EPE6

Installation and Programming Manual

This manual covers the setup and operation of the EPE6 Ethernet Port Expander.

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NR&D

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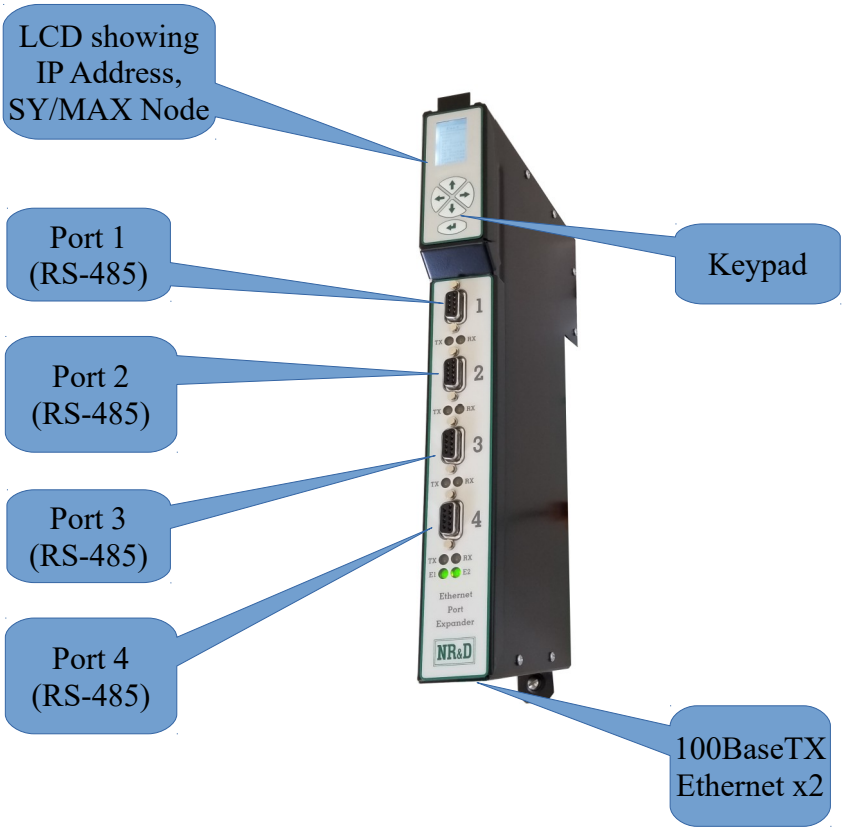
1 Introduction

The Niobrara EPE6 is a SY/MAX® rack-mounted module. It features four serial ports, two 10/100BaseTX Ethernet ports, and a SY/MAX backplane connector capable of rack addressing up to 2048 registers. The EPE6 allows simultaneous pass-through routing data messages from Modbus/TCP Ethernet, SY/MAX 802.3 Ethernet, SY/MAX serial, and Modbus serial between all ports. Full support of PLC programming message pass-through is also provided on all communication ports including SFW375, SY/MATE, and Winmate.

Figure 1.1:EPE6 Front Panel



The EPE6 features two 100BaseTX Ethernet ports that support Modbus/TCP as both a client and a server at the same time. The EPE6 can support up to 64 simultaneous Modbus/TCP connections. A routing table is used to map the incoming Modbus/TCP Destination Index (Slave Address) from an Ethernet client to a downstream route that determines where the message is directed. This route may point to a PLC or slave on one of the EPE6's serial ports, or even back out the Ethernet port to a different device. The Ethernet port also supports the older SY/MAX 802.3 protocol for smoothly integrating legacy Square D Model 650 and 450 PLCs into a Modbus/TCP system.

The two 100BaseTX Ethernet ports support Rapid Spanning Tree Protocol (RSTP) allowing the EPE6 to be used in a copper ring network for redundant Ethernet cable connections. It may also be used in a daisy-chain Ethernet network as well.

There are four serial ports on the EPE6. The ports may operate in 4-wire RS-422, 4-wire RS-485, or 2-wire RS-485 modes with selectable termination and bias. The ports may be independently configured for one of 18 different protocols including Modbus RTU, Modbus ASCII, and SY/MAX. The default mode supports SY/MAX.

The EPE6 features a front panel backlit LCD and keypad that may be used for configuration and troubleshooting. The IP Address and most serial port settings may be configured through this interface which may be password protected to prevent unauthorized changes.

A built-in web server is included in the EPE6. This password protected, AJAX Javascript enabled server allows two user levels for configuration, backup/restore, troubleshooting, and even firmware updating – all from a standard web browser.

2 Installation

WARNING: Do not connect the EPE6 to any Ethernet or network before configuring the appropriate network addresses. Duplicate network address may lead to improper network communication, equipment damage, injury, or death.

Device Mounting/Removal

(1) Remove power from register rack or NRK2.

(2) Mount EPE6 in an available slot in the register rack, or in the NRK2.

(3) Apply power to register rack or NRK2.

Ethernet

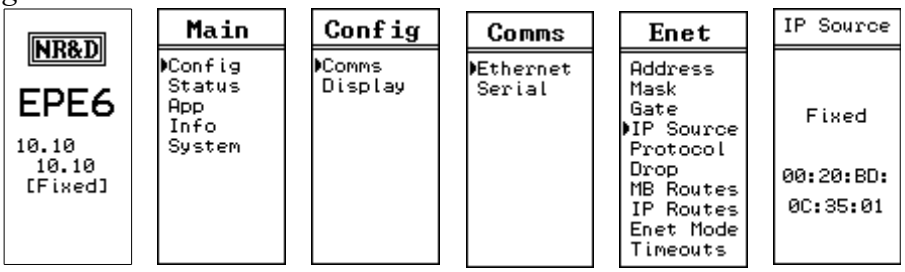
Setting the IP Address

The EPE6 defaults to a fixed IP Address of 10.10.10.10. This is easy to change through the use of the front panel keypad. The EPE6 supports fixed IP Address, DHCP, or BOOTP. Press the ➡ key four times to step through the "> Main > Config > Comms > Ethernet >" pages.

If BOOTP or DHCP is desired, ⬇ arrow to the IP Source menu item, and then press the ➡ key. The ⬆ and ⬇ arrows are used to select FIXED, DHCP, or BOOTP. The ↵ key is used to accept the new value and return to the previous menu.

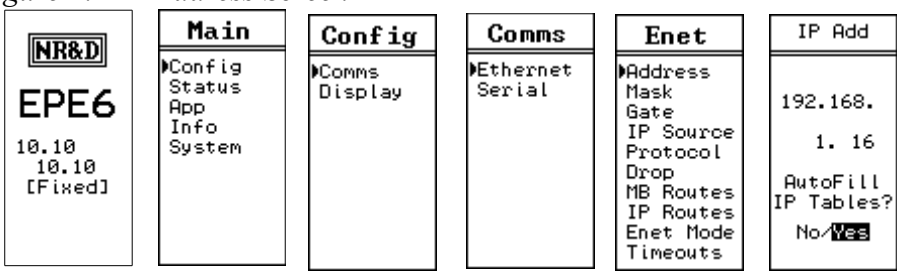
NOTE: BOOTP and DHCP operation usually requires that the server be configured for the MAC Address of the EPE6. The EPE6's MAC address is printed on the serial number label and is also shown on IP Source screen. The example below shows a MAC Address of 00:20:BD:0C:35:01.

Figure 2.1 IP Address Source Screen



If a fixed address is required, make sure that the IP Source is set to Fixed, then select the Address page. The ⇧ and ⇩ arrows are used to adjust the values while the ⇨ and ⇦ arrows move between fields. The ↵ key is used to accept the new value.

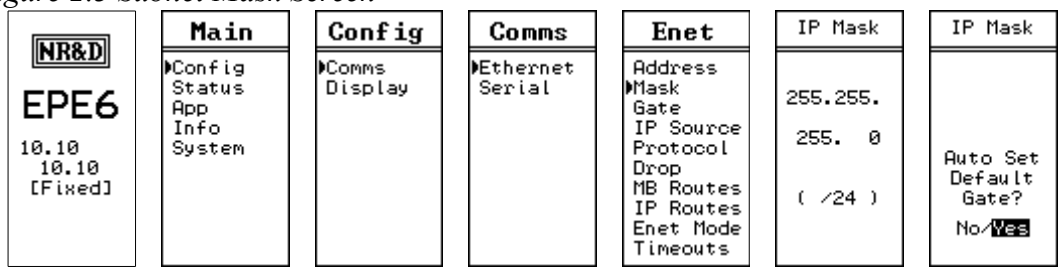
Figure 2.2 IP Address Screen



Setting the Subnet Mask

The Subnet Mask edit page is designed to quickly step through the valid bit-mapped options. Pressing the ↑ and ↓ arrows adjusts the mask value. The ↵ key is used to accept the new value.

Figure 2.3 Subnet Mask Screen

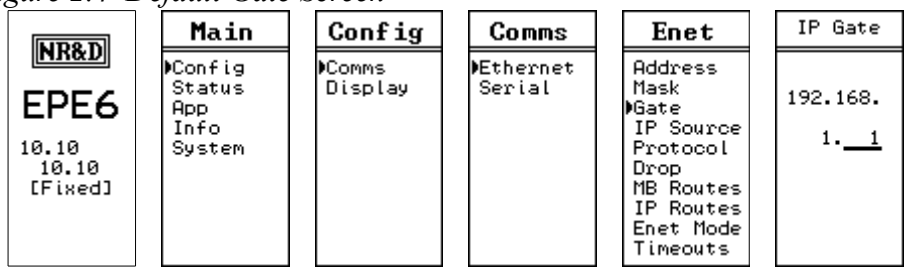


The "Auto Set Default Gate?" applies the new subnet mask to the current IP Address to preset the Default Gate.

Setting the Default Gate

The Default Gate edit page functions just like the IP Address edit page.

Figure 2.4 Default Gate Screen



Ethernet Connection

After the IP Address is configured for the EPE6, it is safe to connect the Ethernet port to the network. The EPE6 includes a standard RJ-45 Ethernet connector with indicators for Link/Activity (green LED) and 100Mb (amber LED). (See Figure 2.5 Ethernet Port) The green Link/Activity light illuminates when the EPE6 has a valid link to the attached network port and blinks off while experiencing network traffic. The 100Mb amber LED is illuminated when the Ethernet port has negotiated 100Mb operation and off while configured for 10Mb operation.

The EPE6's Ethernet port supports 10/100BaseTX auto-crossover operation. Standard CAT5 cables may be used to connect the EPE6 to Ethernet switches and hubs.

Figure 2.5 Ethernet Port

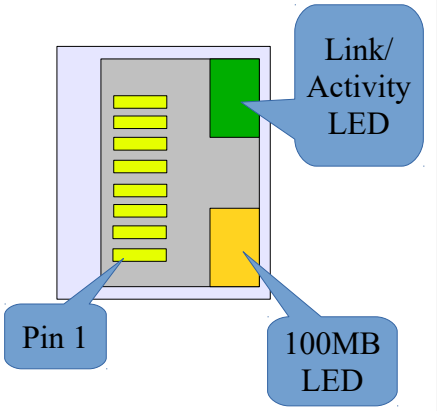
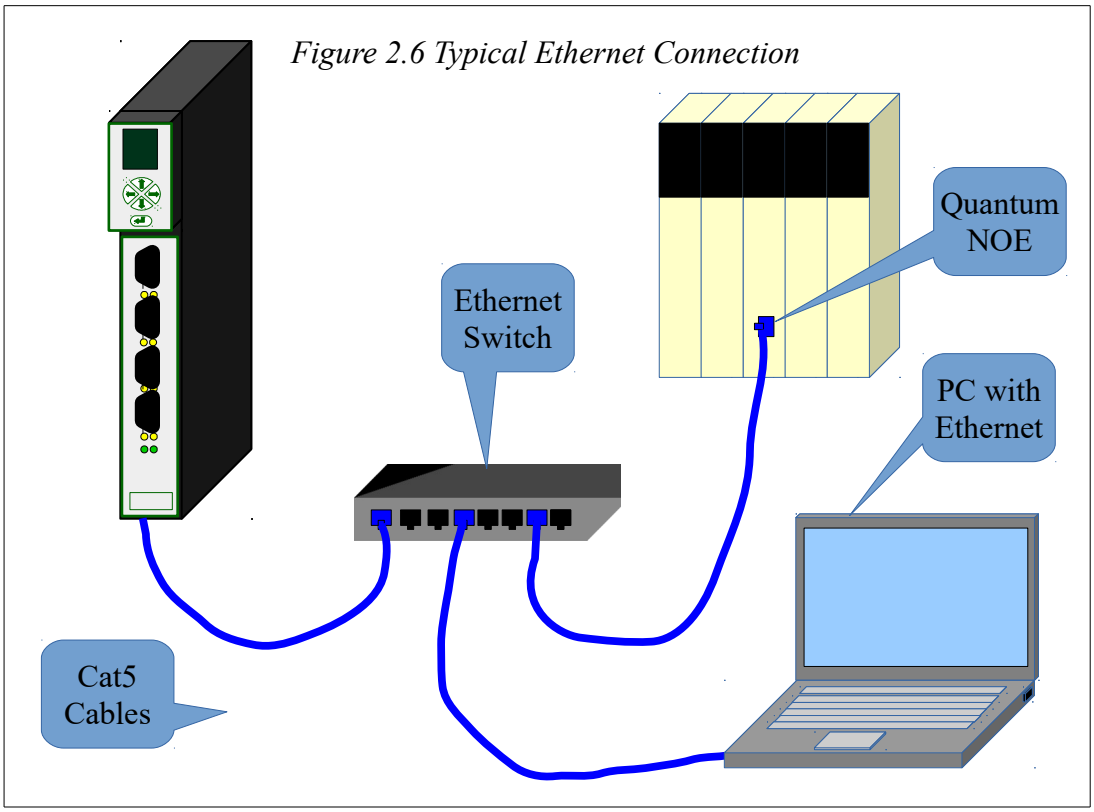
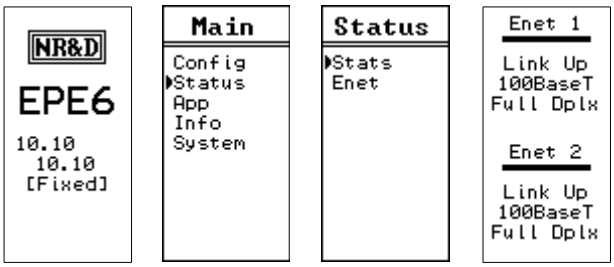


Figure 2.6 Typical Ethernet Connection



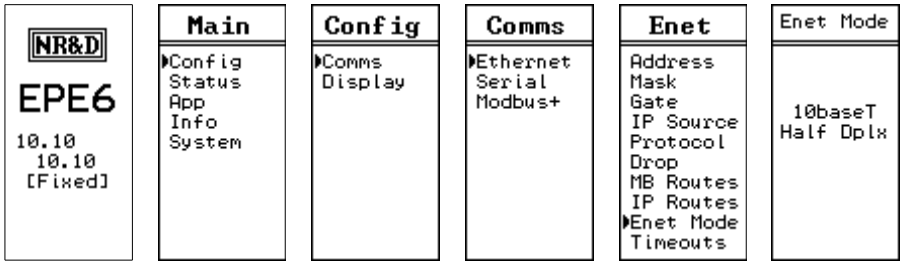
The status of the Ethernet port may be inspected through the front panel LCD by choosing "> Main > Status > Enet >"

Figure 2.7 Ethernet Status



The Ethernet port 1 defaults to "Auto" mode but may be manually set to a fixed 10BaseT or 100BasetT with fixed Full or Half Duplex operation. Ethernet port 2 is always "Auto".

Figure 2.8 Ethernet Mode Configuration for Enet Port 1



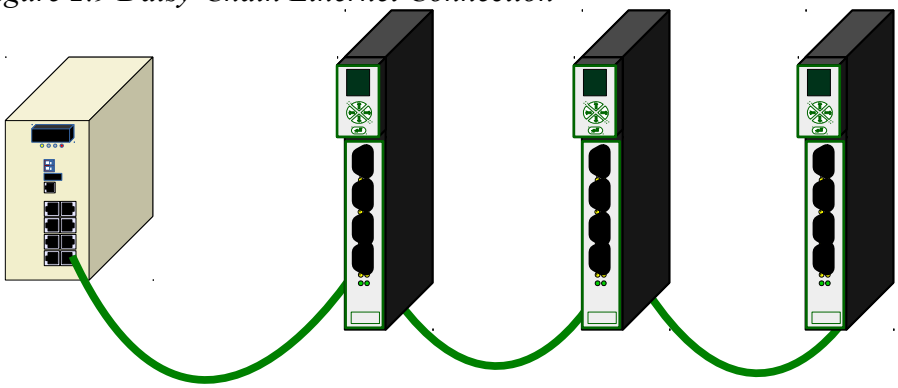
EPE6 Second Ethernet Port

The EPE6 includes two Ethernet ports. The current firmware of the EPE6 supports this second port as daisy-chain or copper ring operation. A future firmware upgrade will allow the second port to operate independently with a second IP Address.

Daisy-Chain Operation

The EPE6 may have its Ethernet ports connected in a Daisy-Chain fashion.

Figure 2.9 Daisy-Chain Ethernet Connection

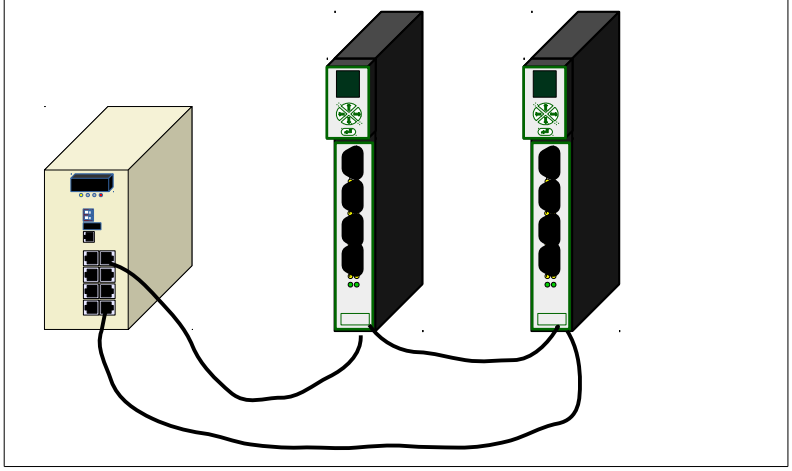


NOTE: Communication to downstream Ethernet devices may be lost if one of the daisy-chain units fails or loses power.

Copper Ring Operation

The EPE6+T may be used in a copper RSTP ring with an appropriate Ethernet switch such as the Schneider-Electric ConneXium TCSESM083F23F0. This ring operation provides redundant cable paths to each EPE6.

Figure 2.10 Copper Ring Operation



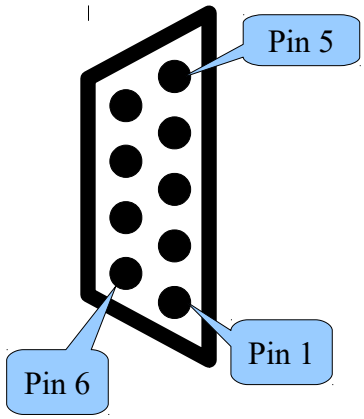
Serial Ports

The EPE6 includes four serial ports. These ports are all RS-485/422 compatible DB9 connectors. The pinout is shown in Figure 2.11 RS-485 Port.

Table 2.1: RS-485 pinout

Pin	Name	Function
1	TX-	(-) data out from EPE6
2	TX+	(+) data out from EPE6
3	RX-	(-) data into EPE6
4	RX+	(+) data into EPE6
5	CTS-	Must be driven more negative than pin 7 for EPE6 to transmit
6	RTS-	Driven low (0V) when EPE6 is ready to transmit
7	CTS+	Must be driven more positive than pin 5 for EPE6 to transmit
8	RTS+	Driven high (5V) when EPE6 is ready to transmit
9	Shield	

Figure 2.11 RS-485 Port



Software Installation

The EPE6_SETUP.EXE file includes this user manual, EPE5SW32.EXE configuration software, the EPE6 firmware files, the RPCLOAD.EXE firmware loader utility, and the

NRDTOOL.EXE register viewer utility. The latest version of this file is located at www.niobrara.com. Follow the link for “Download Area”, select “Module Software” and then “EPE6_SETUP.EXE”. While the EPE5SW32 configuration software is capable of configuring most options in the EPE6, it is recommended to use a web browser or the front panel for the best configuration experience.

Updating the EPE6 Firmware

On occasion it may be necessary to update the operating system of the EPE6.

Updating Firmware through the Web server

This action may be quickly done through the built-in web server.

1. Log into the EPE6's web server as user:admin.
2. Click on the “Admin” link in the left green menu column.
3. Click on the “Update Firmware” link in the left green menu column.
4. Click on the “Browse” button and select the “C:\Niobrara\Firmware\EPE6.qrc” file.
5. Press the “Start Download” button to begin the update.

