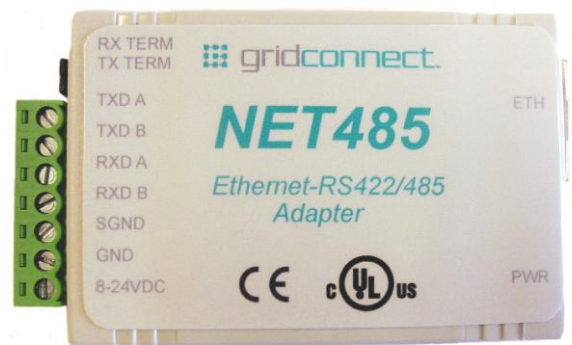# gridconnect™

NET485
RS422/485 Serial to Ethernet Adapter

Revision E October 14, 2013

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Date	Rev.	Author	Comments
05/17/05	A	GR	Preliminary Release
06/23/05	B	GR	Add notes about Product Info Base, Java RE, .NET
03/24/06	C	GR	Firmware to 6.1.0.2 and Web Manager update
07/06/10	D	GR	Remove Dev. Inst., add drawings.
10/14/13	E	GR	UL and CE agency approvals. Support for xPort-05.

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1. NET485 Overview

1.1 Overview

The NET485 is an RS422/485 serial to Ethernet converter Module. The RS422/485 side can connect to serial devices over long distances (up to 4,000 ft.). The Ethernet side converts the serial data from RS422/485 to Ethernet packets. You can now read RS422/485 data over Ethernet from anywhere in the world.

Using RS485 two-wire mode, you can also connect the NET485's serial interface to multiple devices in a multi-drop network.

1.2 Overview of RS422 / RS485

RS232 is an EIA standard transmission system and has been around since 1962. RS232 provides single-ended data communications between a transmitter and a receiver. In that era, it allowed for data transmission from one transmitter to one receiver at relatively slow data rates (20k bits / second) and short distances (up to 50 ft. at the maximum data rate).

While RS232 is well-known for connecting PC's to external devices, RS422 and RS485 are not as well known. When communicating at high data rates, or over long distances in real world environments, single-ended methods are often inadequate. RS422 and RS485 were designed to provide data communications over longer distances, higher Baud rates and provide better immunity to external electro-magnetic noise.

RS422 and RS485 use differential data transmission (balanced differential signal). This offers superior performance by canceling the effects of ground shifts and induced noise signals that can appear as common mode voltages on a network. This also allows for data transmission at much higher data rates (up to 460K bits / second) and longer distances (up to 4000 ft).

What is the difference between RS422 and RS485? Like RS232, RS422 is intended for point-to-point communications. In a typical application, RS422 uses four wires (two separate Twisted Pairs of wires) to transfer data in both directions simultaneously (Full Duplex) or independently (Half Duplex). EIA/TIA-422 specifies the use of one, unidirectional driver (transmitter) with a maximum of 10 receivers. RS422 is often used in noisy industrial environments or to extend a RS232 line.

RS485 is used in applications where multiple devices want to share data communications on a single serial network. RS485 can support up to 32 drivers and 32 receivers on a single two wire (one twisted pair) bus. Most RS485 systems use a Master/Slave architecture, where each slave unit has its unique address and responds only to packets addressed to it. However, peer to peer networks are also possible.

Specification	RS-422	RS-485
Transmission Type	Differential	Differential
Maximum Data Rate	10 MB/s	10 MB/s
Maximum Cable Length	4000 ft.	4000 ft.
Driver Load Impedance	100 Ohm	54 Ohm
Receiver Input Resistance	4 KOhm min	12 KOhm min
Receiver Input Voltage Range	-7V to +7V	-7V to +12V
No of Drivers Per Line	1	32
No of Receivers Per Line	10	32

1.2.1 The RS485 Enable Signal

In a balanced differential system the data signals are produced by a line driver. (See the drawing below) The line driver generates a voltage across a pair of signal wires that transmits the data signals. A balanced line driver can have an optional input signal called an "Enable" signal. The purpose of the enable signal is to connect the driver to its output terminals. If the enable signal is off, the driver is disconnected from the transmission line. When a driver is disconnected from the network it is referred to as being in the "tri-state" condition. Because there are multiple drivers (transmitters) on a RS485 network and only one transmitter can be enabled at a time, the use of this enable control signal is required on all RS485 networks.

The following drawing shows a typical RS485 driver. Pin 3 is the transmit enable pin. Pin 2, the receive enable pin, is tied to 3.3V which forces the receiver to always be enabled. When Pin 3 is high the transmitter is enabled and data passes out the transmit pins. The design of the circuit allows the receiver section to read the data that is being transmitted. When Pin 3 is low the transmitter is disabled and the output goes to a "tri-state" condition. In this condition, the receiver section is still listening to the network.
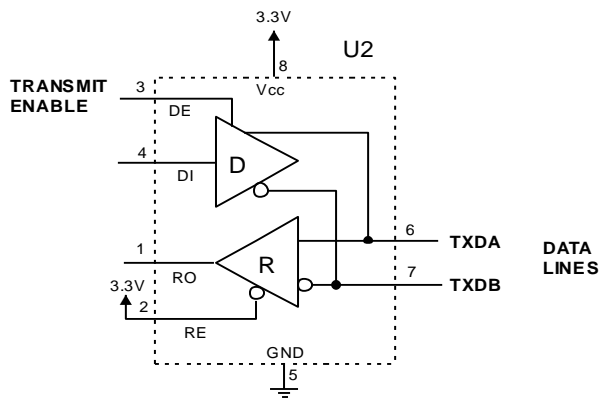
The NET485 provides the Transmit enable signal for RS485 two-wire applications. When configured for RS485 two-wire applications, the NET485 automatically asserts the transmit enable when it is ready to transmit data from its serial port. Once the data has been transmitted, the NET485 automatically de-asserts the enable signal to allow other nodes to transmit their data.

The Transmit enable pin is called a Configurable Pin, meaning it can be selected to do several functions. One of those options is the transmit enable, which is labeled "RS485 TX Enable". The Quick Start Guide explains how to configure the NET485 for proper RS485 operation.

WARNING: The NET485 comes from the factory already configured for RS485 operation. If you reset it to factory defaults, you will have to reconfigure the unit for RS422/485.

NOTE: The RS485 transmit enable pin is configured in the Configurable Pins section of the Web Manager.

Note: There are different versions of the configurable pins window, depending on the version of firmware installed. Make sure you select CP0 for older versions that label the pins CP0 to CP2. Select CP1 for versions labeled CP1-3.

CP	Function	Direction	Active Level
0	General Purpose I/O	● Input ○ Output	● Low ○ High
1	General Purpose I/O	● Input ○ Output	● Low ○ High
2	General Purpose I/O	● Input ○ Output	● Low ○ High

This version of the configurable pins window shows CP 0-2. Web Manager 1.6.0.2.

CP	Function	Direction	Active Level
1	General Purpose I/O	⊙ Input ○ Output	⊙ Low ○ High
2	General Purpose I/O	⊙ Input ○ Output	⊙ Low ○ High
3	General Purpose I/O	⊙ Input ○ Output	⊙ Low ○ High

This version of the configurable pins window shows CP1-3. Web Manager 2.0.0.2.

The NET485 uses Configurable Pin 1 (CP1) for the transmit enable. You must enable **CP1 for RS485_TXEN** during the configuration process. (See the Quick Start Guide for details)

The NET485 uses **CP1** in the Active High condition. You must set **CP1 to Active High** during the configuration process. (See the Quick Start Guide for details)

1.2.2 RS422 Operation

The NET485 can handle both RS485 and RS422 communications. This is done by connecting the processor (CPU) to a pair of RS485 transceivers. The following schematic demonstrates how the circuit is wired for RS422.

For RS422 mode, use the four signals produced by the two transceivers plus a signal ground as shown in *Figure 1 – RS422 Wiring*
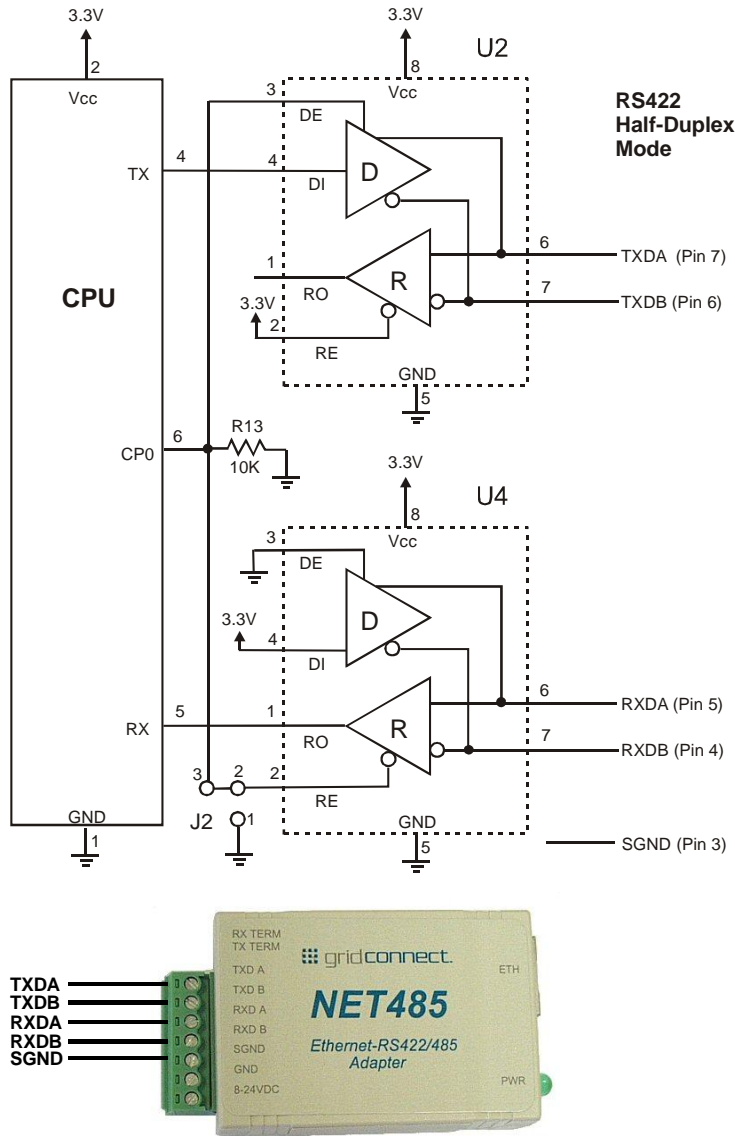
Figure 1 – RS422 Wiring

The transmit section of the CPU is labeled TX on pin 4. The receive section of the CPU is labeled RX on pin 5. Note that the **CP0** pin on the CPU pin 6, which is configured to control the level of RS485_TXEN, is connected to both transceivers. The transmit section is enabled with a High signal on pin 3, U2 and the receive section is enabled with a Low signal on pin 2, U4.

There is a jumper option J2 that permits RS485/RS422 Half Duplex or RS422 Full Duplex. With the jumper in the factory set position between pins 2 and 3, the unit is set for RS485/RS422 Half Duplex.

