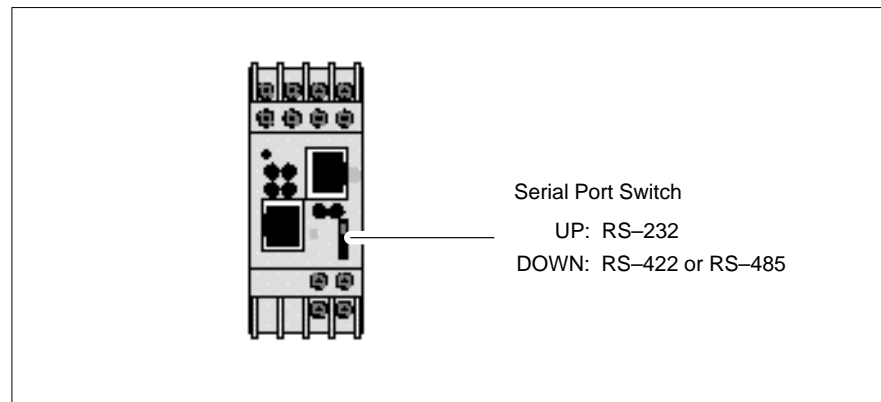
Warning
COMMUNICATION DISRUPTION HAZARD   The serial port switch is a hardware function. It is not sensed by the Bridge's firmware. Changing the switch setting while the Bridge is operating can disrupt communication on the network. Do not change the switch setting unless you have first verified that it will be safe for your application. Failure to observe this precaution can result in injury or equipment damage.

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2.8   # Connecting the Ethernet Cable

Figure 12 shows the RJ45 port connection for the 10baseT Ethernet cable.

Figure 12   Connecting the Ethernet Cable
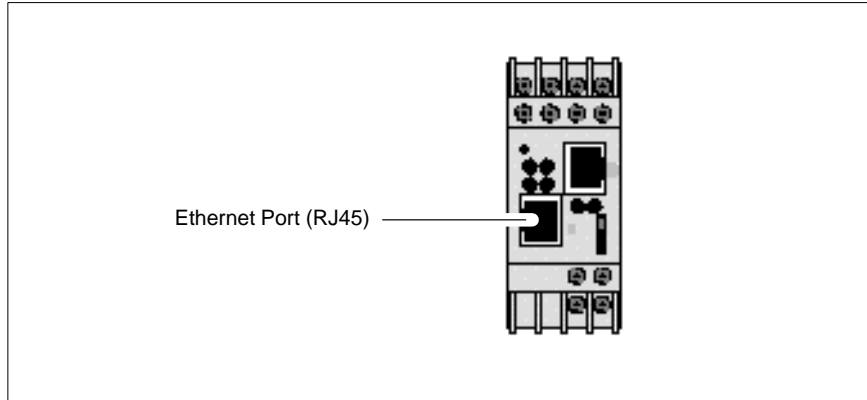
Ethernet Port (RJ45) ————

STOP **Warning**
**COMMUNICATION DISRUPTION HAZARD   Connecting any device to an active
Ethernet network can disrupt communication on the network. Before you
connect the Bridge to your network, and before you apply power to the Bridge,
heed the steps in Chapter 3 for configuring the Bridge in your application.
Failure to observe this precaution can result in injury or equipment damage.**

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Configuring the Bridge

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- ■ Before You Start
- ■ Connecting by the RS–232 Port
- ■ Connecting by Telnet (IP Address Not Assigned)
- ■ Connecting by Telnet (IP Address Assigned)
- ■ Using the Configuration Menu
- ■ Option 1: Network/IP Settings
- ■ Option 2: Serial and Mode Settings
- ■ Option 3: Modem Control Settings
- ■ Option 4: Advanced Modbus Protocol Settings
- ■ Option 5: Unit_ID to IP Address Mapping Table

3.1   Before You Start

3.1.1   Configuration Overview

Your Bridge must be configured to match your system application. Before you start to configure the Bridge, get the Bridge's Ethernet and serial port parameters from your network administrator.