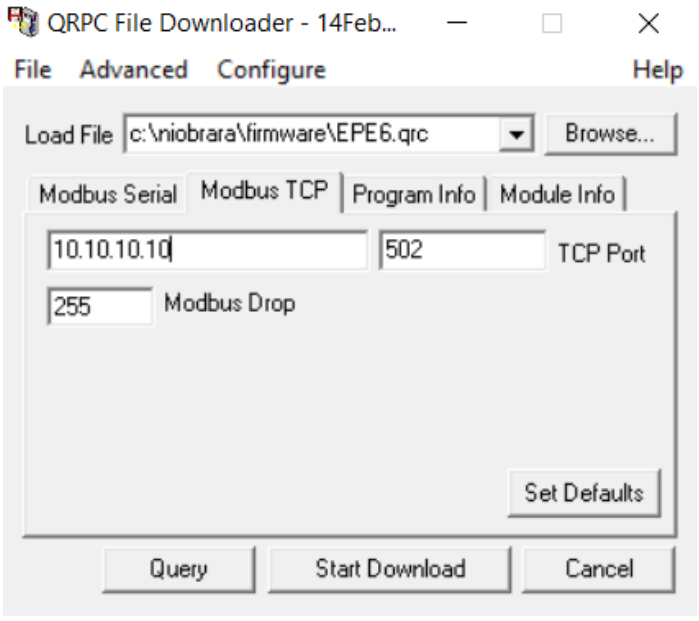
Updating Firmware using RPCLOAD

The RPCLOAD program may be used to install the EPE6 firmware through the Ethernet connection using Modbus/TCP.

If the EPE6 already supports the built-in web server, use the firmware update feature of the web server instead of RPCLOAD. The update process is much faster using the web server.

1. Make sure the EPE6 is powered and running.
2. Start RPCLOAD.EXE. The Windows Start Menu link is “Start, Programs, Niobrara, EPE6, RPCLOAD EPE6 Firmware”.
3. Click on the Browse button and select EPE6.qrc.
4. Select the Modbus TCP tab.
5. Enter the IP Address of the target EPE6 (i.e. 192.168.0.205)
6. Make sure that the TCP port is set to 502.
7. Make sure that the Modbus Drop is set to 255.
8. Press the “Start Download” button. RPCLOAD will open a progress bar to show the status of the download.

Figure 2.12: RPCLOAD Screen



3 Modbus/TCP Operation

The EPE6 can operate as both a Modbus/TCP Server (slave to external masters) and Client (master to external slaves) at the same time. Up to 64 simultaneous TCP/IP connections may be made to the EPE6. These connections are dynamically split between client and server operation.

Server Operation

The EPE6 listens for Modbus/TCP connections on the standard Modbus/TCP port number of 502. Modbus/TCP commands or queries generated by a client are processed by the EPE6 by examining the Destination Index (Modbus Slave Address) of the message.

A look-up table is used to map the Destination Index to a route that tells the EPE6 where to send the message. This table consists of a column for the Destination Index, a translation description (from legacy SY/MAX operation), and a downstream route.

The example in Figure 3.1 shows a PC connected via Ethernet to an EPE6.

A network of power meters is connected to port 1 (drop 101) of the EPE6. The three power meters are addressed as Modbus slaves 1, 2, and 3.

A SY/MAX PLC is connected to port 2 (drop 102) of the EPE6. It will be accessed as index number 1.

Table 3.1 gives a Modbus Routing table for this example. The PC would use index 1 to communicate with the SY/MAX PLC. Index 2 is not used. Index 3 will reach power meter #1.

NOTE: Indeces 0 and 1 have a route of NONE. The EPE6 will internally process incoming Modbus/TCP messages with no route, the special index 255, or any route that doesn't leave the EPE6. This action may result in unexpected reply data since this data is from the EPE6 itself.

Figure 3.1 Ethernet Modbus Routing Example

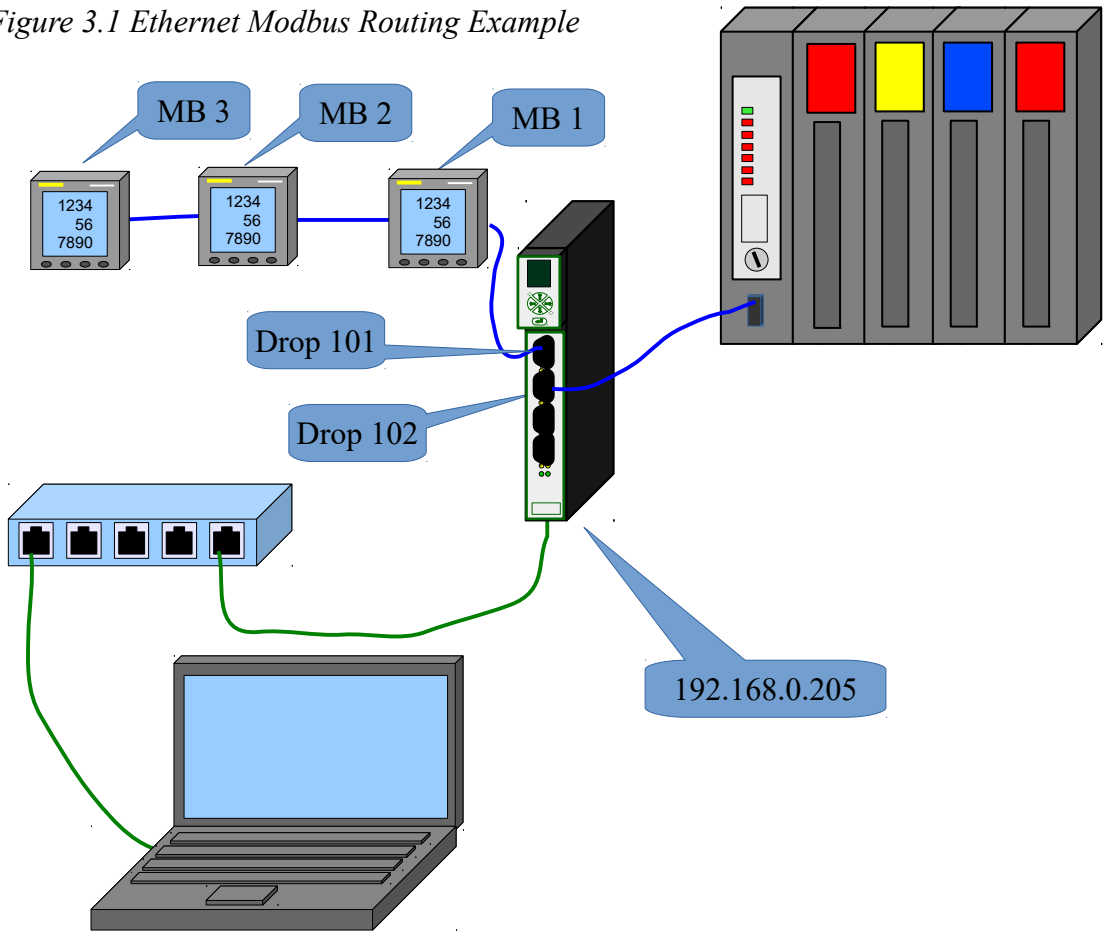


Table 3.1: Ethernet Modbus Routing Table Example

Index	Type	Route	Comments
0	OTHER	NONE	EPE6 Itself
1	OTHER	102	SY/MAX PLC
2	OTHER	45,6,15	EPE6
3	MODBUS	102,1	Power Meter 1
4	MODBUS	102,2	Power Meter 2
5	MODBUS	102,3	Power Meter 3

Default Modbus Routing Table

The default Modbus Routing table for the Ethernet port maps Modbus/TCP destination index values 1-32 to device addresses 1-32 on port 1 of the EPE6. Table entries 1 through 32 are set to have the first drop be port 1's drop number and the second drop be the same as the device address for devices 1 through 32. Entries 33 through 64 use Port 2's drop number, 1 through 32. Entries 65 through 96 use Port 3's drop number, 1 though 32. Entries 97 through 128 use Port 4's drop number, 1 through 32.

Table 3.2: Default Ethernet Modbus Routing Table for Port 1 Drop 1, Port 2 drop 101, Port 3 drop 2, and Port 4 drop 102

Index	Type	Route
0	OTHER	NONE
1	MODBUS	101,1
2	MODBUS	101,2
...	MODBUS	...
31	MODBUS	101,31
32	MODBUS	101,32
33	MODBUS	102,1
34	MODBUS	102,2
...	MODBUS	...
63	MODBUS	102,31
64	MODBUS	102,32
65	MODBUS	103,1
66	MODBUS	103,2
...	MODBUS	...
95	MODBUS	103,31
96	MODBUS	103,32
97	MODBUS	104,1
98	MODBUS	104,2
...	MODBUS	...
127	MODBUS	104,31
128	MODBUS	104,32
129	OTHER	NONE

AutoFix Modbus Table

The EPE6 offers to “AutoFix” the Modbus Routing tables after a serial port drop number is altered. The Ethenet and remaining serial port Modbus Routing tables are examined and entries where the first drop of the route matches the old port drop number are changed to match the new drop number.

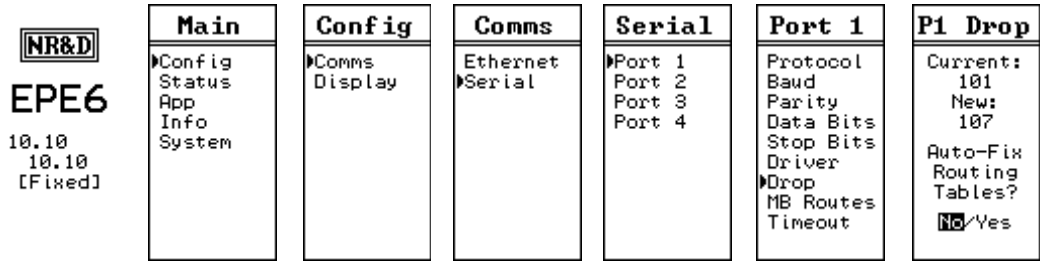


Figure 3.2: Edit Modbus Plus Drop

Table 3.3: Ethernet Modbus Routing Table relative to Port 1 Drop 25 after AutoFix

Index	Type	Route
0	OTHER	NONE
1	MODBUS	25,1
2	MODBUS	25,2
3	MODBUS	25,3
...	MODBUS	...
31	MODBUS	25,31
32	MODBUS	25,32

Front Panel Modbus Route Edit

The Ethernet Modbus Routing tables may be modified from the front panel. The “Index” field may be changed with the UP and DOWN arrows. Pressing the ENTER button on the Index field will exit this screen.

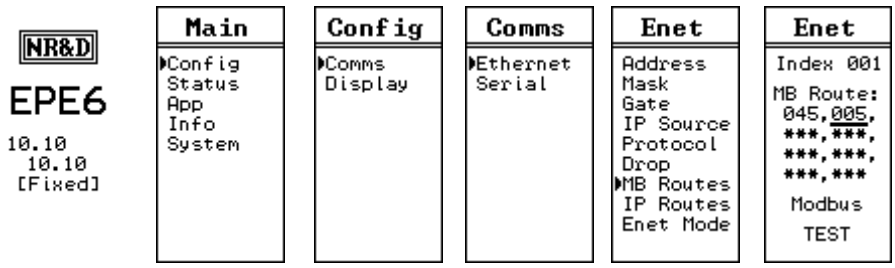


Figure 3.3: Modbus Route Edit Screen

Pressing ENTER button on the TEST field will cause the EPE6 to generate a Modbus opcode 03 Holding Register read of the target device. The test will report PASS or FAIL. A "Downstream Timeout" is a failure but an Error 01 (Illegal Opcode) or Error 02 (Illegal Register) are PASS because the target device responded with the error.

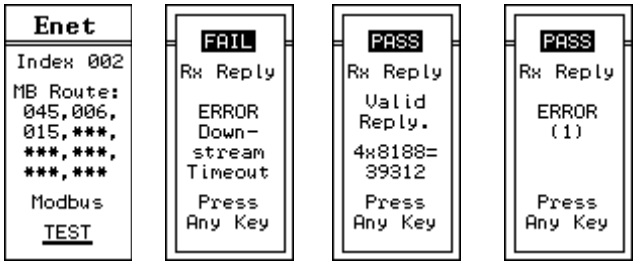


Figure 3.4: Modbus Route Edit TEST Screens

Client Operation

The EPE6 may act as a Modbus/TCP Client even while simultaneous Server operations are occurring. Serial master devices may generate read or write messages that are routed out the EPE6's Ethernet port to access remote Servers.

The EPE6 uses a look-up table to map routing drop numbers to TCP/IP addresses. This table is called the TCP Routing Table within EPE5W32. This table consists of a drop number, target IP Address, and an optional Downstream Route. Messages passing through the EPE6 from the serial ports (or the Ethernet port itself) that are directed out the Ethernet port are sent to the TCP Routing Table to determine the target device.

Figure 3.5 shows an EPE6 connected to a SY/MAX PLC via serial port 1. The Ethernet port is set to be drop 0 and is connected to a Quantum PLC at IP Address 192.168.0.24 and an M340 PLC at 192.168.0.25.

Figure 3.5 Modbus Client Routing Example

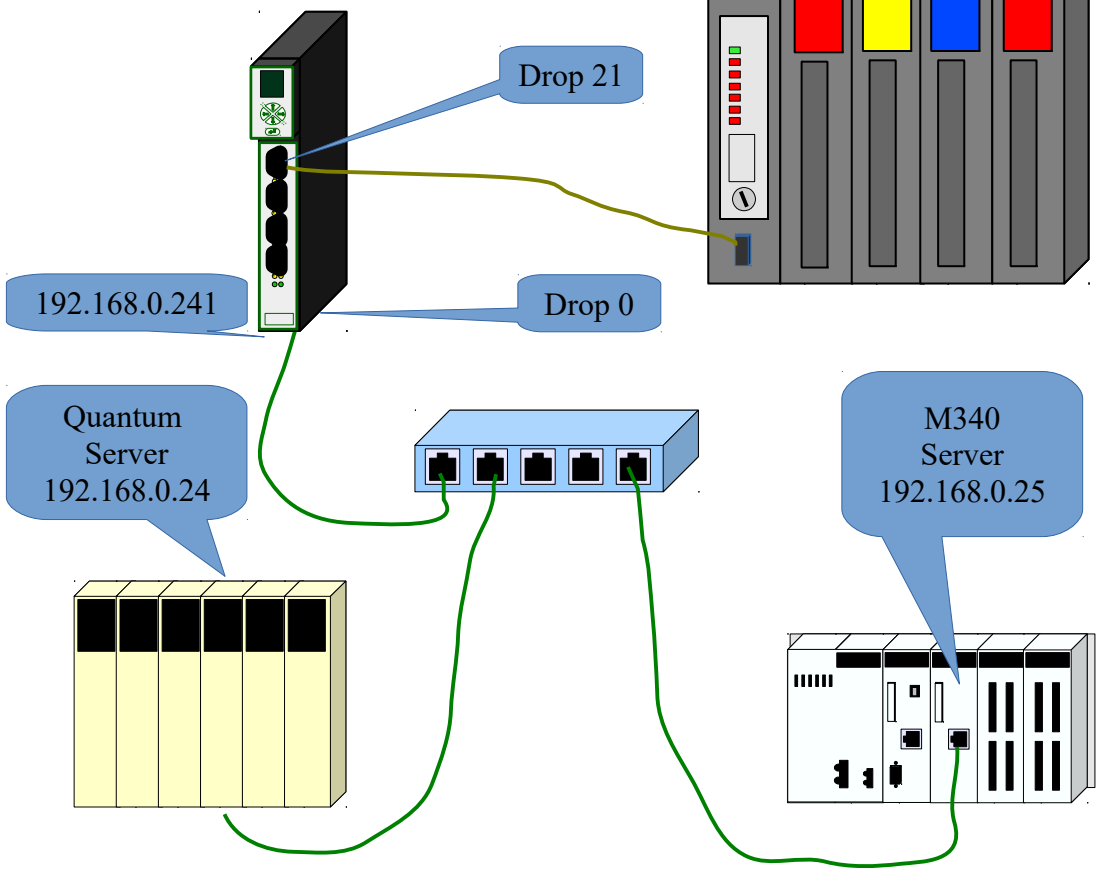


Table 3.4: EPE6 TCP Table Example

Drop	IP Address	Downstream Route	Comments
0	0.0.0.0	NONE	
1	192.168.0.24	NONE	Quantum PLC
2	192.168.0.25	NONE	M340 PLC
3	192.168.0.205	NONE	EPE6 from Figure 3.1
4	0.0.0.0	NONE	

The table below shows routes for TREADs for the SY/MAX PLC in this example.

- The first drop (21) in the route is the drop number of the EPE6 serial port 1.
- The second drop (0) is the Ethernet port of the EPE6.
- The third drop (1, 2, and 3) is the TCP table look-up drop. This number defines the target IP Address.
- The fourth drop (0, 1, 2, 3, 4, 5, and 255) is the destination index for the Modbus/TCP message sent to the target IP device. The local M340 and Quantum NOEs don't care about the value of this number. This number is used in the Modbus Routing table in the remote EPE6 to determine the target for the MSTR message.

Table 3.5: TREAD/TWRITE Routes for SY/MAX PLC in Figure 3.5

MSTR MB+ Route	Target
21,0,1,0	Quantum at 192.168.0.24
21,0,2,0	M340 at 192.168.0.25
21,0,3,1	Compact in Figure 3.1
21,0,3,2	Quantum in Figure 3.1
21,0,3,3	Power Meter 1 in Figure 3.1
21,0,3,4	Power Meter 2 in Figure 3.1
21,0,3,5	Power Meter 3 in Figure 3.1
21,0,3,255	EPE6 in Figure 3.1

NOTE: When the EPE6's Ethernet port is in Modbus+SYMAX mode, the TCP table is how the unit decides to connect a client message via Modbus/TCP or SY/MAX 802.3. If the IP Address for a given drop number is 0.0.0.0 then the message is sent out as SY/MAX 802.3 to that drop number.

AutoFill TCP Table

Changing the IP Address from the front panel keypad will prompt the user to automatically adjust the TCP Routing Table. This feature will automatically fill in the first three bytes of the local IP Address and have the fourth byte match the drop number.

Table 3.6: Default Ethernet TCP Routing Table

Drop	IP Address	Route
0	0.0.0.0	NONE
1	0.0.0.0	NONE
2	0.0.0.0	NONE
3	0.0.0.0	NONE

Table 3.7: Ethernet TCP Routing Table for 206.223.51.155 after AutoFill

Drop	IP Address	Route
0	206.223.51.0	NONE
1	206.223.51.1	NONE
2	206.223.51.2	NONE
3	206.223.51.3	NONE

Front Panel Edit of TCP Table

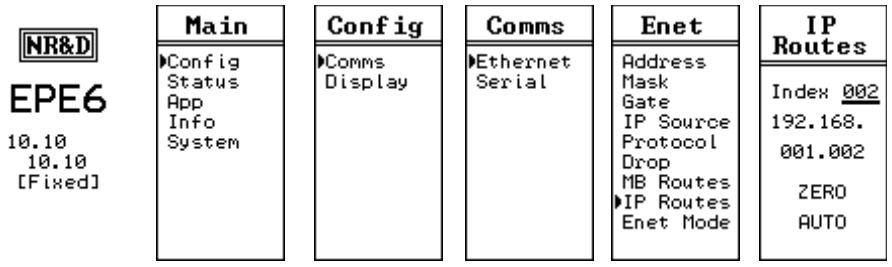


Figure 3.6: IP Route Edit Screen

The IP Routes may be edited from the front panel. The UP and DOWN buttons on the INDEX field scroll through the 200 entries. Pressing the ENTER button while on the INDEX field exits the screen.

Pressing the ENTER button while on the ZERO field will zero the IP Address. This is useful in SY/MAX Ethernet applications.

Pressing the ENTER button while on the AUTO field will auto load the AutoFill value for this Index.

4 Modbus Serial Operation

The EPE6 serial ports can operate as both a Modbus Master and Slave using either Modbus RTU or Modbus ASCII protocols. The protocol modes are labeled “Modbus RTU” and “Modbus ASCII”. All Modbus serial modes can dynamically switch between functioning as a Master or a Slave.

NOTE: The mode “MODBUS HOST” is a version of the RTU mode with special message translation features.

Slave Operation (External Master)

A Modbus mode port on the EPE6 listens for Modbus serial messages whenever it is idle. When a message arrives and has a good checksum, the Modbus Slave Address in the message is examined and compared to entries in the Modbus Routing Table for that serial port. If the entry for that drop number is not empty, then the EPE6 will forward that message according to this defined route. If the entry is empty (NONE), then the message is ignored.

A look-up table is used to map the Destination Index to a route that tells the EPE6 where to send the message. This table consists of a column for the Destination Index, a translation description (from legacy SY/MAX operation), and a downstream route.

The example in Figure 4.1 shows a PC connected via RS-232 to an EPE6 Port 1.

A network of power meters is connected to port 2 (drop 102) of the EPE6. The three power meters are addressed as Modbus slaves 1, 2, and 3.

A SY/MAX PLC is connected to port 3 (drop 103).

Table 4.1 gives a Modbus Routing table for this example. The PC would use index 1 to communicate with the SY/MAX PLC. Index 2 will reach power meter #1.