1.2.3 RS485 Operation

For RS485 mode, the TXDA signal is connected to the RXDA terminal, and the TXDB signal is connected to the RXDB terminal. The three signals are TXDA, RXDB, and signal ground.
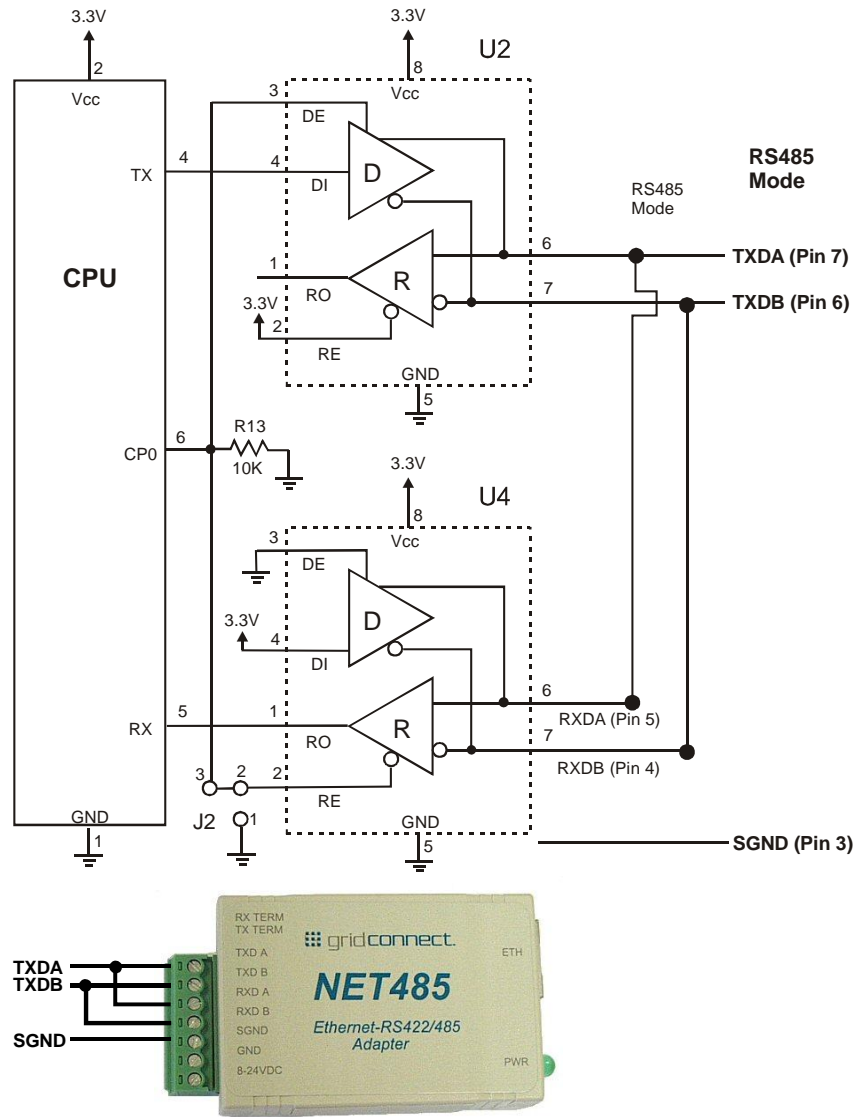
Figure 2 - RS485 Wiring

1.3 RS422 / RS485 Network connections

1.3.1 RS422 Networks

A typical RS422 application uses a four-wire interface (two twisted pairs) and a shield. RS422 networks are often used in a half-duplex mode, where a single master in a system sends a command to a slave device and the slave responds with data. Typically one device (node) is addressed by the host computer and a response is received from that device. Systems of this type (4-wire, half-duplex) are often constructed to avoid "data collision" (bus contention) problems on a network. Figure 3 shows a typical RS422 four wire interface.
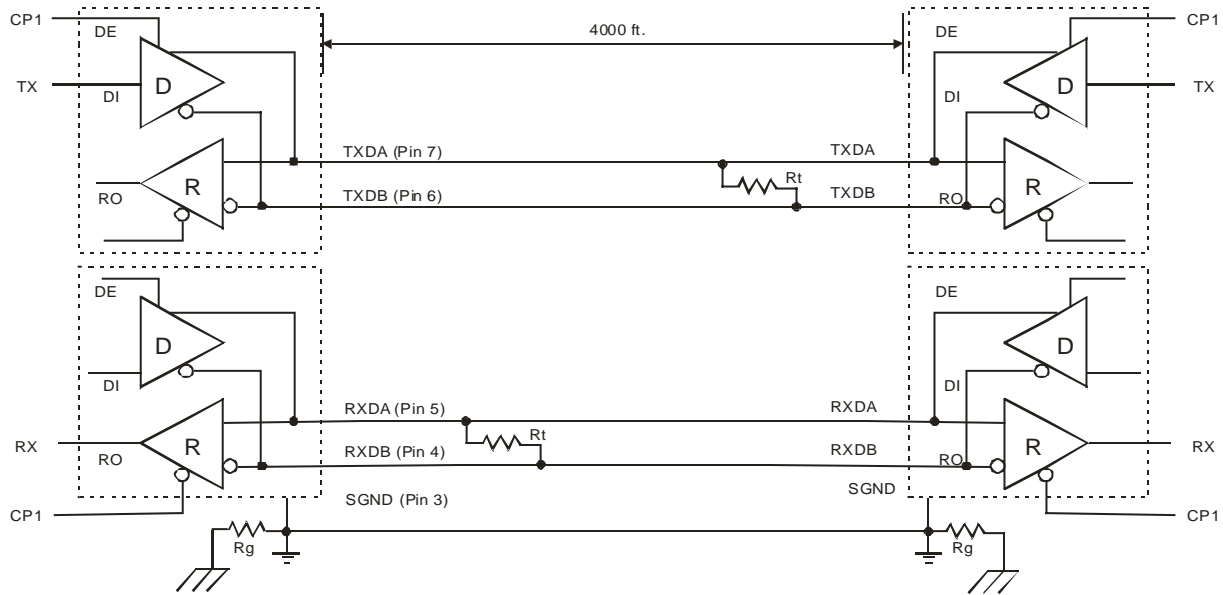
Figure 3 - RS422 Four Wire Interface

Notice that 5 conductors are used (two twisted pairs and a ground wire). Also, when the cable lengths are long and/or the data rates are high, the network must be terminated. To terminate the network, a resistor Rt is added in parallel with the receiver's A and B lines. Rg is an optional resistor between ground and the shield. Rt termination resistors are available as option jumpers on the NET485.

Note: Do NOT install termination resistors on short wire networks. See the Application Notes on the product CD for more information about networks and termination procedures.

1.3.2 RS485 Networks

RS485 permits a balanced transmission line to be shared in a party line or multi-drop configuration. As many as 32 driver / receiver pairs can share a multi-drop network on a single two wire bus. The length of the network is limited to 4,000 ft. between the first node and the last node. RS485 can be used in two-wire or four-wire multi-drop network applications.

Figure 4 shows a typical RS485 two-wire multi-drop network. The tri-state capabilities of 485 allow a single pair of wires to share transmit and receive signals for half-duplex communications. In this configuration, it is important to prevent more than one device from transmitting at the same time. This is controlled by software and the communications protocol. Note that the transmission line is terminated on both ends of the line but not at drop points in the middle of the line. Termination is only required with high data rates and / or long wire runs.

Note: Do NOT install termination resistors on short wire networks. See the Application Notes on the product CD for more information about networks and termination procedures.
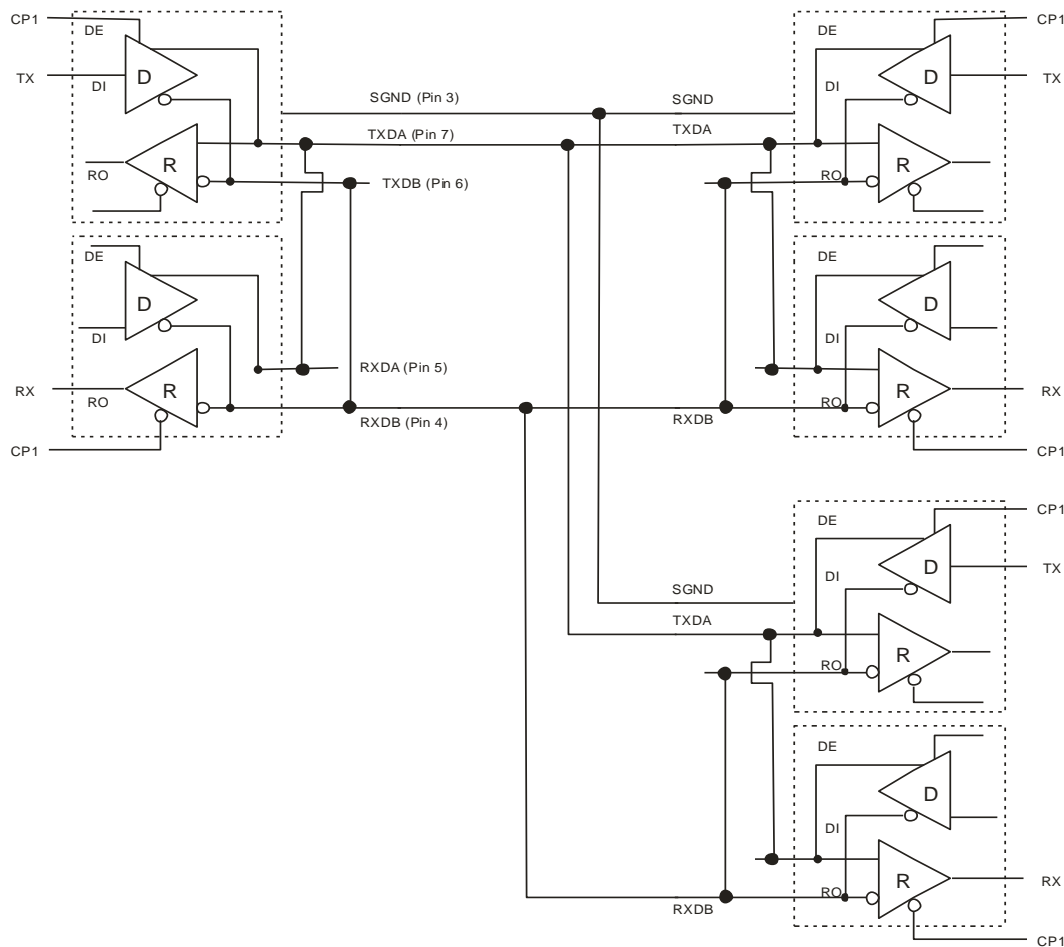
Figure 4 - RS485 Network

2. Introduction

The NET485 product allows you to connect an RS422/RS485 device to the Ethernet. Using RS485 two-wire mode, you can connect the NET485's serial interface to multiple devices in a multi-drop network.

To quickly setup the NET485, please refer to the Quick Start Guide. This section discusses the general details of the NET485.

Figure 5 - Main Features

2.1 Typical Connections

Many electronic devices use the RS422/485 interface for its ability to connect equipment over long distances. The interface design provides for multiple units to connect in a multi-drop protocol. The wiring for these types of networks helps reduce noise and provides for reliable communications. However, the distances are limited to about 4000 feet.

The NET485 allows you to connect an RS422/485 device to the Internet so that you can connect to the device from anywhere there is an Internet connection. Many industrial computers have an RS422/485 interface to connect to their control systems. The software generally connects to one of the communication ports such as COM1. You can still use the same software with the NET485 by installing Com Port Redirector software.

Com Port Redirector v.4 (CPR), is a software utility for network-enabling software applications that do not have network support. Com Port Redirector installs virtual communication ports; these communication (com) ports are redirected over a network to the serial port of a device server.

The drawing shows a PC running Com Port Redirector software. When you run your application software, you can now pick a virtual com port instead of a physical port. Instead of a cable running from the PC to the RS485 device, you can now connect to it through a virtual com port and the NET485.
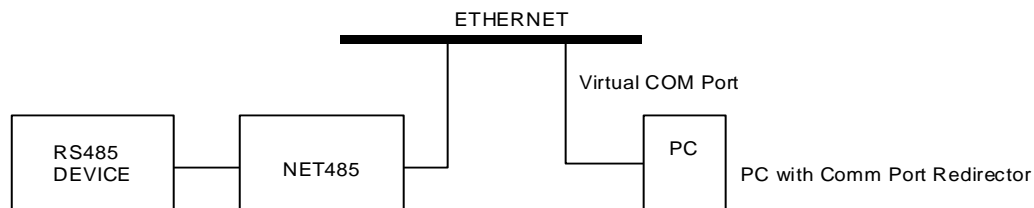
2.2 Protocol Support

The NET485 uses the Internet Protocol (IP) for network communications and the Transmission Control Protocol (TCP) to assure that no data is lost or duplicated and that everything sent to the connection arrives correctly at the target.

Other supported protocols include:
- ARP, UDP, TCP, ICMP, Telnet, TFTP, AutoIP, DHCP, HTTP, and SNMP for network communications and management.
- TCP, UDP, and Telnet for connections to the serial port.
- TFTP for firmware and web page updates.
- IP for addressing, routing, and data block handling over the network.
- User Datagram Protocol (UDP) for typical datagram applications in which devices interact with other devices without maintaining a point-to-point connection.

2.3 Serial RS422/485 Interface

The table below lists the RS422/485 signals for the NET485. The RS422/485 and power interface is a 7-pin removable Phoenix connector, with two of the pins used for power.