Here is your check list for obtaining the configuration information:

- Ethernet IP address.
- Ethernet Gateway address, if applicable to your Bridge's network.
- Serial port interface: RS–232, RS–422, RS–485.
- Serial port communication: Baud rate, Data bits, Parity mode, Stop bits.
- Serial port modem controls: RTS/CTS timing values.
- Serial port device: Modbus Master or Modbus Slave.
- Modbus Protocol: RTU or ASCII.
- Modbus Timeout values: Character timeout, Message timeout.
- Modbus Slave only: Address source from Unit_ID header, or Fixed address.
- Modbus Slave only: Allowing broadcasts to serial port: Enable or Disable.
- Modbus Master only: Mapping of Modbus Slave addresses to IP addresses.

3.1.2   Safety

STOP

Warning
COMMUNICATION DISRUPTION HAZARD   When you view or change the configuration of a running Bridge, you will be restarting it on the network. This will disrupt communication with the Bridge. Ensure that this action will not cause any undesirable effect on your application. Failure to observe this precaution can result in injury or equipment damage.

STOP

Warning
DUPLICATE ADDRESS HAZARD   Having two or more devices with the same IP address can cause unpredictable operation of your network. Ensure that you will be assigning a unique IP address to the Bridge. Failure to observe this precaution can result in injury or equipment damage.

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3.2   # Connecting by the RS–232 Port

To configure the Bridge at its local RS–232 port, use a serial terminal emulation program and a modem cable. See Figure 7 for a connection example.

Regardless of any serial parameters currently set into the Bridge for a user application, it will always use the following parameters for setup: 9600 baud, 8 data bits, No parity, 1 Stop bit (9600,8,N,1). Set your emulator to these parameters.

Figure 13   Example: RS–232 Serial Terminal Emulator Properties
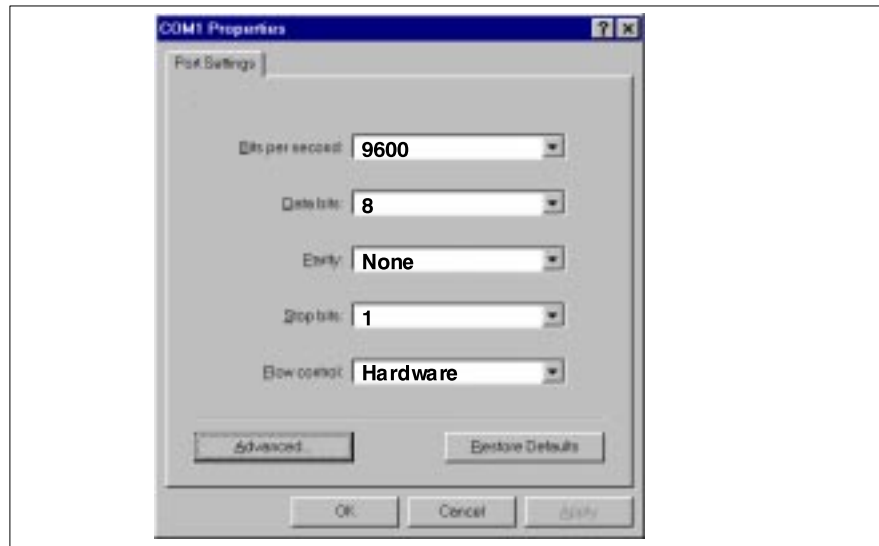
Force the Bridge into its Configuration mode as follows:

■   Ensure the emulator is connected to the Bridge's serial port and ready.

■   Hold down the 'X' key on your emulator keyboard. While holding the key down, initialize the Bridge by cycling its power or by pressing its Reset button.

The Bridge will enter its configuration mode, and you will see this opening screen:

```
Schneider Automation, Inc. – Modbus Bridge (174 CEV 300 10)
Serial Number 101–161   Software Version V01.00 (990402)
Press Enter to go into Setup Mode, wait to close
```

At this screen, press <Enter> to go to the Configuration Menu (see Section 3.5).

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Connecting by Telnet (IP Address Not Assigned)

If the Bridge does not yet have an IP address stored in its memory, you can establish an initial connection using its MAC address. This will allow you to access the Bridge's Configuration Menu, assign an IP address, and make it persistent in the Bridge.

If you are not sure about whether your Bridge has a stored IP address, you must connect at its serial port and access its Configuration Menu.   Section 3.2 describes how to connect to the serial port.

Telnet Host Requirement
In order to use Telnet to set an initial IP address for the Bridge, your Telnet host must be on the same Ethernet subnetwork as the Bridge, both physically and in its IP range. Otherwise the configuration will not work.