Figure 4.1 Serial Master Modbus Routing Example

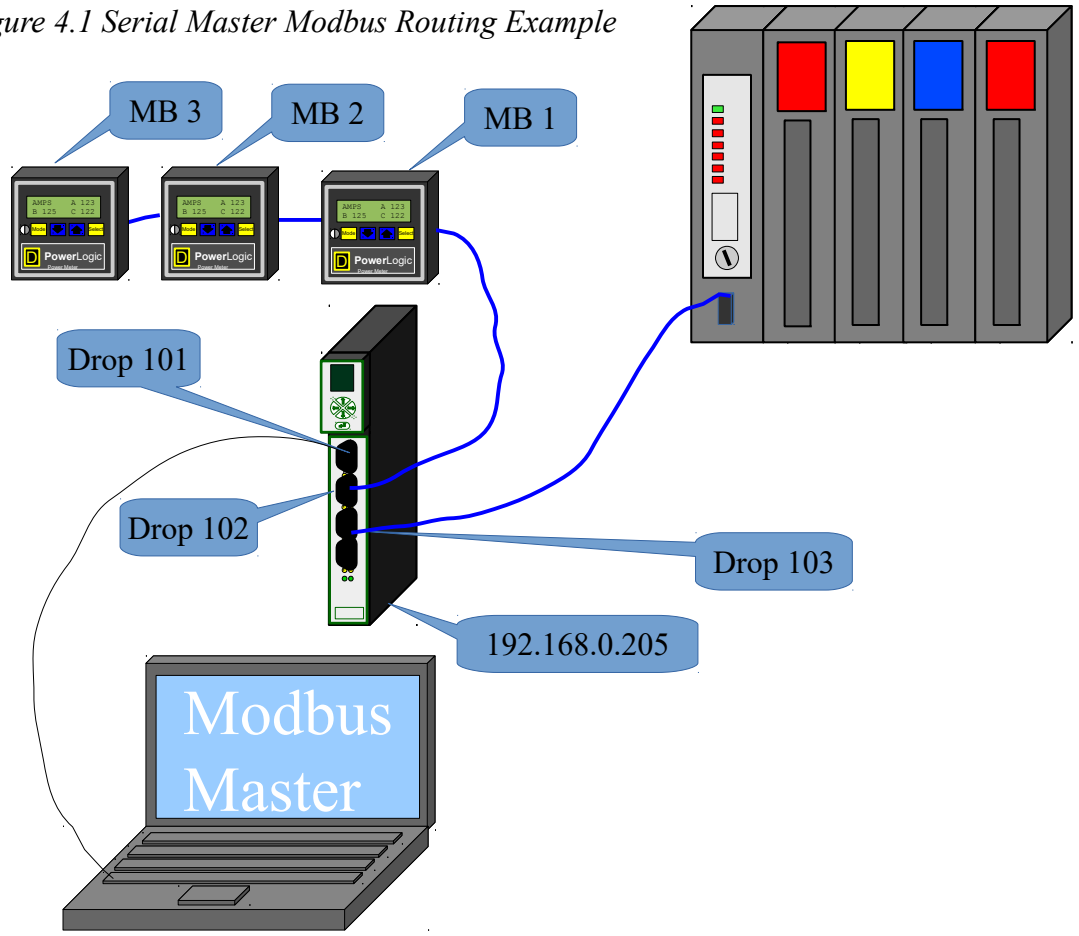


Table 4.1: Serial Modbus Routing Table Example

Index	Type	Route	Comments
1	MODBUS	103	SY/MAX PLC
2	MODBUS	102,1	Power Meter 1
3	MODBUS	102,2	Power Meter 2
4	MODBUS	102,3	Power Meter 3

Default Modbus Routing Tables

The default Modbus Routing table for all serial ports are blank. The user may define them however needed.

AutoFix Modbus Table

The EPE6 offers to "AutoFix" the Modbus Routing tables after the serial port drop number is altered. The Ethenet port and all serial port Modbus Routing tables are examined and entries where the first drop of the route matches the old serial drop number are changed to match the new drop number.

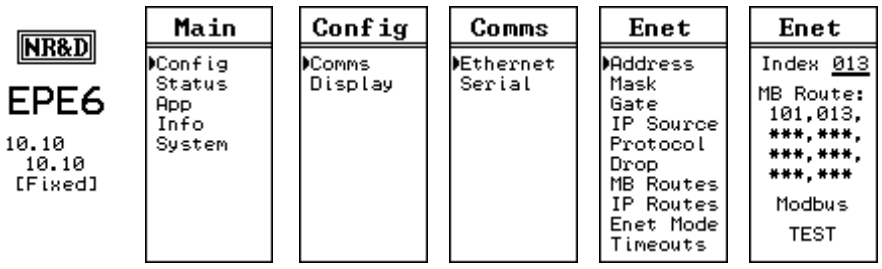


Figure 4.2: Edit Modbus Serial Route

Pressing ENTER button on the TEST field will cause the EPE6 to generate a Modbus opcode 03 Holding Register read of the target device. The test will report PASS or FAIL A "Downstream Timeout" is a failure but an Error 01 (Illegal Opcode) or Error 02 (Illegal Register) are PASS because the target device responded with the error.

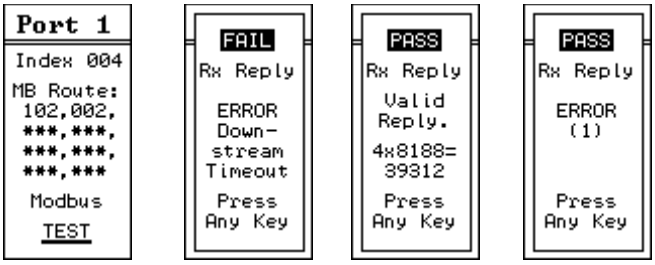


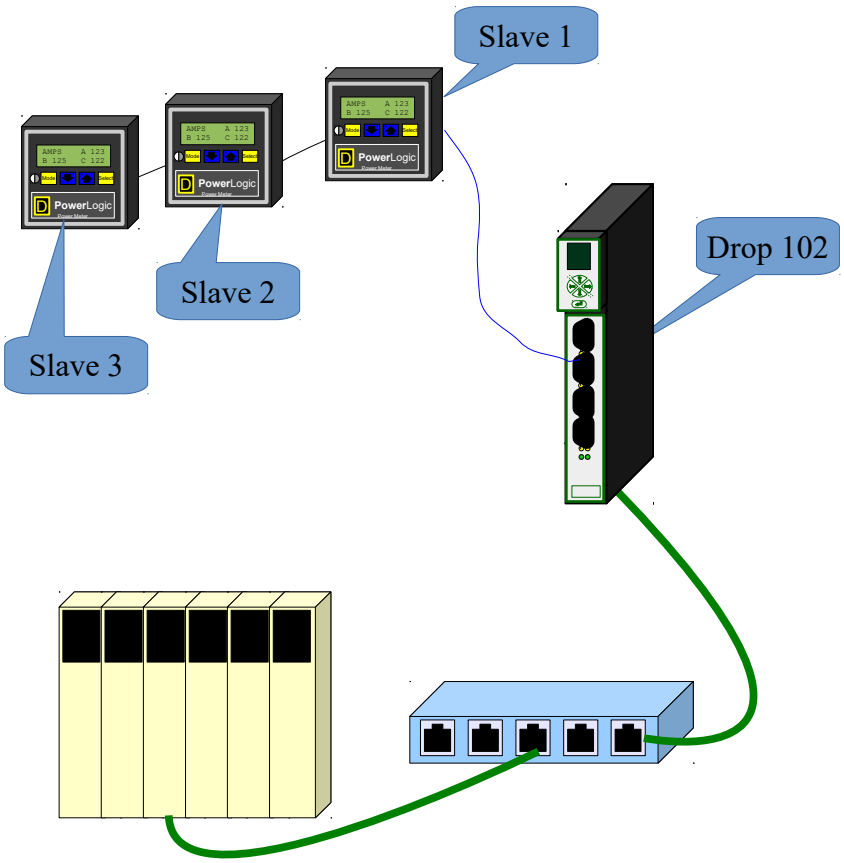
Figure 4.3: Modbus Route Edit TEST Screens

Master Operation (External Slave)

The EPE6 serial ports may be used to connect Modbus slave devices to Ethernet masters. A typical use is to connect a string of Modbus power meters to the EPE6.

Figure 4.4 shows a string of power meters connected to the RS-485 port 2 of the EPE6. Port 2 is configured for Modbus RTU mode and set to match the baud rate and parity of the meters. The drop number of port 2 is left at 102 (default). The normal routing to reach each meter is simply the route to reach port 2, followed by the slave address of the meter.

Figure 4.4 Serial Slaves Modbus Routing Example



A look-up table is used to map the Destination Index to a route that tells the EPE6 where to send the message. This table consists of a column for the Destination Index, a translation description (from legacy SY/MAX operation), and a downstream route.

Table 4.2 gives a Modbus Routing table for this example. The PC would use index 1 to communicate with ower meter #1. Indeces 2 and 3 will communicate with meters 2 and

3, respectively.

Table 4.2: Ethernet Modbus Routing Table Example

Index	Type	Route	Comments
0	OTHER	NONE	EPE6 Itself
1	MODBUS	102,1	Power Meter 1
2	MODBUS	102,2	Power Meter 2
3	MODBUS	102,3	Power Meter 3

5 Legacy SY/MAX Operation

The EPE6 serial and Ethernet ports can operate in a variety of modes to support legacy Square D SY/MAX PLCs and older PowerLOGIC meters.

Translations

The EPE6 translates Modbus messages to SY/MAX (and vice versa) as each message passes through the device.

NOTE: Some Modbus devices may refer to Holding Register 100 as 4x0100, 4:0100, 40100, or 4000100. The 4 at the beginning simply means it is a Holding Register. Analog Input registers (3x) are shown as 3x0001, 3:0001, 300001, or 300001. Output coils (0x) may be shown as 0x0025, 0:0025, 25. Input bits (1x) start with a 1 like 1x1234, 1:1234, 11234, or 101234.

NOTE: Some Modbus devices may start at register 0 instead of register 1. (This is commonly referred as JBUS.) It may be necessary to offset each register number by 1 to access the proper data.

NOTE: SY/MAX bit numbers are 1 to 16 with bit 1 as the least significant bit. This manual will note bit references as Sxxxx-yy where xxx is the SY/MAX register number and yy is the bit number. For example, register 20, bit 14 will be shown as S20-14.

Modbus to SY/MAX Translations

- Holding Registers (4x) – Holding Registers (read/write) are directly mapped 1-to-1 to SY/MAX registers. A Modbus client wanting the data from SY/MAX register 1503 would send a Holding Regsister Read (FC03) to remote register 1503. Modbus single (FC06) and multiple register writes (FC16) are supported with the target register chosen simply as the SY/MAX register number.
- Analog Input Registers (3x) – Modbus clients may access SY/MAX registers as though they are Modbus 3x data (read only). The mapping is just like 4x registers and is simply the target SY/MAX address.
- Coils (0x) - Modbus coils (read/write) may be mapped into SY/MAX registers. The translation starts as SY/MAX register 1, bit 1 (S1-1) = Modbus coil 0x1. S1-16 = 0x16. S2-1 = 0x17. The formula to determine the Modbus coil from a

SY/MAX bit is: COIL = ((REG – 1) * 16) + (BIT).

- Input Bits (1x) – Modbus discrete inputs (read only) are mapped exactly the same as 0x coils.

Incoming Modbus commands (4x, 3x, 1x, 0x) are translated into Non-Priority SY/MAX Read or Write messages. Coil write messages (FC05 and FC15) are translated as bit-masked NP writes when possible to allow single SY/MAX bits to be modified.

NOTE: FC15 multiple coil write message may not be able to be processed when the bits span multiple SY/MAX registers. The SY/MAX bit-masked NP Write message cannot handle this type of masking operation. The EPE6 will send back a Modbus Exception code 5 error when this condition occurs.

NOTE: A few SY/MAX end devices (NIMs for example) do not support Non-Priority messages. It may not be possible for a Modbus client to be able to directly communicate with these devices.

SY/MAX to Modbus Translations

SY/MAX Priority and Non-Priority Read and Write command messages are translated into Holding Register Read (FC03) and Write (FC16) messages. SY/MAX Random Access Read messages are translated into PowerLOGIC's Modbus Random Access Read (FC100).

If the SY/MAX client needs to access other memory spaces on a Modbus serial server, the Modbus Host serial mode may be used. This mode allows the user to manually configure the translation for both the read and the write. Supported Modbus Function Codes are 03 (4x read), 04 (3x read), 02 (1x read), 01 (0x read), 05 (0x single write), 06 (4x single write), 15 (0x multiple write), and 16 (4x multiple write).

NOTE: Standard Priority and non-bit-masked Non-Priority SY/MAX write messages will translate into 16 FC05 coil messages or one 16-bit FC15 message. All 16 bits will be forced.

NOTE: SY/MAX Read and Write messages support up to 128 registers. Modbus messages are limited to a maximum of 125 registers on a read and 120 registers on a write. Individual servers may have additional register count restrictions.

Error Translations

Modbus and SY/MAX do not share the same error messages. Table 5.1 shows the EPE6's translations.

All other errors are passed straight through with no translation.

Modbus Exception Code	SY/MAX Error Code	Meaning
2	3	Illegal Address
3	5	Illegal Value
10	29	Illegal Route
11	17	Device Not Responding

Table 5.1: Modbus and SY/MAX Error Translations

SY/MAX Serial

EPE6 ports 1-4 may be configured to SY/MAX mode to directly connect to a SY/MAX PLC. The RS-485 port is typically used along with the DC1 (EPE6 to SY/MAX) cable.

Default values for SY/MAX ports are 9600, EVEN, 8, 1, RS-422, and BCC.

The drop number of the SY/MAX mode port will be the last drop of an incoming route and the first drop of an outgoing TREAD, TWRITE, or TALARM message from the SY/MAX PLC.

SY/MAX mode ports are full duplex and allow the PLC to be both a master and a slave at the same time.

Figure 5.1 SY/MAX Serial Routing Example shows a SY/MAX Model 400 PLC connected with an DC1 cable to the RS-485 port 1 of an EPE6. This port is set to SY/MAX at drop 101.

An entry in the Ethernet Modbus Routing table must be modified to access the Model 400 PLC. For this example, Entry 1 was chosen since it would be easy to remember. The new route is shown in Table 5.2: Modbus Routing Table for Ethernet Port. The type set to OTHER since this is not a MODBUS target.

A Modbus/TCP client such as the M340 PLC in this example would simply use Modbus/TCP index 1 to access the SY/MAX PLC.

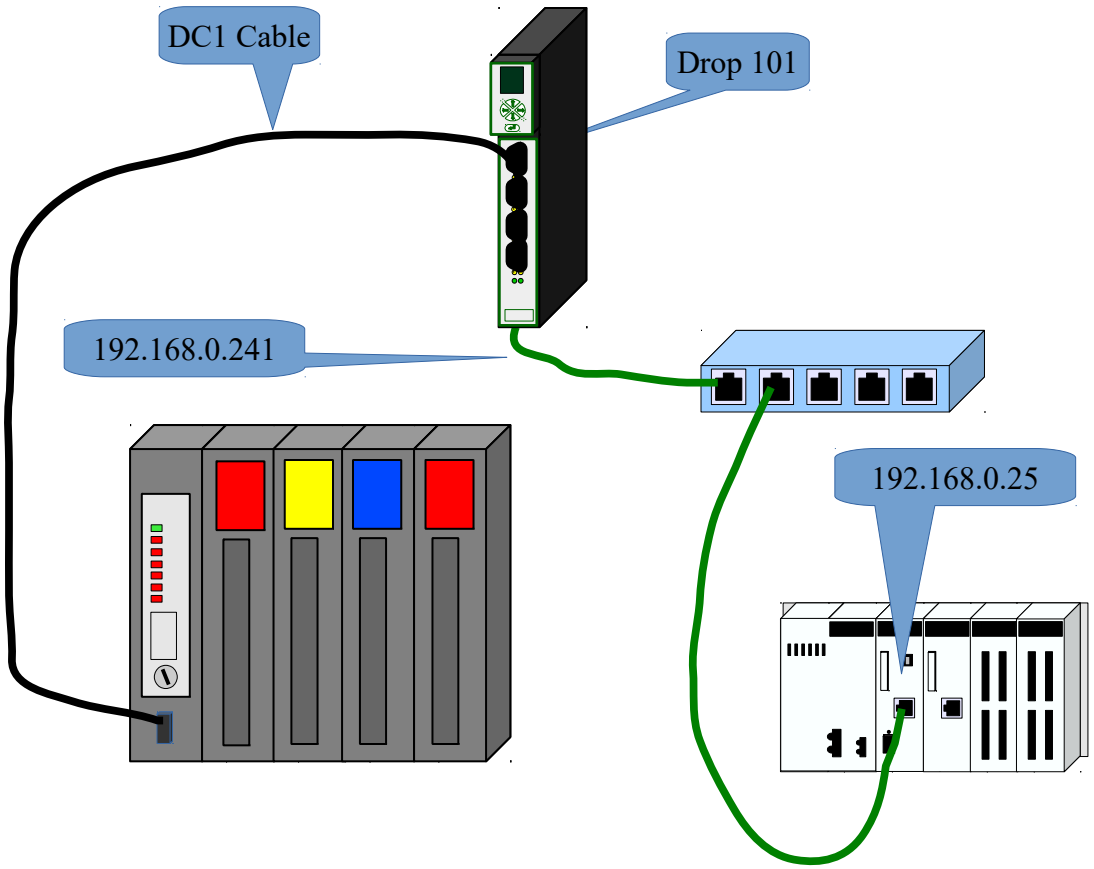
Table 5.2: Modbus Routing Table for Ethernet Port

Index	Type	Route	Comments
0	OTHER	NONE	
1	OTHER	101	Model 400 PLC
2	MODBUS	5,2	
3	MODBUS	5,3	
4	MODBUS	5,4	
5	MODBUS	5,5	
6	MODBUS	5,6	Compact 984 PLC
7	MODBUS	5,7	

The SY/MAX PLC may also use TREAD and TWRITE messages to access the M340.

The route to the M340 would be 101,0,25,1 assuming that the Ethernet port on the EPE6 is set to 0 and TCP table entry 25 has the IP Address of the M340.

Figure 5.1 SY/MAX Serial Routing Example



NET-TO-NET Mode

The EPE6 may be connected to a SY/NET network using the NET-TO-NET mode. This mode is used to connect the EPE6 to an RS-422 port on a CRM-510 NIM, RS-422 port on a SY/LINK (SFI-510) PC card, Niobrara SPE4, EPE5, or even MEB modules.

The following rules apply to NET-TO-NET ports:

- Both ports must be set to NET-TO-NET mode. This may involve setting DIP switches on the NIM.
- Both ports must be set to the same SY/NET drop number. Set the EPE6 port to match the NIM.
- Both ports must have the same baud rate, parity, data bits, stop bits, and checksum. Most NIMs use BCC but the CRM-511 and 512 may be set to use

CRC-16.

The route message includes the NET-TO-NET drop number only once for the port pair.

