



Modbus Hardened Serial Server

Connect Modbus networks (RS-232, RS-422, or RS-485) to Ethernet networks, allowing the Modbus network to become a node on the network.

Access the Modbus network over a LAN/WAN using direct IP mode connections.



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This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

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SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C AND D HAZARDOUS LOCATIONS, OR NONHAZARDOUS LOCATIONS ONLY.

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Instrucciones de Seguridad (Normas Oficiales Mexicanas Electrical Safety Statement)

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico debe ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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Chapter 1: Specifications

1. Specifications

General Specifications

Approvals	FCC Part 15, Class A, CE, NEMA TS2, UL® Class 1, Division 2, Groups A, B, C, and D
Compatible Operating Systems	Windows® XP (32/64 bit), 2003 Server (32/64 bit), Windows Vista® (32/64 bit), 2008 Server (32/64 bit), Windows 7 (32/64 bit)
Configuration Options	Via serial port using Modbus Hardened Serial Server Software, via network using Modbus Hardened Serial Server Software with an Ethernet connection or a standard Web browser such as Internet Explorer® 7, 8, or 9, or Firefox® 3 or 4
Enclosure	Rating: IP30; Mounting: DIN rail mount (35 mm)
User Controls	(1) Reset button
Connectors	(1) DB9 M, (1) 5-pin terminal block, (1) RJ-45, (1) 2-position pluggable terminal block for power
Indicators	(3) LEDs: (1) Ready, (1) Serial, (1) Ethernet Link
Temperature Tolerance	Operating: -40 to +176° F (-40 to +80° C); Storage: -40 to +185° F (-40 to +85° C); Maximum Ambient Surrounding Air Temperature: 176° F (80° C)
Operating Humidity	10 to 95%, noncondensing
Power	Voltage requirements: 10 to 48 VDC (58 VDC max.) external power supply; Consumption: 4.0 watts maximum; Terminal blocks: Wire size: 28 to 16 AWG, Wire Type: Copper wire only, Tightening Torque: 5 kg-cm, Wire Temperature Rating: 105° C minimum, sized for 60° C ampacity <i>NOTE: One conductor per terminal.</i>
Dimensions	1.2"H x 3.3"W x 4.7"D (4.6 x 12.2 x 17.1 cm)

Serial Interface Specifications

Baud Rates	75, 150, 300, 600, 1200, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 115200, 230400
Data Bits	5, 6, 7, 8
Flow Control	None, RTS/CTS, X-ON/X-OFF
Mode Selection	RS-232/422/485 software-selectable
Parity	None, even, odd, mark, space
RS-232 Lines	TXD, RXD, RTS, CTS, DTR, DSR, DCD, GND
RS-422 Lines	TXDA(-), TXDB(+), RXDA(-), RXDB (+), GND
RS-485 (2-Wire)	Data(-), Data(+), GND
RS-485 (4-Wire)	TXDA(-), TXDB(+), RXDA(-), RXDB (+), GND
RS-422/485 Biasing	Auto 4.7 K-ohm pullups and pulldowns
RS-422/485 Termination	Auto termination with through hole (user supplied)
RS-485 Data Control	Auto control via MCU
Stop Bits	1, 1.5, 2

Network Specifications

Character Count	0 to 65535
Connection Modes	Server, Client
Memory	Serial: 8 KB per port; Network memory: 4 KB
Firmware Upgrade	Via serial, Ethernet, or auto Web search
IP Port Addresses	5300: heartbeat and configuration setting in TCP mode; 8888: LES431A update
Network Communications	LAN: 10-/100-Mbps auto-detecting 10BASE-T and 100BASE-TX
Network Physical Layer Standards	Ethernet: IEEE 802.3 autodetecting and auto MDI/MDI-X 10BASE-T and 100BASE-TX
Protocols Supported	TCP, IPv4, UDP, ARP, HTTP 1.0, ICMP/PING, DHCP/BOOTP; IP mode: Static, DHCP, or Auto IP; TCP: User-definable
Search	Serial direct COM and Ethernet autosearch or specific IP
Timeouts	Character: 0 to 65535 ms. default set at 10 ms; Modbus Message: 0 to 65535 ms, default set at 1000 ms; Serial: 0 to 65535 sec.

Dimensional Diagrams

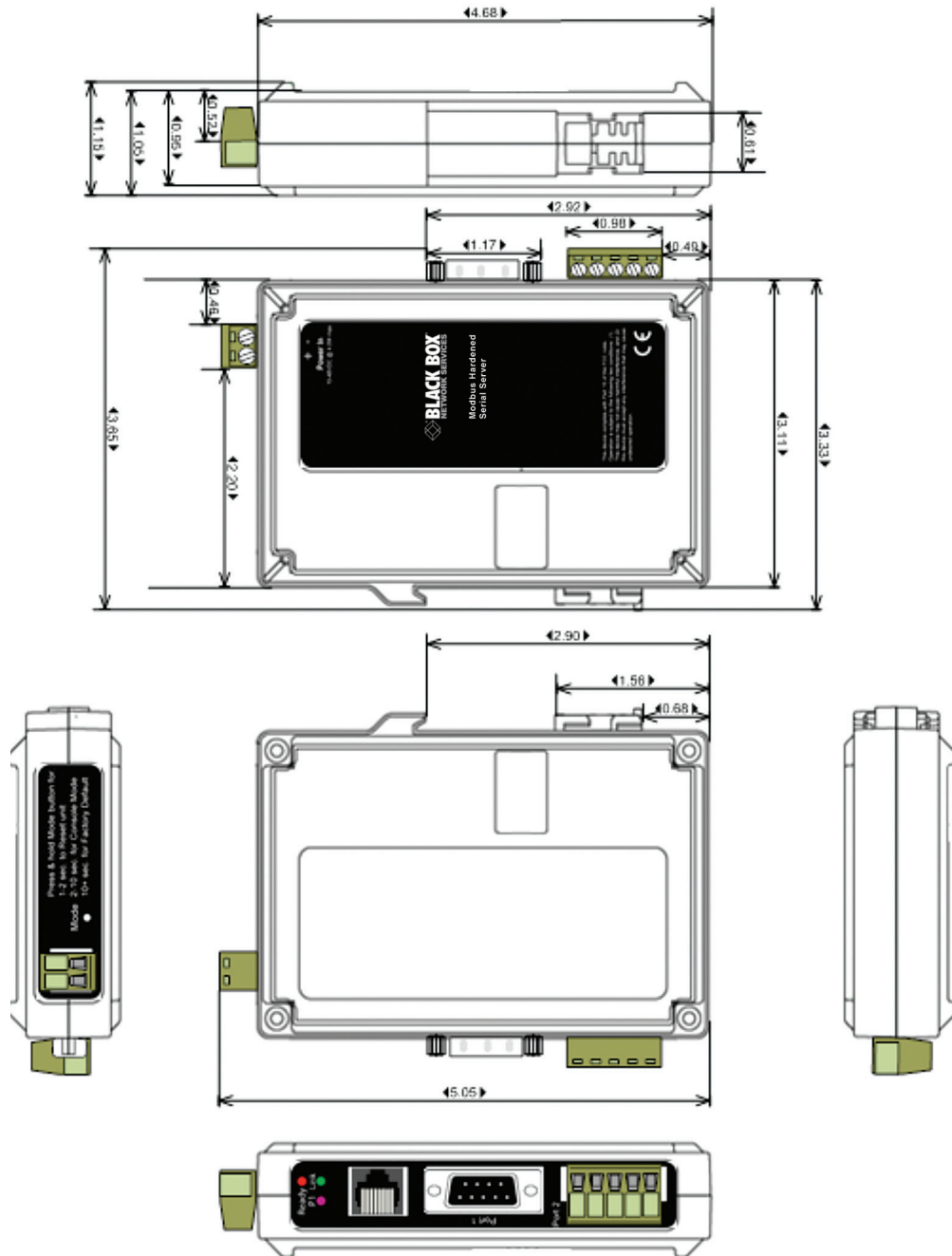


Figure 1-1. Dimensional diagram of a LES431A Modbus Hardened Serial Server.

2. Overview

2.1 Introduction

The 1-Port Modbus Hardened Serial Server connects Modbus networks (RS-232, RS-422, or RS-485) to Ethernet networks, allowing the Modbus network to become a node on the network. The serial port can be accessed over a LAN/WAN using Direct IP Mode connections. Modbus Hardened Serial Servers use 10BASE-T or 100BASE-TX copper network media. The servers are built for use in industrial environments and feature an IP30 approved slim-line DIN-rail-mountable case. The product operates from a range of DC power supply voltages and features pluggable terminal block power connectors. The Modbus Hardened Serial Server has one Ethernet port.

Table 2-1. LES431A details.

Part Number	Serial Ports	Serial Connectors	Ethernet Media	Ethernet Connector	Power
LES431A	1	(1) DB9M and (1) 5-pin terminal block <i>NOTE: Use either the DB9 or the terminal block connector, but not both at the same time.</i>	RJ-45	RJ-45	(1) 3-wire terminal block

2.2 Features

- Single Ethernet connector.
- Multi-interface serial port (RS-232, RS-422, RS-485).
- DB9M and pluggable terminal block serial port connector options.
- All serial ports are software selectable for RS-232, RS-422, or RS-485 2- and 4-wire communication.
- Configuration can be done via network or direct serial connection.
- Slim-line DIN rail or panel mountable.
- Accepts DC power over a wide voltage range.
- Supports 10-/100-Mbps Ethernet with auto-selection and auto MDI/MDI-X.
- LAN and WAN communications.
- Configurable for TCP Client or Server operation.
- Upload firmware over the Ethernet port for future revisions/upgrades.
- Supports Windows® XP (32/64 bit), 2003 Server (32/64 bit), Vista (32/64 bit), 2008 Server (32/64 bit), Windows 7 (32/64 bit).
- Configure Ethernet and serial port settings using Modbus Hardened Serial Server Software.

2.3 What's Included

Your package should include the following items. If anything is missing or damaged, contact Black Box Technical Support at 724-746-5500 or info@blackbox.com.

- 1-Port Modbus Hardened Serial Server module (LES431A).
- A printed quick start guide.

To download this user manual, go to ftp://ftp.blackbox.com/anonymous/manuals/L/LES431A_USER_rev1.pdf or visit the Black Box Web site (www.blackbox.com) and enter **LES431A** in the search bar.

2.4 Hardware Description

1-Port Modbus Hardened Serial Server (LES431A)

Figures 2-1 and 2-2 show the front, back, and top panels of the LES431A. Table 2-2 describes its components.

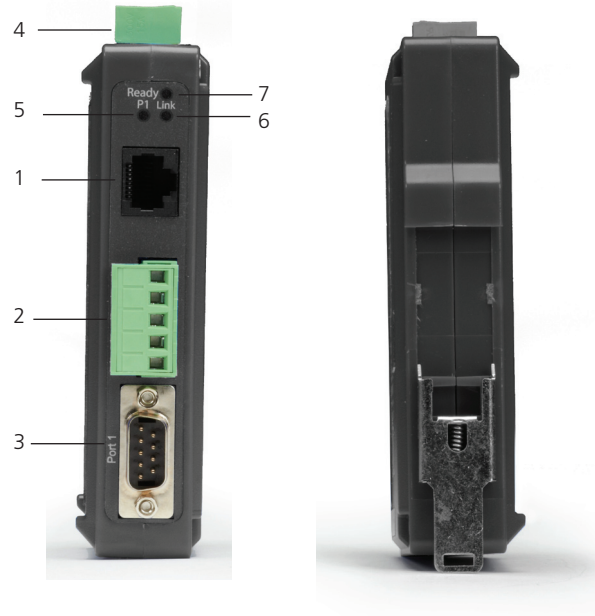


Figure 2-1. LES431A front and back panels.



Figure 2-2. LES431A top panel.

Table 2-2. LES431A components.

Number in Figure 2-1 or 2-2	Component	Description
1	(1) RJ-45 connector	Connects a standard Ethernet network drop using a straight-through RJ-45 male Ethernet cable.
2	(1) 5-position terminal block connector	Connects to an RS-422 or RS-485 serial device when the DB9 M (RS-232) connector is disabled.
3	(1) DB9 male connector	Connects to an RS-232 serial device when the 5-position terminal block (RS-422/RS-485) is disabled.
4	(1) 2-wire terminal block connector	Removable 2-position terminal block with +, -, and chassis ground connections.
5	(1) Serial Port LED	Flashes green when data is being transmitted or received on the serial port. Lights steady green when the serial port is open.
6	(1) Ethernet Link LED	Lights when a connection to the network is made. Blinking when there is data traffic on the Ethernet link.
7	(1) Ready LED	Blinks once per second when the system is operating correctly. Blinks three times per second in reset, configuration mode, or when loading factory defaults. Off or steady On when the system is not operating correctly.
8	(1) Reset mode switch	Used to initiate a hardware reset, enter console mode, or reload factory defaults.

2.5 Modbus Hardened Serial Server Configuration Software

Modbus Hardened Serial Server configuration software enables you to find connected Modbus Hardened Serial Servers, configure them, upgrade Modbus Hardened Serial Server firmware, and save/load configuration files. Its graphical user interface (GUI) is convenient and easy to use.

Chapter 3: Installation and Initial Setup

3. Installation and Initial Setup

NOTE: In this section, devices to be connected to the Modbus Hardened Serial Server's serial connections are simply referred to as the "Modbus network."

3.1 Connecting the Power Supply

Connect a DC power supply to the power terminals on the side of the Modbus Hardened Serial Server. Polarity of the wires is indicated on the label on the side of the Modbus Hardened Serial Server. Acceptable voltages are between 10 VDC and 58 VDC. The power supply must be capable of supplying 4 watts to the LES431A.

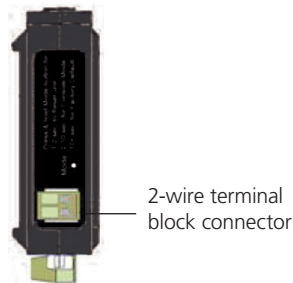


Figure 3-1. LES431A power supply connections.

3.2 Connecting Modbus Hardened Serial Servers to Modbus Networks

The Modbus Hardened Serial Servers can be connected to Modbus networks using RS-232, RS-422, RS-485 2-wire, or RS-485 4-wire. The LES431A uses either (1) DB9 M connector or (1) 5-position terminal strip.

3.2.1 RS-232

RS-232 connections support eight signal lines plus Signal Ground. Signals are single-ended and referenced to Ground. Default communication parameters are 9600, 8, N, 1, and no flow control implemented.

3.2.2 RS-422

RS-422 connections support two signal pairs: TDA (-), TDB (+), RDA (-), RDB (+), and GND. The data lines are differential pairs (A and B) in which the B line is positive relative to the A line in the idle (mark) state. In RS-422, the transmitter is always enabled. Signal Ground provides a common mode reference.

3.2.3 RS-485

RS-485 connections support 2-wire or 4-wire operation.

When configured for 4-wire operation, the connection supports two signal pairs: TDA (-), TDB (+), RDA (-), RDB (+), and GND. This makes full-duplex operation possible. The data lines are differential pairs (A and B) in which the B line is positive relative to the A line in the idle (mark) state. Signal Ground provides a common mode reference.

When configured for 2-wire operation, the connection supports one signal pair: Data A (-) and Data B (+). These lines transmit and receive signals using half-duplex operation. The data lines are differential with the Data B line positive relative to Data A in the idle (mark) state. Signal Ground provides a common mode reference.

Connecting the Modbus Hardened Serial Server

The LES431A has one serial connection that supports RS-232, RS-422, and RS-485 (2- and 4-wire). The unit has two connectors: a DB9 male connector and a 5-position terminal block.

If you select RS-232 mode when you configure the Modbus Hardened Serial Server, you must connect the Modbus serial network to the Modbus Hardened Serial Server via a serial cable. The LES431A is a DTE. If the Modbus network is a DTE, use a null-modem (crossover) cable. If the Modbus network is a DCE, use a straight-through cable. DTE and DCE ports are complementary; the output signals on a DTE port are inputs to a DCE port, and output signals on a DCE port are inputs to a DTE port. The signal names match each other and connect pin-for-pin. Signal flow is in the direction of the arrows (see Table 3-1, below).

Table 3-1. DTE to DCE Connections.

DTE Device (Computer) DB9			DCE Device (Modem) DB9		
Pin #	RS-232 Signal Names	Signal Direction	Pin #	RS-232 Signal Names	
1	Carrier Detect (CDA)	<-----	1	Carrier Detect (CD)	
2	Receive Data (RX)	<-----	2	Receive Data (RX)	
3	Transmit Data (TX)	----->	3	Transmit Data (TX)	
4	Data Terminal Ready (DTR)	----->	4	Data Terminal Ready (DTR)	
5	Signal Ground (SG)	-----	5	Signal Ground (SG)	
6	Data Set Ready (DSR)	<-----	6	Data Set Ready (DSR)	
7	Request to Send (RTS)	----->	7	Request to Send (RTS)	
8	Clear to Send (CTS)	<-----	8	Clear to Send (CTS)	
9	Ring Indicator (RI)	<-----	9	Ring Indicator (RI)	
Soldered to DB9 metal—Shield (FGND)			Soldered to DB9 metal—Shield (FGND)		

If you select RS-422 mode, RS-485 2-wire mode, or RS-485 4-wire mode when you configure the Modbus Hardened Serial Server, you must connect the Modbus network appropriately, via the 5-position terminal block.

NOTE: Refer to Appendix B for connector pinout information.

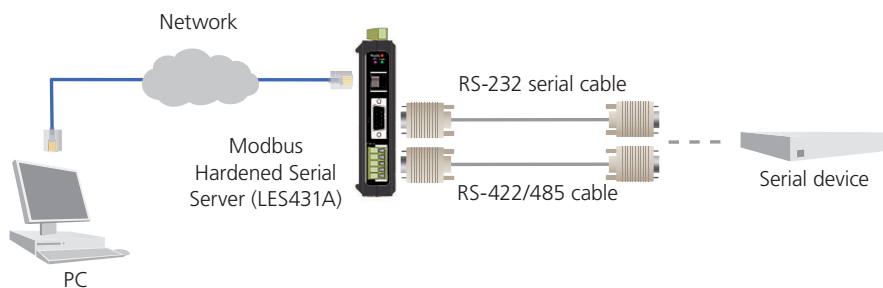


Figure 3-2. LES431A connections.

3.3 Connecting Modbus Hardened Serial Servers to a Network

When connecting a Modbus Hardened Serial Server equipped with a 10BASE-T/100BASE-TX network connection (RJ-45 connector) to an Ethernet network drop, use a standard unshielded twisted-pair cable. PCs configuring and/or communicating with the Modbus Hardened Serial Server are also connected to the network.

3.4 Modbus Hardened Serial Server Configuration Connections

The Modbus Hardened Serial Servers can be configured using three methods:

- Via the network using Modbus Hardened Serial Server Software.
- Via the network using a Web browser.
- Via a serial port using Modbus Hardened Serial Server Software (Console Mode).

Chapter 3: Installation and Initial Setup

3.4.1 Installing Modbus Hardened Serial Server Configuration Software

Step 1: Download the Modbus Configuration Manager Software from <ftp://ftp.blackbox.com>. Double-click on the executable file. The file name is Modbus Hardened Serial Server Manager Vx.x.x.

a. The following screen will be displayed on your computer.