Step 1 **Get the Bridge's MAC Address.** The Bridge's MAC address is printed on the label on the Bridge's side panel.

Example: MAC address: **00 20 4A 01 65 A1**.

Step 2 **Issue an "arp" Command to the Bridge.** Open a Console or DOS window. Issue an `arp` command to the Bridge with this syntax:

Syntax: `arp  -s  <IP_address>  <MAC_address>`

Example (UNIX):   `arp  -s  192.168.1.23  00:20:4A:01:65:A1`
Example (DOS):   `arp  -s  192.168.1.23  00-20-4A-01-65-A1`

Step 3 **Connect by Telnet to Port 1.** Open a Telnet connection to the IP address you assigned in Step 2, using port 1. This connection will fail, but the Bridge will change its IP address to the one in this Telnet connection. This will allow you to make your final connection for configuring the Bridge.

Step 4 **Connect by Telnet to Port 9999.** Open a new a Telnet connection to the IP address using port 9999. This connection will succeed. You should now see the Bridge's opening screen:

```
Schneider Automation, Inc. - Modbus Bridge (174 CEV 300 10)
Serial Number 101-161  Software Version V01.00 (990402)
Press Enter to go into Setup Mode, wait to close
```

At this screen, press <Enter> to go to the Configuration Menu (see Section 3.5).

3.4   # Connecting by Telnet (IP Address Assigned)

If the Bridge already has an IP address stored in its memory, and you know that address, you can establish a Telnet connection to the Bridge using port 9999.

If you do not know the IP address currently stored in the Bridge, you can find that address by connecting to the Bridge's serial port and accessing its Configuration Menu. Section 3.2 describes how to connect to the serial port.

If you want to verify the existence of an Ethernet device at a known IP address, you can use the PING utility. Refer to your Ethernet documents for a description of PING.

Telnet Host Requirement
In order to use Telnet to set an initial IP address for the Bridge, your Telnet host must be on the same Ethernet subnetwork as the Bridge, both physically and in its IP range. Otherwise the configuration will not work.

Figure 14 Example: Telnet Connection
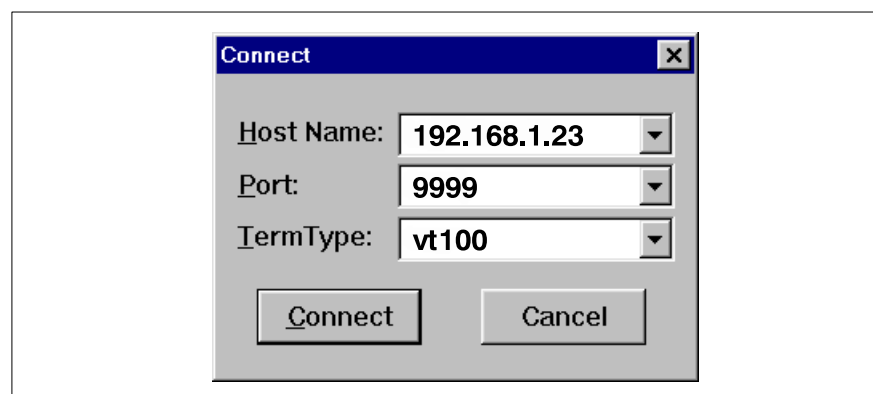
When the connection is established, you should see the Bridge's opening screen:

```
Schneider Automation, Inc. - Modbus Bridge (174 CEV 300 10)
Serial Number 101-161  Software Version V01.00 (990402)
Press Enter to go into Setup Mode, wait to close
```

At this screen, press <Enter> to go to the Configuration Menu (see Section 3.5).

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3.5   Using the Configuration Menu

When the Bridge enters its configuration mode it displays its opening screen:

```
Schneider Automation, Inc. - Modbus Bridge (174 CEV 300 10)
Serial Number 101-161   Software Version V01.00 (990402)
Press Enter to go into Setup Mode, wait to close
```

At this screen, press <Enter> to see the Configuration Menu.