Figure 5.2 NET-TO-NET Serial Routing Example

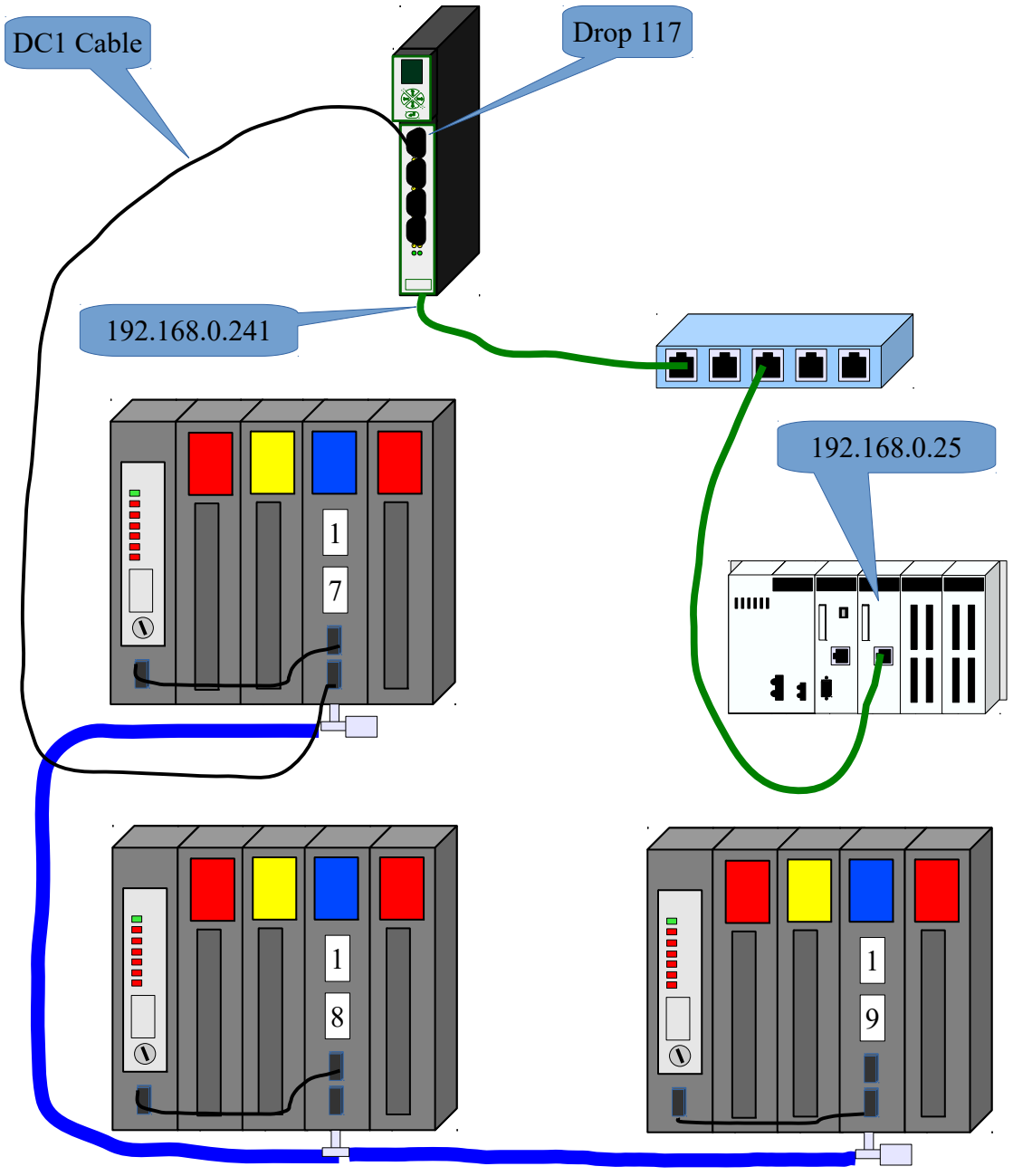


Figure 5.2 NET-TO-NET Serial Routing Example show an EPE6 port 1 connected NET-TO-NET to a CRM-510 set to node 17. This NIM is on a small “Blue Hose” SY/NET network with two other NIMs set to 18 and 19. NIMs 17 and 18 have a PLC connected to the 0xx port with a CC-100 cable. NIM 19 has the PLC connected to port 119. The EPE6 is connected to the 117 port so the drop number of the EPE6 port 1 must also be set to 117. Both the NIM port and EPE6 must be set to NET-TO-NET mode.

Table 5.3: Modbus Routing Table for Ethernet Port

Index	Type	Route	Comments
0	OTHER	NONE	
1	OTHER	NONE	
...	...	...	
16	OTHER	NONE	
17	OTHER	117,17	PLC on NIM port 17
18	OTHER	117,18	PLC on NIM port 18
19	OTHER	117119	PLC on NIM port 119

The Modbus/TCP Ethernet routing table shows the Modbus/TCP Index values of 17, 18, and 19 that will allow clients to access the SY/MAX PLCs.

Any of the SY/MAX PLCs may access devices through the EPE6 with TREAD or TWRITE messages.

Table 5.4: SY/MAX NET-TO-NET Routes

Source	Target	Route
PLC 17	M340	17,117,0,25,1
PLC 18	M340	18,117,0,25,1
PLC 119	M3340	119,117,0,25,1

SY/MAX Ethernet

The EPE6's Ethernet port may be configured to support Modbus/TCP and SY/MAX 802.3 protocols at the same time. Thus the user may bridge older SY/MAX Ethernet enabled PLCs (Model 450 and Model 650) to Modbus/TCP and various serial networks.

> NOTE: Always check that the SY/MAX 802.3 node number is unused on the LAN before setting the EPE6's address. SY/MAX Ethernet devices that detect duplicate drops remove themselves from the LAN and in many cases must be power cycled before they function again. This action may result in equipment damage, personal injury, or death.

The SY/MAX 802.3 protocol supports up to 100 physical node addresses (0-99). Logical Node numbers 100-199 are possible on Niobrara devices (MEB, EPE5, RPC) by setting a serial port to “On Ethernet YES”. Node numbers above 100 also consume the node modulo 100. For example, if the EPE6's Ethernet port is set to 55 then node 155 is also required to be within this EPE6. Therefore serial port 1 may be set to drop 155 and have “On Ethernet YES” configured.

SY/MAX Routing

The EPE6 in the combination Modbus/TCP+SY/MAX Ethernet mode simply becomes another drop in the SY/MAX route between the source and the target. Inbound Ethernet messages include the EPE6's Ethernet port drop number as the next drop in the route.

Figure 5.3 SY/MAX Ethernet Routing Example

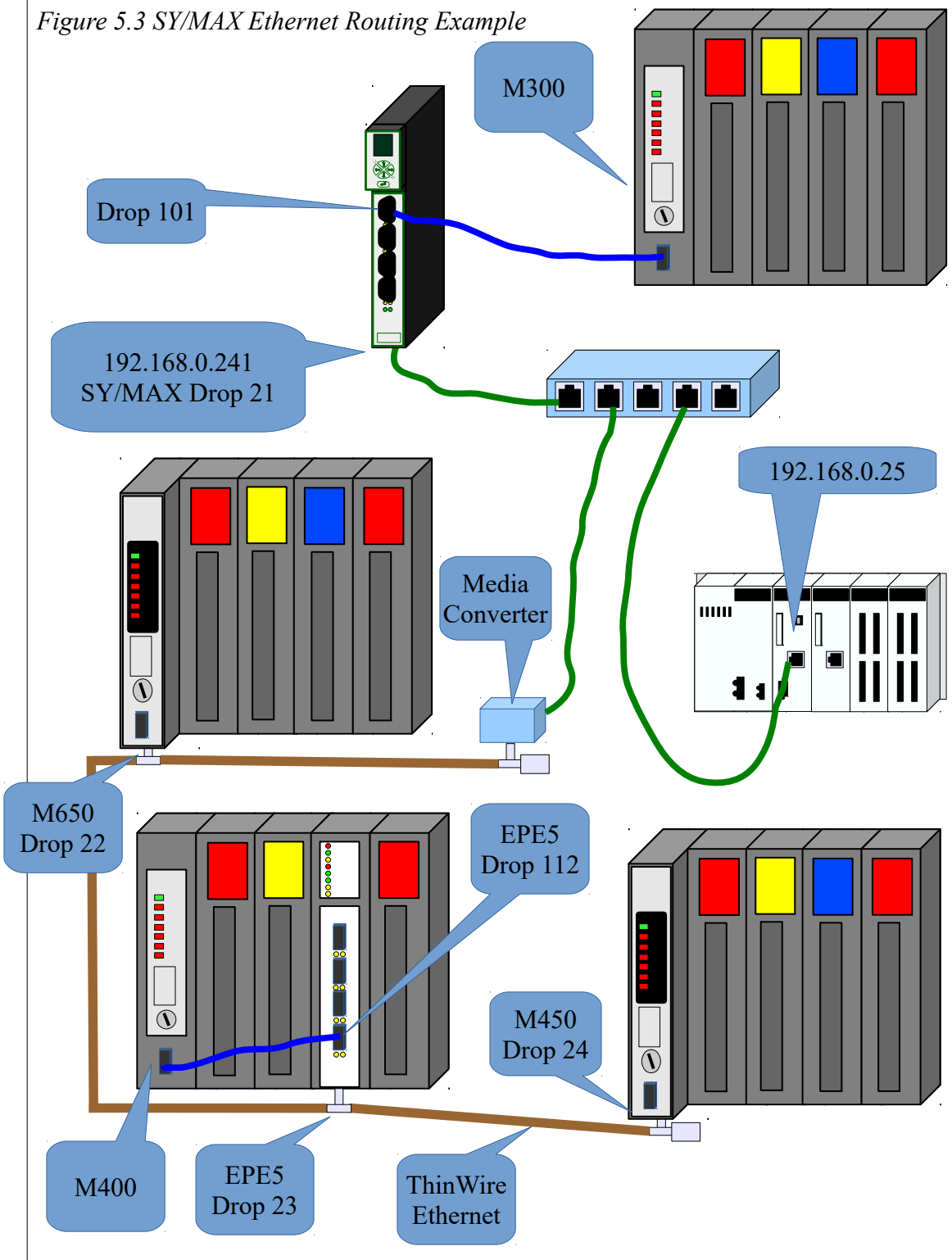


Table 5.5: SY/MAX Ethernet Routes

Source	Target	Route
Model 650	Model 300	22,21,101
Model 400	Model 300	112,23,21,101
Model 450	Model 300	24,21,101
Model 650	M340	22,21,21,25,1
Model 400	M340	112,23,21,21,25,1
Model 450	M340	24,21,21,25,1
Model 300	Model 650	101,21,22
Model 300	Model 400	101,21,23,112
Model 300	Model 450	101,21,24
M340	Model 650	192.168.0.241 index 22
M340	Model 400	192.168.0.241 index 23
M340	Model 450	192.168.0.241 index 24

The outbound messages to the M340 PLC have the EPE6's Ethernet drop number in the route twice. The first entry to select the EPE6, the next entry to route the message back out the Ethernet port. The drop following the second entry is the TCP Table entry of the M340 PLC.

The EPE6 uses the entry in the TCP routing table to decide to send the message out as Modbus/TCP (entry not 0.0.0.0) or SY/MAX 802.3 (entry is 0.0.0.0).

Table 5.6: Modbus Routing Table for Ethernet Port

Index	Type	Route	Comments
0	OTHER	NONE	
1	OTHER	NONE	
...	...	...	
22	OTHER	21,22	Model 650
23	OTHER	21,23,112	Model 400
24	OTHER	21,24	Model 450
25	OTHER	NONE	

Table 5.7: Ethernet TCP Routing Table

Drop	IP Address	Route	Description
0	0.0.0.0	NONE	SY/MAX node 0
1	192.168.0.1	NONE	Modbus/TCP
2	192.168.0.2	NONE	Modbus/TCP
3	192.168.0.3	NONE	Modbus/TCP
...	...	...	
20	192.168.0.20	NONE	Modbus/TCP
21	192.168.0.21	NONE	Modbus/TCP
22	0.0.0.0	NONE	SY/MAX node 22
23	0.0.0.0	NONE	SY/MAX node 23
24	0.0.0.0	NONE	SY/MAX node 24
25	192.168.0.25	NONE	Modbus/TCP
26	192.168.0.26	NONE	Modbus/TCP
...	...	...	
200	192.168.0.200	NONE	Modbus/TCP

PowerLogic Serial Modes

All newer Square D PowerLogic electric meters and breaker panels communicate with Modbus serial and Modbus/TCP Ethernet protocols. Older meters like the CM2000 and PowerLink AS units use the SY/MAX based PLOGIC and PNIM protocols. The EPE6 supports all of these protocols plus a mixed mode called CHEVRON which allows both PNIM and Modbus RTU devices to reside on the same daisy-chain.

Note that some PowerLogic devices only support 4-wire RS-485, some only support 2-wire RS-485, and some may be used in either mode.

Note that some PowerLogic devices only support EVEN parity, some only support NONE, and some support both settings.

Table 5.8: Common PowerLogic Devices

	Device Series	Protocols	RS-485	Parity	Notes
	CM100 CM200	PLOGIC PNIM	4-wire	EVEN	Must cycle power when changing between PNIM and PLOGIC
	CM2000	PLOGIC PNIM	4-wire	EVEN NONE	Dynamically switches between PNIM and PLOGIC
	CM3000 CM4000	Modbus RTU Modbus ASCII	4-wire 2-wire	NONE EVEN ODD	
	PM600	PLOGIC PNIM Modbus RTU	4-wire 2-wire	EVEN NONE	Dynamically switches between PNIM and PLOGIC
	PM700 PM800	Modbus RTU Modbus ASCII	2-wire	NONE EVEN ODD	
	Enercept	Modbus RTU	2-wire	NONE	
	BCM	Modbus RTU	4-wire 2-wire	NONE EVEN ODD	
	BCPM	Modbus RTU	4-wire 2-wire	NONE EVEN ODD	
	PowerLink AS	PLOGIC PNIM	4-wire only	EVEN	Must cycle power when changing between PNIM and PLOGIC
	PowerLink G3	Modbus RTU Modbus ASCII	4-wire 2-wire	NONE EVEN ODD	

6 Front Panel Operation

Keypad Buttons

The front panel includes five push buttons.

- The RIGHT arrow advances to the next screen or field. In many cases, it has the same behavior as the key.
- The LEFT arrow escapes to the previous screen or field. Changes are saved when the left arrow is pressed.
- The UP arrow moves up in a list or increments a selection.
- The DOWN arrow moves down in a list or decrements a selection.
- The ENTER key accepts the values on a screen and exits to a previous screen.

LCD Screen

The EPE6 includes a high resolution LCD screen main screen to assist the user in configuring and troubleshooting the device. Ethernet, and serial port parameters and may be observed and modified. Statistical information is also provided through the front panel interface.

Backlight

The LCD backlight will illuminate on any button press. The timeout for the backlight is configured through Modbus drop 255 register 7003 and defaults to 300 seconds.

Operating Screens

Splash Screen

The main page shows the IP Address of the EPE6 and the source of that IP address, and SY/MAX 8023 drop number (if enabled).

Error conditions may be displayed on the splash screen as they occur. Indications for duplicate IP Address or duplicate SY/MAX 802.3 node are shown. Certain errors will cause the backlight to flash , drawing attention to the EPE6. The flasshing will continue until the error goes away, or until a key is pressed.

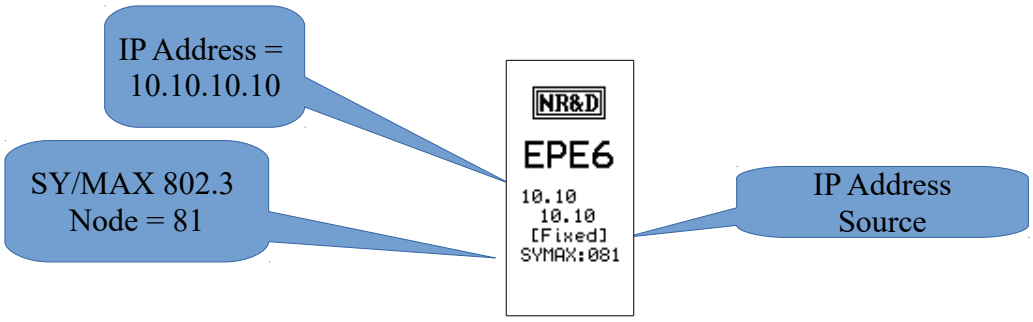


Figure 6.1: Splash Screen

Main Menu Screen

Pressing a key while the splash screen is displayed will move to the Main menu page. A pointer along the left margin indicates the sub-menu to be chosen. Pressing the UP or DOWN arrows will move the pointer. Pressing the RIGHT arrow or ENTER buttons will select the sub-menu. Pressing the LEFT arrow will return to the splash screen page.

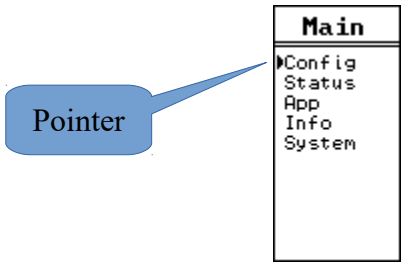


Figure 6.2: Main Menu Screen

Configuration Menu

Selecting the Config item leads to the Config menu and a choice of Comms and Display. The Comms sub-menu moves on to Ethernet and serial port options while the Display sub-menu allows the user to adjust the screen contrast.

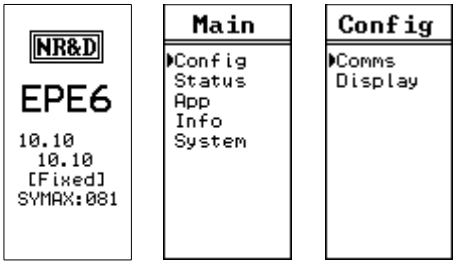


Figure 6.3: Config Menu Screen

Comms Menu Screen

The Comms menu allows the selection of editing the settings for the Ethernet and Serial ports.

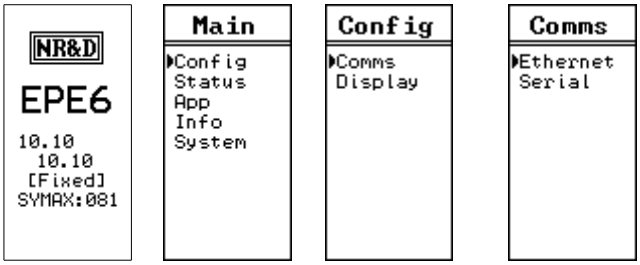


Figure 6.4: Comms Menu Screen

Ethernet Configuration Menu

The Ethernet menu allows the selection of editing the settings for the IP Address, Subnet Mask, Default Gateway, IP Source, Ethernet Protocol, port drop number, Modbus Routes, IP Route table, and the physical Ethernet port mode settings.

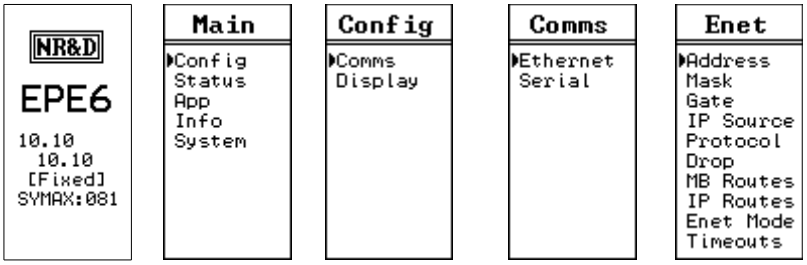


Figure 6.5: Ethernet Menu Screen

IP Add Screen

The IP Address of the EPE6 may be quickly changed using the IP Add screen. Move the cursor with the LEFT and RIGHT arrows and adjust the octet with the UP and DOWN arrows. Holding the UP or DOWN key will scroll the value quickly. When the new address is finished, press the ENTER key and a prompt for "AutoFill IP Tables?" is presented. Select "Yes" to have the EPE6 automatically fill the TCP table with the first 3 octets of this IP Address and the fourth octet the index value.

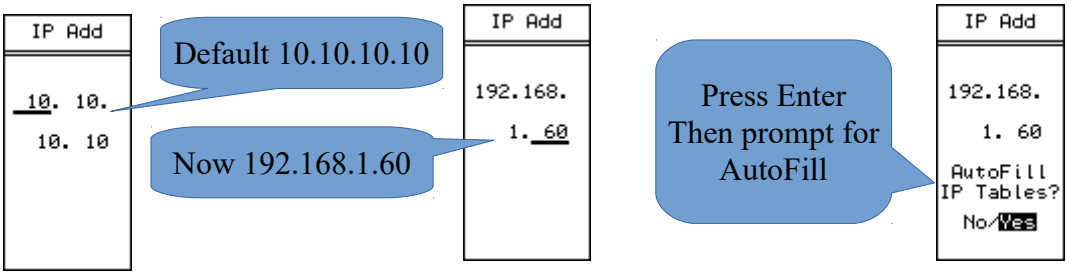


Figure 6.6:IP Address Screens

Subnet Mask Screen

The Subnet Mask of the EPE6 may be quickly changed using the Mask screen. The UP and DOWN buttons are used to adjust the number of bits in the mask. When the new mask is finished, press the ENTER key and a prompt for "Auto Set Default Gate?" is presented. Select "Yes" to have the EPE6 automatically apply the subnet mask to the IP Address to generate most of the default gateway setting..

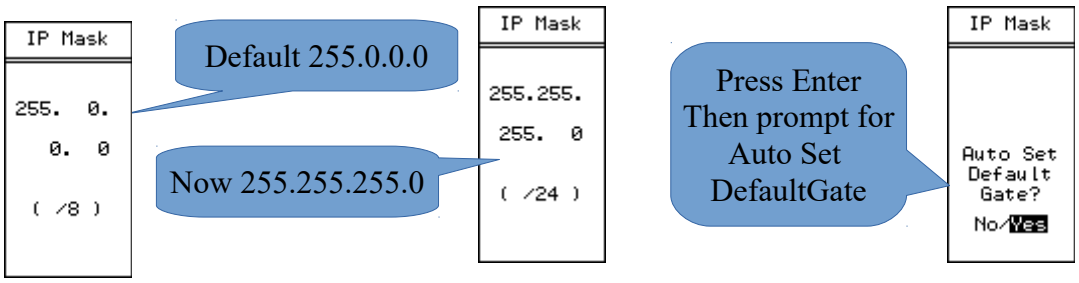


Figure 6.7:Subnet Mask Screens

Default Gate Screen

The Default Gateway of the EPE6 is edited just like the IP Address. The LEFT and RIGHT buttons move the cursor while the UP and DOWN buttons are sued to adjust the value. Press ENTER to accept the new value.

Set the Default Get to 0.0.0.0 to disable routing operation outside the local subnet.