Table 1 - RS422/485 Signals

NET485 Signal	7-Pin Phoenix
TXDA	7
TXDB	6
RXDA	5
RXDB	4
SGND	3
GND	2
8-24VDC	1

Termination Jumpers
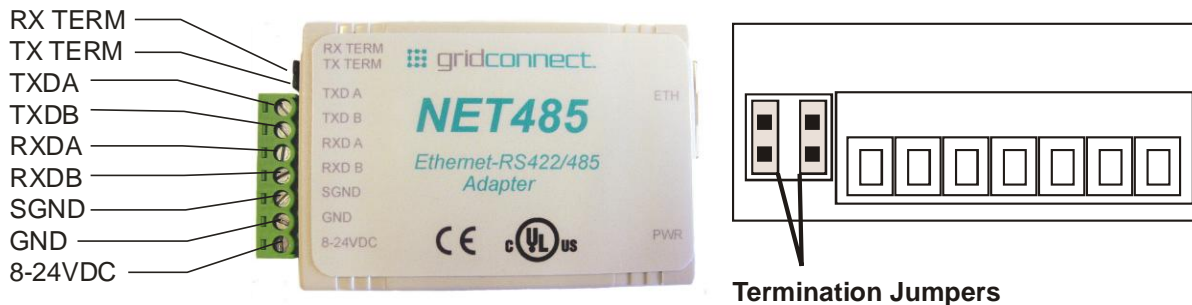
Figure 6 - Phoenix Connector

The NET485 uses protective clamping structures on its inputs and outputs that clamp the voltage to a safe level and dissipate the energy present in ESD (electrostatic) and EFT (electrical fast transients) discharges. This protection structure achieves ESD protection up to 8 kV according to IEC1000-4-2, and EFT protection up to 2 kV on all input/output (I/O) lines.

The NET485 has jumper terminals for adding termination resistors to the RX and TX lines. Add these jumpers ONLY if you have long transmission lines and termination resistors are needed.

WARNING: Jumpers must be installed vertically.

Note: Do NOT use RX Term and TX Term jumpers on short transmission lines. Remove these jumpers to remove the 120 Ohm resistors from the transmit and receive lines.

Note: See the Application Notes on the product CD for more information about networks and termination procedures.

2.4 Full Duplex-Half Duplex Jumper

The NET485 is factory set for RS485. You can change it to RS422 by changing the protocol for the port setting. See *Channel 1 Configuration* on page 3-3. You can select Full or Half Duplex by changing the internal jumper J2. The factory default setting is Half Duplex, pins 2 and 3 are connected.

J2
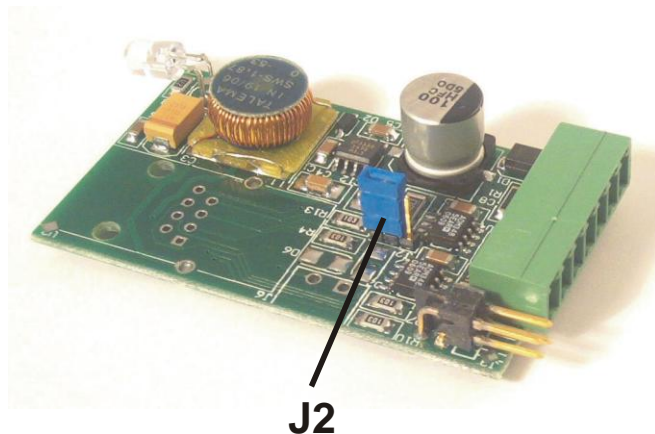
Figure 7 - J2 Setting for Half Duplex

To change the jumper J2 to Full Duplex, open the case and locate the jumper J2. Move the jumper to pins 1 and 2 as shown in the drawing.

J2
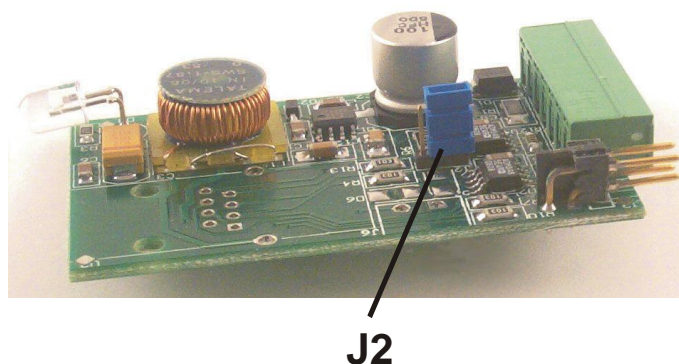
Figure 8 - J2 Setting for Full Duplex

2.5 Power Supply

The NET485 can use a DC power source from 5VDC to 24VDC, even though the label shows 8-24VDC. The current draw is determined by network activity and serial port communications. In general, a 2.5W supply will handle the load.

Most modular power supplies use the same method of designating which lead is positive and which one is negative. Generally, the lead with a white stripe, or white markings, is the positive lead. Verify the lead markings with a meter before connecting a power source to the NET485.

Connect the positive lead to the terminal marked 8-24VDC. Connect the negative lead to the terminal marked GND. See Figure 6 for lead identification. The power LED will come on when power is supplied.

The unit will go through a self-test and will attempt to connect to a server. The LEDs on the Ethernet connector will indicate the connection status.

2.6 Ethernet Interface

The NET485 device contains the following LEDs:
- 10BaseT/100BaseTX (Bi-color, Left LED)
- Full/Half Duplex (Bi-color, Right LED)
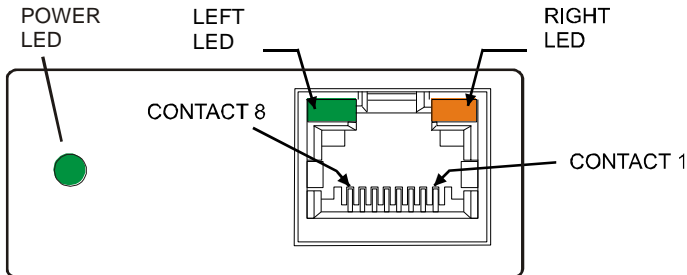
Figure 9 - Ethernet Jack

Table 2 - NET485 LED Functions

Left LED	Right LED	Meaning
Solid Amber		10BASE-T
Solid Green		100BASE-Tx
	Blinking Amber	Half Duplex Activity
	Blinking Green	Full Duplex Activity

2.7 Product CD

The CD sent with the NET485 contains software and technical manuals to support the NET485. Device Installer is one of the main software utilities that allows for fast and easy configuration of the NET485.

1. Insert the CD into your CD-ROM drive. The CD will automatically start and display the main window.

   If the CD does not launch automatically:

   a) Click the Start button on the Task Bar and select Run.

   b) Enter your CD drive letter, colon, backslash, autorun.exe (e.g., D:\autorun.exe).

To view the Quick Start Guide, click on **NET485 Quick Start** button.

The technical manuals are in PDF format. If you do not have Acrobat Reader installed, you can install it from the Adobe website.

To install Device Installer, click the **Go to Software Page** button, then select **Device Installer** button.

2.8 Additional Documentation

The following guides are available on the product CD. There are several other manuals on the CD, however, they do not apply to the NET485 product.

Title	Description	File Name
NET485 User Guide	This manual in PDF format.	NET485_UM.pdf
Device Installer User Guide	Information about installing and using Device Installer Utility.	DeviceInstaller_UG.pdf
NET485 Quick Start Guide	Quick steps to get the unit up and running.	NET485_QS.pdf
Comm Port Redirector Guide	Provides information on using the Windows based utility to create a virtual com port.	Redirector_UG_800235.pdf
Web Enable User Guide	Explains the steps to get your device Web enabled.	Web_Enabling_UG_800236.pdf
UDP Configuration Guide	How to use UDP to configure the unit. How to acquire and use setup records to configure a unit.	UDPconfig_800238.pdf
Tech Notes	Additional information to aid in using the NET485.	485_Notes_800239.pdf
Application Note	Serial Tunneling	AN_SerTun_800304.pdf
Technical FAQ	Frequently Asked Questions	Technical FAQ.pdf

2.9 Technical Specifications

Table 3 - Technical Specs

The transceiver used in the NET485 is intended for balanced data transmission and complies with both EIA Standards RS-485 and RS-422. It contains a differential line driver and a differential line receiver, and is suitable for half-duplex transfer. The input impedance is 19KOhm allowing up to 50 transceivers to be connected on the bus.

Category	Description
CPU	DSTni-EX 186 CPU, 256 KB zero wait state SRAM 2048KB Flash, 16KB Boot ROM, 1024KB SRAM
Firmware	Upgradeable via TFTP
Reset Circuit	Reset In is low active. (Software reset only)
Serial Interface	RS422/485. Baudrate software selectable (300 to 921600)
Serial Line Formats	7 or 8 data bits, 1-2 Stop bits, Parity: odd, even, none
Network Interface	RJ45 Ethernet 10Base-T or 100Base-TX (Auto-sensing)
Compatibility	Ethernet: Version 2.0/IEEE 802.3
Protocols Supported	ARP, UDP, TCP, Telnet, ICMP, SNMP, DHCP, BOOTP, TFTP, Auto IP, SMTP, and HTTP
Power Input	5VDC to 24VDC, approximately 2.5 W.
LEDs	10Base-T & 100Base-TX Activity, Full/half duplex.
Management	Internal web server, SNMP (read only) Serial login, Telnet login
Security	Password protection, Locking features, optional Rijndael 128-bit encryption
Internal Web Server	Serves static web pages and Java applets
Weight	1.7oz
Material	Case: Flame Retardant
Temperature	Operating range: -40°C to +85°C (-40°F to 185°F) High performance mode has an upper temperature limit of 75°C.
Relative Humidity	Operating: 5% to 95% non-condensing
Warranty	1-year limited warranty
Included Software	Windows™ NT/2000/XP based Device Installer configuration software, Windows™ based Comm Port Redirector.
EMI Compliance	Radiated & conducted emissions - complies with Class B limits of EN 55022:1998 Direct & Indirect ESD - complies with EN55024:1998 RF Electromagnetic Field Immunity - complies with EN55024:1998 Electrical Fast Transient/Burst Immunity - complies with EN55024:1998 Power Frequency Magnetic Field Immunity - complies with EN55024:1998 RF Common Mode Conducted Susceptibility - complies with EN55024:1998
UL Certification E357346-A1	UL 60950-1, 2nd Edition, 2011-12-19 (Information Technology Equipment - Safety - Part 1: General Requirements) CSA C22.2 No. 60950-1-07, 2nd Edition, 2011-12 (Information Technology Equipment - Safety - Part 1: General Requirements) NWGQ, NWGQ7 (Information Technology Equipment Including Electrical Business Equipment)

3. Getting Started

This chapter covers the required steps to get the NET485 Serial to Ethernet adapter on-line and working. The NET485 contains a complete device server that controls the network communications.

Note: See the Quick Start Guide for a quick setup procedure.

3.1 Quick Rundown

For the unit to operate correctly on a network, it must have a unique IP address on the network. There are three basic methods for logging into the device server and assigning the IP address:

- **DHCP**: By default, Dynamic Host Configuration Protocol (DHCP) is enabled on the device server. DHCP allows a DHCP server to automatically assign an IP address to the device server. If you use DHCP, the device server is assigned a new IP address each time it boots.
- **Device Installer**: You can manually assign the IP address using a graphical user interface (GUI) on a PC attached to a network.
- **Serial Port Login**: With this method, you connect a terminal or a PC running a terminal emulation program to the unit's serial port.

All of the methods for assigning an IP address will be discussed in *Methods of Assigning the IP Address* on page 3-2.

It is important to consider the following points before logging into and configuring the device server:

- The device server's IP address must be configured before a network connection is available.
- Only one person at a time may be logged into the network port. This eliminates the possibility of several people simultaneously attempting to configure the device server.
- Network port logins can be disabled. The system manager will not be able to access the unit. This port can also be password protected.

For the unit to operate correctly with your device, you must configure the serial port properties. Make sure the unit is configured for RS422/485, the baud rate matches your device, and the wiring matches the diagrams shown in previous sections.

3.2 Physically Connecting the Unit

1. Connect an active network Ethernet cable to the NET485's Ethernet port.

2. Supply power to your unit. See the specifications table for input power range.

3. Attach signal cables to the unit, based on RS422 or RS485 interface requirements. See previous chapter for wiring details.

4. Select half or full duplex operation.

Note: The unit is shipped from the factory set for Half Duplex and configured for RS485 operation.