3.5.1   Configuration Menu

The Configuration Menu shows the Bridge's current settings. Here is an example:

```
Modbus Bridge Firmware Setup, Schneider Automation, Inc.

1) Network/IP Settings:
   IP Address ................... 192.168.1.23
   Default Gateway .............. 192.168.1.30
   Netmask ..................... 255.255.255.000

2) Serial & Mode Settings:
   Protocol .................... Modbus/RTU, Slave(s) attached
   Serial Interface ............ 19200,8,E,1,RS232

3) Modem Control Settings:
   RTS 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

Commands:  D)efault settings,  S)ave,  Q)uit without save

Select Command or Parameter (1...4) to change: __
```

3.5.2   Modbus Master Device: Additional Menu Items

If the serial port has already been configured for a Modbus Master device, menu item 4 will omit references to a Slave device, showing only the following:

```
4) Advanced Modbus Protocol Settings:
   Character, Message Timeout ... 00100 ms, 05000 ms
```

Menu item 5 will show current mapping between Modbus addresses and IP addresses.

```
5) Unit ID -> IP Address Table:
```
(followed by the current mapping table).

3.5.3   Configuration Options: 1 ... 5

These are your configuration options. Each option is described in detail in the following sections of this book:

- **1) Network/IP Settings:** See Section 3.6.

- **2) Serial & Mode Settings:** See Section 3.7.

- **3) Modem Control Settings:** See Section 3.8.

- **4) Advanced Modbus Protocol Settings:** See Section 3.9.

- **5) Unit ID -> IP Address Table:** See Section 3.10.

3.5.4   Viewing and Changing Configuration Parameters

When you view the Bridge's configuration parameters, you can retain their current values or change them.

Retaining the Current Value
In all cases, if you press <Enter> when the current value is displayed, you will retain the current value. For example, if the Bridge's current values are as shown below, pressing <Enter> at each field will retain that current value:

`IP Address : (192) .(168) .(001) .(023)`

Changing a Value
To change a value, type the new value into the field at the point shown on your screen. For example, to change the Bridge's IP address to: 192.168.1.24:

`IP Address : (192) .(168) .(001) .(023) 24`

In this example, you would type the **24** immediately following the **(023).** Then press <Enter> for the Bridge to accept your entry.

3.5.5   Commands: Default settings, Save, Quit without save

These are your commands:

- **E D)efault settings:** Restores the Bridge's factory–installed default settings for all parameters except the Ethernet IP settings.

- **S S)ave:** Stores the current settings into the Bridge's memory, and exits the configuration. The Bridge will restart immediately using the current settings.

- **Q Q)uit without save:** Exits the configuration. The Bridge will restart immediately using the settings it had prior to the last Save.

3.6   **Option 1: Network/IP Settings**

When you select option 1 on the Configuration Menu, the Bridge displays its current Ethernet settings. Here is an example:

```
IP Address : (192) .(168) .(001) .(023)

Set Gateway IP Address (Y):

Gateway IP Address : (192) .(168) .(001) .(030)

Set Netmask (N for default) (Y): (255) .(255) .(255) .(000)
```

IP Address
The four entry fields for the IP address are shown as parenthesis (   ).

To retain the Bridge's current IP address, just press <Enter> at each field. To assign a new IP address, enter it into each field.

IP 0.0.0.0:   Note that setting the IP address to all zero (0.0.0.0) causes the Bridge to be in an "Address Not Assigned" status. It reports its address as: 0.0.0.0/DHCP. Disregard the reference to DHCP.

Set Gateway IP Address
The Gateway IP Address is used only if your Ethernet network is larger than one continuous network (it contains subnetworks).

Each node within the subnetwork can directly reach all the other nodes within the same subnetwork. If the Bridge's subnetwork has a gateway to another subnetwork, the Gateway IP Address parameter identifies the gateway's address.

Set Netmask
If the Bridge's subnetwork has a gateway node, the Bridge needs to know how to recognize which IP addresses it can communicate with directly on its own subnetwork and which addresses it must refer to the gateway node.

The Netmask (subnetwork mask) specifies which portion of the an IP address defines devices on the local subnetwork, and which portion defines the entire subnetwork the devices are on. By comparing IP addresses with the subnetwork mask, the Bridge can determine which addresses are on its subnetwork and which are not.

Users can define different subnetwork masks to support their requirements. For example, common "Class C" IP addresses assume a default subnetwork mask of

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0xFFFFFF00 or 255.255.255.0, using the lower 8 bits for the host part of the IP address. This allows up to 255 devices on the local subnetwork.

This default mask is the example shown in the menu above.