IP Source Screen

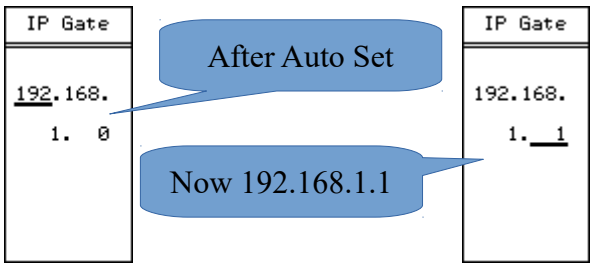


Figure 6.8:Default Gate Screen

The EPE6 may have a fixed IP Address or use BOOTP or DHCP to have its IP settings configured. The IP Source screen allows the user to configure the appropriate setting. Use the UP and DOWN buttons to select the setting. DHCP and BOOTP typically require the server to be configured for the MAC address of the EPE6's Ethernet port.

This MAC address is shown on the screen in hexadecimal (00:20:BD:03:18:F9).

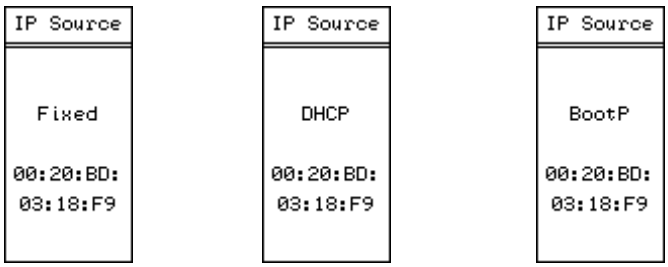


Figure 6.9:IP Source Screen

Ethernet Protocol Screen

The Ethernet port may be configured for only Modbus/TCP or a combination of Modbus/TCP plus SY/MAX 802.3 for support of legacy SY/MAX Ethernet devices. The Protocol screen allows the setting of the mode.

> WARNING: Set the drop number of the Ethernet port to SY/MAX 802.3 drop that is **not** present on the connected network before setting the port to MB+SYMAX mode. Choosing a duplicate drop on the network will result in both nodes halting SY/MAX communication which may result in equipment damage, injury, or death.

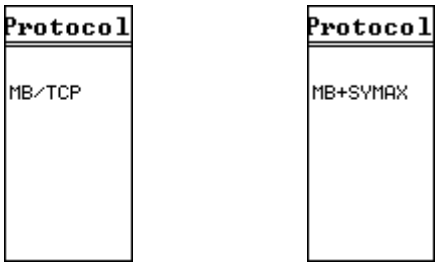


Figure 6.10:Ethernet Protocol Screens

Ethernet Drop Screen

The drop number of the Ethernet port defaults to 0 and rarely needs to be changed. This drop number is used to set the SY/MAX 802.3 Ethernet node number when the Ethernet port is set to MB+SYMAX protocol mode.

> WARNING: Set the drop number of the Ethernet port to SY/MAX 802.3 drop that is **not** present on the connected network before setting the port to MB+SYMAX mode. Choosing a duplicate drop on the network will result in both nodes halting SY/MAX communication which may result in equipment damage,

injury, or death.

After selecting the new drop number by pressing the Enter button, a prompt for “Auto-Fix Routing Tables?” is presented. Selecting Yes will automatically adjust entries in the Ethernet and serial ports 1-4 Modbus Routing tables. Route entries with the old drop number as the first drop in the route will be changed so the new drop number replaces the old value .

Figure 6.11:Ethernet Drop Screen

Modbus Route Screen

The Modbus Routing table for the Ethernet port may be edited through the Modbus Route screen. This screen shows a single entry from the table with the index on the top line. The cursor is moved with the left and right arrows. Values are altered with the up/down buttons.

The enter button exits the screen when on the index field.

The enter button on the TEST field causes a test message to be sent using the route to the target device.

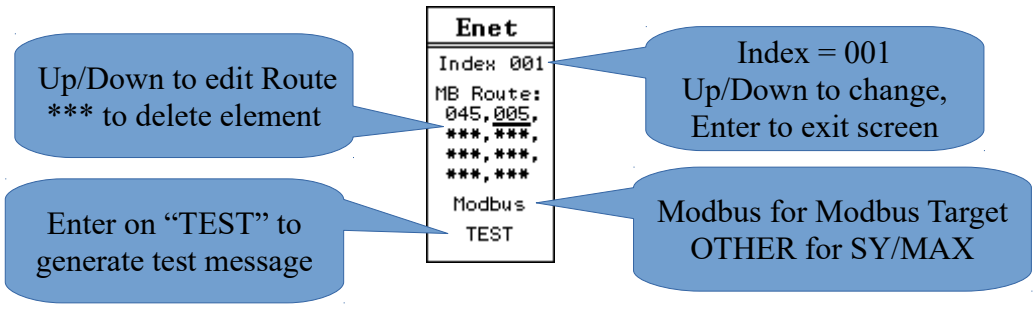


Figure 6.12:Modbus Route Edit Screen

The TEST message is an opcode 03 Modbus Holding Register read of remote register 8188. Possible results from this read are:

- A valid reply is received from the target slave. The screen will show PASS along with the decimal value of the remote register 4x8188. On older SY/MAX PLCs, this value is the PLC model number.
- A valid error reply is received from the target slave. The screen will show PASS along with the returned error code. Possible errors are:
    - Error 01 = Illegal Opcode. This means that the slave does not support Modbus opcode 03 (Holding Register read). The slave is replying to the test message, it just does not support the test message.
    - Error 02 = Illegal register. This means that the slave does not have Holding Register 4x8188. This is also a PASS condition, it just means that the test message asked for a register that does not exist in the slave.
- The network was unable to receive a reply from the slave. This is a FAIL condition with the error message Downstream Timeout.
- The EPE6 was unable to generate the query because the first drop in the route was not a valid drop number of another port in the EPE6. The FAIL message will show

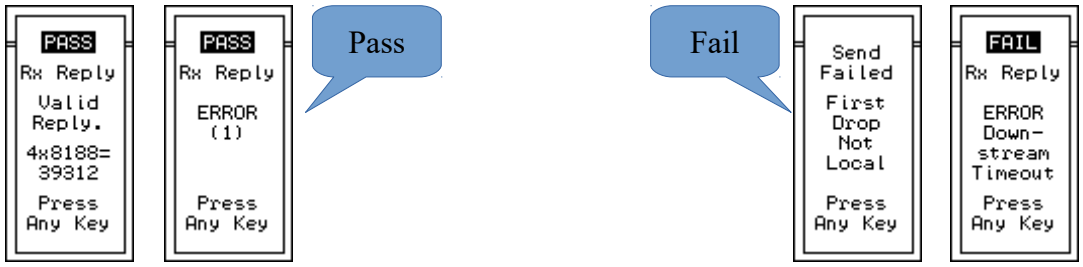


Figure 6.13:Modbus Route Test Results Screens

IP Route Screen

The IP Routing table for the Ethernet port may be edited through the IP Route screen. This screen shows a single entry from the table with the index on the top line. The cursor is moved with the left and right arrows. Values are altered with the up/down buttons.

The enter button exits the screen when on the index field.

The enter button on the ZERO field causes the IP Address to be set to 0.0.0.0. This is handy for zeroing an entry for SY/MAX 802.3 Ethernet entries.

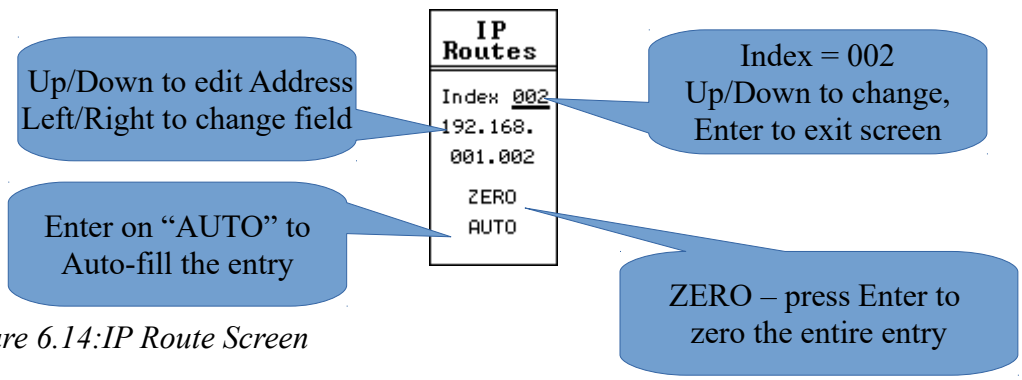


Figure 6.14:IP Route Screen

The AUTO field sets the entry to the EPE6's IP Address with the last octet set to match the index.

Ethernet Mode Screen

The Ethernet Mode screen allows the physical configuration of the Ethernet port. The port defaults to "AUTO" mode which automatically sets itself to match the attached device. The possible settings are:

- AUTO
- 10BaseT – Full Duplex
- 10BaseT – Half Duplex
- 100BaseT – Full Duplex
- 100BaseT – Half Duplex

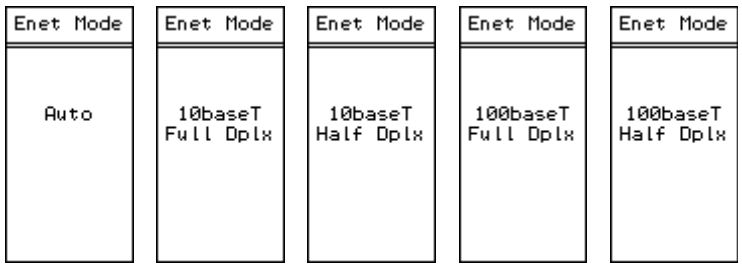


Figure 6.15:Ethernet Port Mode Screens

Timeouts Menu

The Timeouts Menu allows the user to adjust the timeouts of a message being handled by the Ethernet port. The possible settings are Inbound (messages from a Modbus/TCP master to a slave attached to the EPE6) and Outbound (messages from a master attached to the EPE5 intended for a Modbus/TCP slave). Default timeouts are 11 seconds and 10 seconds, respectively.

Figure 6.16:Ethernet Timeout Screens

Serial Port Menu

The Serial menu allows the selection a particular serial port to edit. Choices are Port 1, Port 2, Port 3, and Port 4.

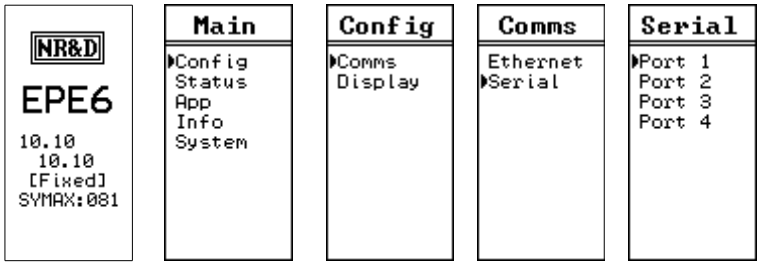


Figure 6.17: Serial Pot Menu Screen

Port 1 Menu

All serial port share the same menu list.

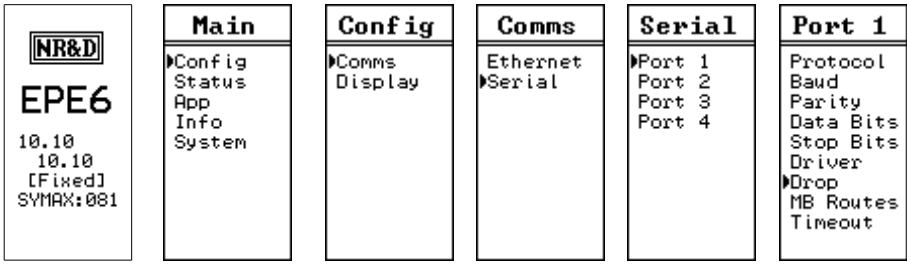


Figure 6.18: Serial Pot 1 Menu Screen

Settings available for the four serial ports are:

- Protocol
  - Modbus RTU (default)
  - Modbus ASCII
  - Modbus Host (RTU with special translations)
  - Chevron (combination Modbus RTU master with RNIM master)
  - Dual Slave (combination Modbus RTU slave and SY/MAX slave)
  - SY/MAX, NET-TO-NET, RNIM Master, RNIM Slave (legacy Square D PLC serial protocols)
  - PNIM and PLOGIC (legacy PowerLOGIC protocols)

- IDEC (legacy Square D Model 50 and Micro-1)
- Transfer (legacy Square D PLC Hot Backup)
- Peripheral, Share, Transfer (legacy Square D ASCII)
- Gateway (legacy Niobrara ASCII)
- Multidrop (legacy Niobrara serial network)

- Baud Rate – 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600 (default), 19200
- Parity – EVEN (default), ODD, NONE
- Data Bits – 8 (default), 7 (ASCII modes only)
- Stop Bits – 1 (default), 2
- Driver – RS-232 (default), RS-422, RS-485 + Bias, RS-485 - Bias
- Drop – 101 (default for port 1), 102 (default for port 2)
- Modbus Routes – See Modbus Route Screen on page 57
- Timeout – Only available to change when relevant to the selected protocol

Display Edit Screen

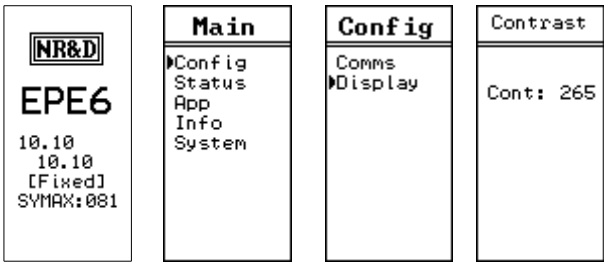


Figure 6.19: Display Contrast Edit Screen

The Display screen allows the user to adjust the contrast value for the display. The UP and DOWN arrows allow the changing of the setting. The ENTER or LEFT arrows accept the new value.

Status Menu Screens

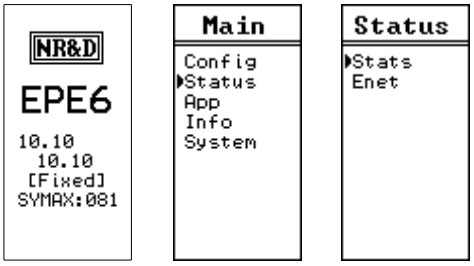


Figure 6.20: Status Menu Screen

The Status menu item gives access to physical status and communication statistics for all ports.

Stats Screen

Each port has multiple screens to give statistical counters about communication through the port. LEFT and RIGHT arrows change between ports. UP and DOWN move between pages for a given port. ENTER returns to the previous menu.

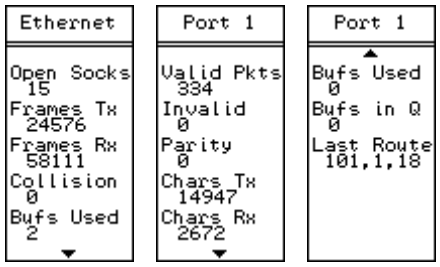


Figure 6.21: Stats Screens

Enet Status Screen

The Enet status screen shows the current physical connection status of the Ethernet port.

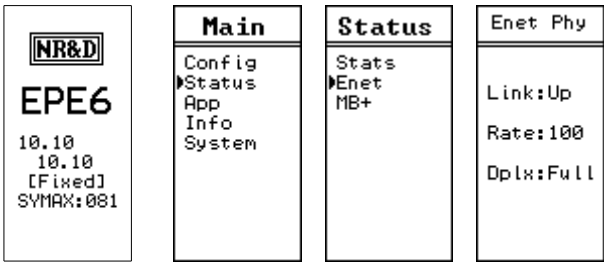


 Figure 6.22: Status Menu Screen

App Menu

The APP menu allows the user to halt the EPE6 application. This feature should only be used when directed by Niobrara Technical Support.

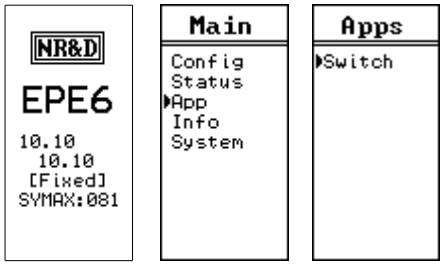


Figure 6.23: App Menu Screen

Switch Screen

The Switch screen allows the user to HALT or RUN the EPE6 application. The MEM PROT setting is ignored at this time and is the same as RUN.

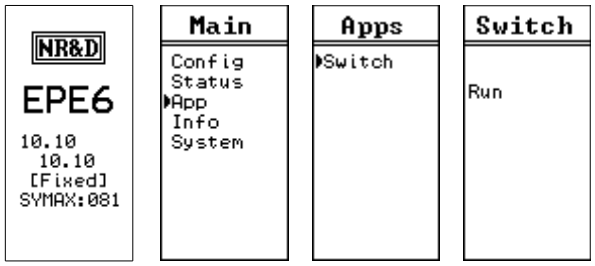


Figure 6.24: Switch Screen

Info Menu

The Info Menu provides access to various information about the EPE6 firmware and network connections.

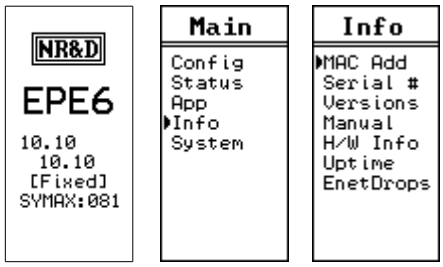


Figure 6.25: Info Menu Screen

MAC Address Screen

The MAC address screen shows the hardware address of the Ethernet port in hexadecimal. This information is useful when the IP Address is set by BOOTP or DHCP.

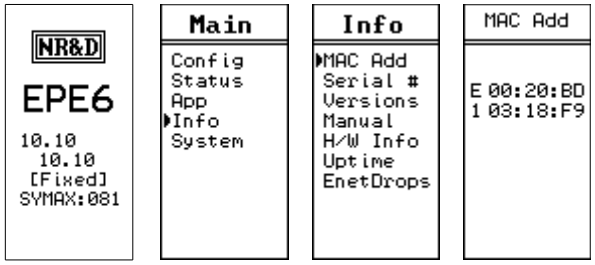


Figure 6.26: MAC Address Screen

Serial Number Screen

This screen shows the serial number of the EPE6.

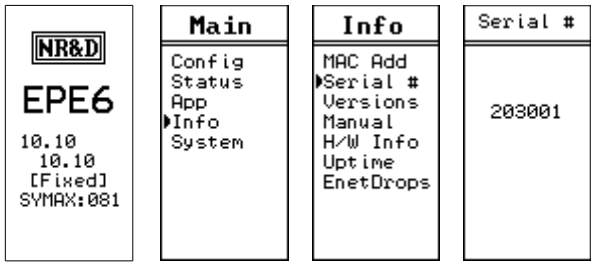


Figure 6.27: Serial Number Screen

Versions Screen

The Versions menu gives access to the EPE6 firmware, UCM firmware, and boot version.

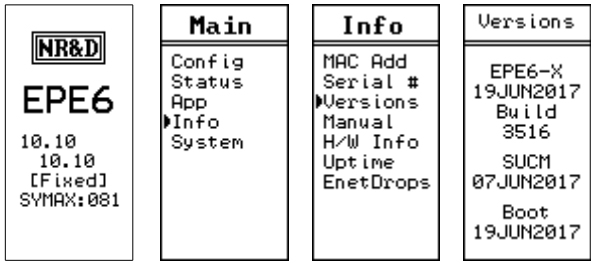
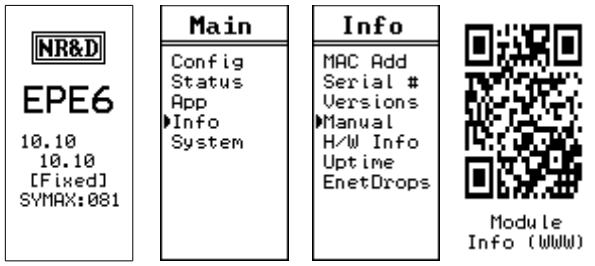


Figure 6.28: Versions Screen

Manual Screen

The Manual screen provides a QR code that points to the EPE6 page of our website (www.niobrara.com/html/epe6_cut.html).



EP*Figure 6.29: Manual Screen*

H/W Info Screen

The H/W Info screen provides the hardware version number of the EPE6 being used. This is sometimes helpful when talking with tech support.

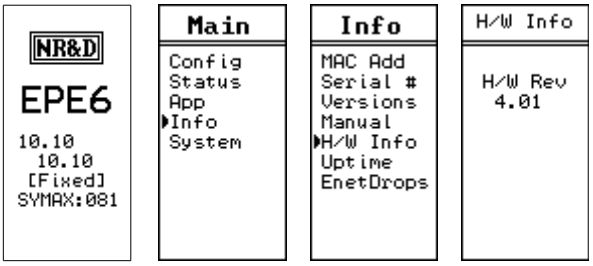


Figure 6.30: Hardware Info Screen

Uptime Screen

The Uptime screen will tell the user how many times the EPE6 has booted, and the amount of time since the last boot.