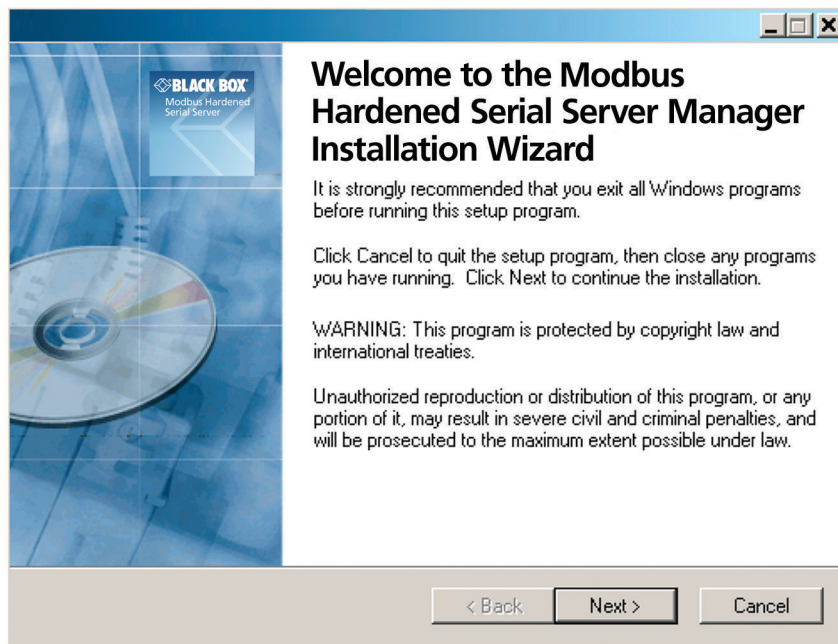


Figure 3-3. Modbus Hardened Serial Server Manager Installation Welcome screen.

b. Click "Next." The License Agreement Screen will be displayed on your computer.

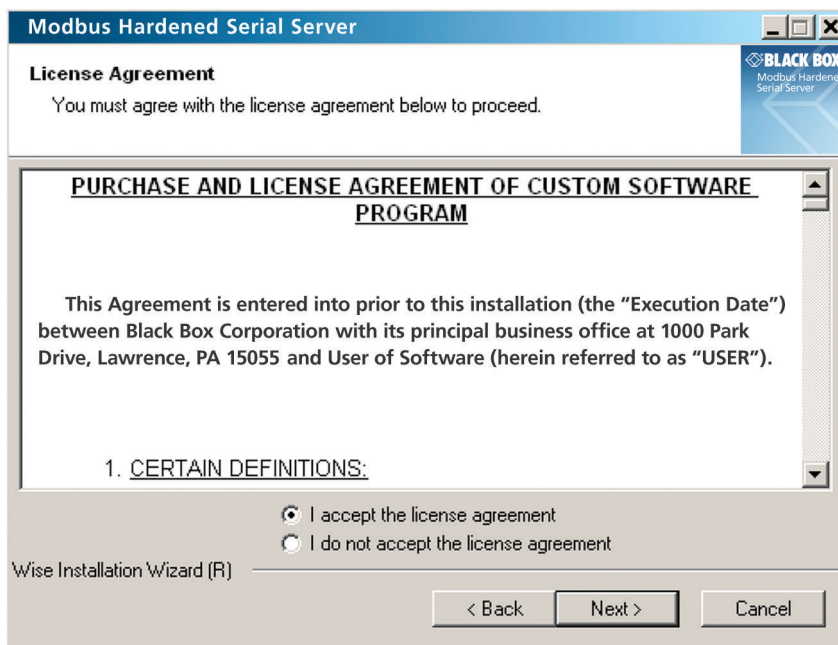


Figure 3-4. Modbus License Acceptance Screen.

- c. Click “Next.” The User Information Screen will be displayed on your computer. Enter your name and organization (optional) and select if the software will be accessible to your account or anyone who uses the computer.

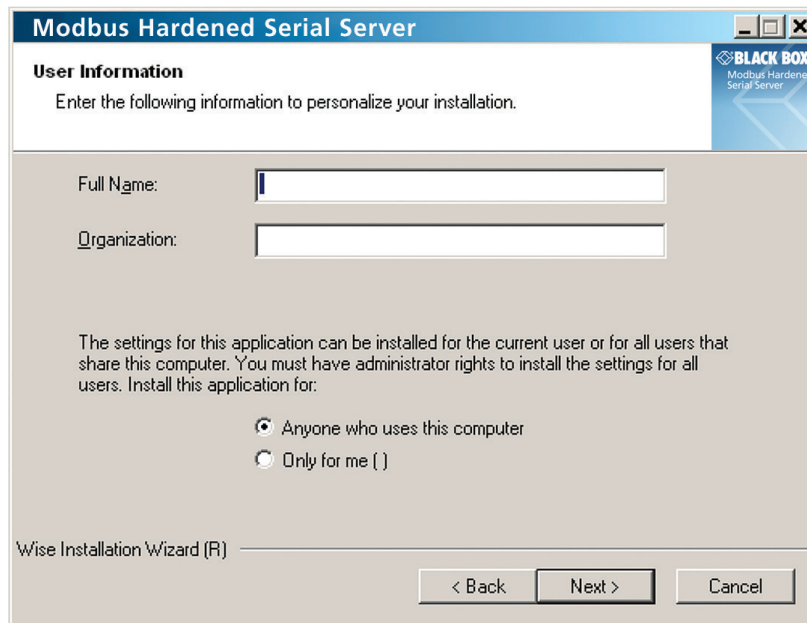


Figure 3-5. User information screen.

- d. Click “Next.” The Destination Folder Screen will be displayed on your computer. The default directory is: C:\Program Files\Black Box\Modbus Hardened Serial Server\
- If desired, you can select another location by pressing the “Browse” button.

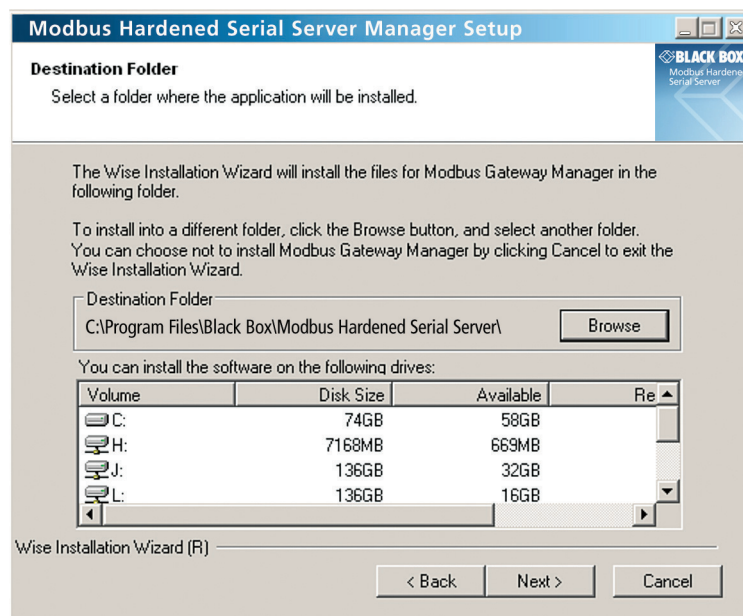


Figure 3-6. Destination folder screen.

- e. Click “Next.” The Ready to Install Application Screen will be displayed on your computer. You can select the “Back” button to change the destination folder.

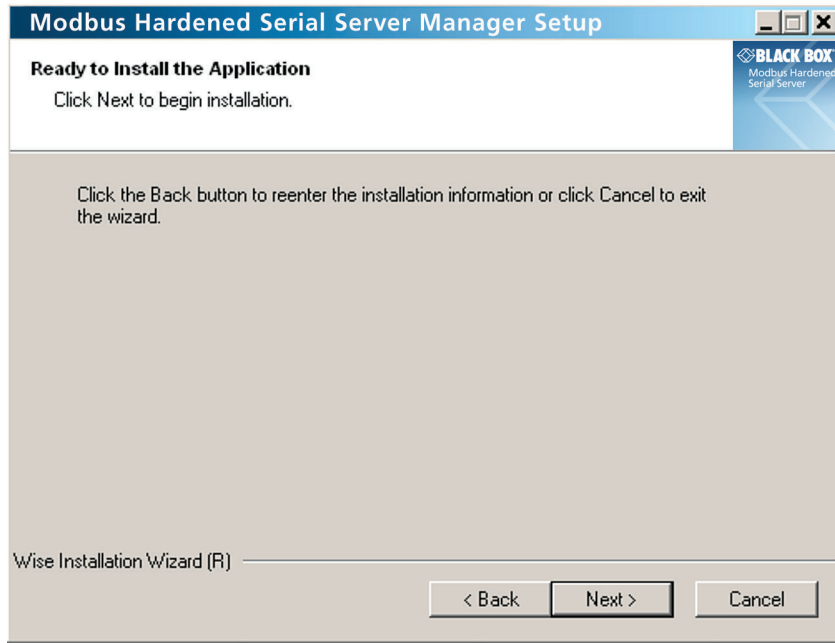


Figure 3-7. Ready to Install Application screen.

f. Click "Next." The software will begin installing.

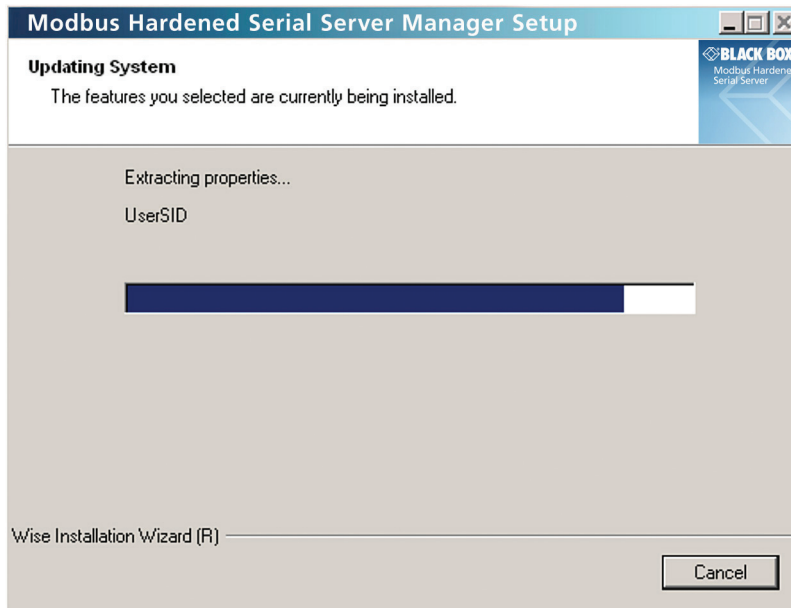


Figure 3-8. Software Installing screen.

- g. After the installation is complete, an information screen will be displayed containing contact information and release notes. Click "Next."

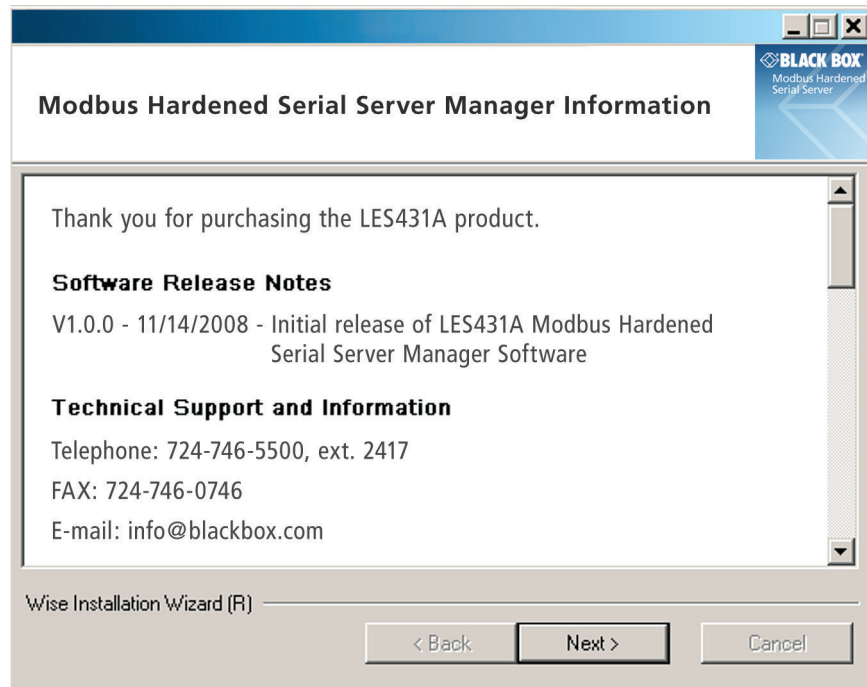


Figure 3-9. Information screen.

- h. The Installation Complete screen will be displayed on your computer. Click "Finish" to finish the installation.

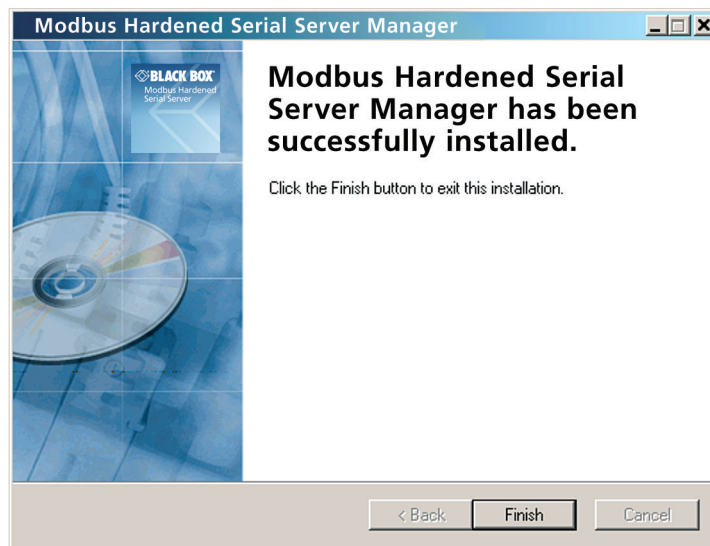


Figure 3-10. Installation Complete screen.

3.4.2 Configuring the Modbus Hardened Serial Server via the Network Connection

To configure via the network, you can use either Modbus Configuration software or the Web interface.

Configuring with Modbus Configuration Manager

LES431A Modbus Hardened Serial Servers can be configured over the network Modbus Configuration manager software running on a PC.

Chapter 3: Installation and Initial Setup

To open Modbus Hardened Serial Server Configuration Manager:

1. From the Desktop, click Start—>Programs—>Modbus Hardened Serial Server Manager. An alternate method is to double-click the shortcut installed on the desktop.

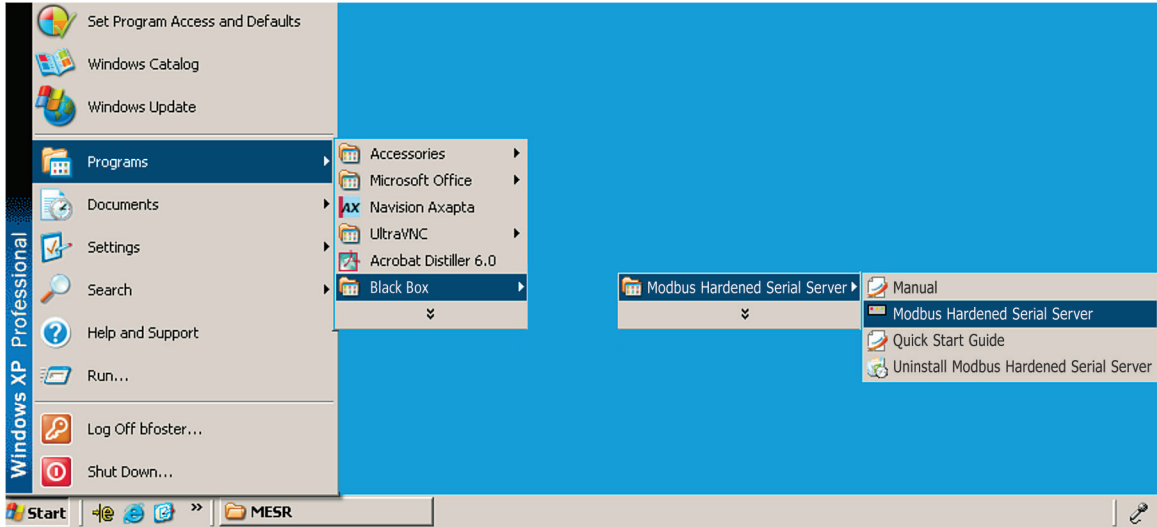


Figure 3-11. Opening Modbus Hardened Serial Server Configuration Manager.

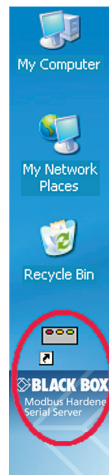


Figure 3-12. Modbus Hardened Serial Server Configuration Manager Shortcut Icon.

2. The Modbus Hardened Serial Server Configuration Manager Device Discovery window appears.

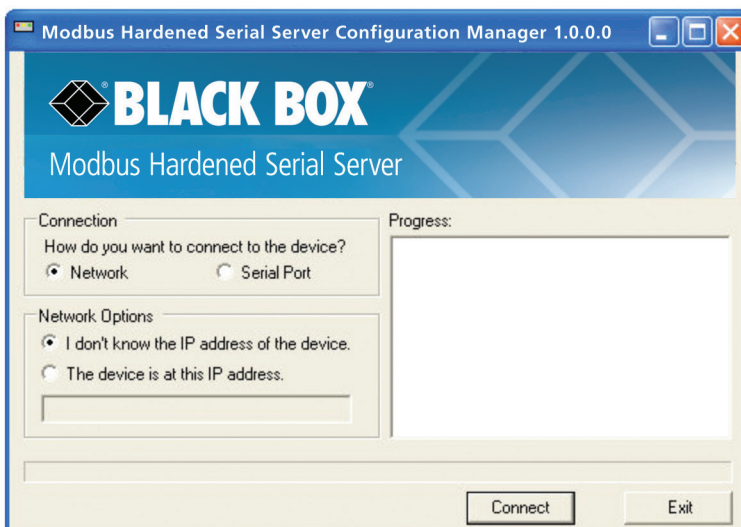


Figure 3-13. Modbus Hardened Serial Server Configuration Manager Discovery window.

3. If you do not know the IP address, check the “Network” and “I don’t know the IP address of this device” selections and press the “Connect Button.” The software will discover any LES431A Gateways on the network. The configuration manager screen will be displayed on your computer. All available devices will be listed on the top portion of this screen. If you know the IP address, you may select “The device is at this IP address” and input the address in the box provided.