If the user desires to have multiple subnetworks with up to 32 devices on each the subnetwork mask could define 5 "host" bits or 255.255.255.224. With this setting, the decimal value 224 configures the lower 8 bits of the address, with the upper 3 of these bits addressing up to 8 subnetworks, and the lowest 5 bits forming the part of the address for the 32 local devices.

If you wish to specify a subnetwork mask, enter **Y** at the menu prompt and then enter your values for the mask.

Enter **N** to use the default subnetwork mask of 255.255.255.0.

3.7

Option 2: Serial and Mode Settings

When you select option 2 on the Configuration Menu, the Bridge displays its current serial port settings. Here is an example:

```
Attached Device (1=Slave, 2=Master) (001):

Serial Protocol (1=Modbus/RTU, 2=Modbus/ASCII) (001):

Interface Type (1=RS232, 2=RS422, 3=RS485) (001):

Enter Serial Parameters (9600,8,E,1):
```

Attached Device
Identify the type of Modbus device (Slave or Master) attached to the Bridge's serial port. The default is Slave.

Serial Protocol
Identify the type of Modbus protocol (RTU or ASCII) to be used at the serial port. The default is RTU.

Interface Type
Identify the type of communication interface (RS232, RS422 or RS485) used at the serial port. The default is RS232.

Enter Serial Parameters
Enter the serial communication parameters used at the port, delimited by commas:

```
<baudrate>,<databits>,<parity>,<stopbits>
```

The defaults are: 9600,8,E,1.

The allowed values are:

- Baud rate: 300, 1200, 2400, 4800, 9600, 19200, 38400
- Data bits: 7, 8
- Parity: E, O, N
- Stop bits: 1, 2.

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3.8

Option 3: Modem Control Settings

When you select option 3 on the Configuration Menu, the Bridge displays:

```
RTS/CTS Mode (1=Fixed, 2=Variable) (001):
```

RTS/CTS Mode
RTS (Request to Send) and CTS (Clear to Send) are serial port signals that coordinate the starting and stopping of data requests between the Bridge and its port device. You can customize the RTS/CTS mode.

The options are: Fixed or Variable. The default is Fixed. This causes the Bridge to apply RTS/CTS with no time delays.

if you enter **2** to select the Variable option, you can specify timing values to allow a slower device to respond in the RTS/CTS dialog. When you choose this option the Bridge displays:

```
Delay after output RTS (0-1275 msec, 5 ms resolution) (00000):

Wait for CTS to go active (N):

Delay after CTS going active (0-1275 msec, 5 ms res) (00000):

Delay dropping RTS after TX (0-1275 msec, 5 ms res) (00000):
```

Example
If you select the RTS/CTS Variable mode and enter the following values:

```
RTS/CTS Mode (1=Fixed, 2=Variable) (001):  2

Delay after output RTS (0-1275 msec, 5 ms resolution) (00000):  200

Wait for CTS to go active (N):  Y

Delay after CTS going active (0-1275 msec, 5 ms res) (00000):  250

Delay dropping RTS after TX (0-1275 msec, 5 ms res) (00000):  300
```

... you are specifying that after the Bridge asserts RTS it should wait up to 200 ms for the serial port device to respond with CTS. It will then wait 250 ms before sending data to the device. It will wait 300 ms before dropping RTS at the end of transmission.

Your new values will be now be shown in the Bridge's Configuration Menu:

```
3) Modem Control Settings:
   RTS Output ................... Variable, Delay 0200 ms, Hold 0250 ms
   CTS Input to TX Delay ........ 0300 ms
```

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Option 4: Advanced Modbus Protocol Settings

When you select option 4 on the Configuration Menu, the Bridge displays parameters for the type of Modbus device (Slave or Master) at its serial port.

Slave Device: Slave device parameters are:

```
Slave Address (0 for auto, or 1...255 fixed) (000):

Allow Modbus Broadcasts (1-Yes, 2=No) (002):

Character Timeout (10-1275 msec, 5 ms res) (00050):

Message Timeout (500-60000 msec, 250 ms res) (05000):
```

Master Device: Master device parameters are:

```
Character Timeout (10-1275 msec, 5 ms res) (00050):

Message Timeout (500-60000 msec, 250 ms res) (05000):
```

Slave Address
The Bridge's Slave Address parameter specifies how the Bridge will direct messages received from Ethernet to a Slave device at the serial port.

Each message originated from a Modbus Master contains a Unit_ID field that addresses a Modbus Slave destination device. The Bridge can be configured to use that Unit_ID address as received, or to substitute a fixed address instead.