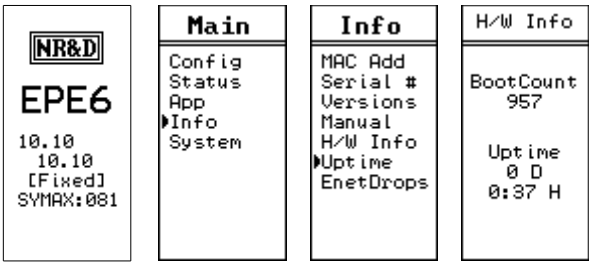


Figure 6.31: Hardware Info Screen

Enet Drops Screen

The Enet drops screen will show the SY/MAX 802.3 drops accessible to the EPE6. This page may extend beyond a single screen and the UP and DOWN buttons are used to move between screens.

Any drop numbers local to the EPE6 are highlighted. This includes the Ethernet port and any other port with "ON ETHERNET" set to YES.

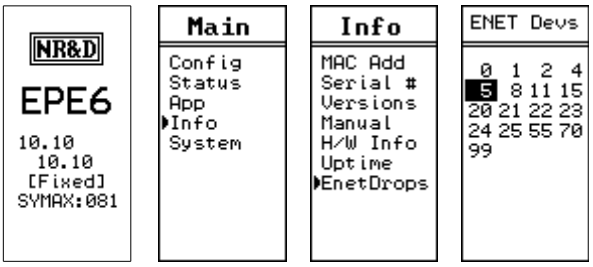


Figure 6.32: SY/MAX Ethernet Drops Screen

System Menu

The System menu provides access to the front panel password, reboot, and reset to factory defaults.

Reboot Screen

This screen allows the user to force a hardware reboot of the EPE6 without physically removing the power.

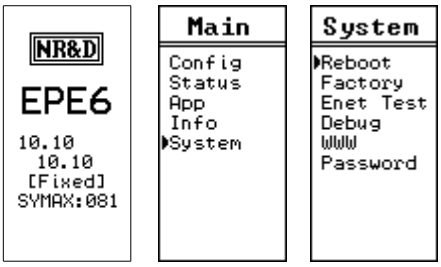


Figure 6.33: Reboot Screen

Factory Defaults Screen

The Factory screen allows the user to quickly reset the EPE6 to factory defaults. The reset process also includes a reboot. Selecting "NO" will return to the previous menu without altering the current setup.

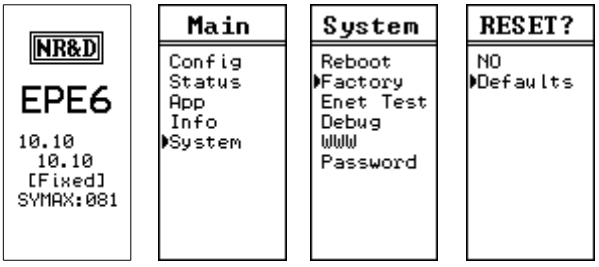


Figure 6.34: Factory Defaults Screen

Enet Test Screen

The EPE6's Ethernet port has the ability to detect a broken cable. If the cable is broken, the LCD will display the approximate distance from the port where the open was detected.

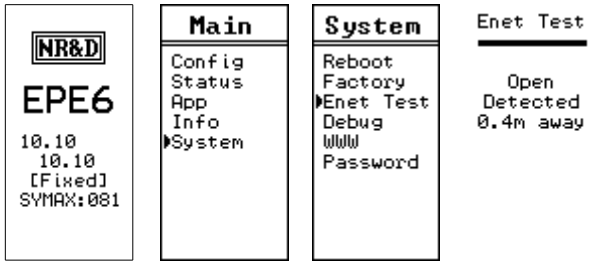


Figure 6.35: Enet Test Screen

Debug Screen

The EPE6 has a mode that causes a large amount of debug messages to be sent form the Ethernet or serial ports of the module. A user would only enter this mode at the direction of Niobrara technical support, and further instructions would be provided on storing this information and relaying it to Niobrara staff.

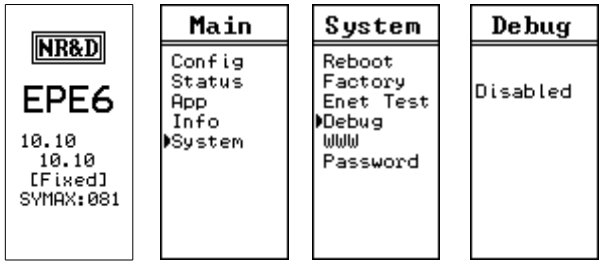


Figure 6.36: Debug Screen

WWW Screen

The preferred method of configuring the EPE6 is via the built-in web interface. However, as a security measure, the user may want to disable this feature. This screen allows the user to turn off the interface.

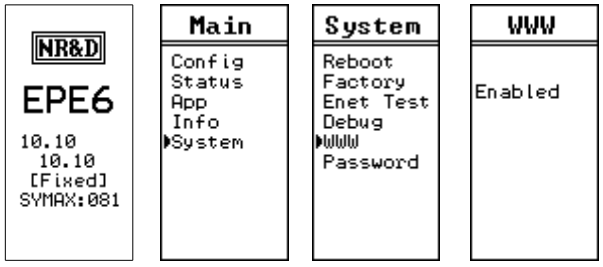


 Figure 6.37: WWW Screen

Password Screen

The EPE6 may have a password enabled to limit front panel operation. The password is a four digit number (0000-9999) that must be entered before settings are altered. Once the password is entered, it settings may be altered until a reboot or the backlight timeout occurs.

Setting the password to 0000 disables the feature.

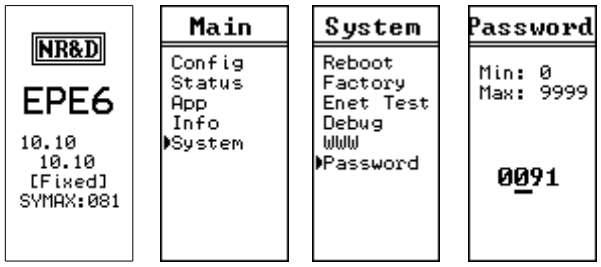


Figure 6.38: Password Screen

7 Recommended Cables

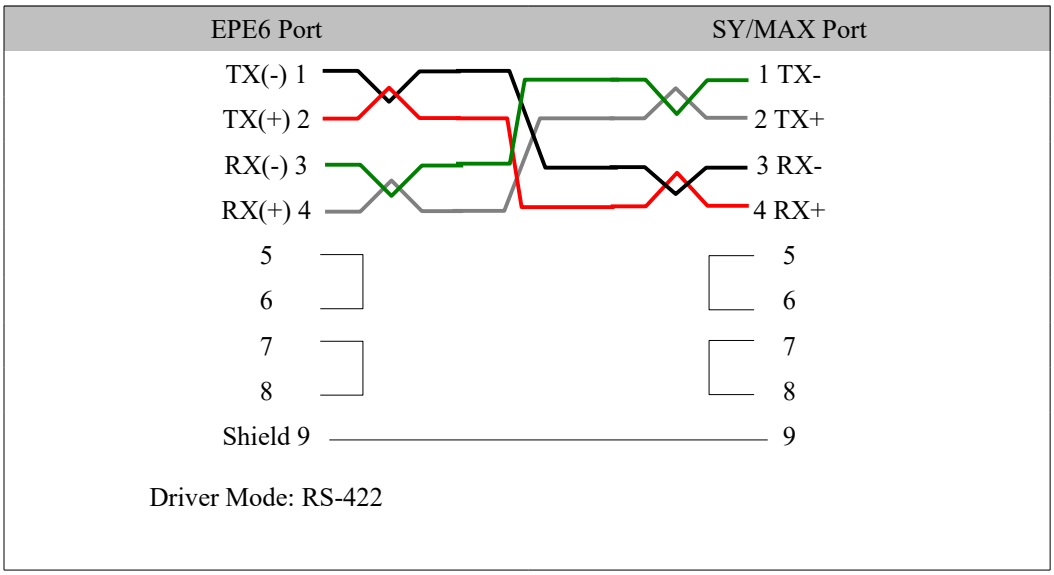
RS-485 Cables

DC1 (EPE6 to SY/MAX)

The Niobrara DC1 cable is used to connect the RS-485 port of the EPE6 to a standard SY/MAX DB9 female port. This cable is normally used to connect the EPE6 directly to a SY/MAX PLC or NIM module.

NOTE: The EPE6 port driver mode is normally set to RS422 when connected to a SY/MAX serial port.

Figure 7.1.: DC1 Serial Cable



EPE6 Master to 4-wire RS-485 Slaves

The EPE6 may be used to be a master on a 4-wire RS-485 network. An example of this network is a string of PowerLogic meters attached to the EPE6.

An external terminator should be used at the last slave across its RX pair. Normally, this

is a 120 ohm resistor or the PowerLogic MCT-485.

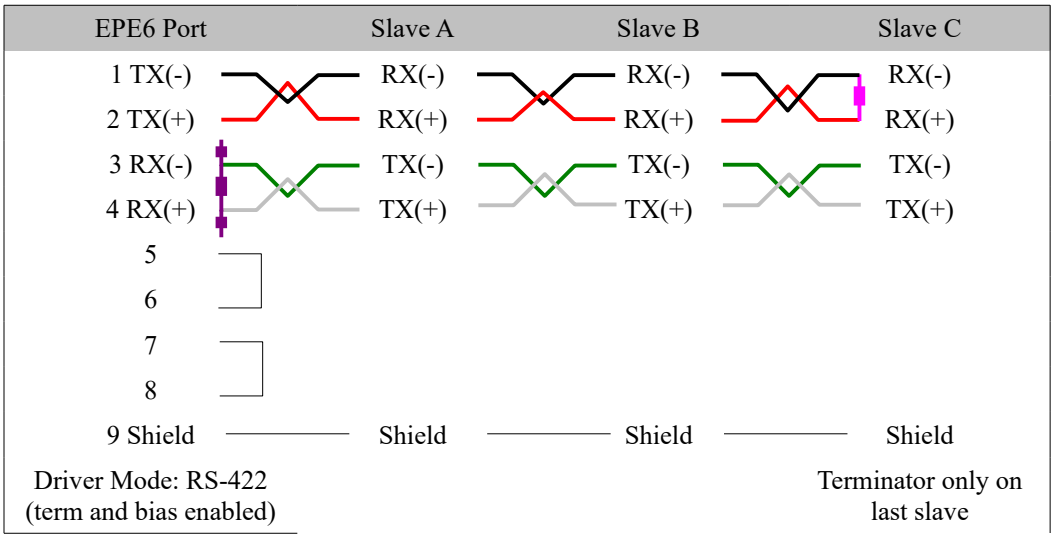
The Driver Mode for the EPE6 port should be set to RS-422. This mode enables the transmitter of the port at all times to bias the receivers of all of the slaves. This mode also enables the internal termination and bias of the EPE6's receiver.

Belden 8723 or equivalent is recommended for this type of network.

The shield wire should only be grounded at one location - usually at the master. The EPE6 ports' pin 9 is connected to the ground of the enclosure for this purpose.

For the user's convenience, the DC7 cable may be used between the EPE6 port and the first slave.

Figure 7.2.: 4-wire RS-485 Master



EPE6 to 2-wire RS-485

The EPE6 may be used as a master or slave on a 2-wire RS-485 network. An example of this network is a string of 2-wire RS-485 PowerLogic meters attached to the EPE6.

The EPE6 must have the TX(+) and RX(+) lines jumpered together to make the (+) connection on a 2-wire network. The TX(-) and RX(-) lines must also be jumpered together to connect to the (-) line.

Terminator should be used at the last slave on each end of the daisy-chain. Normally, this is a 120 ohm resistor.

Bias should only be enabled on one device of the 2-wire network. Typically, the bias is enabled at the Master device since it is required to be active on the network.

If the EPE6 is the Master of the network, then it should be located at one end of the daisy-chain and the Driver Mode should be set to RS485+Bias. The RS845+Bias mode enables the internal bias and termination resistors.

NOTE: RS485+Bias mode always enables both the internal termination and bias resistors. If another device on the 2-wire network is providing the bias then the EPE6 port must be set for RS485-Bias and an external termination resistor must be used.

Belden 9841 or equivalent is recommended for this type of network.

The shield wire should only be grounded at one location - usually at the master. The EPE6 ports' pin 9 is connected to the ground of the enclosure for this purpose.

Figure 7.3.: 2-wire RS-485 Network with internal Bias

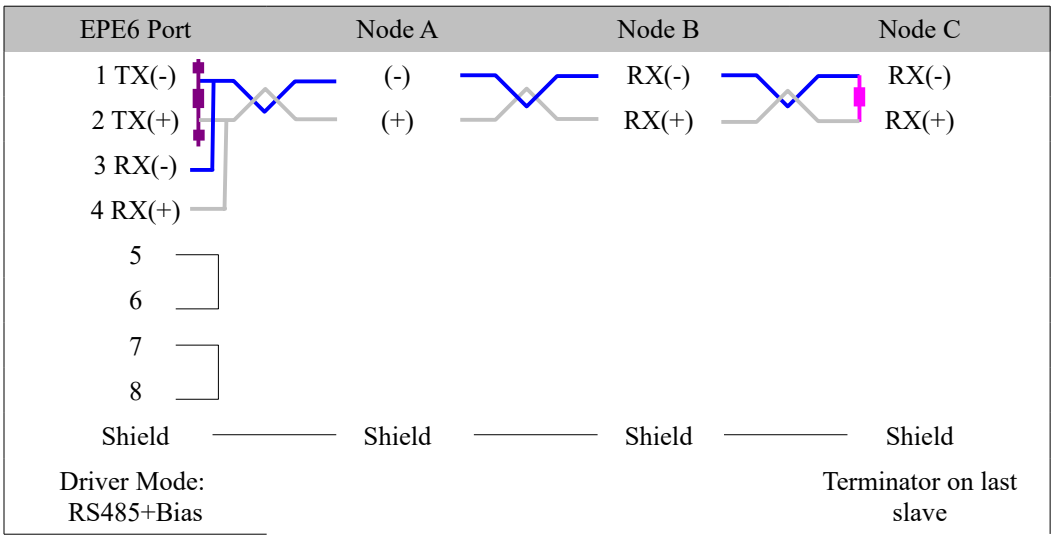
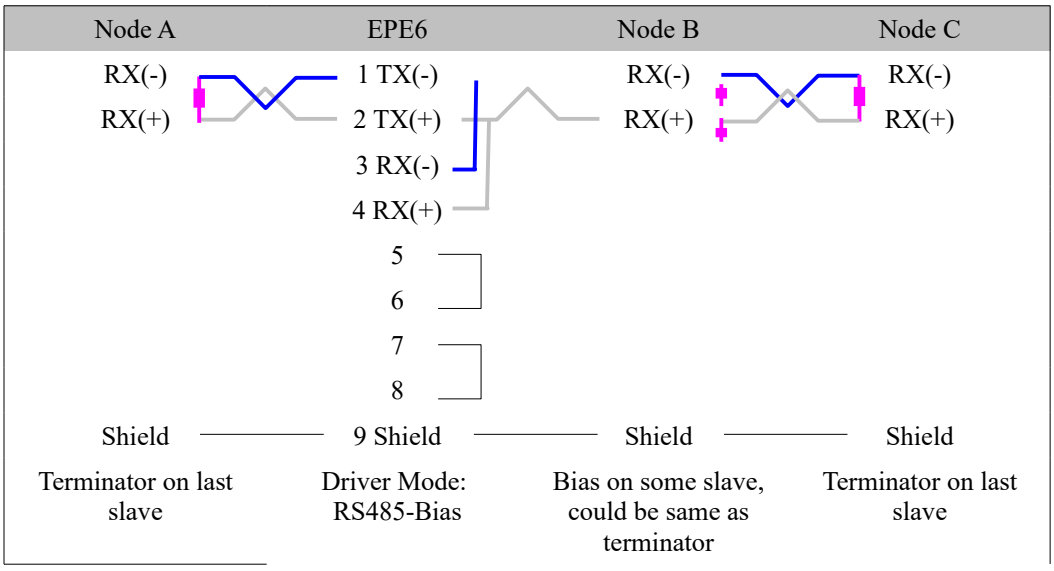


Figure 7.4.: 2-wire RS-485 Network without internal Bias



8 Web Server

The EPE6 uses a built-in Web server for remote configuration over the Ethernet network. This Web server requires the use of Javascript.

Login

The EPE6 Web server supports two user access levels: “User” and “Admin”. These usernames are not changeable and are not case sensitive. “User” provides read-only access to view the configuration of the EPE6. “Admin” provides full configuration edit capabilities as well as backup/restore and firmware upgrade.

The Default Password for each user is shown below and are not case sensitive:

Username: user

Password: user

Username: admin

Password: master

Figure 8.1 shows the Login page. Enter the appropriate username and password to gain access to the EPE6.

If the “User” account is used and the operator attempts to modify a setting in the EPE6, a pop-up notification will appear to announce that modifications are not allowed for this user level. (See Figure 8.2)

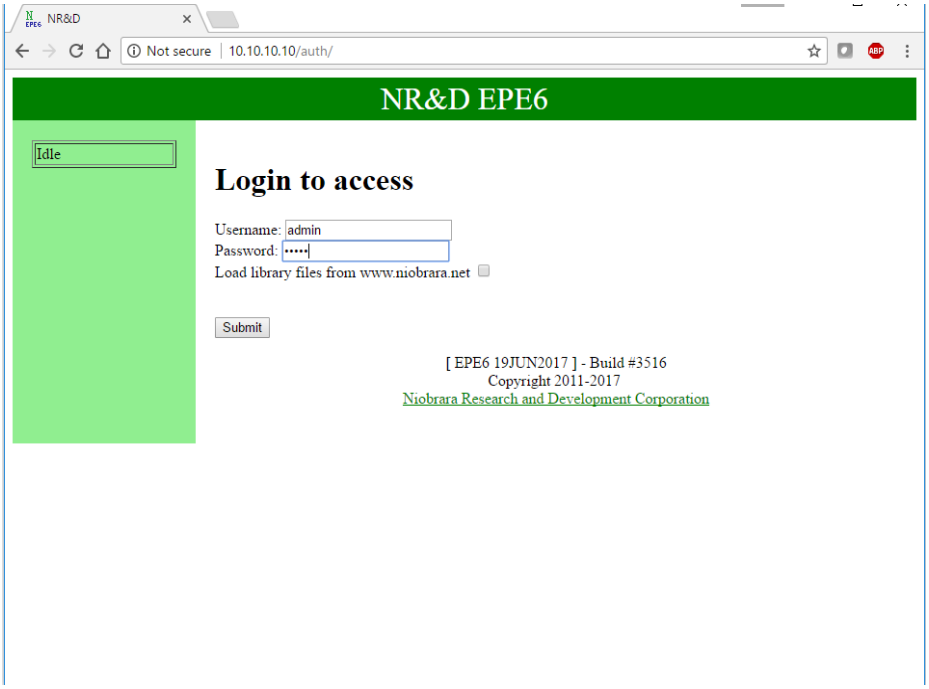


Figure 8.1: Login Screen

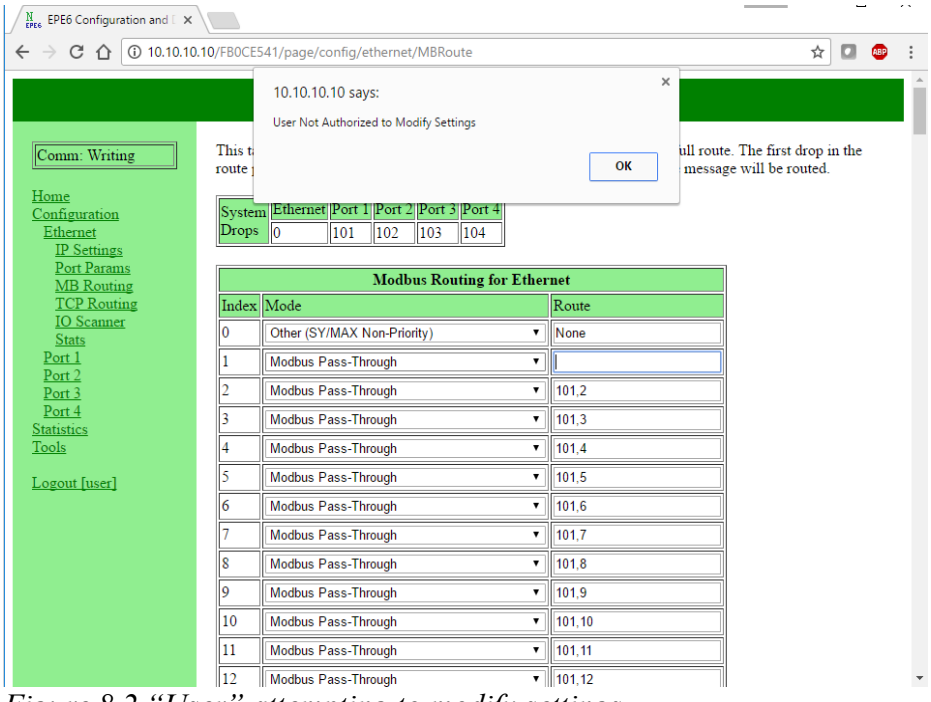
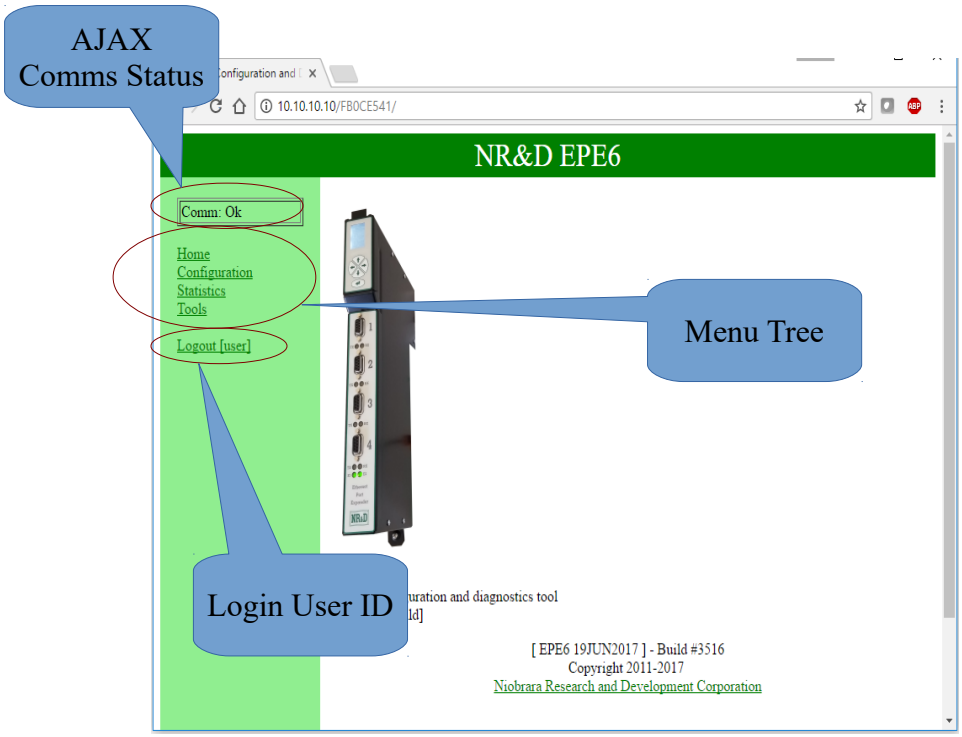


Figure 8.2 "User" attempting to modify settings

Home

Figure 8.3: Home



The typical web page includes an AJAX status box showing the state of the Javascript communication between the browser and the EPE6. The background of this box turns red when comm errors are occurring.