3.3 Methods of Assigning the IP Address

The unit's IP address must be configured before a network connection is available. You have several options for assigning an IP to your unit, however, **we recommend** *Device Installer* on page *3-3***.**

Method	Description
Device Installer	You manually assign the IP address using a Graphical User Interface on a PC attached to the network. See Device Installer on page 3-3.
Telnet	You manually assign the IP address and other network settings at a command prompt using a UNIX or Windows-based system. Only one person at a time can be logged into the configuration port (port 9999). This eliminates the possibility of several people simultaneously attempting to configure the unit. See Telnet Connection on page 3-5.

3.3.1 Hardware Address

You need to know the unit's hardware address (also known as MAC address), which is on the manufacturers ID label on the bottom of the unit. It is in the format: 00-20-4a-XX-XX-XX, where the XXs are unique numbers assigned to the product.

Hardware Address: 00-20-4a- ____ - ____ - ____

3.3.2 IP Address

Your NET485 must have a unique IP address on your network. The systems administrator generally provides the IP address and corresponding subnet mask and gateway. The IP address must be within a valid range, unique to your network, and in the same subnet as your PC.

IP Address: _____ _____ _____ _____

Subnet Mask: _____ _____ _____ _____

Gateway: _____ _____ _____ _____

3.3.3 DHCP

The unit ships with a default IP address of 0.0.0.0, which automatically enables DHCP.

Provided a DHCP server exists on the network, it will provide the unit with an IP address, gateway address, and subnet mask when the unit boots up.

You can use the **Device Installer** software to search the network for the IP address your unit has been assigned by the DHCP server and add it to the managed list.

3.3.4 AutoIP

The unit ships with a default IP address of 0.0.0.0, which automatically enables Auto IP within the unit. AutoIP is an alternative to DHCP that allows hosts to automatically obtain an IP address in smaller networks that may not have a DHCP server. A range of IP addresses (from 169.254.0.1 to 169.254.255.1) has been explicitly reserved for AutoIP-enabled devices. The range of Auto IP addresses is not to be used over the Internet.

If your unit cannot find a DHCP server, and you have not manually assigned an IP address to it, the unit automatically selects an address from the AutoIP reserved range. Then, your unit sends out a (ARP) request to other nodes on the same network to see whether the selected address is being used.

- If the selected address is not in use, then the unit uses it for local subnet communication.
- If another device is using the selected IP address, the unit selects another address from the AutoIP range and reboots. After reboot, the unit sends out another ARP request to see if the selected address is in use, and so on.

AutoIP is not intended to replace DHCP. The unit will continue to look for a DHCP server on the network. If a DHCP server is found, the unit will switch to the DHCP server-provided address and reboot.

Note: If a DHCP server is found, but it denies the request for an IP address, the unit does not attach to the network, but waits and retries.

AutoIP can be disabled by setting the unit's IP address to 0.0.1.0. This setting enables DHCP but disables AutoIP.

3.4 Device Installer

Device Installer is a Windows-based utility for configuring embedded device servers found in products such as the NET232, NET232jr and NET485 Serial to Ethernet adapters. Device Installer supports several functions such as setting network parameters, pinging a network device, and changing baud rate. The first operation you must do is to locate the device on your network and assign the device a fixed IP address. Once the unit has a fixed IP address, you can use several methods to setup the unit for your specific application.

Please locate and read the **Device Installer User Guide** found on the product CD. The manual can be read by clicking the **Device Installer Manual** button on the software page of the product CD. You can also browse the CD to find the manual. Locate the **doc** folder and double-click on **DeviceInstaller_UG.pdf**.

Device Installer is used to configure many different types of Ethernet devices. There are some important differences when configuring a NET485.

3.4.1 Channel 1 Configuration
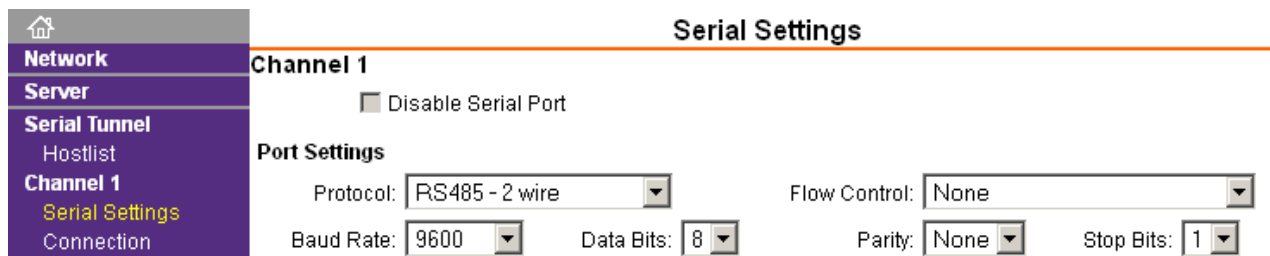
To configure the channel's serial settings:

1. On the main menu, click **Serial Settings** (under **Channel 1**) to display the Serial Settings window.

2. In the Protocol field, enter RS485 2-wire OR RS422/RS485 4-wire.

3. When you are finished, click the **OK** button.

4. On the main menu, click **Apply Settings**.

3.4.2 Configurable Pin Settings

There are three configurable hardware pins on the NET485. See the notes in **The RS485 Enable Signal** on page 1-2.

To configure the NET485 for RS485 Tx Enable:

1. On the main menu, click **Configurable Pins**. The Configurable Pins page opens.

2. Set CP1 to RS485 TxEnable and Active level HIGH.

3. When you are finished, click the **OK** button.

4. On the main menu, click **Apply Settings.**

3.5 Configuration Using Telnet

You must configure the unit so that it can communicate on a network with your serial device. The unit's configuration is stored in nonvolatile memory and is retained without power. You can change the configuration at any time. The unit performs a reset after the configuration has been changed and stored.

You can establish a Telnet connection by clicking the Telnet Configuration tab in the Device Installer window or by starting a Telnet session in command mode.

Telnet Configuration using Device Installer

Click the **Telnet Configuration** tab. When the window opens, click the **Connect** button.
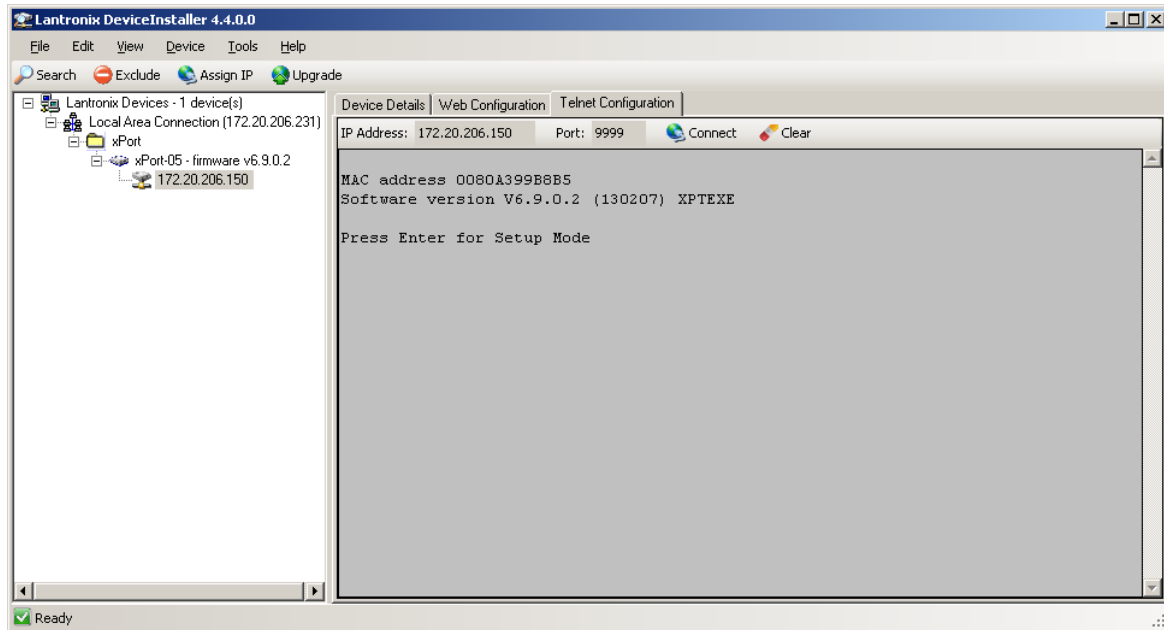
Go to **Telnet Messages** on page 3-6

3.5.1 Telnet Connection

To configure the unit over the network, establish a Telnet connection to port 9999.

Note: If you use the Telnet Configuration tab on Device Installer, skip steps 1and 2.

1. From the Windows Start menu, click **Run** and type the following command, where x.x.x.x is the IP address and 9999 is the unit's fixed network configuration port number.

        telnet x.x.x.x 9999

Note: Be sure to include a space between the IP address and 9999.

2. Click **OK**.

3.5.2 Telnet Messages

3. The window displays:

```
MAC address 0080A399B8B5
Software version V6.9.0.2 (130207) XPTEXE
Press Enter for Setup Mode
```

4. To enter the Setup Mode, **you must press Enter within 5 seconds**. The configuration settings will appear.

5. Select an option on the menu by entering the number of the option in the **Your choice ?** field and pressing **Enter**.

6. To enter a value for a parameter, type the value and press **Enter**, or to confirm a current value, just press **Enter**.

7. When you are finished, save the new configurations (option **9**). The unit will reboot.

```
*** basic parameters
Hardware: Ethernet TPI
IP addr 0.0.0.0/DHCP/BOOTP/AutoIP, no gateway set
DNS Server not set
DHCP device name : not set
DHCP FQDN option: Disabled

*** Security
SNMP is               enabled
SNMP Community Name: public
Telnet Setup is       enabled
TFPT Download is      enabled
Port 77Feh is         enabled
Web Server is         enabled
Web Setup is          enabled
ECHO is               disabled
Encryption is         disabled (not in all units)
Enhanced Password is disabled
Port 77F0h is         enabled

*** Channel 1
Baudrate 9600, I/F Mode 4C, Flow 00
Port 10001
Connect Mode : C0
Send '+++' in Modem Mode enabled
Show IP addr after 'RING' enabled
Auto increment source port  disabled
Remote IP Adr: --- none ---, Port 00000
Disconn Mode : 00
Flush   Mode : 00

*** Expert
TCP Keepalive     : 45s
ARP cache timeout : 600s
CPU performance : Regular
Monitor Mode @ bootup : enabled
RS485 tx enable  : active low   (Should be set to high for NET485)
HTTP Port Number : 80
SMTP Port Number : 25
MTU Size: 1400
TCP Re-transmission timeout: 500 ms
Alternate MAC: disabled
Ethernet connection type:  auto-negotiate
```

```
***************** E-mail *****************
Mail server: 0.0.0.0
Unit       :
Domain     :
Recipient 1:
Recipient 2:

*** Trigger 1
Serial trigger input: disabled
  Channel: 1
  Match: 00,00
Trigger input1: x
Trigger input2: x
Trigger input3: x
Message :
Priority: L
Min. notification interval: 1 s
Re-notification interval  : 0 s

*** Trigger 2
Serial trigger input: disabled
  Channel: 1
  Match: 00,00
Trigger input1: x
Trigger input2: x
Trigger input3: x
Message :
Priority: L
Min. notification interval: 1 s
Re-notification interval  : 0 s

*** Trigger 3
Serial trigger input: disabled
  Channel: 1
  Match: 00,00
Trigger input1: x
Trigger input2: x
Trigger input3: x
Message :
Priority: L
Min. notification interval: 1 s
Re-notification interval  : 0 s

Change Setup:
  0 Server
  1 Channel 1
  3 E-mail
  5 Expert
  6 Security
  7 Defaults
  8 Exit without save
  9 Save and exit              Your choice ?
```

Figure 10 - Setup Mode Window

3.6 Server Configuration (Option 0 Network Configuration)

These are the unit's basic network parameters. The following parameters are displayed when you select **Server**(Option 0).

```
IP Address : (000) .(000) .(000) .(000)
Set Gateway IP Address (N)
Netmask: Number of Bits for Host Part (0=default)  (0)
Set DNS Server IP addr  (N)
Change telnet config password (N)
Change DHCP device name (not set) ? (N) ?
Enable DHCP FQDN option :  (N)
```

3.6.1 IP Address

DHCP is not used to assign IP addresses, enter the IP address manually. The IP address must be set to a unique value in the network. Enter each octet and press **Enter** between each section. The current value displays in parentheses.