Setting the Slave Address parameter to 0 (zero) configures the Bridge to use the Unit_ID field as received in the message. It will pass the message out its Modbus port to the Slave device addressed in the Unit_ID field.

Setting the Slave Address parameter to any non–zero value causes the Bridge to always use that fixed value as the Slave address for all messages sent out its Modbus port, regardless of the Unit_ID contained in the message. This routes all messages to a single device.

The allowable non–zero range for entering this value is 1 ... 255 decimal. Note that Modbus Slave addresses are valid in the range 1 ... 247 only.

The default is 0 (zero), specifying the Bridge to use the received Unit_ID field.

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Allow Modbus Broadcasts

This parameter specifies whether the Bridge may allow a Modbus Broadcast message to be sent to Slave devices at its serial port, or not allow those messages. Broadcast messages are those received by the Bridge containing a Unit_ID of 0 (zero).

If Modbus Broadcasts are allowed, broadcast messages are passed to the serial port as received with the Unit_ID contents of 0 (zero).

If Modbus Broadcasts are not allowed, the Unit_ID in the message is disregarded and the message is sent to Slave address 1 at the serial port.

The default is to not allow Broadcast messages to the serial port.

Character Timeout

This parameter sets the timeout value between successive characters in messages. If this timeout is exceeded, the Bridge returns an error response to the originating Master. Typically RTU protocol already contains a 3.5 character timeout, but some serial devices might have internal interrupts or other delays which can cause pauses of 5 to 10 characters during transmission. This parameter can be set to accommodate those devices.

The allowable range is 10 ... 1275 msec in 5 msec increments.

The default is 50 msec.

Message Timeout

This parameter sets the timeout value for the expected response from a Slave device. If a response is not received within this time, the Bridge continues with other tasks if any are pending from other Master devices. The Master application must provide its own method of handling the message timeout.

The allowable range is 500 ... 60000 msec (0.5 ... 60 sec) in 250 msec increments.

The default is 5000 msec (5 sec).

3.10

Option 5: Unit ID to IP Address Mapping Table

If you have specified the Bridge's serial port Attached Device parameter as a Modbus Master (see Section 3.7), you will need to map the Slave addresses received in messages from that Master to their intended IP address destinations. The Bridge maps the one–byte Modbus Slave address to an IP address for delivery on Ethernet.

3.10.1

How the Address Mapping Works

The Bridge contains an address mapping table with eight entries. Each entry maps a Modbus Slave address (range 1 ... 247 decimal) to a standard IP address (XXX.XXX.XXX.XXX).

When the Bridge receives a message from the Master at its serial port, the Bridge searches the table for a match between the message's Slave address and a Slave address entry in the mapping table. If a match is found, the Bridge forwards the message to the IP address specified in that location in the table. If a match is not found, a message timeout will occur. If a match is found, but there is not an active TCP connection at the IP address, a message timeout will occur. The Master application must provide its own method of handling the message timeout.

The Bridge begins its search at table location 1, and continues in the sequence 1, 2 ... 8. It stops at the first location which matches the Slave address, and sends the message to the corresponding IP address. Thus any duplicate entry, if one exists in the table, will be ignored.

If you have configured the serial port for a Modbus Master, you must use the mapping table to associate the ranges of Slave addresses in your Master application to the IP destination addresses for those Slaves.

3.10.2

Example: Address Mapping

If you have configured the serial port for a Modbus Master, and have entered your mapping, it will appear on the Bridge's initial Configuration Menu. Here is an example.

```
5) Unit ID -> IP Address Table:
   001-001: 192.168.001.020    002-002: 192.168.001.021
   003-003: 192.168.001.022    010-010: 192.168.001.024
   011-247: 192.168.001.025
```

In this example, the Bridge maps Modbus Slave address 1 to IP address 192.168.1.20. It maps Slave addresses 2, 3, 10 as shown in the table. It maps any Slave address in the range 11 ... 247 to IP address 192.168.1.25.