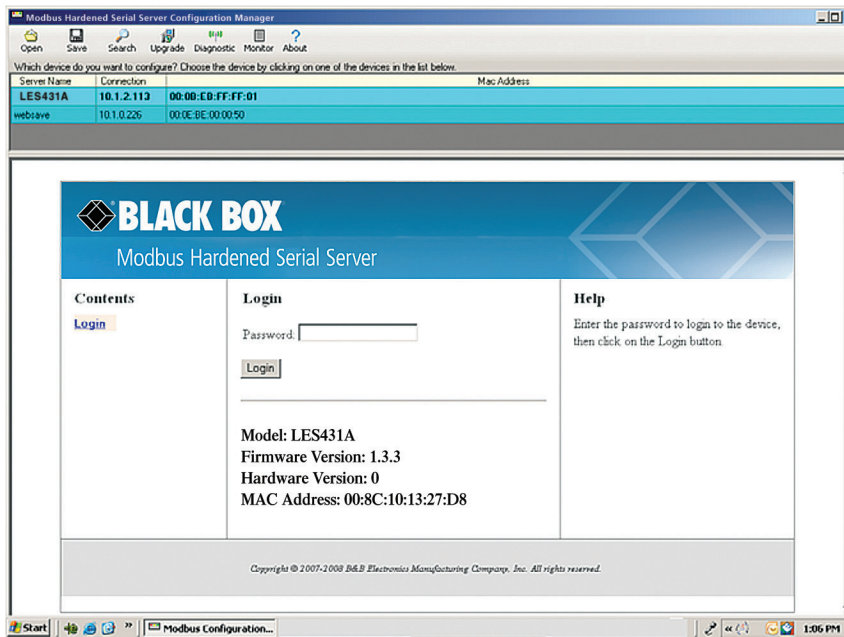


Figure 3-14. Modbus Hardened Serial Server Configuration Manager screen.

4. All Modbus Hardened Serial Servers on the network will be displayed in the top portion of the screen. To select a gateway, simply click the appropriate device on the top portion of the screen.

a. The main portion of the screen displays the model, firmware version, hardware version, MAC address, and link status. The IP address is also displayed on the top portion of the screen and title graphic area.

Chapter 3: Installation and Initial Setup

5. The default password is no password. Click the “Login” button. The “General” Settings screen will be displayed on your computer.
6. See the Modbus Hardened Serial Server Manager Settings Screen Overview in Figure 3-15.

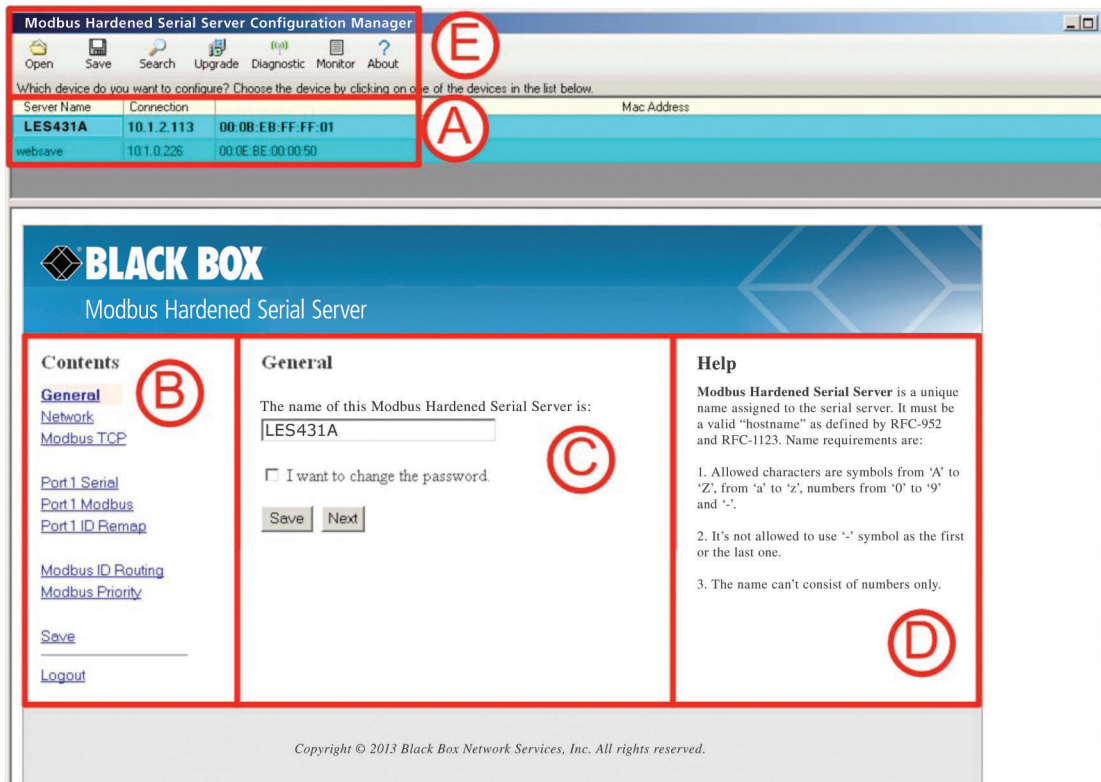


Figure 3-15. Settings Screen Overview.

- A. This area shows Modbus Hardened Serial Servers available on the network.
- B. This area is used to skip directly to the specific configuration screen you need to access. An alternate method of accessing the configuration screens is to use the “Next” button in area C.
- C. This area contains dialog boxes specific to the configuration screen.
NOTE: Save any configuration changes you make using the “Save” button.
- D. This area contains helpful information about the configuration screen you are currently on.
- E. This area contains shortcuts to specific functions.
 1. “Open” allows you to load a previously saved configuration file into your Modbus Hardened Serial Server.
 2. “Save” allows you to save your configuration to a file. This should not be confused with the “Save” button described in 6.C above.
 3. “Search” allows you to search for Modbus Hardened Serial Servers on the network.
 4. “Upgrade” allows you to upgrade your Modbus Hardened Serial Server’s firmware.
 5. “Diagnostic” allows you to test a configured Modbus Hardened Serial Server.
 6. “Monitor” allows you to monitor a Modbus Hardened Serial Server.
 7. “About” contains information about your Modbus Hardened Serial Server.

7. See the General Settings screen in Figure 3-16.

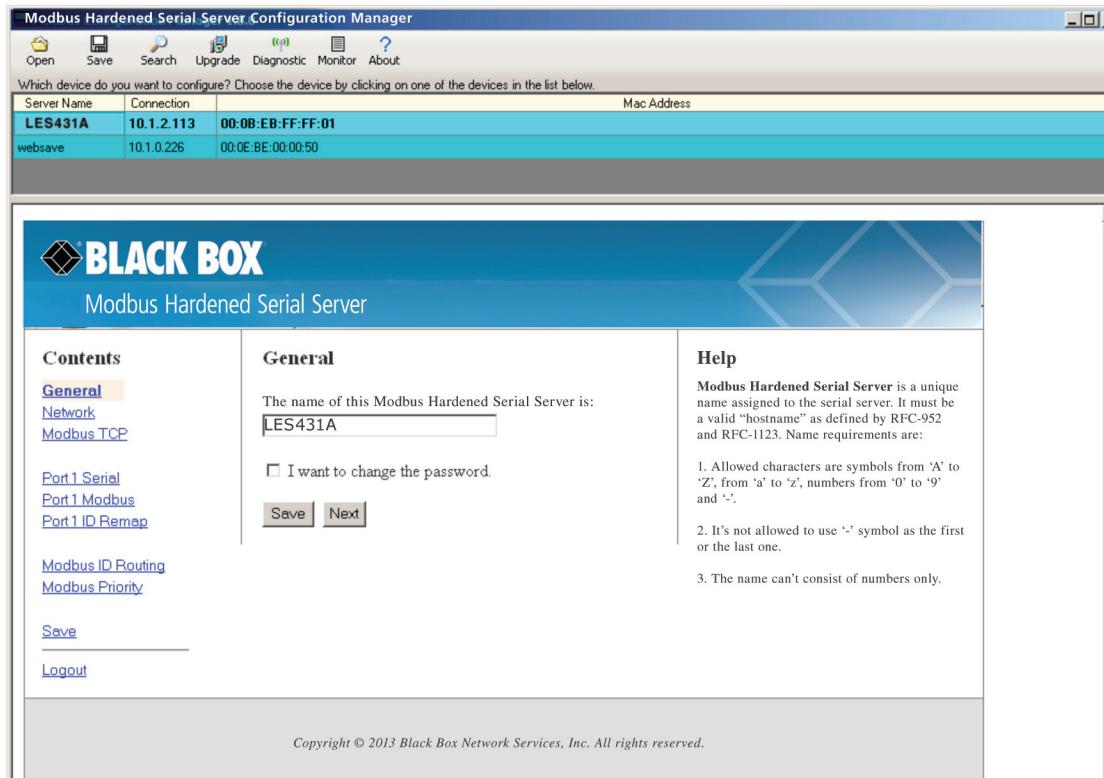


Figure 3-16. General Settings screen.

- a. This screen enables you to assign a unique name to the gateway. This allows you to easily identify a particular gateway when multiple devices are used on the same network. To change the name, type a new name in the “The Name of this Modbus Hardened Serial Server is” box. The name must be a valid “hostname” as defined by RFC-952 and RFC-1123. Allowed characters are A to Z, a to z, 0 to 9 and “-”. The “-” symbol cannot be the first or last character. The name cannot consist of numbers only. To save the new name, click the “Save” button.
- b. You can also change the gateway’s password on this screen. To do this, check the “I want to change the password” box. New password entry boxes will appear on the screen.

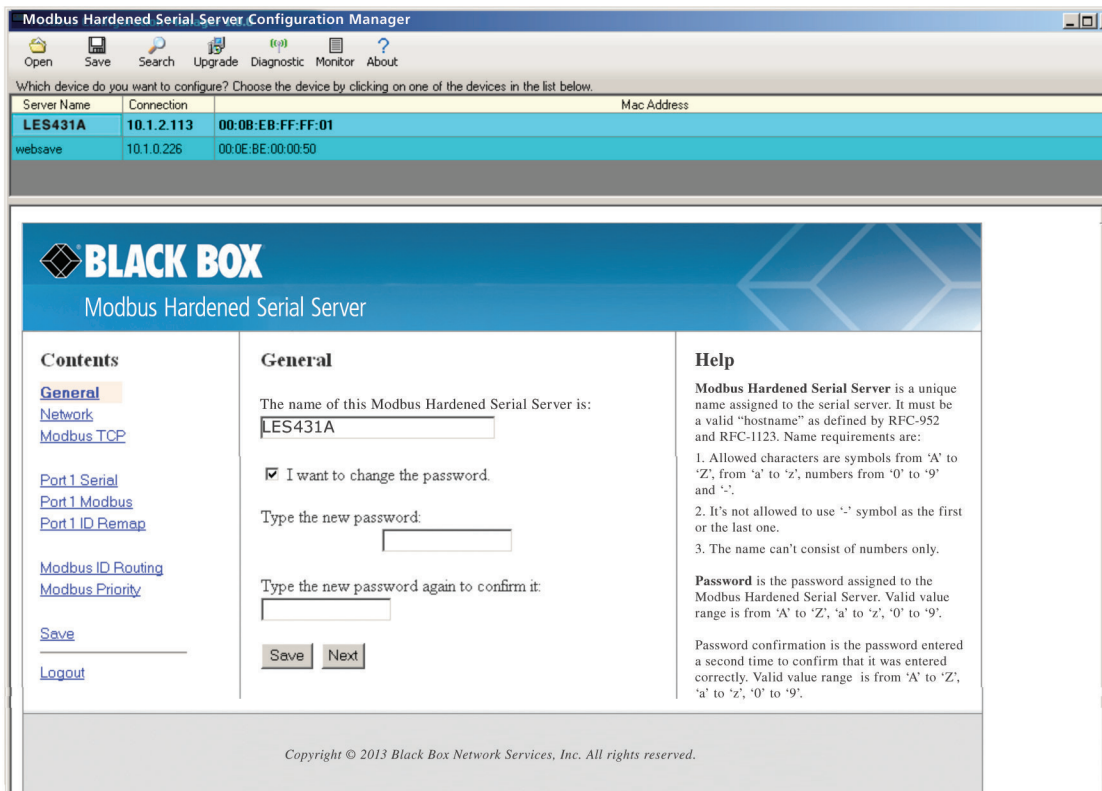


Figure 3-17. Changing the password.

- c. Type your new password in the "Type the new password box." Verify the password by typing it again in the box provided. To save the new password, click the "Save" button.
 - d. Password is the password assigned to the Modbus Hardened Serial Server. Valid value range is from "A" to "Z," "a" to "z," "0" to "9."
 - e. Password Confirmation is the password entered a second time to confirm that it was entered correctly. Valid value range is from "A" to "Z," "a" to "z," "0" to "9."
8. See the Network Settings screen in Figure 3-18.
- a. To get to the Network Settings Screen, you can either click the "Next" button or click on the "Network" link on the left side of the screen.

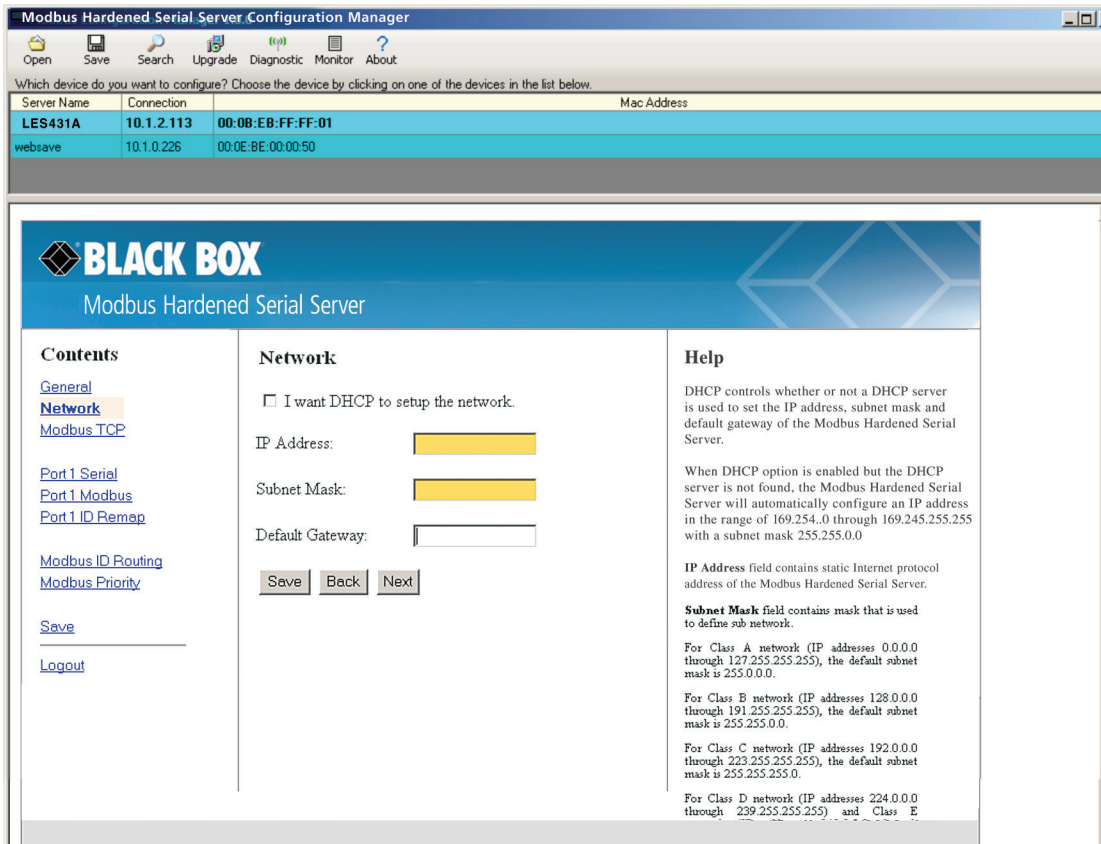


Figure 3-18. Network Settings screen (DHCP selected).

NOTE: To see the rest of the information for Class D listed below that is cut off in Figure 3-18, scroll down in the screen.

- b. The default network configuration is to receive an IP address assignment from a DHCP server. DHCP controls whether or not a DHCP server is used to set the IP address, subnet mask, and default gateway of the Modbus Hardened Serial Server. When the DHCP option is enabled but the DHCP server is not found, the Modbus Hardened Serial Server will automatically configure IP address 169.254.102.39 with a subnet mask 255.255.0.0.
- c. To configure your Modbus Hardened Serial Server without using a DHCP Server, uncheck the “I want DHCP to setup the network” box. You will need to know the IP Address, Subnet Mask, and Default Gateway.

The IP Address field contains the static internet protocol address of the Modbus Hardened Serial Server.

Subnet Mask field contains the mask that is used to define the sub-network.

For a Class A network (IP addresses 0.0.0.0 through 127.255.255.255), the default subnet mask is 255.0.0.0.

For a Class B network (IP addresses 128.0.0.0 through 191.255.255.255), the default subnet mask is 255.255.0.0.

For a Class C network (IP addresses 192.0.0.0 through 223.255.255.255), the default subnet mask is 255.255.255.0.

For a Class D network (IP addresses 224.0.0.0 through 239.255.255.255) and a Class E network (IP addresses 240.0.0.0 through 255.255.255.255), the subnet mask is ignored.

The Default Gateway field contains default route to remote networks.

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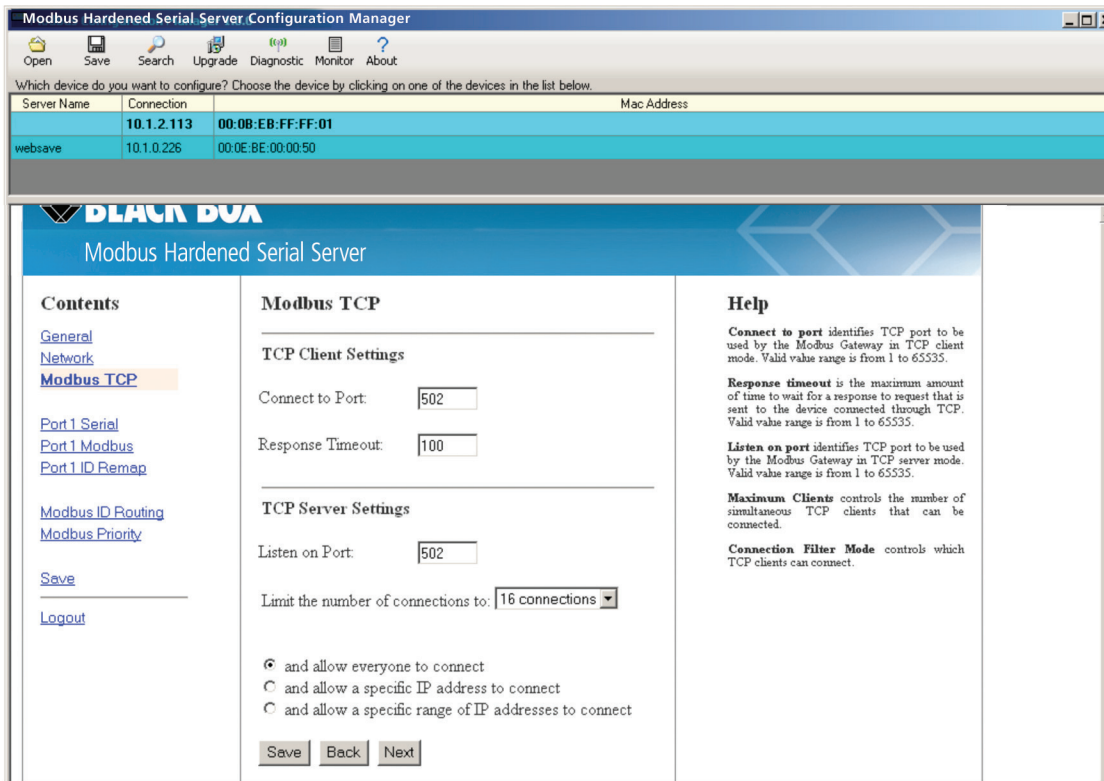


Figure 3-19. Network Settings screen (DHCP not selected).