If DHCP is used, the third octet of the IP address sets the BootP/DHCP/AutoIP options. The following table shows the bits you can manually configure to force the XPort to disable AutoIP, DHCP, or BootP. To disable an option, set the appropriate bit.

Options	Bit
AutoIP	0
DHCP	1
BootP	2

For example, if the third octet is 0.0.5.0, the AutoIP and BootP options are disabled; only DHCP is enabled. (The value 5 results from adding the binary equivalents of 0 and 2.) This is the most common setting when using DHCP.

3.6.2 Set Gateway IP Address

The gateway address, or router, allows communication to other LAN segments. The gateway address should be the IP address of the router connected to the same LAN segment as the unit. The gateway address must be within the local network. The default is **N** (No), meaning the gateway address has not been set. To set the gateway address, type **Y** and enter the address.

3.6.3 Netmask: Number of Bits for Host Part

A netmask defines the number of bits taken from the IP address that are assigned for the host section.
Note: Class A: 24 bits; Class B: 16 bits; Class C: 8 bits.

The unit prompts for the number of host bits to be entered, then calculates the netmask, which is displayed in standard decimal-dot notation when the saved parameters display (for example, 255.255.255.0).

Table 4 - Standard IP Network Netmasks

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

Table 5 - Netmask Examples

Netmask	Host Bits
255.255.255.252	NOT Recommended
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
255.255.240.0	12
255.255.224.0	13
255.255.192.0	14
255.255.128.0	15
255.255.0.0	16
255.254.0.0	17
255.252.0.0	18
255.248.0.0	19
255.240.0.0	20
255.224.0.0	21
255.192.0.0	22
255.128.0.0	23
255.0.0.0	24

3.6.4 Set DNS Server IP Address

The DNS server allows the name of a remote machine to be resolved automatically. Enter the IP address of the DNS server. If the device is DHCP enabled, the DHCP server provides the DNS server IP address, which will override this configured value.

Note: This setting is applicable only in Manual Connection mode.

3.6.5 Change Telnet configuration password

Setting the Telnet configuration password prevents unauthorized access of the setup menu via a Telnet connection to port 9999 or through Web pages. The password is limited to 4 characters. An enhanced password setting of 16 characters is available under Security Settings for Telnet access only.

3.6.6 DHCP Naming

If a DHCP server has automatically assigned the IP address and network settings, you can discover the unit by using the Device Installer network search feature.

There are 3 methods for assigning DHCP names to these products.

1) **Default DHCP name.** If you do not change the DHCP name, and you are using an IP of 0.0.0.0, then the DHCP name will default to CXXXXXX (XXXXXX is the last 6 digits of the MAC address shown on the label on the bottom/side of the unit). For example, if the MAC address is 00-20-4A-12-34-56, then the default DHCP name is C123456.

2) **Custom DHCP name.** You can create your own DHCP name on these products. If you are using an IP address of 0.0.0.0, then the last option in "Server configuration" will be "Change DHCP device name". The "Change DHCP device name" option will allow you to change the DHCP name to an alpha-numeric name.

```
Change DHCP device name (not set) ? (N) Y
Enter new DHCP device name : LTX
```

3) **Numeric DHCP name.** You are able to change the DHCP name by specifying the last octet of the IP address. When you use this method, the DHCP name will be LTXYY where YY is what you chose for the last octet of the IP address. If the IP address you specify is 0.0.0.12, then the DHCP name will be LTX12. This method will only work with 2 digit numbers (0-99).

3.6.7 Enable DHCP FQDN option

FQDN is the *fully qualified domain name* of the remote host

Dynamic update enables a DHCP server to register address (A) and pointer (PTR) resource records on behalf of a DHCP client by using DHCP Client FQDN option 81. Option 81 enables the DHCP client to provide its FQDN to the DHCP server. The DHCP client also provides instructions to the DHCP server describing how to process DNS dynamic updates on behalf of the DHCP client.

3.7 Channel 1 Configuration (Serial Port Parameters)

This section describes how to setup the serial port. The following parameters are displayed when you select **Channel 1** (Option 1).

```
Baudrate (9600)
I/F Mode (4C)
Flow (00)
Port No (10001)
ConnectMode (C0)
Send '+++' in Modem Mode  (Y) ?
Show IP addr after 'RING'  (Y) ?
Auto increment source port (N) ?
Remote IP Address : (000).(000).(000).(000)
Remote Port (00000)
DisConnMode (00)
FlushMode   (00)
DisConnTime (00:00) :
SendChar 1  (00)
SendChar 2  (00)
```

3.7.1 Baudrate

The unit and attached serial device, such as a modem, must agree on a speed or baud rate to use for the serial connection. Valid baud rates are 300, 600, 1200, 2400, 4800, 9600 (default), 19200, 38400, 57600, 115200, and 230400 bits per second. XPort-03 and greater units also support high-performance baud rates of 460800 and 921600 bps.

3.7.2 I/F (Interface) Mode

The Interface (I/F) Mode is a bit-coded byte that you enter in hexadecimal notation.

Table 6 - Interface Mode Options

I/F Mode Option	7	6	5	4	3	2	1	0
RS-232C [1]							0	0
RS-422/485							0	1
RS-485 2-wire							1	1
7 Bit					1	0		
8 Bit					1	1		
No Parity			0	0				
Even Parity			1	1				
Odd Parity			0	1				
1 Stop bit	0	1						
2 Stop bit [1]	1	1						

(1) 2 stop bits are implemented by software. This might have influence on performance.

Note: RS-422/485 I/F Modes are supported on XPort-03 with firmware 6.1.0.0 and above.

The following table demonstrates how to build some common Interface Mode settings:

Table 7 - Common Interface Mode Settings

Common I/F Mode Setting	Binary	Hex
RS-232C, 8-bit, No Parity, 1 stop bit	0100 1100	4C
RS-232C, 7-bit, Even Parity, 1 stop bit	0111 1000	78

3.7.3 Flow

Flow control sets the local handshaking method for stopping serial input/output.

Table 8 - Flow Control Options

Flow Control Option	Hex
No flow control	00
XON/XOFF flow control	01
Hardware handshake with RTS/CTS lines (see note)	02
XON/XOFF pass characters to host	05

3.7.4 Port Number

The setting represents the source port number in TCP connections. It is the number used to identify the channel for remotely initiating connections.

Note: When using Comm Port Redirector software, use this port number.

Default setting for Port 1 is 10001. Range: 1-65535 except for the following reserved port numbers:

Table 9 - Reserved Ports

Port Numbers	Reserved for
1 – 1024	Reserved (well known ports)
9999	Telnet setup
14000-14009	Reserved for Comm Port Redirector
30704	Reserved (77F0h)
30718	Reserved (77FEh)

Warning: We recommend that you not use the reserved port numbers for this setting as incorrect operation may result.

The port number functions as the TCP/UDP source port number for outgoing packets. Packets sent to the unit with this port number are received to this channel. The port number selected is the Incoming TCP/UDP port and Outgoing TCP/UDP source port. Port 0 is used when you want the outgoing source port to change with each connection.

If the port number is set to 0, the initial value of 50000 will be used to actively establish a connection. Each subsequent connection will increment the number by 1. When the port number reaches 59999, it will wrap back to 50000.

The automatic port increment feature must only be used when this device is the one initiating a connection using TCP. The port must be set to a non-zero value when this is a passive device or when UDP is being used instead of TCP.

3.7.5 Connect Mode

Connect Mode defines how the unit makes a connection, and how it reacts to incoming connections over the network. Enter Connect Mode options in hexadecimal notation.

Note: If you do not want to convert the binary numbers to hexadecimals yourself, look up the values in the Tech Notes guide.

Table 10 - Connect Mode Options

Connect Mode Option	7	6	5	4	3	2	1	0
Incoming Connection								
Never accept incoming	0	0	0					
Accept with DTR Active	0	1	0					
Always Accept	1	1	0					
Response								
Nothing (quiet)				0				
Character response (C=connect, D=disconnect, N=unreachable)				1				
Active Startup								
No active startup					0	0	0	0
With any character					0	0	0	1
With DTR Active					0	0	1	0
With a specific start character					0	0	1	1
Manual connection					0	1	0	0
Autostart					0	1	0	1
Hostlist	0	0	1	0				
Datagram Type								
Directed UDP					1	1	0	0
Modem Mode								
No Echo			0	0		1	1	
Data Echo and Modem Response (Numeric)			0	1		1	1	1
Data Echo and Modem Response (Verbose)			0	1		1	1	0
Modem Response Only (Numeric)			0	0	1	1	1	1
Modem Response Only (Verbose)			0	0	1	1	1	0

INCOMING CONNECTION:

Never Accept Incoming:	Rejects all external connection attempts.
Accept with DTR Active:	Accept external connection requests only when the DTR input is asserted. Cannot be used with Modem Mode.
Always Accept:	Accept any incoming connection when a connection is not already established. This is the default setting.

RESPONSE:

Character Response:	A single character is transmitted to the serial port when there is a change in connection state: C = connected, D = disconnected, N = host unreachable. This option is overridden when the Active Start Modem Mode or Active Start Host List is in effect. Default setting is Nothing (quiet).

ACTIVE STARTUP:

No Active Startup:	No attempt to initiate a connection under any circumstance. This is the default setting.
With Any Character:	Attempts to connect when any character is received from the serial port.
With DTR Active:	Attempts to connect when the DTR input changes from not asserted to asserted.
With a Specific Start Char:	Attempts to connect when it receives a specific start character from the serial port. The default start character is carriage return.
Manual Connection:	Attempts to connect when directed by a command string received from the serial port. The first character of the command string must be a C (ASCII 0x43), and the last character must be either a carriage return (ASCII 0x0D) or a line feed (0x0A). No blanks or space characters in the command string. Between the first and last command string characters must be a full or partial destination IP address and may be a destination port number.

The IP address must be presented in standard dot-decimal notation and may be a partial address, representing the least significant 1, 2 or 3 bytes of the remote IP address. The period is required between each pair of IP address numbers.

If present, the port number must follow the IP address, must be presented as a decimal number in the range 1-65535 and must be preceded by a forward slash (ASCII 0x2F). The slash separates the IP address and the port number. If the port number is omitted from a command string, the internally stored remote port number is used to start a connection.

For Active Start options requiring internally stored destination IP address and port number, the unit will not attempt a connection if this information is not configured (all zeros).

If a partial IP address is presented in a command string, it will be interpreted to be the least significant bytes of the IP address and will use the internally stored remote IP address to provide the most significant bytes of the IP address.

For example, if the remote IP address already configured in the unit is 129.1.2.3, then an example command string would be C3/7. (This would connect to 129.1.2.3 and port 7.) You may also use a different ending for the connection string. For example, C50.1/23 would connect you to 129.1.50.1 and port 23.

Table 11 - Manual Connection Address Example

Command String	Result if remote IP is 129.1.2.3 and remote port is 1234
C121.2.4.5/1	Complete override; connection is started with host 121.2.4.5, port 1
C5	Connect to 129.1.2.5, port 1234
C28.10/12	Connect to 129.1.28.10, port 12
C0.0.0.0/0	Enter Monitor Mode

Autostart (Automatic Connection):

If **Autostart** is enabled, the unit automatically connects to the remote IP address and remote port specified when the firmware starts.

Hostlist:

If you enable this option, the unit scrolls through the hostlist until it connects to a device listed in the hostlist table. Once it connects, the unit stops trying to connect to any others. If this connection fails, the unit continues to scroll through the table until it is able to connect to another IP in the hostlist.

Hostlist supports a minimum of 1 and a maximum of 12 entries. Each entry contains the IP address and the port number. The host list will be disabled for Manual Mode and for Modem Mode. The unit will not accept a data connection from a remote device when the host list option is enabled.

```
Baudrate (9600)
I/F Mode (4C)
Flow (00)
Port No (10001)
ConnectMode (21)
Send '+++' in Modem Mode (Y) ?
Auto increment source port (N) ?

Hostlist :
01. IP : 010.010.010.001  Port : 00023
02. IP : 010.010.010.002  Port : 00023
03. IP : 010.010.010.003  Port : 00023

Change Hostlist ? (N)
Hostlist Retrycounter    (3)
Hostlist Retrytimeout    (250)
DisConnMode (00)
FlushMode   (00)
DisConnTime (00:00) :
SendChar 1  (00)
SendChar 2  (00)
```

Figure 11 - Hostlist Option

To use the Hostlist option, follow these steps:

1. Enter a **Connect Mode** of 0x20 (**2X**). The menu shows you a list of current entries already defined in the product.