The menu tree may has the following branches: Home, Configuration, Statistics, Tools, and Admin.

NOTE: Admin is not present when logged in as “user”.

Configuration

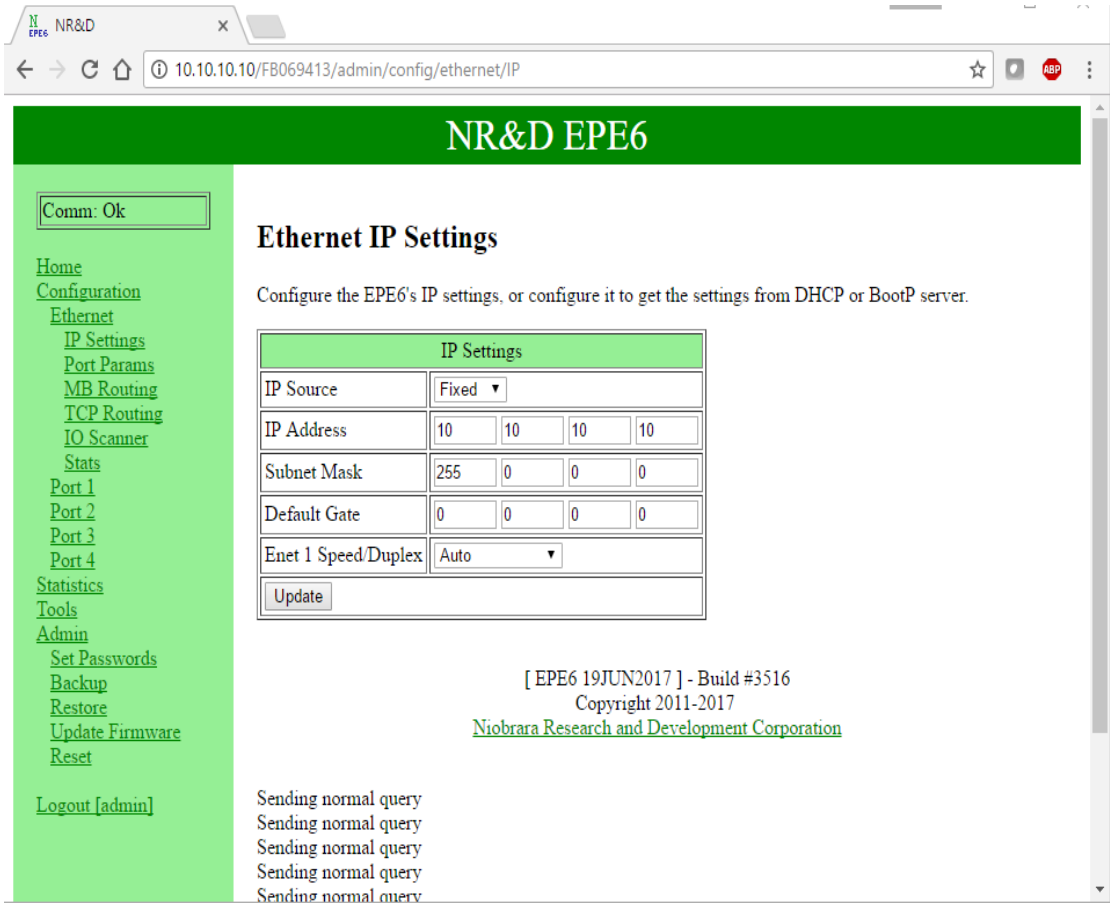
The Configuration menu provides access to the settings for Ethernet, Port 1, Port 2, Port 3, and Port 4.

Ethernet

There are pages for setting the IP Address, Ethernet Protocol, Modbus Routing, TCP Client Routing, and I/O Scanner.

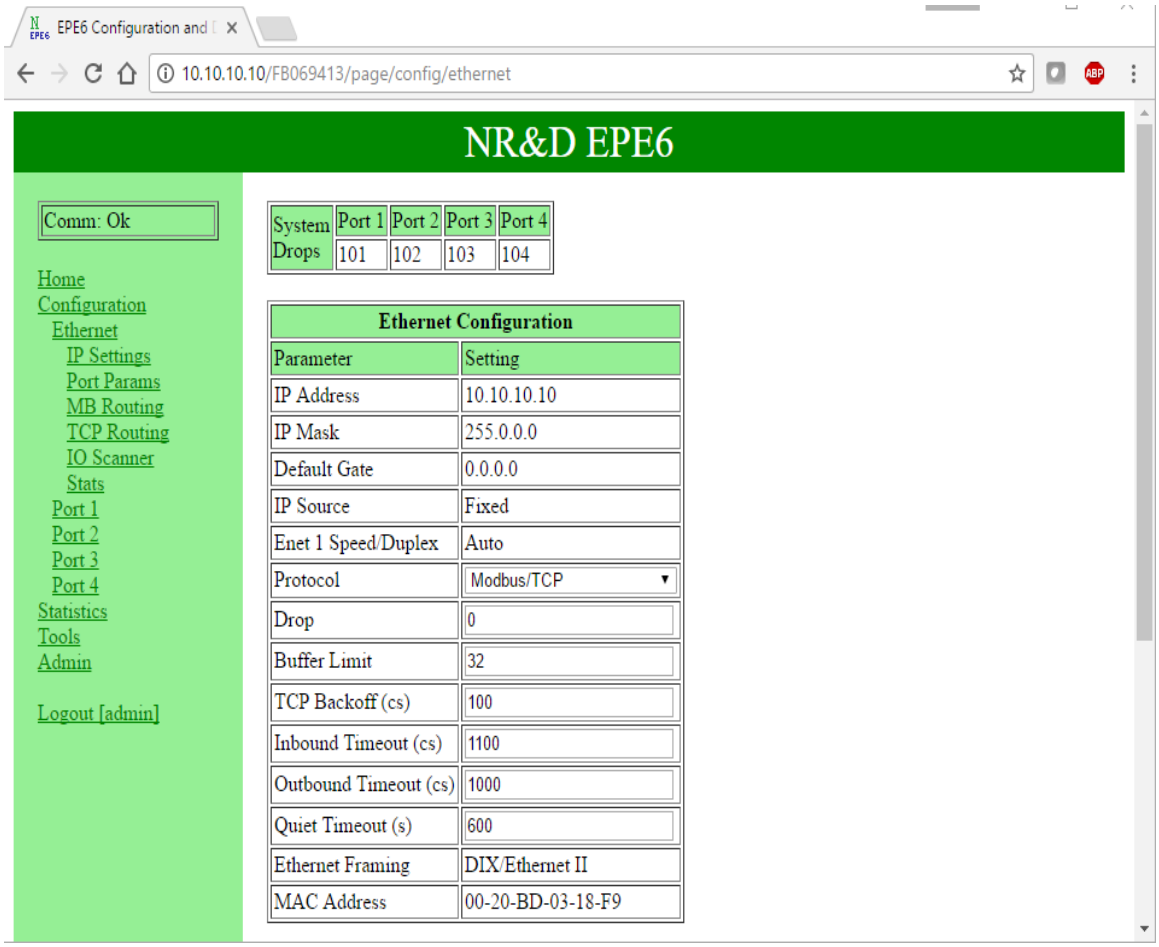
IP Settings

The IP Settings page allows the Admin to select the IP Parameters for the module.



Ethernet Port Parameters

This page allows the Admin to configure the EPE6 to operate in Modbus/TCP or SY/AMX+Modbus/TCP mode and set the SY/MAX 802.3 drop number.



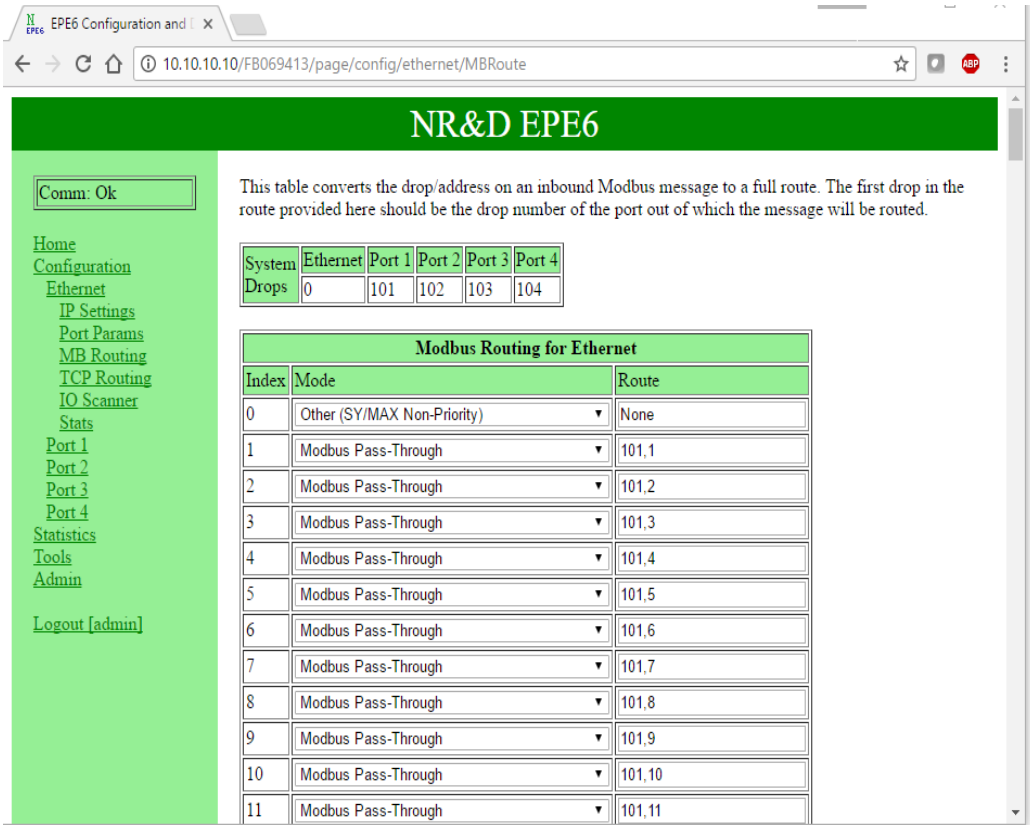
Modbus Routing for Ethernet Port

The Ethernet port has 254 entires in its Modbus Routing table. The Route typically consists of the drop number of the outbound EPE6 port followed by any additional drops needed to reach the target.

NOTE: Entries with no route will allow that index to access the EPE6's internal registtters.

NOTE: Entries with the first drop in the route that does not match a drop number of any port on the EPE6 will access the EPE6's internal registers.

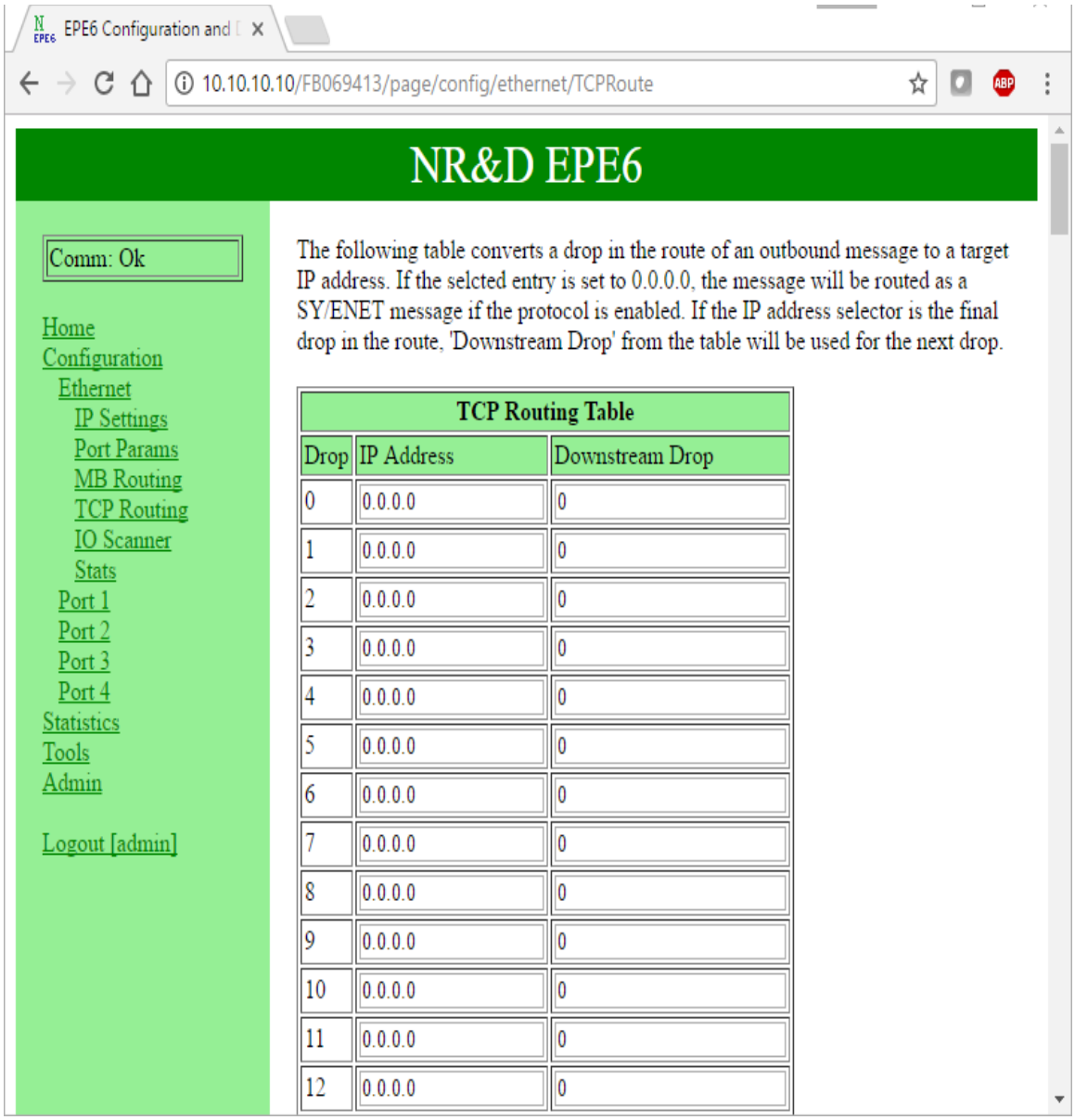
NOTE: Using the Ethernet port's drop number as the first drop in the route will cause the message to be routed back out the Ethernet port. This feature allows the EPE6 to translate between Modbus/TCP and SY/MAX 802.3 Ethernet.



TCP Routing Table

The TCP Routing table is used for Modbus/TCP Client operation.

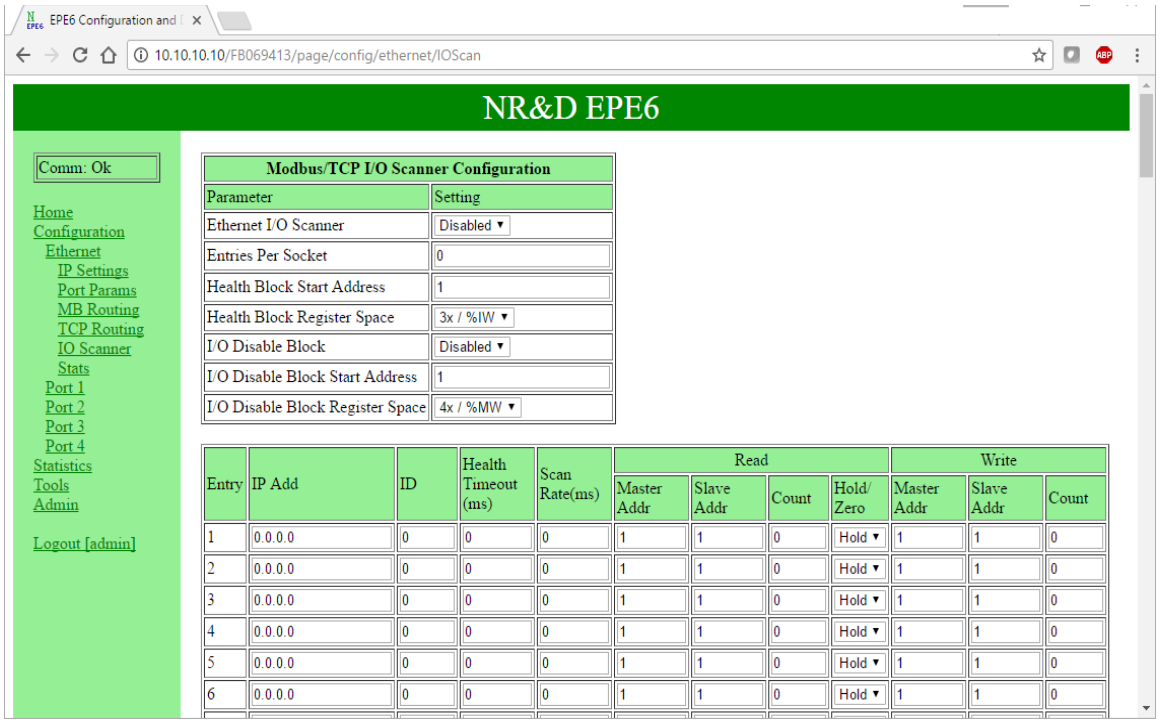
NOTE: SY/MAX 802.3 Ethernet client operation is selected by setting the drop number IP Address to 0.0.0.0.