- d. More information about assigning an IP address without using a DHCP Server is contained in the section "Configuring the Modbus Hardened Serial Server on Networks without a DHCP Server."
- e. Save changes by clicking the "Save" button.
9. See the Modbus TCP Settings screen in Figure 3-20.
 - a. To access this screen, click the "Next Button" or click on the Modbus TCP link on the left side of the screen.
 - b. This screen allows you to see Modbus TCP client and server settings.

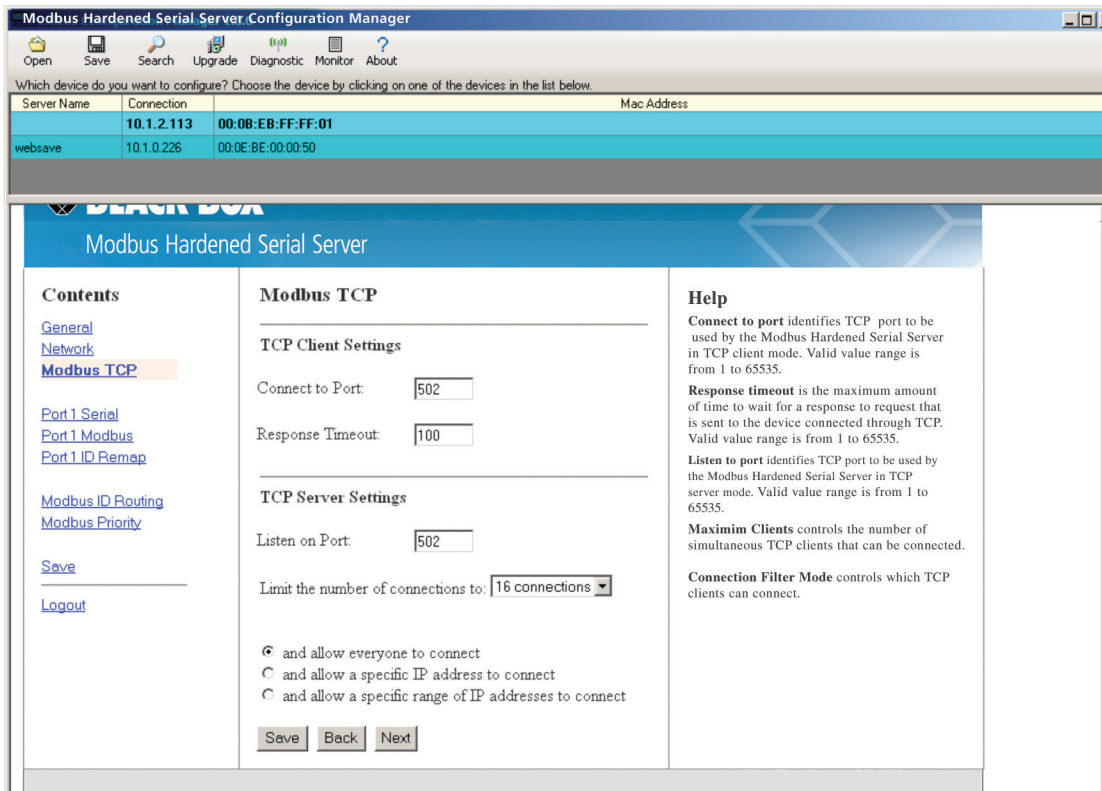


Figure 3-20. Modbus TCP Settings screen.

c. TCP Client Settings:

1. “Connect to Port” identifies the TCP port to be used by the Modbus Hardened Serial Server in TCP client mode. Valid value range is from 1 to 65535.
2. “Response Timeout” is the maximum amount of time to wait for a response to a request that is sent to the device connected through TCP. Valid value range is from 1 to 65535.
3. Save settings by clicking the “Save” button.

b. TCP Server Settings:

1. “Listen on Port” identifies the TCP port to be used by the Modbus Hardened Serial Server in TCP server mode. Valid value range is from 1 to 65535.
2. “Limit the number of connections to” pull-down box allows you to control the number of simultaneous TCP clients that can be connected. Choices are 1 through 16.
3. “Connection Filter Mode” controls which TCP clients are able to connect. The default is: “and allow everyone to connect.”

- a. You can select “and allow specific IP addresses to connect.” This filter is limited to 4 IP addresses.

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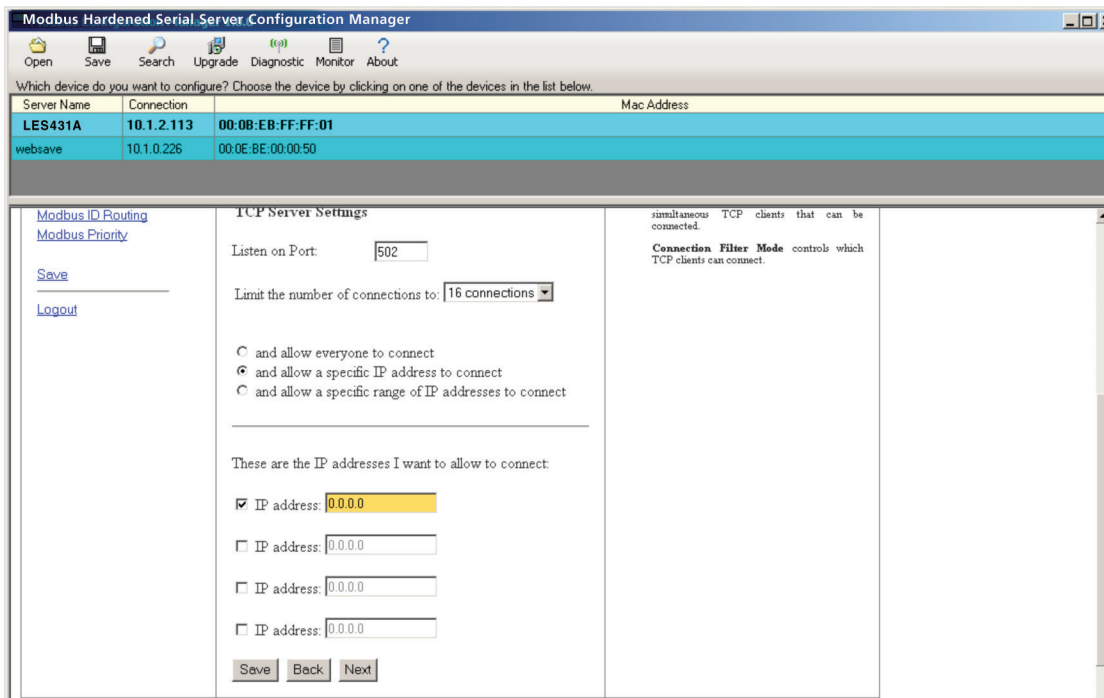


Figure 3-21. TCP Connection Filter “Allow Specific IP addresses to Connect.”

- You can select “and allow a specific range of IP addresses to connect.” This filter is limited to 4 IP address ranges.
- Save settings by clicking the “Save” button.

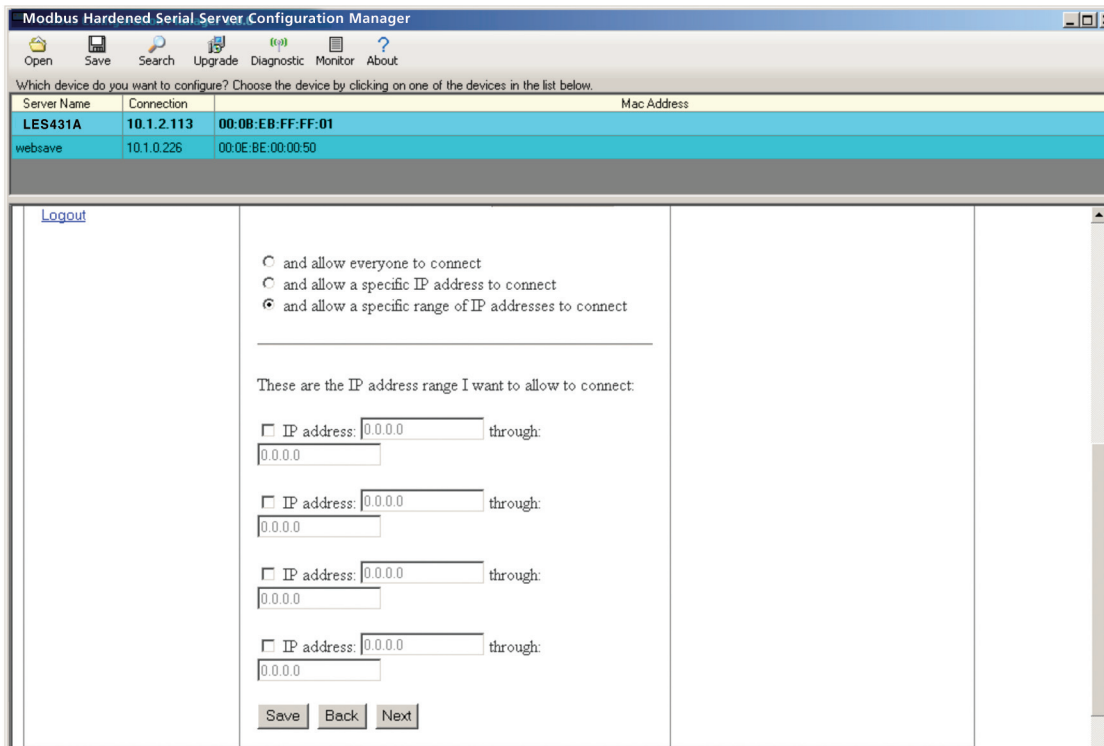


Figure 3-22. TCP Connection Filter “and Allow Specific Range of IP Addresses to Connect.”

10. See the PORT x Serial Settings screen in Figure 3-23.

a. To access this screen, click the "Next" button or click the Port X Serial link on the left side of the screen. X = The Serial Port number (1 or 2).

b. This screen allows you to change the serial port settings.

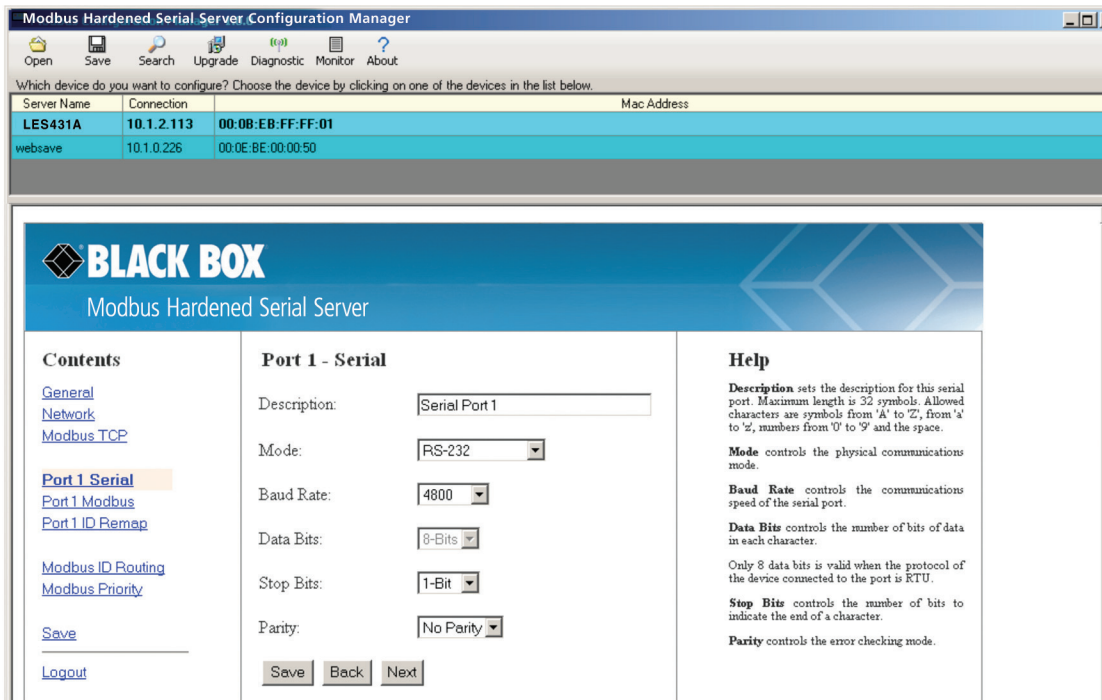


Figure 3-23. Serial Port screen.

c. "Description" sets the description for this serial port. The maximum length is 32 symbols. Allowed characters are symbols from "A" to "Z," from "a" to "z," numbers from "0" to "9," and the space character.

d. "Mode" controls the physical communications mode for the server. The Mode can be RS-232, RS-422 (4-Wire), RS-485 (2-Wire), or RS-485 (4-Wire).

e. "Baud Rate" controls the communications speed of the serial port. The Baud Rate can be 2400, 7200, 9600, 14400, 19200, 14400, 28800, 38400, 57600, 115200, or 230400.

f. "Stop Bits" controls the number of bits to end a character. Choices are 1 or 2.

g. "Parity" controls the error checking mode. Choices are "Odd," "Even," "Mark," or "Space."

h. Save settings by clicking the "Save" button.

11. See the Port X Modbus screen.

a. To access this screen, click the "Next" button or click the "Port X Modbus" Link on the left side of the screen. X = The Serial Port Number (1 or 2).

b. This screen allows you to change the Modbus settings for the port.

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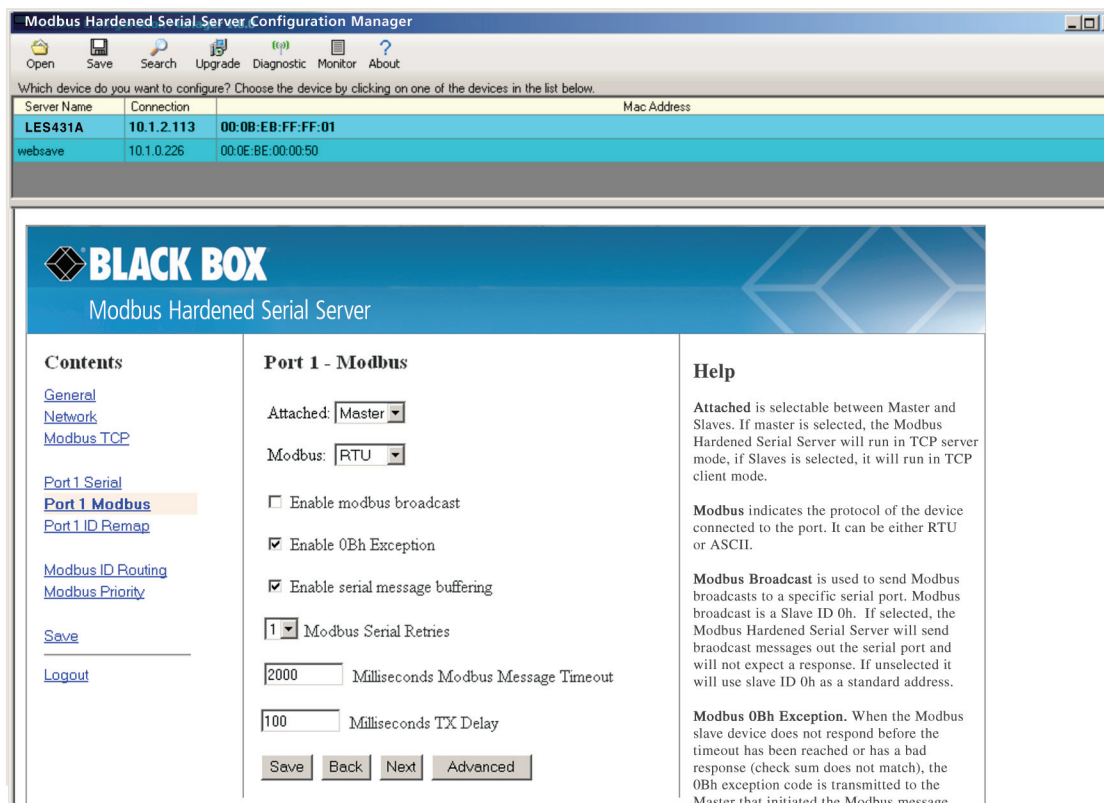


Figure 3-24. Modbus Port screen.

- c. “Attached”—This is selectable between Master and Slaves. If “Master” is selected, the Modbus Hardened Serial Server will run in TCP server mode, if “Slaves” is selected, it will run in TCP client mode.
- d. “Modbus” indicates the protocol of the device connected to the port. It can be either RTU or ASCII.
- e. “Enable Modbus Broadcast”—Check this box to send Modbus broadcasts to a specific serial port. Modbus broadcast is Slave ID 0h. If selected, the Modbus Hardened Serial Server will send broadcast messages out the serial port and will not expect a response. If unselected, it will use slave ID 0h as a standard address.
- f. “Enable 0Bh Exception”—Check this box to enable. When the Modbus slave device does not respond before the timeout has been reached or has a bad response (check sum does not match), the 0Bh exception code is transmitted to the Master that initiated the Modbus message.
- g. “Enable Serial Message Buffering”—If this option is selected, the gateway will buffer up to 32 message requests per port. If this option is unselected, the Modbus Hardened Serial Server will respond with a 06h if it has a message out on the port with no response yet.
- h. “Modbus Serial Retries”—Select 0 through 5. This sets the maximum number of times that the Modbus Hardened Serial Server will retry to send a Modbus message to a Modbus client, before reporting a 0Bh exception if it is selected. Number of retries is limited to 5.
- i. “Milliseconds Modbus Message Timeout”—This is the maximum amount of time to wait for a response to the message. Valid value range is from 1 to 65535.
- j. “Milliseconds TX Delay”—This is the minimum amount of time after receiving a response before the next message can be sent out. Valid value range is from 1 to 65535.
- k. Save settings by clicking the “Save” button.

12. See the Port x ID Remap screen.

- a. To access this screen, click the "Next" button or click the "Port x ID Remap" link on the left side of the screen.
- b. This screen allows you to set Modbus Slave ID Remap settings.

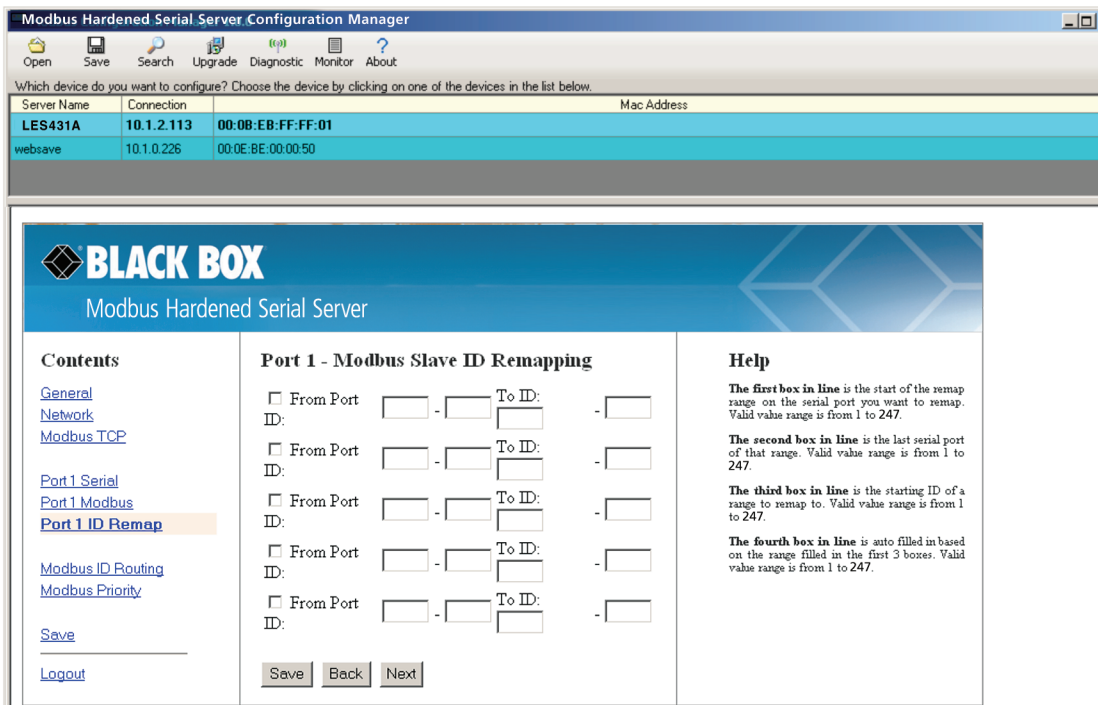


Figure 3-25. Port ID Remap screen.