2. To delete, modify, or add an entry, select **Yes**. If you enter an IP address of 0.0.0.0, that entry and all others after it are deleted.

3. After completing the hostlist, repeat the previous step if necessary to edit the hostlist again.

4. For **Retrycounter**, enter the number of times the unit should try to make a good network connection to a hostlist entry that it has successfully ARPed. The range is 1-15, with the default set to 3.

5. For **Retrytimeout**, enter the number of seconds the unit should wait before failing an attempted connection. The time is stored as units of milliseconds in the range of 1-65535. The default value is 250.

DATAGRAM TYPE:

Directed UDP: When selecting this option, you will be prompted for the Datagram type. Enter **01** for directed or broadcast UDP.

When the UDP option is in effect, the unit will never attempt to initiate a TCP connection because it will use UDP datagrams to send and receive data.

MODEM MODE:

In Modem (Emulation) Mode, the unit presents a modem interface to the attached serial device. It accepts **AT**-style modem commands and handles the modem signals correctly.

Normally there is a modem connected to a local PC and a modem connected to a remote machine. A user must dial from the local PC to the remote machine, accumulating phone charges for each connection. Modem Mode allows you to replace modems with NET232/USBs, and to use an Ethernet connection instead of a phone call, without having to change communications applications and make potentially expensive phone calls.

To select Modem Mode, set the Connect Mode to **06** (no echo), **16** (echo with full verbose), or **17** (echo with 1-character response).

Note: If the unit is in Modem Mode and the serial port is idle, the unit can still accept network TCP connections to the serial port if Connect Mode is set to 06 (no echo), 16 (echo with full verbose), or 17 (echo with 1-character response).

Without Echo:	In Modem Mode, echo refers to the echo of all of the characters entered in command mode; it does not mean to echo data that is transferred. Quiet Mode (without echo) refers to the modem not sending an answer to the commands received (or displaying what was typed).
Data Echo & Modem Response	**Full Verbose**: The unit echoes modem commands and responds to a command with a message string shown in the table below. **Numeric Response**: The unit echoes modem commands and responds to a command with a numeric response.
Modem Responses Only	**Full Verbose:** The unit does not echo modem commands and responds to a command with a message string shown in the table below. **Numeric Response**: The unit does not echo modem commands and responds to a command with a numeric response.

Message	Meaning
OK	Command was executed without error.
CONNECT	A network connection has been established.
DISCONNECT	A network connection has been closed.
RING n.n.n.n.	A remote device, having IP address n.n.n.n, is connecting to this device.

Message	Meaning
OK	Command was executed without error.
CONNECT	A network connection has been established
NO CARRIER	A network connection has been closed.
RING n.n.n.n	A remote device, having IP address n.n.n.n, is connecting to this device.
0	OK
1	Connected
2	Ring
3	No Carrier
4	Error

Received commands must begin with the two-character sequence **AT** and must be terminated with a carriage return character.

Any character sequence received not starting with **AT** will be ignored. The unit will only recognize and process single **AT**-style commands. Compound **AT** commands will be treated as unrecognized commands.

If the **Full Verbose** option is in effect, an unrecognized command string that is otherwise formatted correctly (begins with **AT** and ends with carriage return) will be responded to with the **OK** message and no further action is taken.

If the Numeric Response option is in effect, unrecognized command strings that are otherwise formatted correctly will be responded to with **OK** and no further action is taken.

When an active connection is in effect, the unit will be transferring data and will not process commands received from the serial interface.

When a connection is terminated or lost, the unit will revert to command mode.

When an active connection is in effect, the unit will terminate the connection if the following sequence is received from the attached serial device:

1. No serial data is received for one second.
2. The character sequence +++ is received, with no more than one second between each two characters.

3. No serial data is received for one second after the last + character. At this time the unit will respond affirmatively per the selected echo/response mode.

4. The character string **ATH** is received, terminated with a carriage return. The unit will respond affirmatively per the selected echo/response mode and drop the network connection. The serial interface will revert to accepting command strings.

If the above sequence is not followed, the unit will remain in data transfer mode.

Table 12 - Modem Mode Commands

Modem Mode Command	Function
ATDTx.x.x.x,pppp or ATDTx.x.x.x/pppp	Makes a connection to an IP address (x.x.x.x) and a remote port number (pppp).
ATDTx.x.x.x	Makes a connection to an IP address (x.x.x.x) and the remote port number defined within the unit.
ATD0.0.0.0	Forces the unit into Monitor Mode if a remote IP address and port number are defined within the unit.
ATD	Forces the unit into Monitor Mode if a remote IP address and port number are not defined within the unit.
ATDx.x.x.x	Makes a connection to an IP address (x.x.x.x) and the remote port number defined within the unit.
ATH	Hangs up the connection (Entered as +++ATH).
ATS0=n	Enables or disables connections from the network going to the serial port. n=0 disables the ability to make a connection from the network to the serial port. n=1-9 enables the ability to make a connection from the network to the serial port. n>1-9 is invalid.
ATEn	Enables or disables character echo and responses. n=0 disables character echo and responses. n=1 enables character echo and responses.
ATVn	Enables 1-character response or full verbose. n=0 enables 1-character response. n=1 enables full verbose.

Note: These AT commands are only recognized as single commands like ATE0 or ATV1; compound commands such as ATE0V1 are not recognized. All other AT commands with Modem Mode set to full verbose acknowledge with an OK, but no action is taken.

3.7.6 Send the Escape Sequence (+++) in Modem Mode

Disable or enable the ability to send the escape sequence. The default is **Y** (Yes) (send the escape sequence).

3.7.7 Show IP Address after 'RING'

The ability to enable or disable the display of the remote IP address in modem mode. Not used with NET485.

3.7.8 Auto Increment Source Port

Y (Yes) auto increment the source port. The NET232 increments the port number used with each new connection.

3.7.9 Remote IP Address

This is the destination IP address used with an outgoing connection.

*Note: This option does not display when Hostlist is enabled from the **ConnectMode** prompt.*

3.7.10 Remote Port

The remote TCP port number must be set for the unit to make outgoing connections. This parameter defines the port number on the target host to which a connection is attempted.

To connect an ASCII terminal to a host using the unit for login purposes, use the remote port number 23 (Internet standard port number for Telnet services).

Note: This option does not display when Hostlist is enabled from the ConnectMode prompt.

3.7.11 DisConnMode

This setting determines the conditions under which the unit will cause a network connection to terminate.

Note: In DisConnMode (Disconnect Mode), DTR drop either drops the connection or is ignored.

Note: DTR is not factory enabled.

Note: There is no State LED on the NET485.

Table 13 - Disconnect Mode Options

Disconnect Mode Option	7	6	5	4	3	2	1	0
Disconnect with DTR drop [6]	1							
Ignore DTR	0							
Telnet mode and terminal type setup [1]		1						
Channel (port) password [2]				1				
Hard disconnect [3]					0			
Disable hard disconnect					1			
State LED off with connection [4]								1
Disconnect with EOT (^D) [5]			1					

1. The NET485 will send the "Terminal Type" upon an outgoing connection.

2. A password is required for a connection to the serial port from the network.

3. The TCP connection will close even if the remote site does not acknowledge the disconnection.

4. When there is a network connection to or from the serial port, the state LED will turn off instead of blink.

5. When Ctrl+D or Hex 04 is detected, the connection is dropped. Both Telnet mode and Disconnect with EOT must be enabled for Disconnect with EOT to function properly. Ctrl+D will only be detected going from the serial port to the network.

6. When DTR transitions from a high state to a low state, then the network connection to or from the serial port will drop.

3.7.12 Flush Mode (Buffer Flushing)

Using this parameter, you can control line handling and network buffers with connection startup and disconnect. You can also select between two different packing algorithms.

Table 14 - Flush Mode Options

Function	7	6	5	4	3	2	1	0
Input Buffer (Serial to Network)								
Clear with a connection that is initiated from the device to the network				1				
Clear with a connection initiated from the network to the device			1					
Clear when the network connection to or from the device is disconnected		1						
Output Buffer (Network to Serial)								
Clear with a connection that is initiated from the device to the network								1
Clear with a connection initiated from the network to the device							1	
Clear when the network connection to or from the device is disconnected						1		
Alternate Packing Algorithm (Pack Control)								
Enable	1							

3.7.13 Pack Control

Two firmware-selectable packing algorithms define how and when packets are sent to the network. The standard algorithm is optimized for applications in which the unit is used in a local environment, allowing for very small delays for single characters while keeping the packet count low. The alternate packing algorithm minimizes the packet count on the network and is especially useful in applications in a routed Wide Area Network (WAN). Adjusting parameters in this mode can economize the network data stream.

Pack control settings are enabled in **Flush Mode**. Set this value to **00** if specific functions are not needed.

Table 15 - Pack Control Options

Option	7	6	5	4	3	2	1	0
Packing Interval								
Interval: 12ms							0	0
Interval: 52ms							0	1
Interval: 250ms							1	0
Interval: 5sec							1	1
Trailing Characters								
None					0	0		
One					0	1		
Two					1	0		
Send Characters								
2-Byte Send Character Sequence				1				
Send Immediately After Send chars			1					

Packing Interval: Packing Interval defines how long the unit should wait before sending accumulated characters. This wait period is between successive network segments containing data. For alternate packing, the default interval is 12 ms.

Trailing Characters: In some applications, CRC, Checksum, or other trailing characters follow the end-of-sequence character; this option helps to adapt frame transmission to the frame boundary.

Send Characters: If 2-Byte Send Character Sequence is enabled, the unit interprets the sendchars as a 2-byte sequence; if not set, they are interpreted independently.

If **Send Immediately After Send Characters** is not set, any characters already in the serial buffer are included in the transmission after a "transmit" condition is found. If set, the unit sends immediately after recognizing the transmit condition (sendchar or timeout).

Note: A transmission might occur if status information needs to be exchanged or an acknowledgment needs to be sent.

3.7.14 DisConnTime (Inactivity Timeout)

Use this parameter to set an inactivity timeout. The connection is dropped if there is no activity on the serial line before the set time expires. Enter time in the following format: **mm:ss**, where **m** is the number of minutes and **s** is the number of seconds. To disable the inactivity timeout, enter **00:00**. Range is 0 (disabled) to 5999 seconds (99 minutes, 59 seconds). Default setting is 0.

3.7.15 Send Characters

You can enter up to two characters in hexadecimal representation in the parameters "sendchar." If a character received on the serial line matches one of these characters, it is sent immediately, along with any awaiting characters, to the TCP connection. This minimizes the response time for specific protocol characters on the serial line (for example, ETX, EOT, etc.). Setting the first sendchar to **00** disables the recognition of the characters. Alternatively, the two characters can be interpreted as a sequence.

3.7.16 Telnet Terminal Type

This parameter appears only if the terminal type option is enabled in Disconnect Mode. If this option is enabled, you can use the terminal name for the Telnet terminal type. Enter only one name.

If the terminal type option is enabled, the unit also reacts to the EOR (end of record) and binary options, which can be used for applications like terminal emulation to IBM hosts.

3.7.17 Channel (Port) Password

This parameter appears only if the channel (port) password option is enabled in Disconnect Mode. If the option is enabled, you can set a password on the serial port.

3.8 E-mail Settings

Note: Part of the NeET485 design is the option of using three I/O pins for different purposes. These are referred to as Configurable Pins and are designated CP1, CP2, and CP3 in the Web Manager.

In order to use the E-mail function on the XPort, you will need access to the configurable pins. The NET485 limits the access so you cannot use the configurable pins to trigger an E-mail message. Your only option is to use a two-byte serial string to initiate a trigger.

If your device sends out a lot of character strings, then it might not be a good choice to use with the E-mail trigger option.