3.10.3   **Entering New Address Mapping**

When you select option 5 on the Configuration Menu, the Bridge displays it current mapping. Then it prompts:

```
A)dd,  D)elete,  E)xit  --  select function:
```

Adding a New Map Entry
Press **A** to add a new entry into the mapping table. The Bridge will prompt you to enter the new mapping values. The values will go into the first available (empty) table location. Here is an example:

```
Modbus addr from (000):  1

Modbus addr to (000):  1

Slave IP address (192) .(168) . (001) .(020)
```

Deleting a Map Entry
Press **D** to delete an entry from the mapping table. The Bridge will prompt you to enter the number of the table location you want to delete. Here is an example:

```
Delete entry number:  1
```

Changing an Existing Map Entry
If you want to change an existing entry in the mapping table, you must first delete that entry and then add your changes as a new entry.

- Press **D** to delete the current entry from the table.

- Press **A** to add a new entry into the table, supplying the values for the new entry.

3.10.4   **Exiting the Mapping Menu**

Press **E** to exit the Mapping Table menu and return to the initial Configuration Menu. The Configuration Menu will display the new mapping (see Section 3.10.2).

Note that when you return to the Configuration Menu, you must select Save on that menu to save the address mapping in the Bridge's memory. Selecting Save will also restart the Bridge. See Section 3.5 for a description of your Configuration Menu.

Using Panel Software

■   Using Concept or Modsoft

■   Using Other Software

4.1 Using Concept or Modsoft

4.1.1 Software Versions

To support Modbus/TCP to the Bridge, you need Concept version 2.1 or later, or Modsoft version 2.6 or later. Set the communications parameters as follows:

- Protocol: TCP/IP
- Dest_Port: 502
- Dest_Index: Modbus Slave address

  Note that the Bridge contains an internal Slave Address configuration option which might affect the delivery of messages to a Slave device at its serial port.

  With this option, the Bridge may be configured internally to use the Dest_Index address exactly as received in the message, or it may be configured to steer all messages to a fixed Slave address, ignoring the Dest_Index address.

- TCP/IP Address: as required.

4.1.2 Modbus Slave Address

This is an additional explanation of how the Bridge uses the Modbus Slave address.

In a Modbus TCP message sent to the Bridge, the Slave address (defined in panel software as the Dest_Index address) is stored in the Unit_ID field of the message. This field is used to address a unique Slave device on a Modbus network which may contain multiple Slave devices.

The Bridge's internal configuration contains a Slave Address parameter which can be set to override the Unit_ID address received in the message. Section 3.9 of this book describes how to set up the Slave Address parameter.

If the parameter is set to 0 (zero), the message will be delivered to the Slave device whose address is defined in the Unit_ID field. If the parameter is set to a non–zero value (range 1 ... 255), the message will be delivered to the Slave device at that numerical address, regardless of the contents of the Unit_ID field.

For example: If you are accessing the device at Modbus Slave address 34, you must:

- Set the Dest_Index field to 34, and
- Ensure the Bridge's internal Slave Address parameter is configured to 0 (zero).

4.2   **Using Other Software**

4.2.1   Intellution FIX MMI

The Bridge allows Windows workstations with Intellution FIX software to access Modbus devices by TCP/IP over Ethernet.

The current version of this software does not support the Modbus/TCP Unit_ID field. Therefore if you have configured the Bridge for a Slave device at its serial port, you must configure the Bridge's internal Slave Address parameter for that device. This restricts the Bridge to a single Slave device at its port.

Refer to your software product's documentation for further information.

4.2.2   WinTech Modscan

WinTech supplies ModScan32 software, which can select and poll coils and registers from various Modbus RTU/ASCII and Modbus TCP devices.

This software supports the Modbus/TCP Unit_ID field, so RS–485 multiple–drop configurations are supported through the Bridge.

Refer to your software product's documentation for further information.

4.2.3   Worderware MMI

The Bridge allows Windows workstations with Wonderware software to access Modbus devices by TCP/IP over Ethernet. You will need the Wonderware Modicon Ethernet I/O Server software, at version 7.0.0.15 or higher.

The current version of this software does not support the Modbus/TCP Unit_ID field. Therefore if you have configured the Bridge for a Slave device at its serial port, you must configure the Bridge's internal Slave Address parameter for that device. This restricts the Bridge to a single Slave device at its port.

Refer to your software product's documentation for further information.

Glossary

address
On a network, the identification of a station. In a frame, a grouping of bits that identifies the frame's source or destination.

API
Application Program Interface. The specification of functions and data used by one program module to access another; the programming interface that corresponds to the boundary between protocol layers.