- c. The first box in line is the start of the remap range on the serial port you want to remap. Valid value range is from 1 to 247.
- d. The second box in line is the last serial port of that range. Valid value range is from 1 to 247.
- e. The third box in line is the starting ID of a range to remap to. Valid value range is from 1 to 247.
- f. The fourth box in line is auto filled-in based on the range filled in the first 3 boxes. Valid value range is from 1 to 247.
- g. Save settings by clicking the "Save" button.

13. See the Modbus ID Routing screen.

- a. To access this screen, click the "Next" button or click the "Modbus ID Routing" Link on the left side of the screen.
- b. This screen allows you to set the Modbus Slave ID routing.

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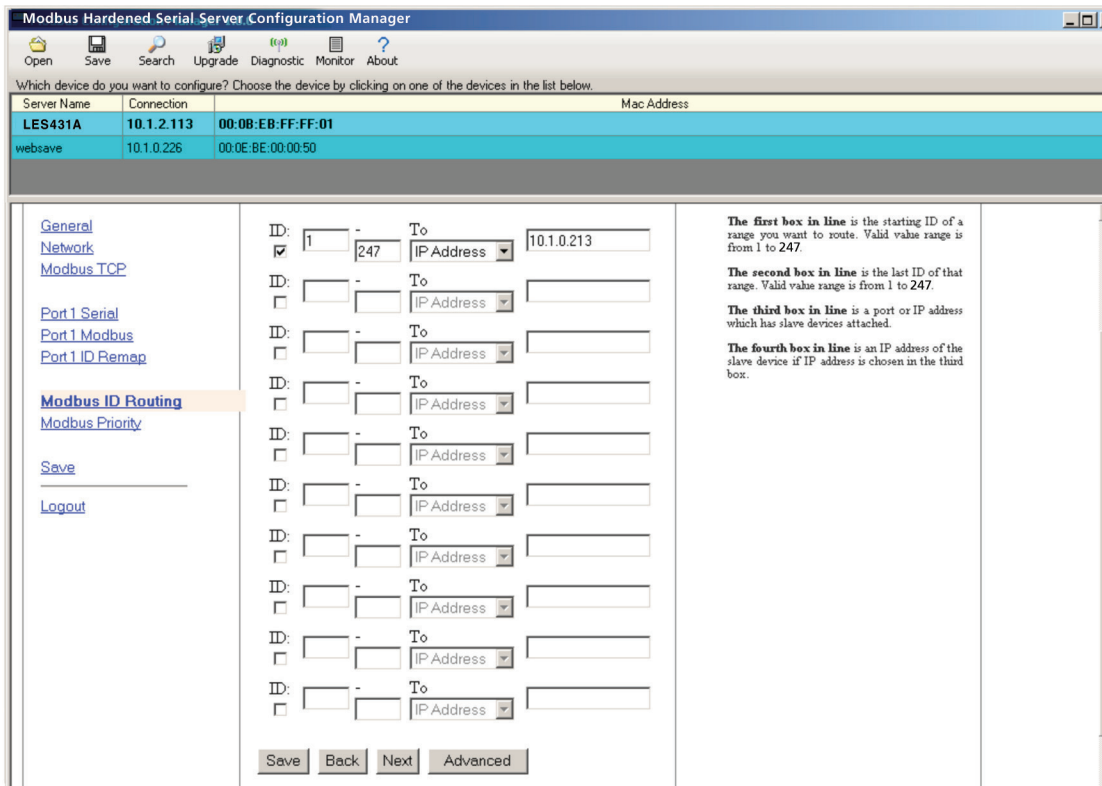


Figure 3-26. Modbus ID Routing Screen.

- c. The first box in line is the starting ID of a range you want to route. Valid value range is from 1 to 247.
 - d. The second box in line is the last ID of that range. Valid value range is from 1 to 247.
 - e. The third box in line is a port or IP address that has slave devices attached.
 - f. The fourth box in line is an IP address of the slave device if IP address is chosen in the third box.
 - g. Save settings by clicking the "Save" button.
14. See the Modbus Priority screen.
- a. To access this screen, click the "Next" button or click the "Modbus Priority" link on the left side of the screen.
 - b. This screen allows you to configure the Modbus Hardened Serial Server to move high priority messages to the front of the serial message buffer.

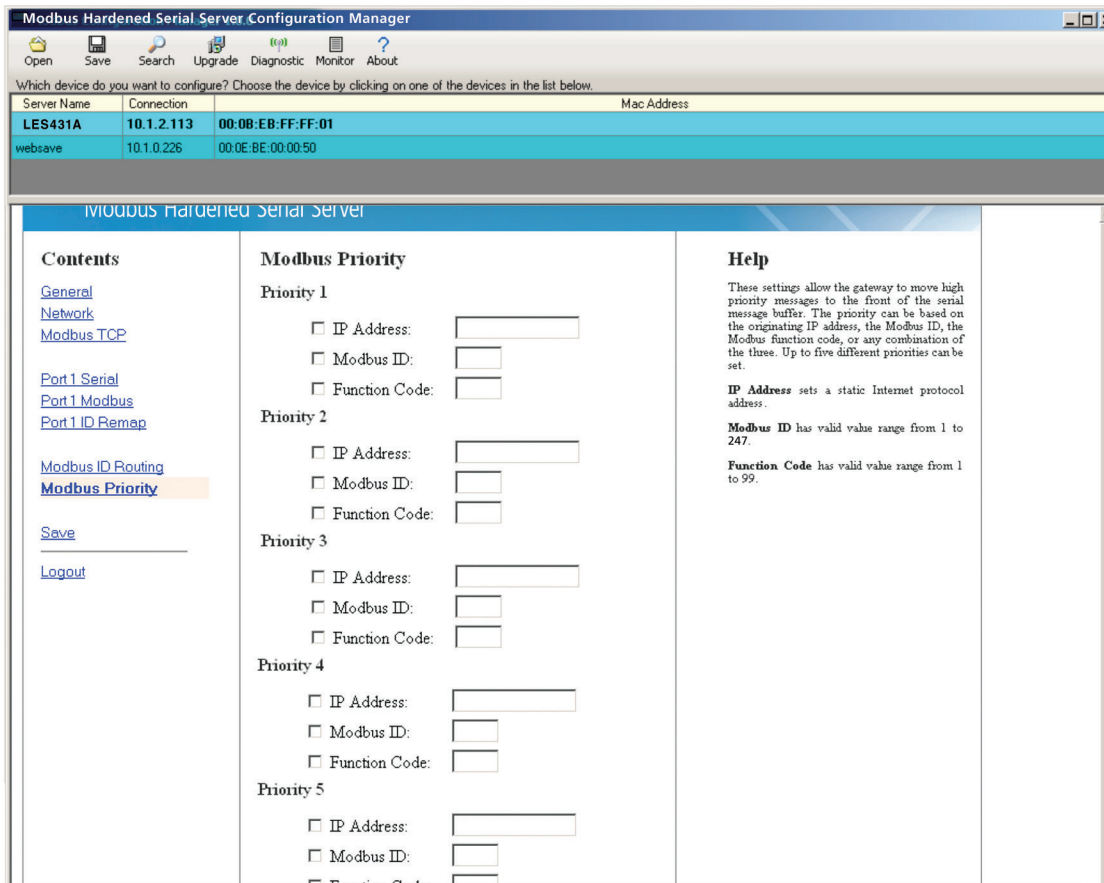


Figure 3-27. Modbus Priority screen.

- c. These settings allow the gateway to move high priority messages to the front of the serial message buffer. The priority can be based on the originating IP address, the Modbus ID, the Modbus function code, or any combination of the three. Up to five different priorities can be set.
- d. "IP Address"—Used to set a static Internet protocol address for the Modbus Hardened Serial Server.
- e. "Modbus ID"—Valid range is from 1 to 247.
- f. "Function Code"—Valid range is from 1 to 99.
- g. Save settings by clicking the "Save" button.

Configuring with the Web Interface

LES431A Modbus Hardened Serial Servers can be configured over the network using a standard Internet browser such as Internet Explorer® or Firefox®.

To open the Web configuration interface:

1. On a PC connected to the network, open a Web browser.

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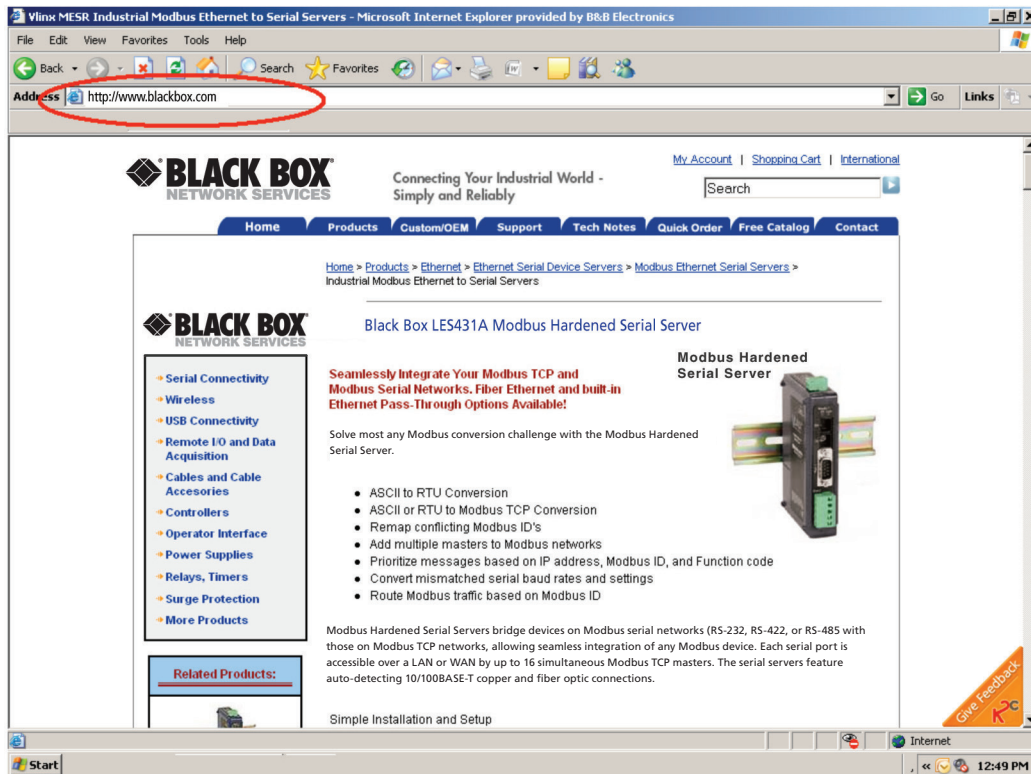


Figure 3-28. Open Web Browser.

2. In the browser's address bar, type the IP address of the Modbus Hardened Serial Server.

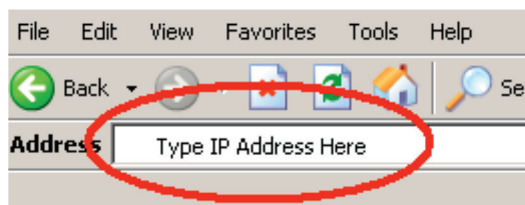


Figure 3-29. Type IP Address.

NOTE: Your Modbus Hardened Serial Server comes from the factory pre-configured to receive an IP address assignment from a DHCP server. If a DHCP Server is not available on your network, it will default to 169.254.102.39.

The Web interface Login page appears.

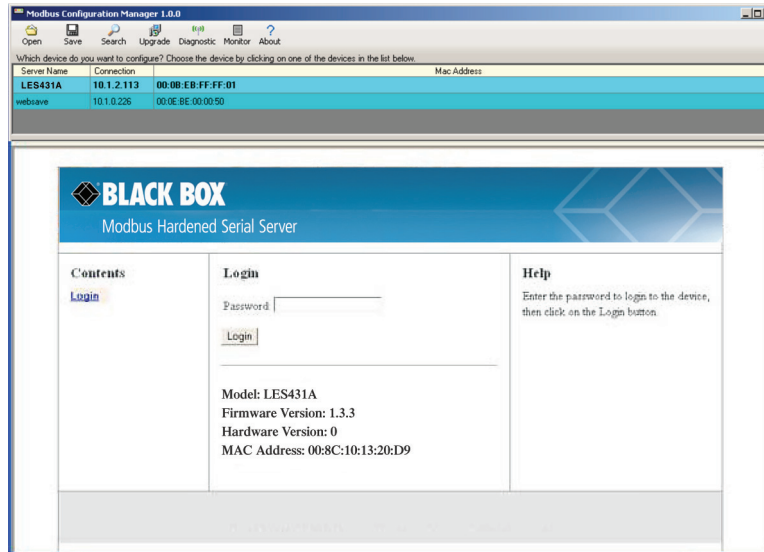


Figure 3-30. Modbus Hardened Serial Server Login Screen.

3. The screens for configuring your gateway using a Web browser are the same as those used to configure the Modbus Hardened Serial Server Manager software.

3.4.3 Configuring the LES431A Modbus Hardened Serial Server on Networks without a DHCP Server

Your Modbus Hardened Serial Server comes from the factory set up to receive an IP assignment from a DHCP Server. If there is not a DHCP server on your network, the Modbus Hardened Serial Server will default to IP address 169.254.102.39. If this address does not work with your PC, there are two methods to manually configure the network information.

1. Method 1: Change your PC Network to Match the Modbus Hardened Serial Server.

a. Open your network connection.

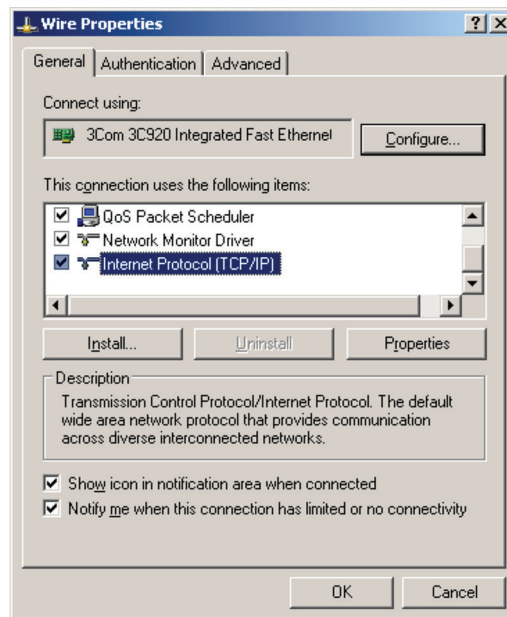


Figure 3-31. Web properties screen.

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b. Click on “Internet Protocol (TCP/IP)” and click “Properties.” Change the parameters to the following:

IP Address = 169.254.102.1

Subnet Mask = 255.255.0.0

Default Gateway = 169.254.102.100

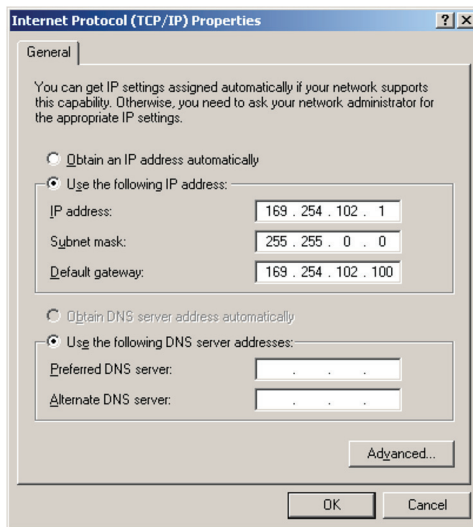


Figure 3-32. TCP/IP properties screen.

c. Use the Modbus Hardened Serial Server Manager Software to search for, discover, and configure the Modbus Hardened Serial Server.

2. Method 2: Change the Modbus Hardened Serial Server’s network settings to match your PC using Console Mode.

a. Connect a null-modem serial cable (crossover cable) from port 1 on the Modbus Hardened Serial Server to an available COM port on your PC.

b. Open Hyperterminal® or similar serial emulation software and connect to the COM port used in step one. Ensure the port is configured to 115,200 baud, 8 data bits, no parity, and 1 stop bit.

c. Enter Console Mode. Press and hold the Modbus Hardened Serial Server’s Mode button for 2 to 10 seconds. The LED indicators will respond as follows:

Model: LES431A

Port 1 LED: OFF

Ready LED: OFF

d. Release the “Mode” button. The READY LED will blink once per second for five seconds. This indicates that the Modbus Hardened Serial Server is re-booting in Console Mode.

e. When the Modbus Hardened Serial Server has successfully restarted in Console Mode, the READY LED will be OFF and the PORT 1 LED will be ON.

f. Open the Modbus Hardened Serial Server Manager Software and select “Serial Port” as the method to connect to the Modbus Hardened Serial Server.

g. After logging in, click on “Network.”

h. Un-check the box next to “I Want DHCP to setup the Network.”

i. Re-configure the Modbus Hardened Serial Server's network settings to something within the range of your PC's network settings. For example:

PC Network Settings

IP Address = 192.168.0.1

Subnet Mask = 255.255.0.0

Default Gateway = 192.168.0.100

Change the Modbus Hardened Serial Server's network settings to:

IP Address = 192.168.0.50

Subnet Mask = 255.255.0.0

Default Gateway = 192.168.0.100

j. Save the settings and remove power from the Modbus Hardened Serial Server.

k. Re-apply power. Open the Modbus Hardened Serial Server Manager Software and select "Network" as the method to connect to the device.

3.4.4 Configuring the LES431A Modbus Hardened Serial Server via the Serial Port

Your Modbus Hardened Serial Server can be configured via a serial port using Modbus Hardened Serial Server Manager. To use this feature, the Modbus Hardened Serial Server's serial port must be connected to the serial port of a PC (using a null-modem cable).

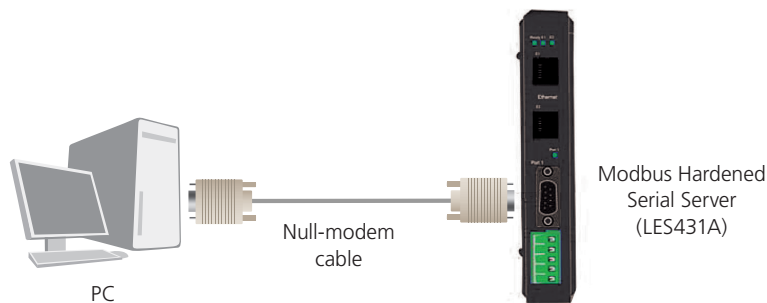


Figure 3-33. Console Mode Setup.