Note: You can change these settings via Telnet or serial connections only, not on the Web-Manager. To configure e-mail settings via DeviceInstaller, see E-mail Notification in the DeviceInstaller User Guide.

```
***************** E-mail *****************
Mail server (0.0.0.0) (000) .(000) .(000) .(000)
Unit name ():
Domain name ():
Recipient 1 ():
Recipient 2 ():

- Trigger 1
Enable serial trigger input (N) ?
Trigger input1 [A/I/X] (X) ?
Trigger input2 [A/I/X] (X) ?
Trigger input3 [A/I/X] (X) ?
Message ():
Priority (L):
Min. notification interval (1 s):
Re-notification interval (0 s):
```

```
        *** Trigger 2
        Enable serial trigger input (N) ?
        Trigger input1 [A/I/X] (X) ?
        Trigger input2 [A/I/X] (X) ?
        Trigger input3 [A/I/X] (X) ?
        Message ():
        Priority (L):
        Min. notification interval (1 s):
        Re-notification interval (0 s):

        *** Trigger 3
        Enable serial trigger input (N) ?
        Trigger input1 [A/I/X] (X) ?
        Trigger input2 [A/I/X] (X) ?
        Trigger input3 [A/I/X] (X) ?
        Message ():
        Priority (L):
        Min. notification interval (1 s):
        Re-notification interval (0 s):
```

3.8.1 E-mail Setup

E-mail setup requires you to set up the e-mail server location as follows:

Mail server: The IP address in decimal-dot notation.
Unit: The user name used by the NET485 to send e-mail messages
Domain: The Domain name of your e-mail server
Recipient 1: Full e-mail address of the recipient.
Recipient 2: Full e-mail address of the second recipient.

3.8.2 Trigger Setup

A trigger event can occur by receiving two bytes of a specified sequence on the serial port. If the serial sequence is set to **00,00** then it is disabled. At the **Serial Sequence** prompt, enter the ASCII Hex value. Example: A two byte sequence of 12 would be 0x31, 0x32.

Set all the configurable pins to **X** (Don't Care) so they are disabled. If both the serial sequence and the configurable pins are disabled, the trigger is disabled.

Message: Enter the subject line of the e-mail.
Priority: L is for normal priority, H is for High Priority.
Min. notification interval: The minimum time allowed between individual triggers. If a trigger event occurs faster than the minimum interval, the trigger will be ignored.
Re-notification interval: If a single trigger event stays asserted, then an e-mail message will be sent at this time interval.

Each trigger is independent from the others. Each condition within an individual trigger must be met before the e-mail will be sent.

3.9 Expert Settings

Note: You can change these settings via Telnet or serial connections only, not on the Web-Manager.

```
These parameters should only be changed if you are an expert
and definitely know the consequences the changes might have.

TCP Keepalive time in s (1s – 65s; 0s=disable): (45)
ARP Cache timeout in s (1s – 600s) : (600) ?
CPU Performance (0=Regular, 1=Low, 2=High): (0) ?
Disable Monitor Mode @ bootup  (N) ?
RS485 tx enable active level (0=low; 1=high): (0) ?
HTTP Port Number :  (80) ?
SMTP Port Number :  (25) ?
MTU Size (512 – 1400): (1400) ?
TCP Re-transmission Timeout  (500 – 4000) (ms):  (500) ?
Enable alternate MAC (N) ?
Ethernet connection type: (0) ?
```

3.9.1 TCP Keepalive time in seconds

This option allows you to change how many seconds the unit will wait during a silent connection before attempting to see if the currently connected network device is still on the network. If the unit then gets no response, it will drop that connection.

3.9.2 ARP Cache timeout in seconds

Whenever the unit communicates with another device on the network, it will add an entry into its ARP table. The ARP Cache timeout option allows you to define how many seconds (1-600) the unit will wait before timing out this table.

3.9.3 Enable High Performance

This option applies to XPort-03 and greater units only. It allows you to increase the CPU performance and utilize the higher baud rates on the serial interface (i.e. 460Kbps and 920Kbps). Increasing CPU performance requires more power and lowers the unit's operating temperature. The standard CPU performance mode supports up to 230400 baud.

Note: If baud rates of 460Kbps or 920Kbps is set and the high performance mode disabled, the operation of the serial channel would be out of the specified error tolerance thereby leading to inconsistent speed settings on the two ends of the serial channel.

3.9.4 Disable Monitor Mode at Bootup

This option allows you to disable the Monitor Mode only during the startup sequence. This prevents all entries into Monitor Mode except thru 'xxx' followed by 'M'. All other Monitor Mode entry sequences, e.g. 'zzz' and 'yyy', are blocked during startup.

Note: Since the NET485 is not capable of Monitor Mode at Bootup, this option is not used.

3.9.5 RS-485 TX Enable Active Level

This option allows the selection of the active level (either active high or active low) for the RS485_TXEN signal.

For the RS-485 interface mode to operate correctly, configure CP1 to RS485_TXEN and set Active Level High. To change the configurable pins' settings, use DeviceInstaller or send setup records to port 77FE.

Note: The NET485 must be configured for CP1 to RS485 Tx Enable and Active Level HIGH.

3.9.6 HTTP Port Number

This option allows changing the HTTP port number. The valid range is from 1 - 65535. The default value is 80.

3.9.7 SMTP Port Number

This option allows you to configure the SMTP (email) port number. Valid range is from 1 - 65535. The default value is 25.

3.9.8 MTU Size

The Maximum Transmission Unit (MTU) is the largest physical packet size a network can transmit for TCP and UDP. Enter between 512 and 1400 bytes. The default is 1400 bytes.

3.9.9 TCP Re-transmission Timeout (500 – 4000) (ms): (500) ?

This feature allows the configuration of the desired TCP re-transmission timeout value. If the ACK is not received for a packet sent from the xPort device, then the unit will retransmit the data. The valid range is 500-4000 msec. Enable Alternate MAC

If necessary, enable the alternate MAC address (if specified in the OEM setup record).

3.9.10 Enable Alternate MAC

If necessary, enable the alternate MAC address (if specified in the OEM setup record).

3.9.11 Ethernet Connection Type

The NET485 allows for the Ethernet speed and duplex to be manually configured. Enter 0 for auto-negotiation (default). To select the speed and duplex, enter one of the following: 2 (10Mbit/half duplex), 3 (10Mbit/full duplex), 4 (100Mbit/half duplex), or 5 (100Mbit/full duplex).

3.10 Security Settings

Note: You can change these settings via Telnet or serial connections only, not on the Web-Manager. We recommend that you set security over the dedicated network or over the serial setup. If you set parameters over the network (Telnet 9999), someone else could capture these settings.

Caution: *Disabling both Telnet Setup and Port 77FE will prevent users from accessing the setup menu from the network. Disabling Port 77FE also disables the Web from configuring the device.*

```
Disable SNMP (N)
SNMP Community Name (public):
Disable Telnet Setup (N)
Disable TFTP Firmware Update (N)
Disable Port 77FEh (N)
Disable Web Server (N)
Disable Web Setup (N)
Disable ECHO ports (Y)
Enable Encryption (N) (Only if Encrypted NET485)
Enable Enhanced Password (N)
Disable Port 77F0h (N)
```

3.10.1 Disable SNMP

This setting allows you to disable the SNMP protocol on the unit for security reasons.

3.10.2 SNMP Community Name

This option allows you to change the SNMP Community Name on the unit. This allows for ease of management, and possibly some security. If someone tries to violate security but doesn't know what community to connect to, that person will be unable to get the SNMP community information from the unit. The name is a string of 1 to 13 characters plus a null-terminator (14 bytes total). The default setting is **public**.

3.10.3 Disable Telnet Setup

Note: If you choose to disable this option, keep in mind that disabling both Telnet Setup and Port 77FE will prevent users from accessing the setup menu from the network.

This setting defaults to the N (No) option. The Y (Yes) option disables access to this Configuration Menu by Telnet (port 9999). It only allows access locally via the Web pages and the serial port of the unit.

3.10.4 Disable TFTP Firmware Upgrade

This setting defaults to the N (No) option. The Y (Yes) option disables the use of TFTP to perform network firmware upgrades. With this option, firmware upgrades can be downloaded over the serial port using Device Installer's Recover Firmware procedure.

3.10.5 Disable Port 77FE (Hex)

Note: If you choose to disable this option, keep in mind that disabling both Telnet Setup and Port 77FE will prevent users from accessing the setup menu from the network.

Port 77FE is a setting that allows Device Installer, Web-manager, and custom programs to configure the unit remotely. You may want to disable this capability for security purposes.

The default setting is the N (No) option, which enables remote configuration. You can configure the unit by using Device Installer, web pages, Telnet, or serial configuration.

The Y (Yes) option disables remote configuration and web sites.

Note: The Y (Yes) option disables many of the GUI tools for configuring the unit, including the embedded Web-Manager tool.

3.10.6 Disable Web Server

This setting defaults to the N (option). The Y (Yes) option disables web server.

3.10.7 Disable Web Setup

The Y (Yes) option disables configuration using the Web-Manager. This setting defaults to the N (option).

3.10.8 Disable ECHO Ports

Controls whether the serial port will echo characters it receives.

3.10.9 Enable Encryption

Rijndael is the block cipher algorithm chosen by the National Institute of Science and Technology (NIST) as the Advanced Encryption Standard (AES) to be used by the US government. The NET485 supports 128-, 192-, and 256-bit encryption key lengths.

Note: Configuring encryption should be done through a local connection to the serial port of the NET485, or via a secured network connection. Initial configuration information, including the encryption key, is sent in clear text over the network.

To configure AES encryption on the NET485:

1. When prompted to enable encryption, select Y.

2. When prompted, enter the encryption key length. The NET485 supports 128-, 192-, and 256-bit encryption key lengths.

3. When prompted to change keys, select Y.

4. At the Enter Keys prompt, enter your encryption key. The encryption keys are entered in hexadecimal. The hexadecimal values are echoed as asterisks to prevent onlookers from seeing the key. Hexadecimal values are 0-9 and A-F.
    For a 128-bit key length, enter 32 hexadecimal characters.
    For a 192-bit key length, enter 48 hexadecimal characters.
    For a 256-bit key length, enter 64 hexadecimal characters

5. Continue pressing Enter until you return to the Change Setup menu.

6. From the Change Setup menu, select option 9 to save and exit.

Encryption only applies to the port selected for data tunneling (default 10001), regardless of whether you are using TCP or UDP.

Generally, one of two situations applies:
    Encrypted NET485-to-NET485 communication. Be sure to configure both NET485 devices with the same encryption key.

> Third-party application to NET485-encrypted communication: NET485 uses standard AES encryption protocols. To communicate successfully, products and applications on the peer side must use the same protocols and the same encryption key as the NET485.
>
> Lantronix Secure Com Port Redirector provides an encrypted connection from Windows-based applications to the NET485. Information about SCPR is at http://www.lantronix.com/device-networking/software-services/scpr.html

Note: Developers can license the Lantronix Encryption Library Suite. See http://www.lantronix.com/device-networking/utilities-tools/.

3.10.10 Enable Enhanced Password

This setting defaults to the N (option), which allows you to set a 4-character password that protects the Configuration Menu via Telnet and Web pages. The Y (Yes) option allows you to set an extended security password of 16-characters for protecting Telnet and web page access.

3.10.11 Disable Port 77F0 (Hex)

Port 77F0 is a setting that allows a custom application to query or set the three NET485 configurable pins when they are functioning as general purpose I/O (GPIO). You may want to disable this capability for security purposes. The default setting is the N (No) option, which enables GPIO control. The Y (Yes) option disables the GPIO control interface.

Note: The function of the configurable pins on the NET485 should be changed with caution. Some of the configurable pins are not connected or used for other functions.

3.11 Defaults

Select 7 to reset the unit's Channel 1 configuration, email settings, and expert settings to the default settings. The server configuration settings for IP address, gateway IP address, and netmask remain unchanged. The configurable pins' settings also remain unchanged. The specific settings that this option changes are listed below:

Note: If you use default settings, the NET485 will not work properly. You must change the serial port setting for the NET485. See I/F (Interface) Mode on page 3-12.

Channel 1 Configuration Defaults

Baudrate	9600
I/F Mode	4C (1 stop bit, no parity, 8 bit, RS-232C) See Note above
Flow	00
Port number	10001
Connect Mode	C0 (always accept incoming connection; no active connection startup.