ARP
Address Resolution Protocol. A network layer protocol used to determine the physical address which corresponds to the IP address for a host on the network. ARP is a sub–protocol which operates under TCP/IP.

BOOTP
Bootstrap Protocol. A TCP/IP–based protocol that allows a host to configure itself dynamically. Provides a means to assign a host its IP address, typically without user intervention.

bps
Bits per second.

bridge
A device that connects two or more physical networks which use the same protocol. Bridges read frames and decide whether to transmit or block them based on their destination address.

client
A computer process requesting service from other computer processes.

dest_idx
The destination field in a Modbus message. Corresponds to the Modbus device addressed in the message.

default gateway
The IP address of the network or host to which all packets addressed to an unknown network or host are sent. The default gateway is typically a router or other device.

DHCP
Dynamic Host Configuration Protocol. A network protocol used to configure IP addresses dynamically. DHCP is an extension of BOOTP.

DNS
Domain Name System. A protocol within TCP/IP used to find IP addresses based on host names.

field
A logical grouping of contiguous bits that convey one kind of information, such as the start or end of a message, an address, data or an error check.

frame
A group of bits which form a discrete block of information. Frames contain network control information or data. The size and composition of a frame is determined by the network technology being used.

framing types
Two common framing types are Ethernet II and IEEE 802.3.

FTP
File Transfer Protocol. A networking protocol used to exchange files between stations on a network or over the Internet.

gateway
A device which connects networks with dissimilar network architectures and which operates at the Application Layer. This term may refer to a router.

host
A node on a network.

hostname
A domain name given to a specific computer on a network and used to address that computer.

HTTP
HyperText Transport Protocol. A protocol used to deliver hypertext documents.

hub
A device which connects a series of flexible and centralized modules to create a network.

ICMP
Internet Control Message Protocol. A protocol within TCP/IP used to report errors in datagram transmission.

Internet
The global interconnection of TCP/IP based computer communication networks.

IP
Internet Protocol. A common network layer protocol. IP is most often used with TCP.

IP Address
Internet Protocol Address. A 32–bit address assigned to hosts using TCP/IP.

layer
In the OSI model, a portion of the structure of a device which provides defined services for the transfer of information.

MAC Address
Media Access Control address. The hardware address of a device. A MAC address is assigned to an Ethernet TCP/IP module in the factory.

network
Interconnected devices sharing a common data path and protocol for communication.

node
An addressable device on a communications network.

OSI model
Open System Interconnection model. A reference standard describing the required performance of devices for data communication. Produced by the International Standards Organization.

packet
The unit of data sent across a network.

PING
Packet Internet Groper. A program used to test whether a destination on a network can be reached.

port
An access point for data entry or exit within a host using TCP services.

protocol
Describes message formats and a set of rules used by two or more devices to communicate using those formats.

repeater
A device that connects two sections of a network and conveys signals between them without making routing decisions or filtering packets.

router
A device that connects two or more sections of a network and allows information to flow between them. A router examines every packet it receives and decides whether to block the packet from the rest of the network or transmit it. The router will attempt to send the packet through the network by the most efficient path.

server
Provides services to clients. This term may also refer to the computer on which the service is based.

socket
The association of a port with an IP address, serving as an identification of sender or recipient.

stack
The software code which implements the protocol being used. In the case of the NOE modules it is TCP/IP.

STP
Shielded Twisted Pair. A type of cabling consisting of several strands of wire surrounded by foil shielding, twisted together.

subnet
A physical or logical network within an IP network, which shares a network address with other portions of the network.

subnet mask
Used to indicate which bits in an IP address identify a subnet.

switch
A network device which connects two or more separate network segments and allows traffic to be passed between them. A switch determines whether a frame should be blocked or transmitted based on its destination address.

TCP
Transmission Control Protocol.

TCP/IP
A protocol suite consisting of the Transmission Control Protocol and the Internet Protocol; the suite of communications protocols on which the Internet is based.

UDP
User Datagram Protocol. A protocol which transmits data over IP.

URL
Uniform Resource Locator. The network address of a file.

UTP
Unshielded Twisted Pair. A type of cabling consisting of insulated cable strands which are twisted together in pairs.

Winsock
The Microsoft implementation of the Windows Sockets networking API based on the Berkeley UNIX Sockets interface for supporting TCP/IP.

WWW
World Wide Web. A hypertext–based, distributed information system in which clients and servers are freely available.

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