To configure the Modbus Hardened Serial Server, use the Mode switch to put it into Console Mode.

To enter Console Mode, press and hold the Mode switch for between two and ten seconds. The LED indicators respond as follows:

1. The Ready LED blinks three times per second while the button is being pressed.
2. The Modbus Hardened Serial Server is in Console Mode when Port 1 LED is On and the Ready LED is Off.

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To configure the Modbus Hardened Serial Server, open the Modbus Hardened Serial Server Manager software and set up the Modbus Hardened Serial Server's parameters as required.

1. Under Connection, select "Serial Port."

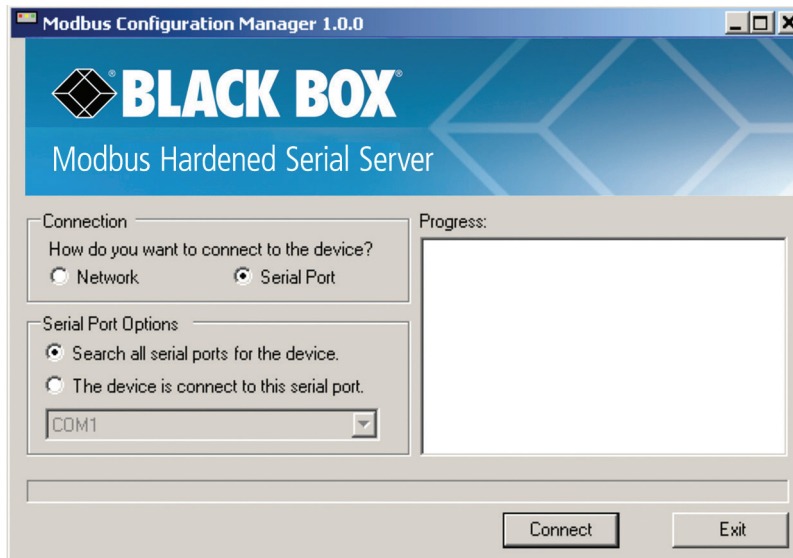


Figure 3-34. Connection.

2. If you do not know which COM port your Modbus Hardened Serial Server is connected to, select "Search all serial ports for the device" under Serial Port Options. If you do know, you may specify the COM port by selecting "The device is connected to this serial port" under Serial Port Options and using the pull-down menu to choose the COM port.

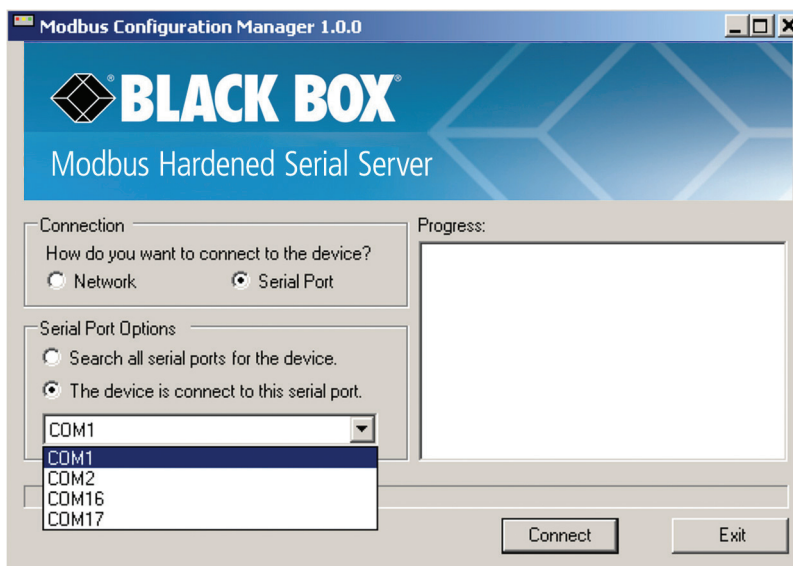


Figure 3-35. Serial Port Selection.

3. The remaining screens are identical to those shown in configuring your gateway using a network connection.

To exit **Console Mode**, press and hold the “Mode” switch for two seconds.

The LEDs go back to their normal states when the device resumes normal operation.

3.5 LES431A Modbus Hardened Serial Server Operational Connections

LES431A Modbus Hardened Serial Servers can operate in Direct IP Mode.

Using LES431A Modbus Hardened Serial Servers in Direct IP Mode

A Direct IP connection allows applications using TCP/IP socket programs to communicate with the COM ports on the Modbus Hardened Serial Server. In this type of application, the Modbus Hardened Serial Server is configured as a TCP server. The socket program running on the PC establishes a communication connection with the Modbus Hardened Serial Server. The data is sent directly to and from the serial port on the server.

To set up a Direct IP Mode connection:

1. Connect the Modbus Hardened Serial Server to the network and a Modbus network as described in previous sections.
2. Configure the Modbus Hardened Serial Server with the appropriate network settings (using Modbus Hardened Serial Server Manager or the Web interface).
3. Configure your software application with the appropriate IP address and port number to communicate with the Modbus network(s).

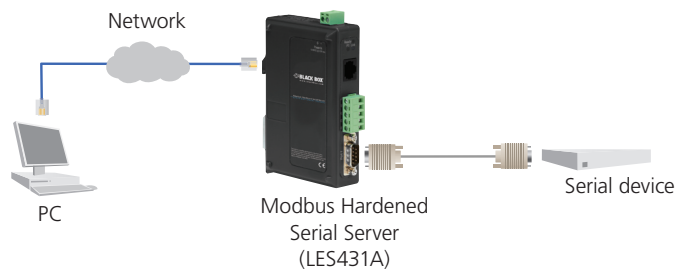


Figure 3-36. Direct IP Connection.

3.6 Initiating a Hardware Reset on the Modbus Hardened Serial Server

To initiate a Hardware Reset on the Modbus Hardened Serial Server, press and hold the Mode switch for 0 to 2 seconds, and then release it. The LED indicators respond as follows:

1. The Ready LED blinks three times per second while the button is being pressed.
2. The Modbus Hardened Serial Server is in Reset Mode when the Port 1 LED is On and the Ready LED is Off.
3. The LEDs go back to their normal states when the device resumes normal operation.

3.7 Reloading Factory Defaults

To reload Factory Defaults, press and hold the Mode switch for more than 10 seconds. The LED indicators respond as follows:

1. The Ready LED blinks three times per second while the button is being pressed.
2. The Modbus Hardened Serial Server is in Factory Default Mode when the Port 1 LED and the Ready LED are both On.

The Modbus Hardened Serial Server reloads all factory default configuration parameters.

3. The LEDs go back to their normal states when the device resumes normal operation.

NOTE: Factory default parameters are listed in Appendix A.

4. Upgrading the Modbus Hardened Serial Server Firmware

Occasionally, updated firmware may become available for your Modbus Hardened Serial Server. The firmware can be upgraded using the Modbus Hardened Serial Server Manager software. The following procedure describes the firmware updating process:

1. Click the “Upgrade” button to open the “Firmware Upgrade” dialog box.

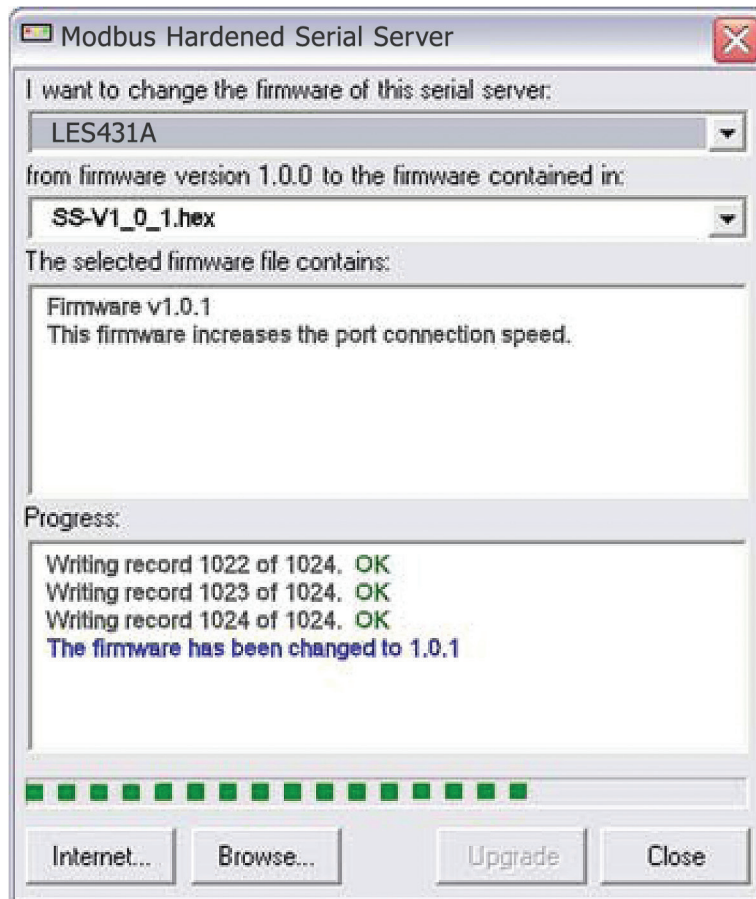


Figure 4-1. Firmware Upgrade Dialog Box.

The name of the currently selected Modbus Hardened Serial Server appears in the top drop-down list. Other Modbus Hardened Serial Servers (that have already been discovered) can be selected from the drop-down list, if desired.

The current firmware version of the selected Modbus Hardened Serial Server is shown in the text below the Modbus Hardened Serial Server name.

Information about the selected firmware file is shown in the third text box.

4.1 Downloading Firmware Files

The “Firmware File” list (second box) displays all firmware files in the firmware installation folder. Only firmware that is compatible with the selected Modbus Hardened Serial Server is available in this list.

To download the latest firmware files from an FTP site on the Internet:

1. Click the “Internet” button at the bottom of the window. The Modbus Hardened Serial Server Manager connects to an FTP server on the Internet.
2. Click the “Check for Updates” button. “Progress Bar” and “Progress Box” display information about and progress of the download.

To download the latest firmware files from a file:

1. Click the “Browse” button to open an “Open File” dialog box.
2. Browse to the drive and folder containing the firmware file.
3. Select and download the file to the local firmware folder.

4.2 Uploading the Firmware to the Modbus Hardened Serial Server

To upgrade the firmware:

1. In the Modbus Hardened Serial Server Selection drop down list, select the Modbus Hardened Serial Server to be upgraded.
2. In the Firmware Description drop-down list, select the firmware to upload to the Modbus Hardened Serial Server.
3. Click the “Upgrade” button. The Progress bar and Progress box provide information on the progress of the transfer.
4. In the Firmware File drop-down list, select the firmware file to upload to the Modbus Hardened Serial Server.
5. Click “Upgrade.”

The Progress box and Progress bar display information on the upgrading process.

6. When the upgrade process is complete, click “Close.”

5. Diagnostics

Clicking the Diagnostics icon opens the “Diagnostics” dialog box and enables you to check the operation of connected Modbus Hardened Serial Servers on the local computer.

The Computer Information box displays information about the type of network connections, the IP addresses, Subnet Masks, and Default Gateways in use.

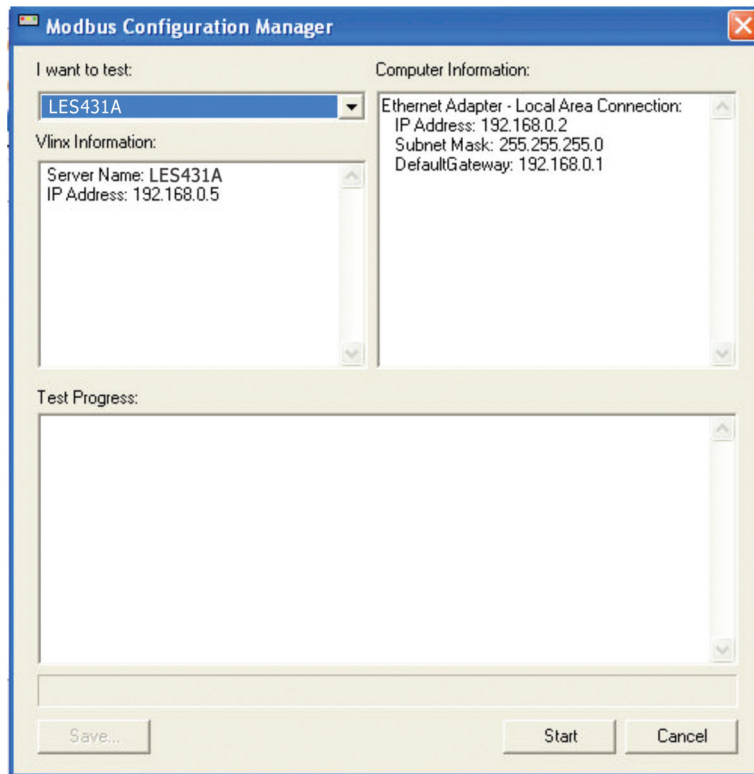


Figure 5-1. Diagnostics dialog box.

Testing a Modbus Hardened Serial Server Connection

To run diagnostics on a Modbus Hardened Serial Server:

1. Click the “Diagnostics” icon.

The “Diagnostics” dialog box appears.

2. In the drop-down box, select the specific Modbus Hardened Serial Server you want to check.
3. Click the “Start” button. Information about the progress of the pinging process is displayed in the “Test Progress” box.

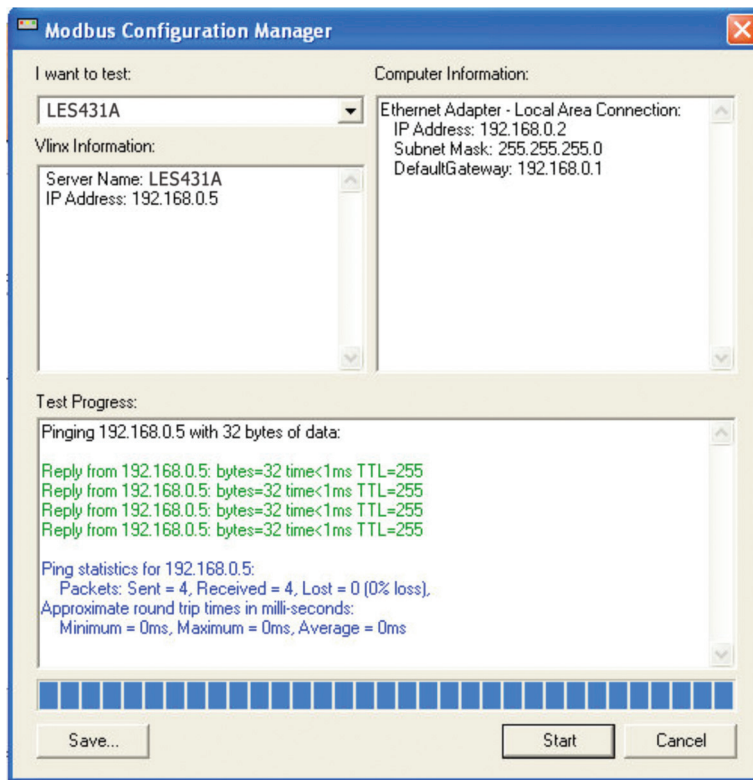


Figure 5-2. Testing a Modbus Hardened Serial Server connection.

6. Application Examples

Modbus Hardened Serial Servers can be used to integrate Modbus networks in a wide variety of settings. Because each setting has its own requirements, users may not understand how a Modbus Hardened Serial Servers helps, or if it's appropriate for their specific needs.

The following scenarios are examples only, and many others are possible. Contact Black Box Technical Support at 724-746-5500 or info@blackbox.com for information on other applications.

6.1 Ethernet Master and Serial Slaves

Your Modbus Hardened Serial Server can be used to integrate serial slave devices on a Modbus TCP network. This allows TCP Masters to control serial slave devices.

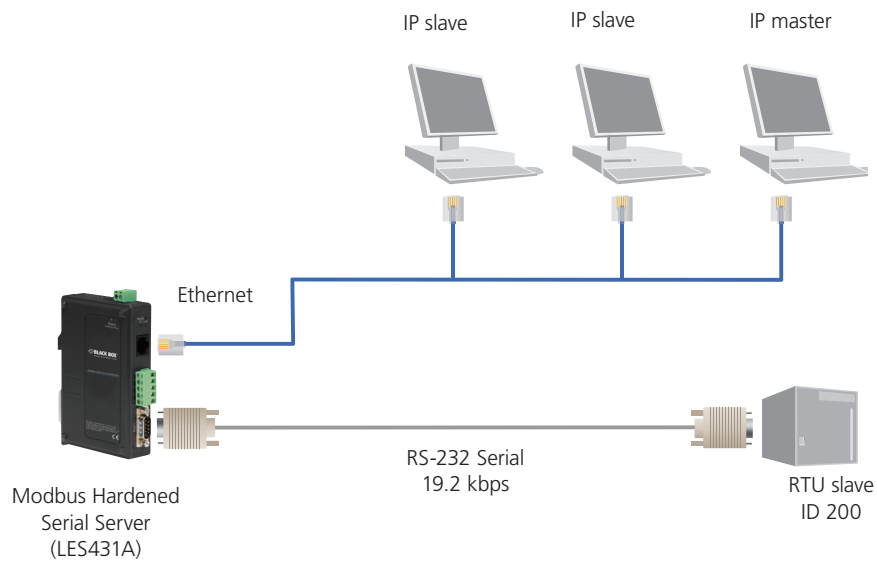


Figure 6-1. Ethernet Master with Serial Slaves.

1. Log into your Modbus Hardened Serial Server software.
2. Access the Serial Port One setup screen by clicking the link on the left side of the screen.

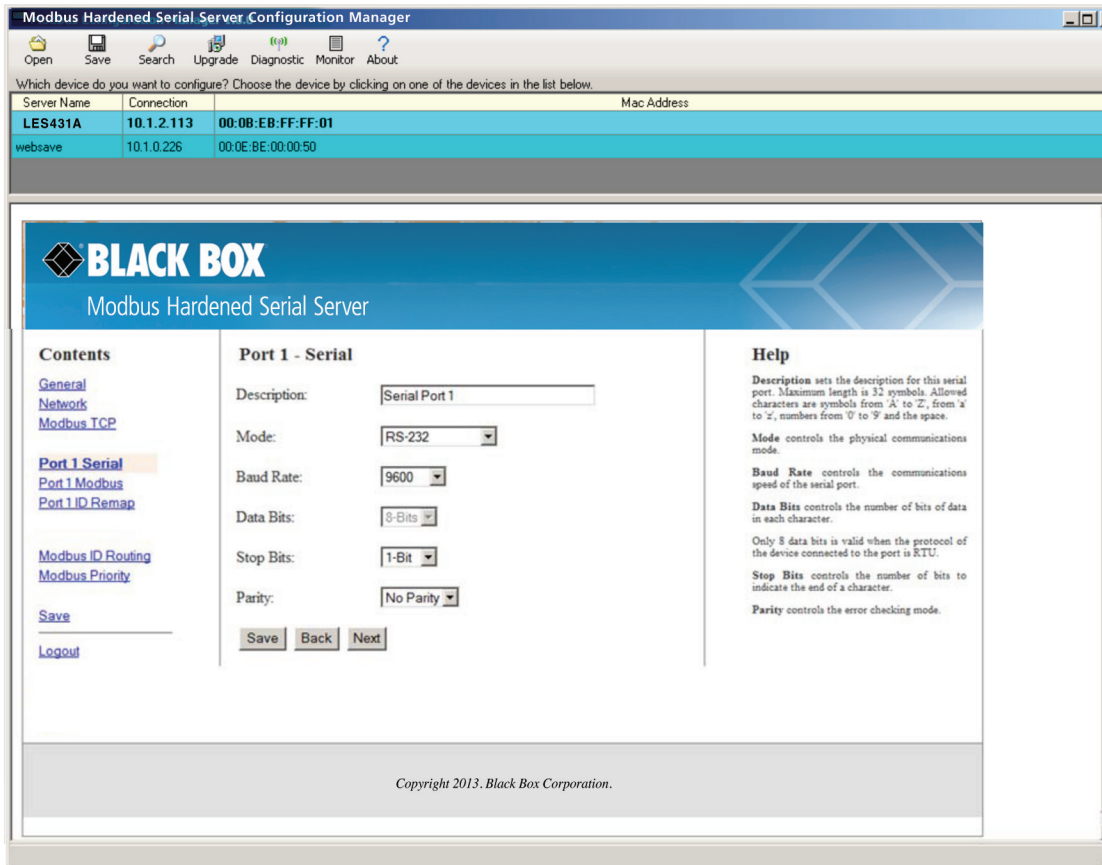


Figure 6-2. Serial Port 1 setup.