Send '+++' in Modem Mode	Enabled
Show IP addr after 'RING'	
Auto increment source port	
Hostlist retry counter	3
Hostlist retry timeout	250 (msec)
Start character for serial channel 1	0xDD (CR)
All other parameters	0

Expert Settings Defaults

TCP Keepalive time in s	45
ARP Cache timeout in s	600

CPU Performance	0 (Regular)
Disable Monitor Mode @ bootup	No
RS485 tx enable	active low
HTTP Port Number (1-65535)	80
SMTP Port Number (1-65535)	25
MTU Size (512 – 1400)	0 (resulting in an operational value of 1400)
TCP Re-transmission Timeout (500-4000)	500 (ms)
Alternate MAC	Disabled (for OEM use only)
Ethernet Connection Type	0 (auto-negotiate)

Security Settings Defaults

Disable SNMP	No
SNMP community name	public
Disable Telnet setup	No
Disable TFTP Firmware Update	No
Disable Port 77FEh	No
Disable Web Server	No
Disable Web Setup	No
Disable ECHO ports	Yes
Enable Encryption	No
Enable Enhanced Password	No
Disable Port 77F0h	No

Email Settings

Priority	L
Min. notification interval	1 (second)
All other parameters	0 (e.g., email notification and triggers are disabled)

Exit Configuration Mode

- Select **8** to exit the configuration mode without saving any changes or rebooting.
- Select **9** to save all changes and reboot the device. All values are stored in nonvolatile memory.

4. Monitoring the Network

Monitor Mode is a command-line interface used for diagnostic purposes.

4.1.1 Entering Monitor Mode via the Network Port

To enter Monitor Mode using a Telnet connection:

1. Establish a Telnet session to the configuration port (9999). The following message appears:

   ```
   MAC address 00204A0113A3
   Software version 01.8 (040806) XPT485
   Press Enter to go into Setup Mode
   ```

2. Type M (upper case). The following message appears:
   *** NodeSet 2.0 ***

A **0>** prompt indicates that you have successfully entered Monitor Mode.

4.1.2 Monitor Mode Commands

The following commands are available in Monitor Mode.

Note: All commands must be in capital letters.

Command	Command Name	Function
VS	Version	Queries software header record (16 bytes) of unit.
GC	Get Configuration	Gets configuration of unit as hex records (120 bytes).
SC	Send Configuration	Sets configuration of unit from hex records.
PI x.x.x.x	Ping	Pings unit with IP address x.x.x.x to check device status.
AT	ARP Table	Shows the unit's ARP table entries.
TT	TCP Connection Table	Shows all incoming and outgoing TCP connections.
NC	Network Connection	Shows the unit's current IP address.
RS	Reset	Resets the unit.
QU	Quit	Exits diagnostics mode.
G0 to G8	Get configuration from memory page	Gets a memory page of configuration information from the device.
S0 to S8	Set configuration to memory page	Sets a memory page of configuration information on the device.

Responses to some of the commands are given in Intel Hex format.

Note: Entering any of the commands listed above generates one of the following command response codes:

Command Response Codes

Response	Meaning
0>	OK; no error
1>	No answer from remote device
2>	Cannot reach remote device or no answer
8>	Wrong parameter(s)
9>	Invalid command

5. Updating Firmware

5.1 Obtaining Firmware

You can obtain the most up-to-date firmware and release notes for the unit from Grid Connect. Do not upgrade firmware unless directed by Technical Support.

5.1.1 Reloading Firmware

Reloading the firmware of a device will destroy all settings and configurations.

Firmware files are not freely distributed since changing the firmware of a device will change is operational features. This should only be done under the direction of technical support.

5.1.2 Via Device Installer

After copying the firmware to your computer, use Device Installer to install it.

1. Store the firmware in a subfolder on your computer.
2. Start Device Installer and search the network for the device you want to upgrade.
3. Select the desired unit and click the **Upgrade** icon or select **Upgrade** from the Device menu. The Device Upgrade Wizard appears. Follow the instructions on the wizard screens.

The unit performs a power reset after the firmware has been loaded and stored.

6. Troubleshooting

This chapter discusses how you can diagnose and fix errors quickly without having to contact Grid Connect. When troubleshooting, always ensure that the physical connections (power cable, network cable, and serial cable) are secure.

NOTE: You cannot configure the NET485 through the serial port. The boot program has no control over the Configurable Pins, so the NET485 will never be able to send data during the boot period (initial 5 seconds).

Note: *Some unexplained errors might be caused by duplicate IP addresses on the network. Make sure that your unit's IP address is unique.*

6.1.1 Problems and Error Messages

Problem/Message	Reason	Solution
Cannot ping or connect to the NET485 DHCP name.	The DHCP server is not automatically setting the DHCP name in DNS on the network.	Contact the Network Administrator to manually add the NET485 to DNS.
When you issue the ARP –S command in Windows, The ARP entry addition failed: 5 message displays.	Your user login does not have the right to use this command on this PC.	Have your IT department log you in with sufficient rights.

Problem/Message	Reason	Solution
When you attempt to assign an IP address to the unit by the ARP method and Telnet to the device server through port 1, the connection fails.	The ARP method only creates a temporary password. When you Telnet to port 1, the connection should fail. When you Telnet into port 9999 and do not press Enter quickly, the device server reboots, causing it to lose the IP address.	Telnet back to Port 1. Wait for it to fail, then Telnet to port 9999 again. Make sure you press Enter within 5 seconds.
When you Telnet to port 9999, the *Press Enter to go into Setup Mode* message displays. However, nothing happens when you press Enter, or your connection is closed.	To enter Setup Mode via Telnet, the Enter key must be pressed within 5 seconds.	Telnet to port 9999 again and press Enter as soon as you see the Press Enter to go into Setup Mode message.
When you Telnet to port 1 to assign an IP address to the device server, the Telnet window	You may have entered the Ethernet address incorrectly with the ARP command.	Confirm that the Ethernet address that you entered with the ARP command is correct. The Ethernet address must only include numbers 0-9 and letters A-F. In Windows and usually in Unix, the segments of the Ethernet address are separated by dashes. In some forms of Unix, the Ethernet address is segmented with colons.
	The IP address you are trying to assign is not on your logical subnet.	Confirm that your PC has an IP address and that it is in the same logical subnet that you are trying to assign to the device server.

does not respond for a long time.	The device server may not have a network connection.	Make sure that the Link LED is lit. If the Link LED is not lit, then the device server does not have a network connection.
The device server is not communicating with the serial device it is attached to.	The most likely reason is the wrong serial settings were chosen.	The serial settings for the serial device and the device server must match. The default serial settings for the device server are RS-232, 9600 baud, 8 character bits, no parity, 1 stop bit, no flow control. For NET485, you must change the setting to RS422 or RS485.
When you try to enter the setup mode on the device server via the serial port, you get no response.	Setup Mode via the serial port is NOT supported on the NET485	Setup Mode via the serial port is NOT supported on the NET485. The unit is able to receive data but it cannot transmit, since the TXEN enable pin is not accessible to the boot firmware.
You can ping the device server, but not Telnet to the device server on port 9999.	There may be an IP address conflict on your network The Telnet configuration port	Turn the device server off and then issue the following commands at the DOS prompt of your computer:
	(9999) is disabled within the device server security settings.	ARP -D X.X.X.X (X.X.X.X is the IP of the device server). PING X.X.X.X (X.X.X.X is the IP of the device server). If you get a response, then there is a duplicate IP address on the network. If you do not get a response, use the serial port to verify that Telnet is not disabled.

7. Binary to Hex Conversion

Many of the unit's configuration procedures require assembling a series of options (represented as bits) into a complete command (represented as a byte). Convert the resulting binary value to a hexadecimal representation.

Following are two simple ways to convert binary numbers to hexadecimals.

7.1.1 Conversion Table

Hexadecimal digits have values ranging from 0 to F, which are represented as 09, A (for 10), B (for 11), etc. To convert a binary value (for example, 0100 1100) to a hexadecimal representation, the upper and lower four bits are treated separately, resulting in a two-digit hexadecimal number (in this case, 4C). Use the following table to convert values from binary to hexadecimal.

| Decimal	Binary	Hex
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

7.1.2 Scientific Calculator

Another simple way to convert binary to hexadecimals is to use a scientific calculator, such as the one available on Windows' operating systems. For example:

1. On the Windows' Start menu, click **Programs/Accessories/Calculator.**
2. On the **View** menu, select **Scientific.** The scientific calculator displays.
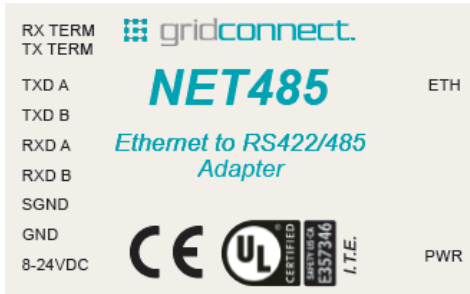3. Click **Bin** (Binary), and type the number to convert.
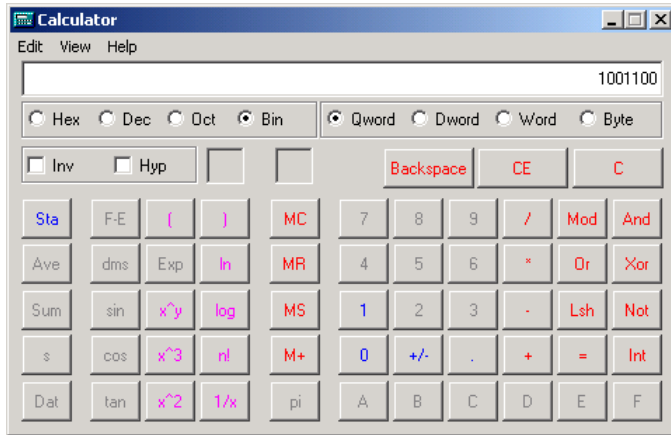
Click Hex. The hexadecimal value displays.
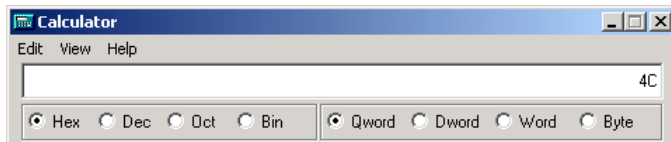
8. Agency Approvals

Revised label for CE and UL marks. For UL marks, see the online database at www.ul.com/database for additional information.

8.1 Certificate of Compliance

CERTIFICATE OF COMPLIANCE

Certificate Number	20130827-E357346
Report Reference	E357346-A1-UL
Issue Date	2013-AUGUST-27

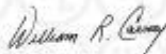|	
Issued to:	GRID CONNECT INC 1630 W DIEHL RD NAPERVILLE IL 60563
This is to certify that representative samples of	INFORMATION TECHNOLOGY EQUIPMENT INCLUDING ELECTRICAL BUSINESS EQUIPMENT SERIAL TO ETHERNET ADAPTER, NET232, NET232-GDC4S, NET485 Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 60950-1, Information Technology Equipment - Safety - Part 1: General Requirements CSA C22.2 No. 60950-1-07, Information Technology Equipment - Safety - Part 1: General Requirements
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Listing Mark for the US and Canada should be considered as being covered by UL's Listing and Follow-Up Service meeting the appropriate requirements for US and Canada.

The UL Listing Mark for the US and Canada generally includes: the UL in a circle symbol with "C" and "US" identifiers; the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name (product identifier) as indicated in the appropriate UL Directory.

Look for the UL Listing Mark on the product.

William R. Carney, Director, North American Certification Programs
UL LLC

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8.2 Electromagnetic Compatibility Tests

Purpose:

This test series was performed to determine if the NET485 would meet selected requirements of the IEC 61000-6-1 and IEC 61000-6-3 specifications.

Deviations, Additions and Exclusions:

There were no deviations, additions to, or exclusions from the test specification during this test series.

EMC Laboratory Identification:

The electromagnetic compatibility tests were performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. Engineering Test Report No. 1302913-01.

Summary of Tests Performed:

The following electromagnetic compatibility tests were performed on the EUT in accordance with IEC 61000-6-1 and IEC 61000-6-3:

Test	Description	Test Range	Result
RE	Radiated Emissions	30MHz to 1GHz	Pass
ESD	Electrostatic Discharge	4kV	Pass
RI	Radiated Immunity	80MHz to 2.7GHz	Pass
EFT	Electrical Fast Trans - Power	500V	Pass
CI	Conducted Immunity	150kHz to 80MHz	Pass

IEC 61000-6-1:2005 "Electromagnetic Compatibility (EMC) - Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments"

IEC 61000-6-3:2011 "Electromagnetic Compatibility (EMC) - Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments"

IEC 61000-4-2:2008 "Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques, Section 2: Electrostatic Discharge Test"

IEC 61000-4-3:2010 "Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques, Section 3: Radiated, Radio-Frequency, Electromagnetic Fields"

IEC 61000-4-4:2011 "Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques, Section 4: Electrical Fast Transient/Burst Immunity"

IEC 61000-4-6:2008 "Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques, Section 6: Immunity to conducted disturbances, induced by radio frequency fields"