3. Configure Serial Port 1. In this case, it is RS-232, 19.2 kbps, 8 data bits, 1 stop bit, and even parity. Save the settings.
4. Access Port 1 Modbus by clicking the link on the left side of the screen.

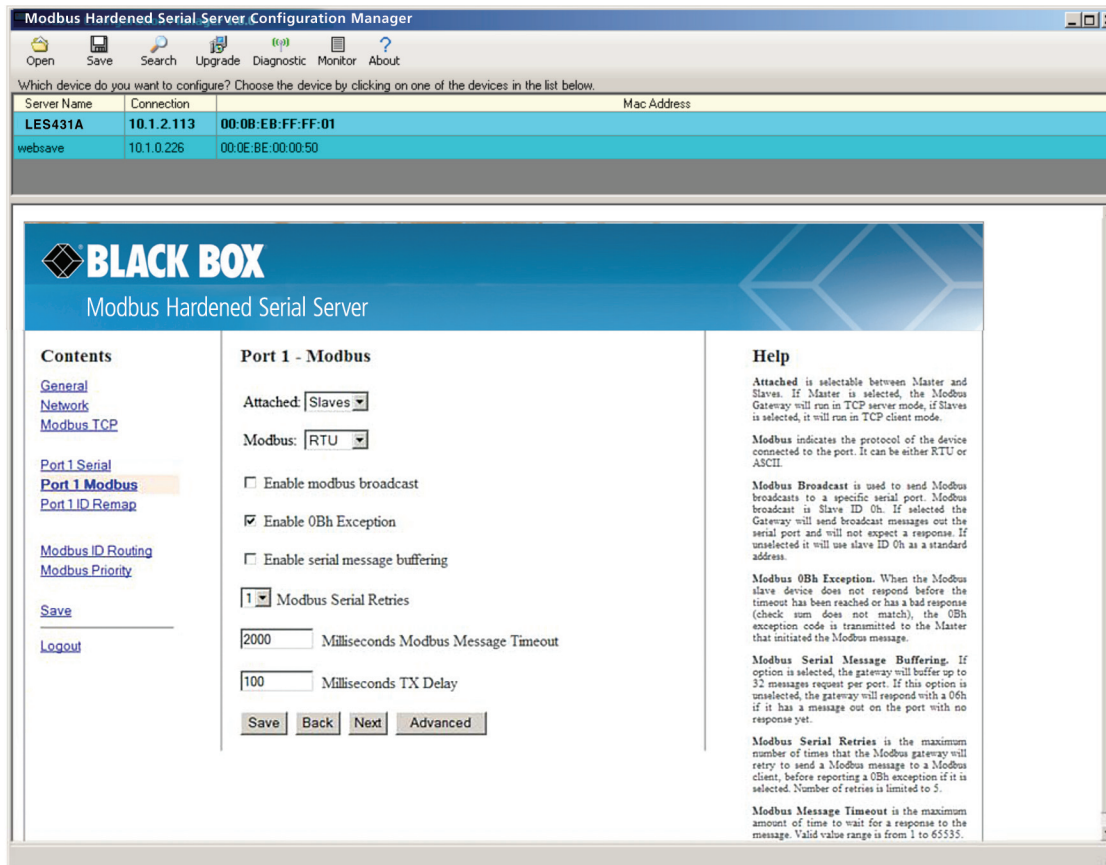


Figure 6-3. Port 1 Modbus.

5. Configure the Port 1 Modbus Settings. In this case, "Attached" should be slaves, "Modbus" should be RTU. The other settings depend on your application.
6. Access Modbus ID Remapping for each port and configure as necessary.

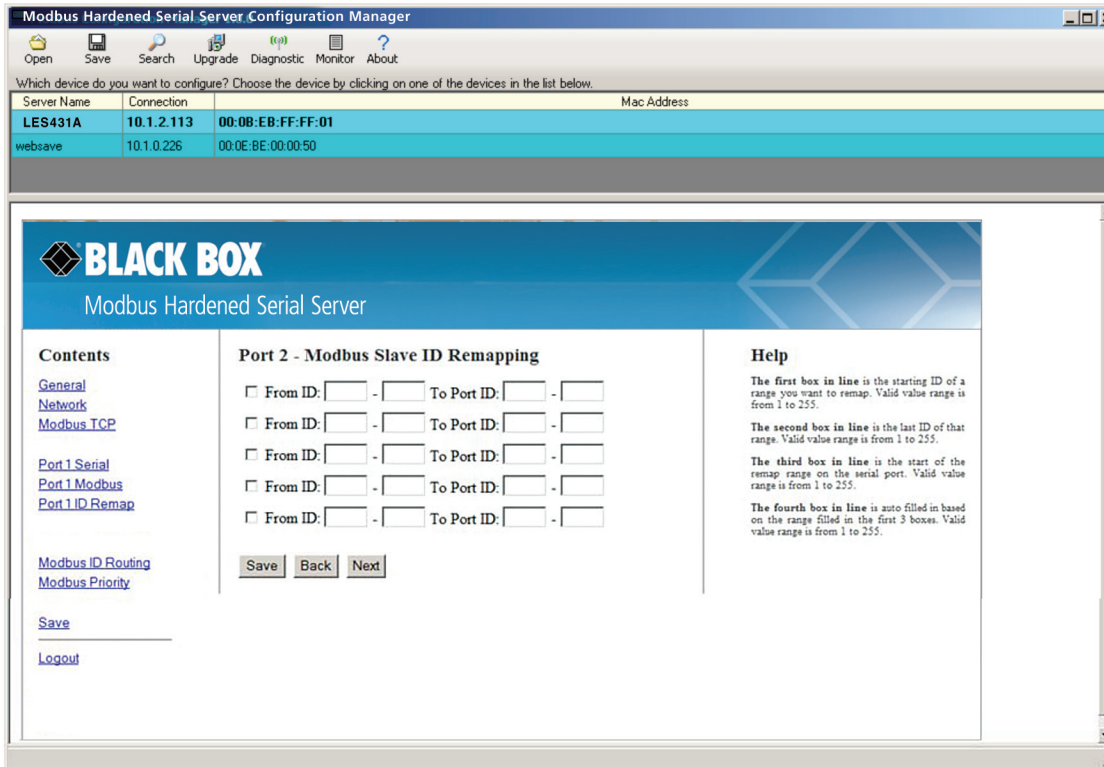


Figure 6-4. Port x Modbus Slave ID remapping.

7. Access Modbus ID Routing. Configure as necessary. In this example, Slave ID 200 is mapped to serial port 1.

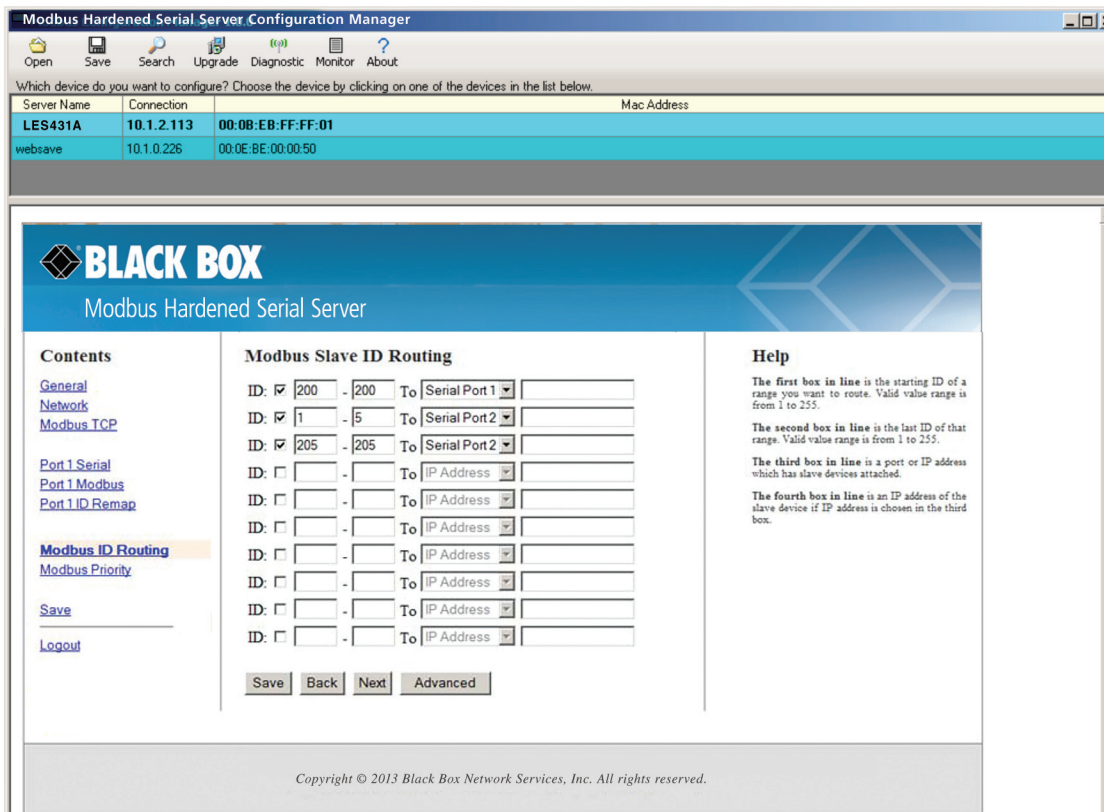


Figure 6-5. Modbus ID routing.

Chapter 6: Application Examples

8. Access the Modbus Priority screen and configure as necessary.

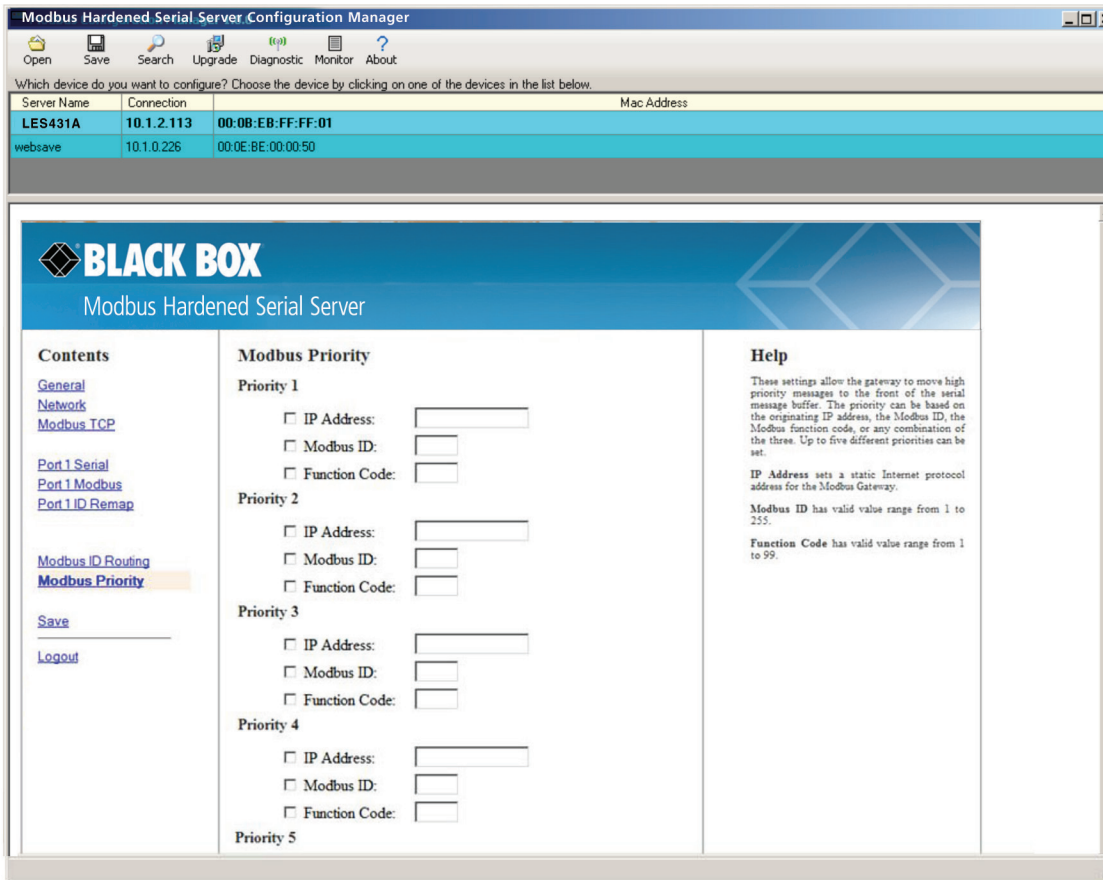


Figure 6-6. Modbus priority.

6.2 Serial and Ethernet Masters, Serial and Ethernet Slaves

Your Modbus Hardened Serial Server can also integrate multiple master devices onto serial and Ethernet Networks.

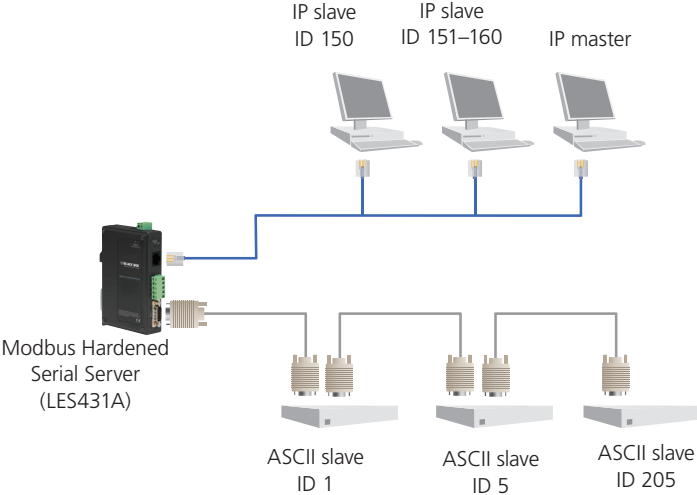


Figure 6-7. Serial and Ethernet masters, Serial and Ethernet slaves.

1. In this example, Serial Port 1 has an RTU master attached. Configure the serial port settings as appropriate for the device. Access the Port 1 Modbus screen and configure the port for Modbus master and RTU.

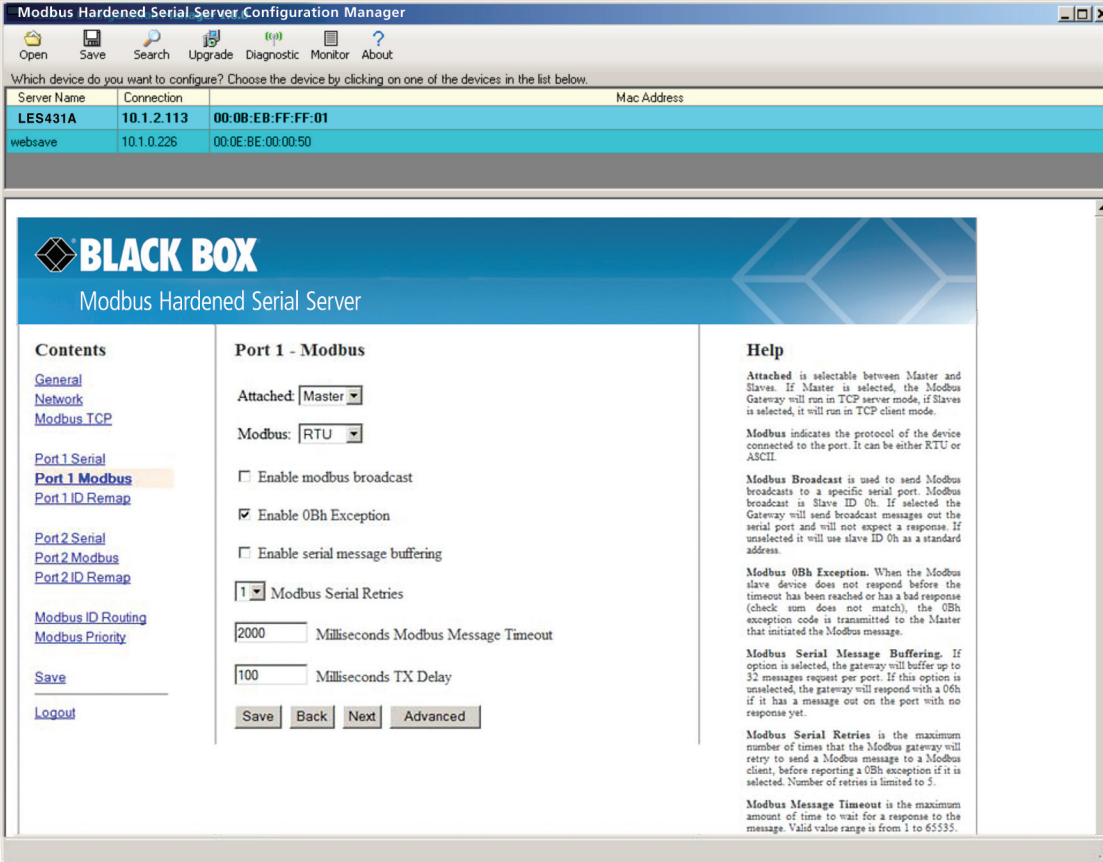


Figure 6-8. Port 1 Modbus.

Chapter 6: Application Examples

2. Configure the Modbus slave ID routing. In this case Modbus slaves 1 through 5 and 205 are on Serial Port 1. Modbus slaves 150 and 151 through 160 have IP assignments.

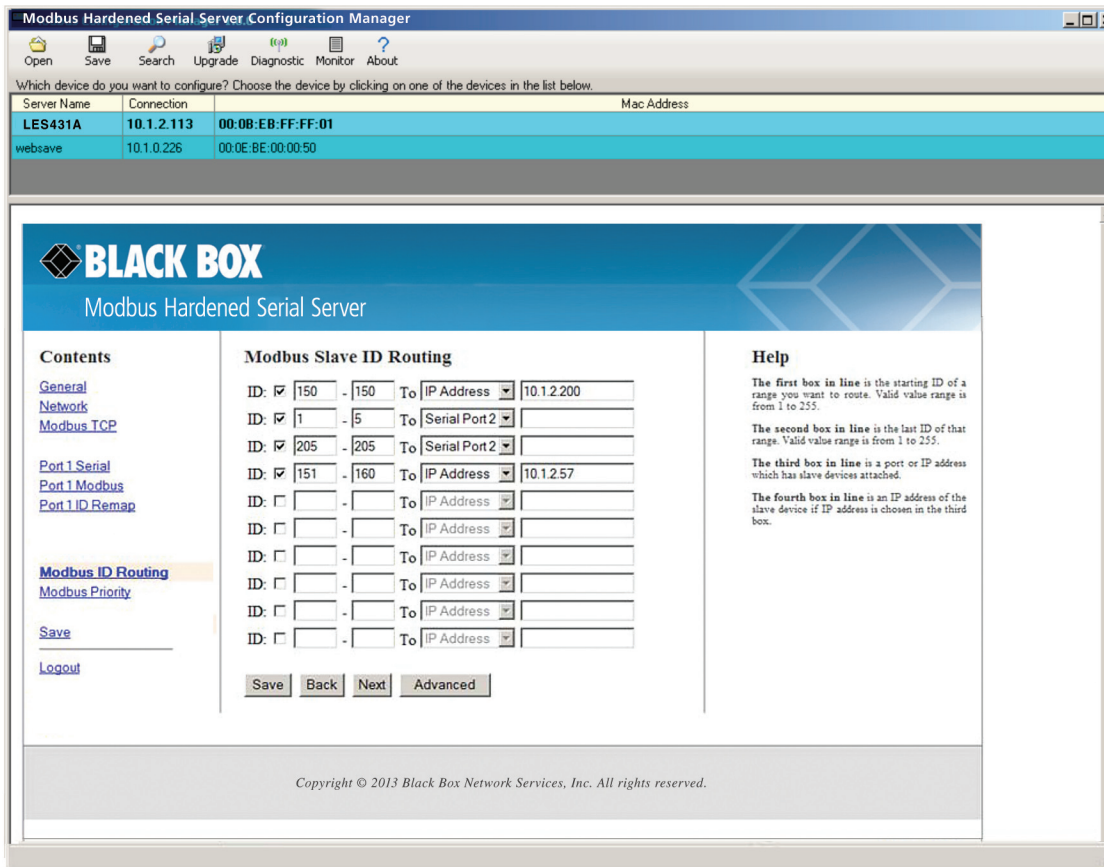


Figure 6-9. Modbus Slave ID routing.

6.3 Serial Masters, IP Slaves

Serial masters can be used to control IP slaves.

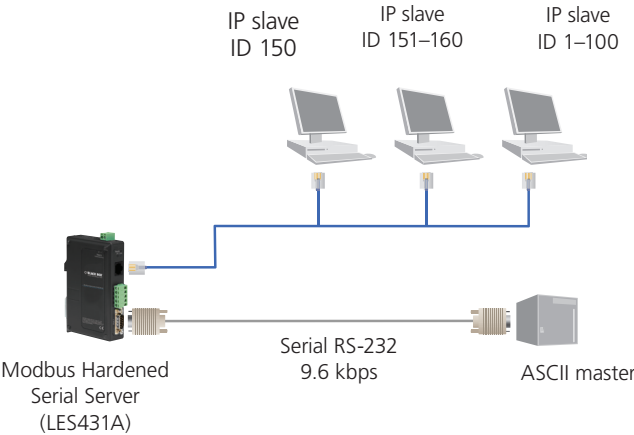


Figure 6-10. Serial masters, IP slaves.

1. In this example, an ASCII master is connected to Serial Port 1. Configure the serial port as appropriate for this device.

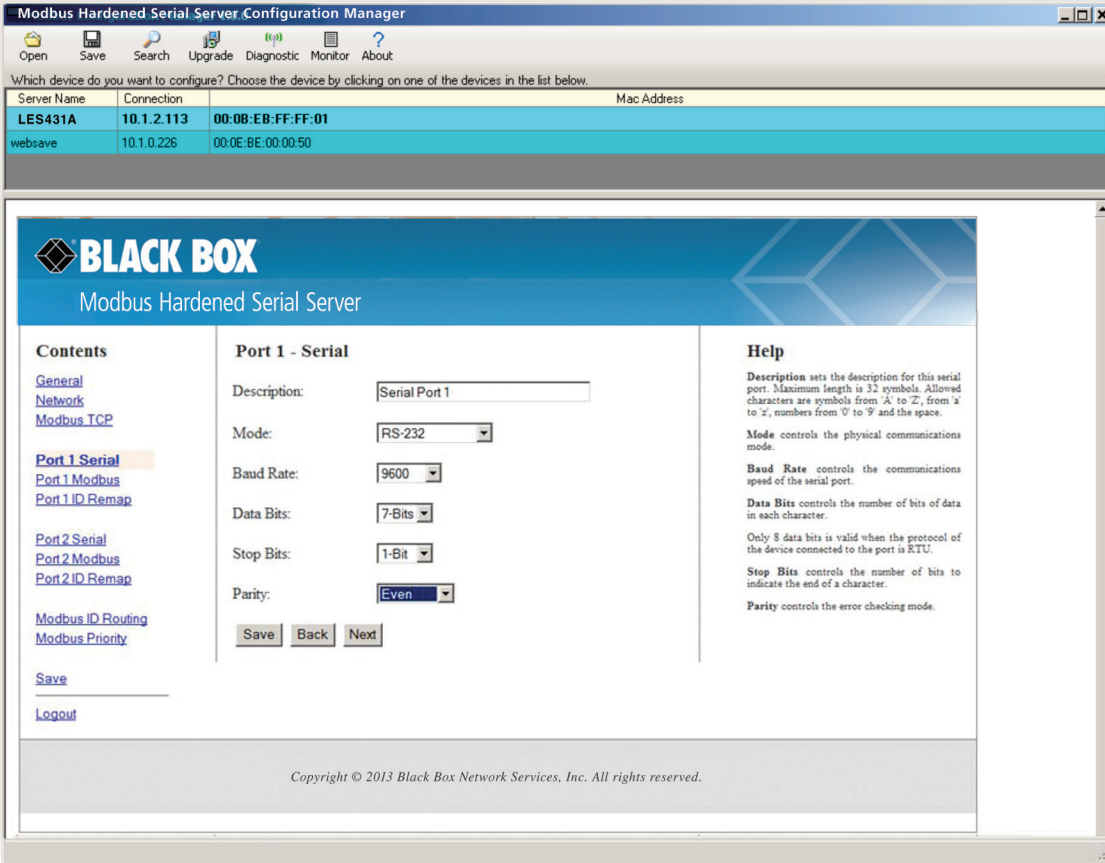


Figure 6-11. Port 1 Serial.

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2. Access the Modbus screen for each port and configure as appropriate. In this case, Port 1 has an ASCII master attached.

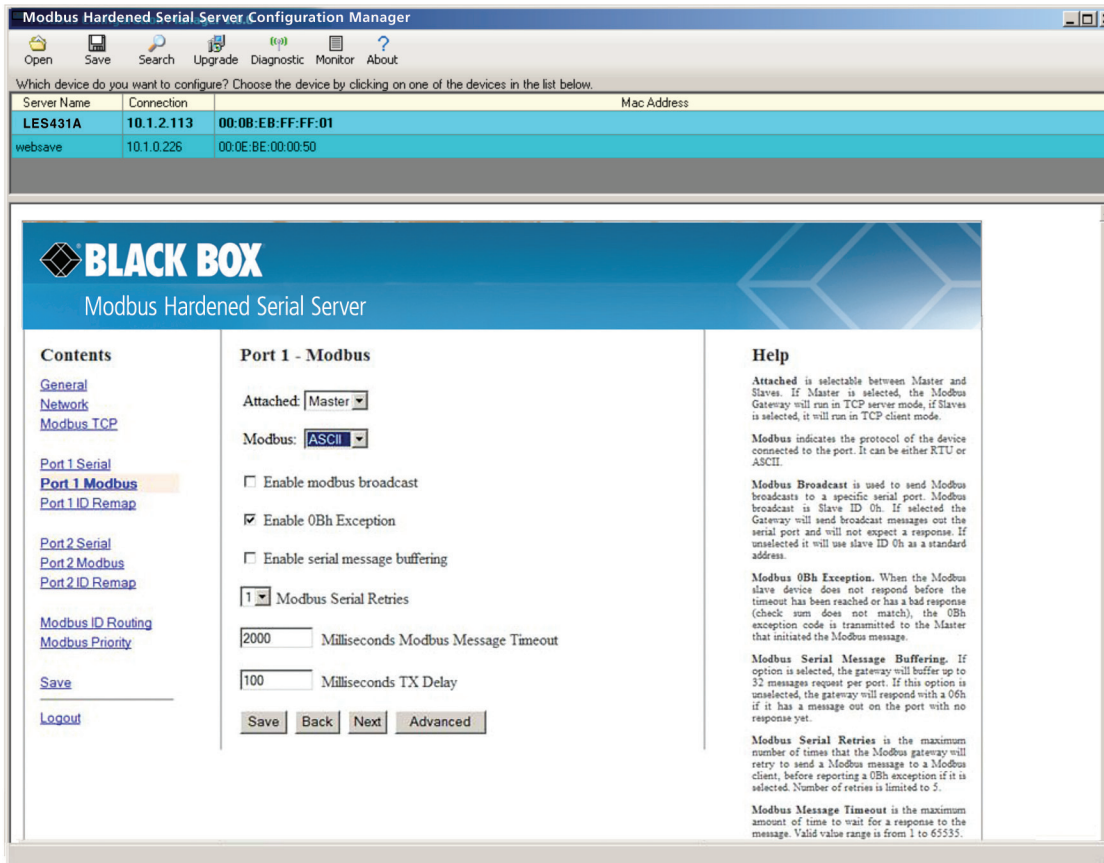


Figure 6-12. Port 1 Modbus.

3. Set up the Slave ID Routing to associate IP addresses with the appropriate Slave ID.

6.4 Identical Hard-Coded Slaves

In this example, two slave devices that are hard-coded with the same ID are required. This is accomplished by putting them on different serial ports.

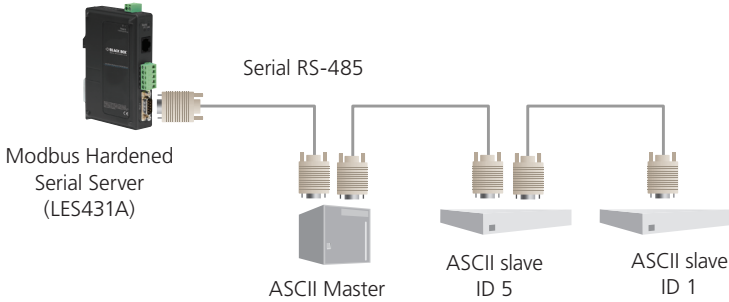


Figure 6-13. Identical hard-coded slaves.

6.5 Identical Production Lines

In this example, identical or backup production lines can be controlled by the same IP Master. This allows the duplicate networks to be configured identically, saving documentation and maintenance time.

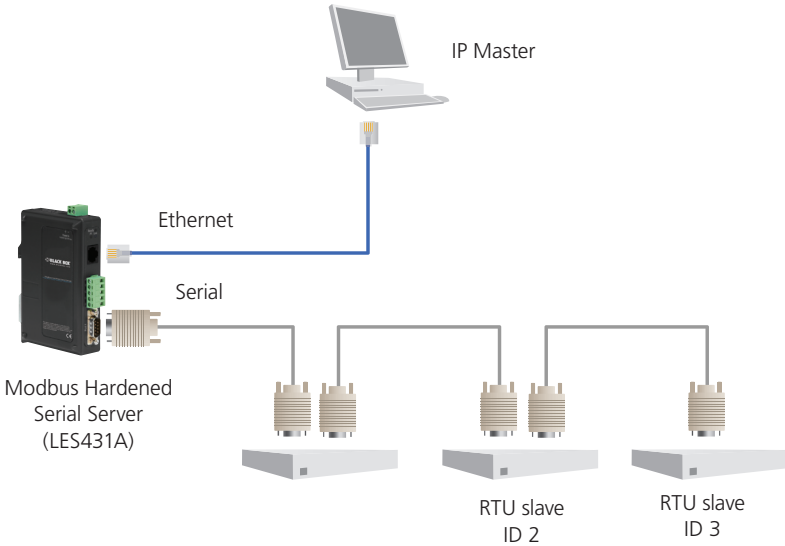


Figure 6-14. Identical production lines.

7. Modbus Help

7.1 Modbus ASCII/RTU Basics

The Modbus protocol emerged in the mid-1970s as an early protocol for linking terminals with Modicon PLCs using a master/slave (sometimes called a master/client) relationship. A simple, open, message-based protocol, it caught on quickly and became a de facto standard in the industry. It supports asynchronous point-to-point and multidrop communications and can be used with a variety of serial interfaces (RS-232, RS-422, RS-485, modems, etc.).

The original Modbus specification included two possible transmission modes: ASCII and RTU. Modbus RTU mode is the most common implementation, using binary coding and CRC error-checking. Modbus ASCII messages mode, though somewhat more readable because it uses ASCII characters, is less efficient and uses less effective LRC error checking. ASCII mode uses ASCII characters to begin and end messages, whereas RTU uses time gaps (3.5 character times) of silence for framing. The two modes are incompatible, so a device configured for ASCII mode cannot communicate with one using RTU.

All Modbus communications are initiated by Modbus masters using a polling query/response format. The master can send broadcast messages (using a slave address of 0), which all slaves accept, but do not reply to. More commonly, the master polls individual slaves sequentially. In each poll, it sends a message containing a device address, followed by a function code, any data that may be required, and an error check field. The addressed slave responds with a similar message structure. Typically, it repeats back its address and the function code, and then sends a field indicating the number of bytes of data it is sending, followed by the data and the error check field.

Slave addresses can range from 1 to 247. Function codes include several common ones typically used in all applications and additional ones that may be implemented in specific cases. Common function codes include: Read Coil Status (01), Read Input Status (02), Read Holding Registers (03), and Read Input Registers (04).

When a master sends a message to a slave, it expects to receive a valid response within a certain length of time. If the slave does not receive the message, or if the slave receives the message but an error is detected, it does not respond. If the slave cannot respond appropriately for some other reason (e.g. it does not recognize the function code), it will return a message containing an exception response.

7.2 Hints and Tips

A few simple suggestions that may assist you if your system is experiencing problems include:

- Slowing down the polling rate may be helpful if power cycling doesn't cure the problem.
- A common misperception is that every serial network must terminate with a resistor. While this was true of early serial network configurations, it's typically the wrong answer—contact Black Box Technical Support at 724-746-5500 or info@blackbox.com and verify if you're an exception.

A sometimes difficult problem is the difference in grounding voltage between various network locations. Stray voltage from lightning or other sources may also find its way onto the network. These conditions make isolation necessary in many settings.

Appendix A. Default Modbus Hardened Serial Server Settings

Table A-1. Default server settings.

Setting	Default Value
Server Name	User assigned
Password	Password field is blank from factory
DHCP	Enabled
IP Address	DHCP will configure. If a DHCP assignment is not available, the device will default to 169.254.102.39
Net Mask	255.255.255.0
Modbus Serial Server	169.254.102.100
MAC Address	Fixed—see bottom label
Firmware Version	X.X.X (Current Version)
Hardware Version	X.X (Current Version)
Port	1
Serial port mode	RS-232
Baud Rate	9600
Data bits	8
Parity	None
Stop bits	1
Flow Control	None
Protocol	TCP
Serial timeout	0 seconds
Inter-character timeout	0 ms
Protocol	TCP
TCP port	Port 1 = 4000
Max. connection	1

Appendix B: Connector Pinouts

Appendix B. Connector Pinouts

B.1 DB9 M Connector

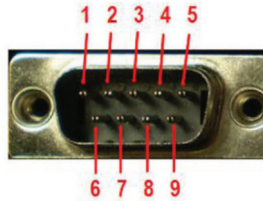


Figure B-1. DB9 M connector.

Table B-1. DB9 M connector pinout.

DB9 M Pin	Direction	RS-232
1	Input	DCD
2	Input	RXD
3	Output	TXD
4	Output	DTR
5	—	GND
6	Input	DSR
7	Output	RTS
8	Input	CTS
9	Input	RI

B.2 Terminal Block

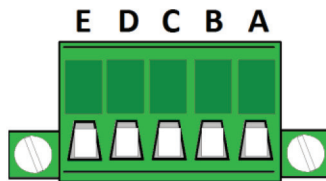


Figure B-2. Terminal block connector.

Table B-2. Terminal block connector pinout.

Terminal	RS-232	Direction (RS-232)	RS-422	RS-485
A	RTS	Output	TDA (-)	Data A (-)
B	TD	Output	TDB (+)	Data B (+)
C	CTS	Input	RDA (-)	—
D	RD	Input	RDB (+)	—
E	GND	—	GND	GND

NOTES:

1. In RS-422 mode, TX lines are outputs and RX lines are inputs. Connect the serial server TXB(+) line to the RXB(+) line of the serial device, and the serial server TXA(-) to the RXA(-) of the serial device.
2. Ground is signal ground and provides a common mode reference for the RS-422 receivers and transmitters.

B.3 Standard Ethernet Cable RJ-45 Pinout

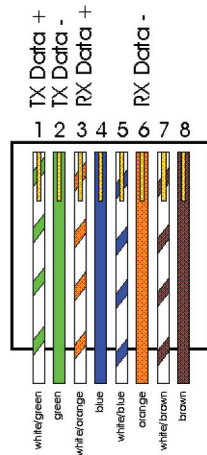


Figure B-3. RJ-45 Ethernet cable pinout.

Table B-3. RJ-45 cable pinout.

RJ-45 Pin	Signal	Wire Color
1	TX+	White-Green
2	TX-	Green
3	RX+	White-Orange
4	Not used	Blue
5	Not used	White-Blue
6	RX-	Orange
7	Not used	White-Brown
8	Not used	Brown

Appendix C: Glossary

Appendix C. Glossary

ADU—Application Data Unit.

ASCII—American Standard Code for Information Interchange.

Baud Rate—Number of bits per second.

CRC—Cyclical Redundancy Checking.

Data Bits—Number of bits per byte, normally 7 with Modbus ASCII, and 8 with Modbus RTU.

DHCP—Dynamic Host Configuration Protocol.

Flow Control—The process of managing the rate of data transmission between two nodes.

Function Code—A code field that tells the Modbus Hardened Serial Server what kind of action to perform.

GUI—Graphical User Interface.

IP—Internet Protocol.

IPv4—Internet Protocol version 4.

LED—Light emitting diode. Used as a visual indicator.

LES431A—Modbus Hardened Serial Server, RS-232/RS-422/485 on serial port.

MBAP—MODBUS Application Protocol.

MEI—Multi Electrical Interface via RS-232/422/485.

Modbus—A request/reply protocol that offers services specified by function codes.

Modbus Gateway — A bridge to get from Modbus TCP to Modbus Serial.

Parity Bit—A binary digit that is added to ensure that the number of bits with value of one in a given set of bits is always even or odd. It may also be a Mark (1), or a Space (0).

PDU—Protocol Data Unit.

RS-232—Interface between data terminal equipment and data circuit-terminating equipment employing serial binary data interchange.

RS-422—Electrical characteristics of generators and receivers for use in balanced digital point-to-point systems.

RS-485—Electrical characteristics of generators and receivers for use in balanced digital multipoint systems.

RTU—Remote Terminal Unit.

Stop Bit—Number of bit times after a character is transmitted before the next character can start transmission.

TCP—Transmission Control Protocol

Unit ID—Unit Identifier. This is the same as the slave's address.

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