I/O Scanner

The EPE6 includes a Modbus/TCP I/O Scanner. This scanner allows automatic Read, Write, and Read+Write time based messages to be generated between the EPE6 and up to 128 Modbus TCP servers. The I/O Scanner operates on the Mailbox registers (1-2048) in

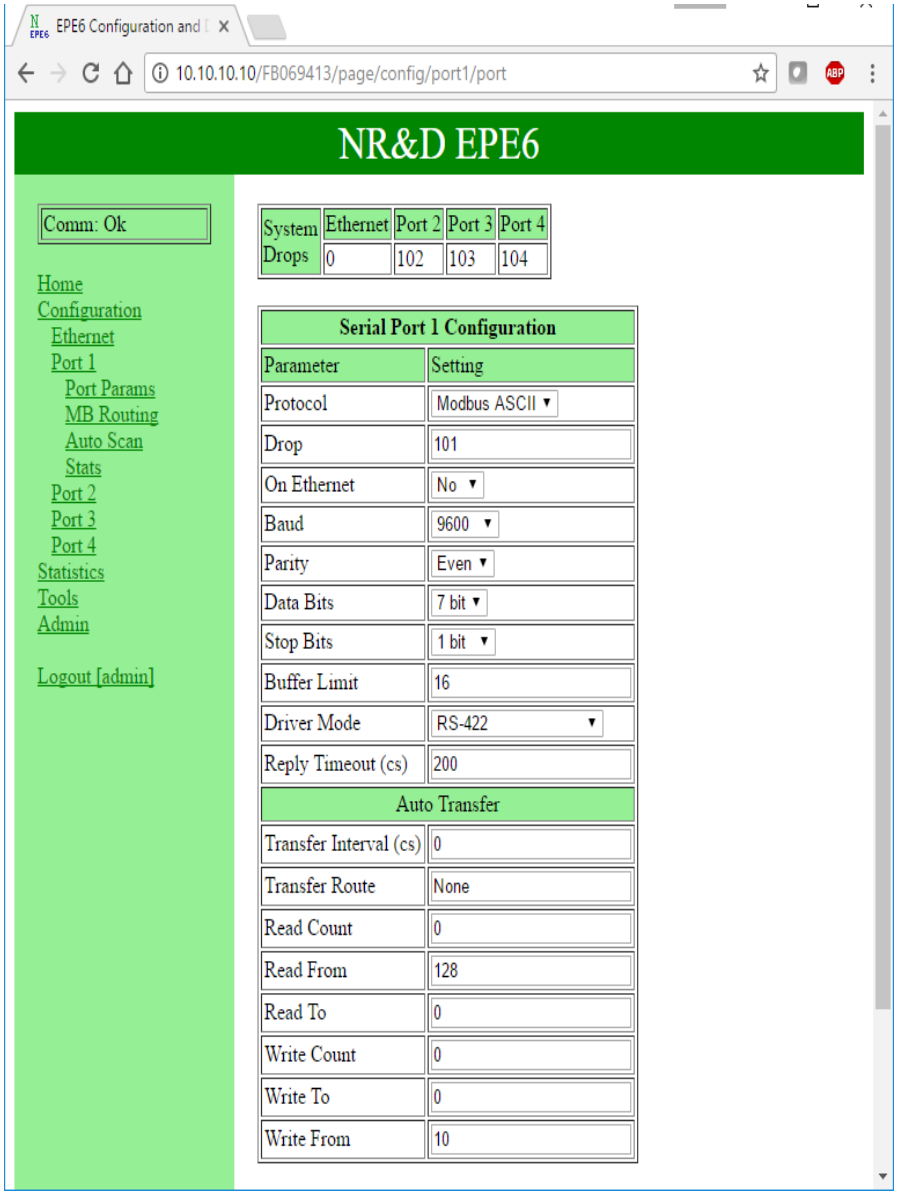
the EPE6's internal registers.



Serial Ports

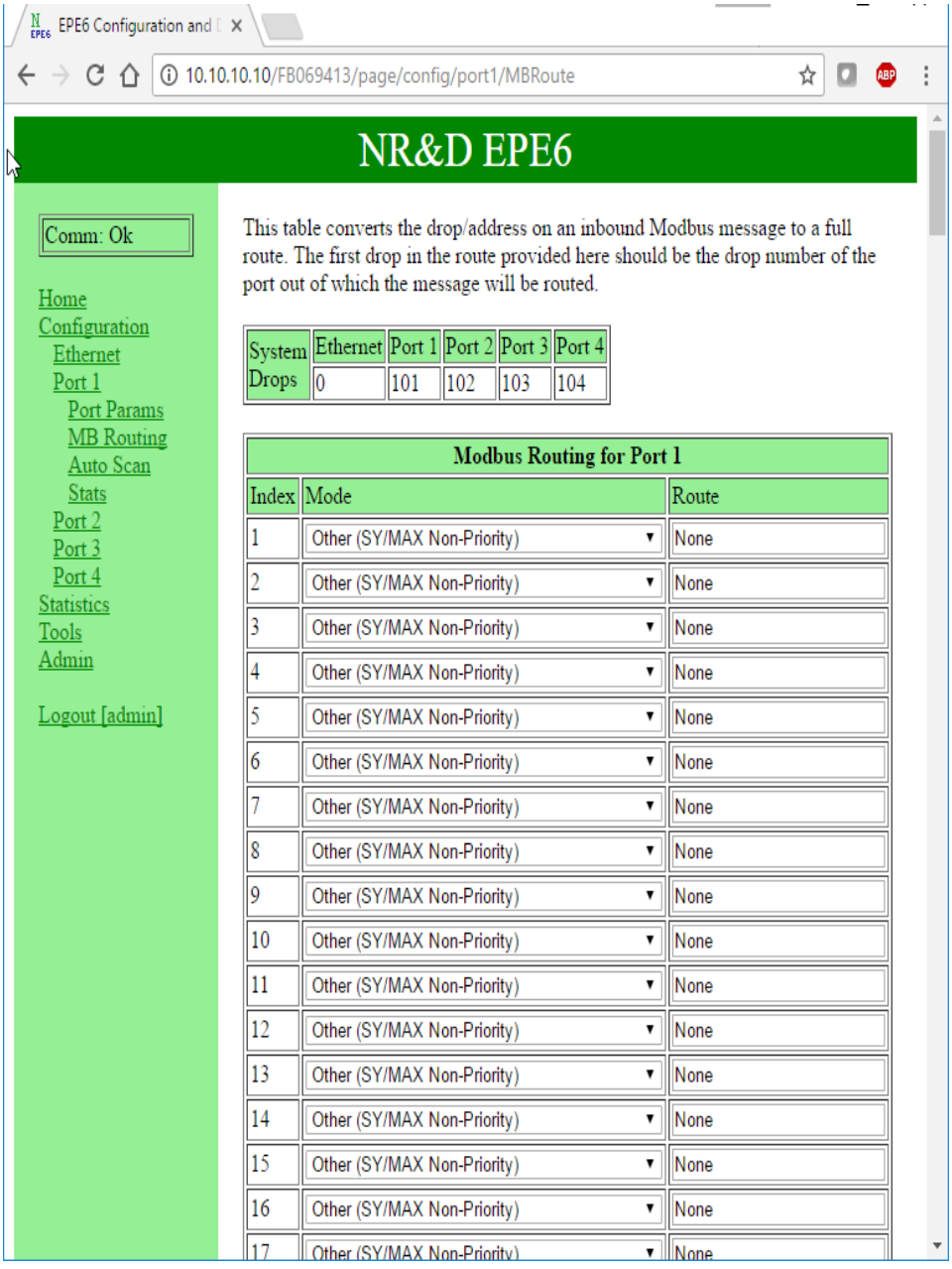
Port Parameters

The Port Parameters page will show the settings for a given serial port. Various protocol modes have different settings that may be displayed. Changing the protocol mode will prompt the "Admin" to "Apply typical settings" for the new mode. Selecting "OK" will change many of the settings to match the normal usage of the new mode.



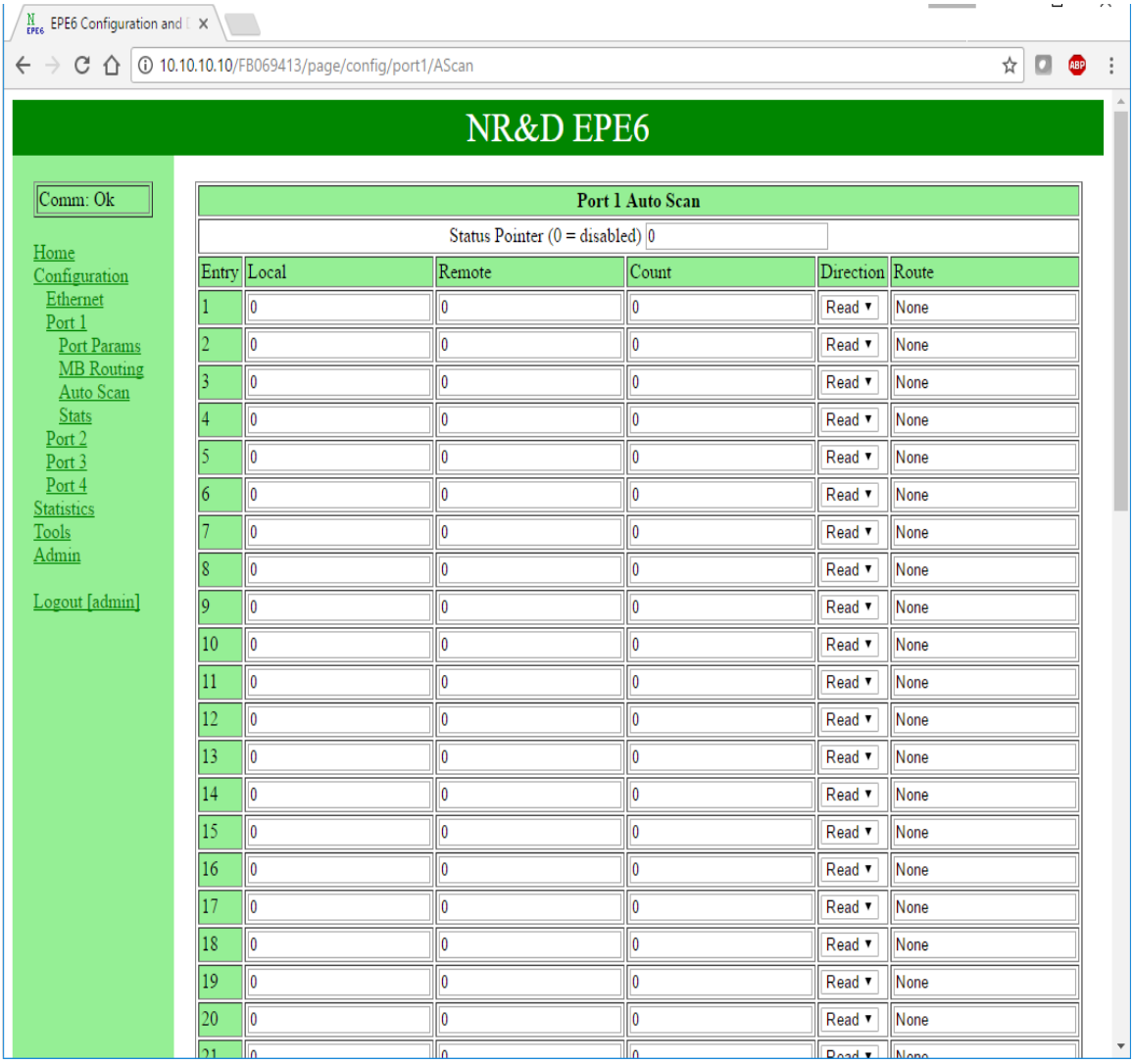
Serial Port Modbus Routing Table

Each serial port includes its own 254 entry look-up table for Modbus Slave operation. The first drop in the Route field is the drop number of the outbound EPE6 port.



Serial Port Auto Scan

Each serial port may be configured to automatically poll attached slave(s) on a timed interval. This table provides the configuration for each of the 48 possible entries.



Statistics

Pages are provided for statistical counter pages for each port.

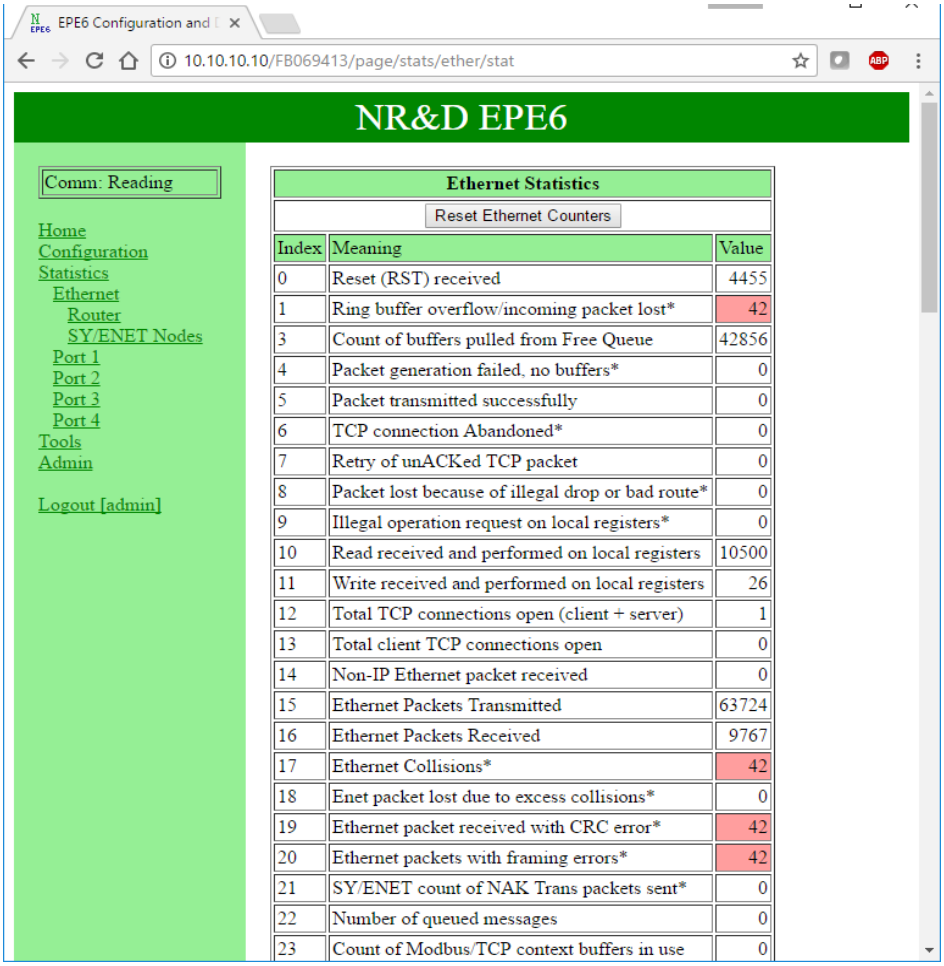
Many of these pages have “Reset Counter” buttons that allow either the “User” or “Admin” to zero the counters.

NOTE: These counters are typically unsigned words and will roll over from 65535 to 0 with no indication that a rollover has occurred.

NOTE: These counters do not survive a power cycle/reboot.

Ethernet Router Stats

The Ethernet Router page shows counters for the SY/MAX / Modbus router for this port.



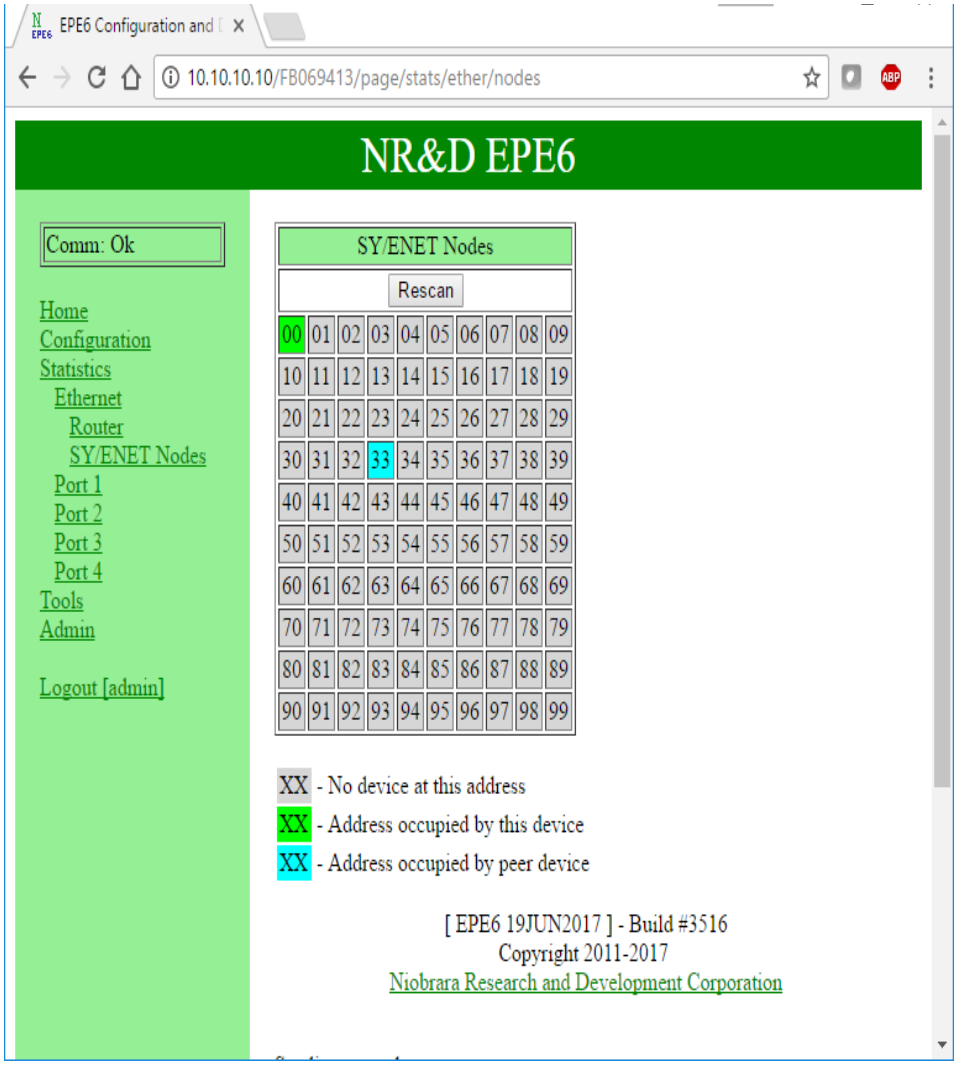
SY/MAX 802.3 Ethernet Nodes

This table shows all of the visible SY/MAX Ethernet devices on the EPE6's local Ethernet network.

NOTE: The EPE6 Ethernet port must be set for SY/MAX+Modbus mode for this table to be accurate.

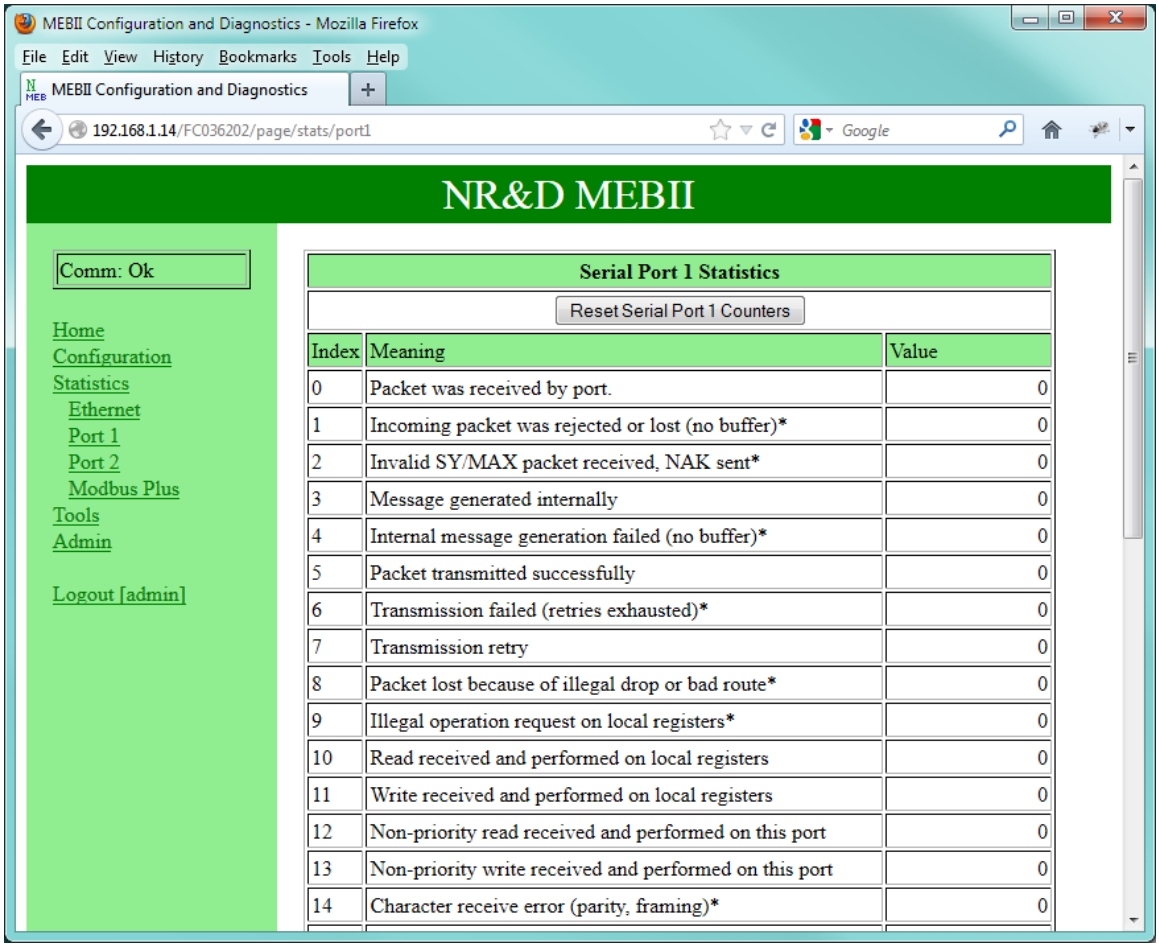
Any SY/MAX Ethernet drop number occupied by this EPE6 is highlighted in green. This includes any serial port that is set for "ON Ethernet YES". Serial ports that have a drop number greater than 100 and configured for "ON Ethernet YES" will also consume the SY/MAX drop number minus 100.

Drop Number of peer devices are highlighted in blue.



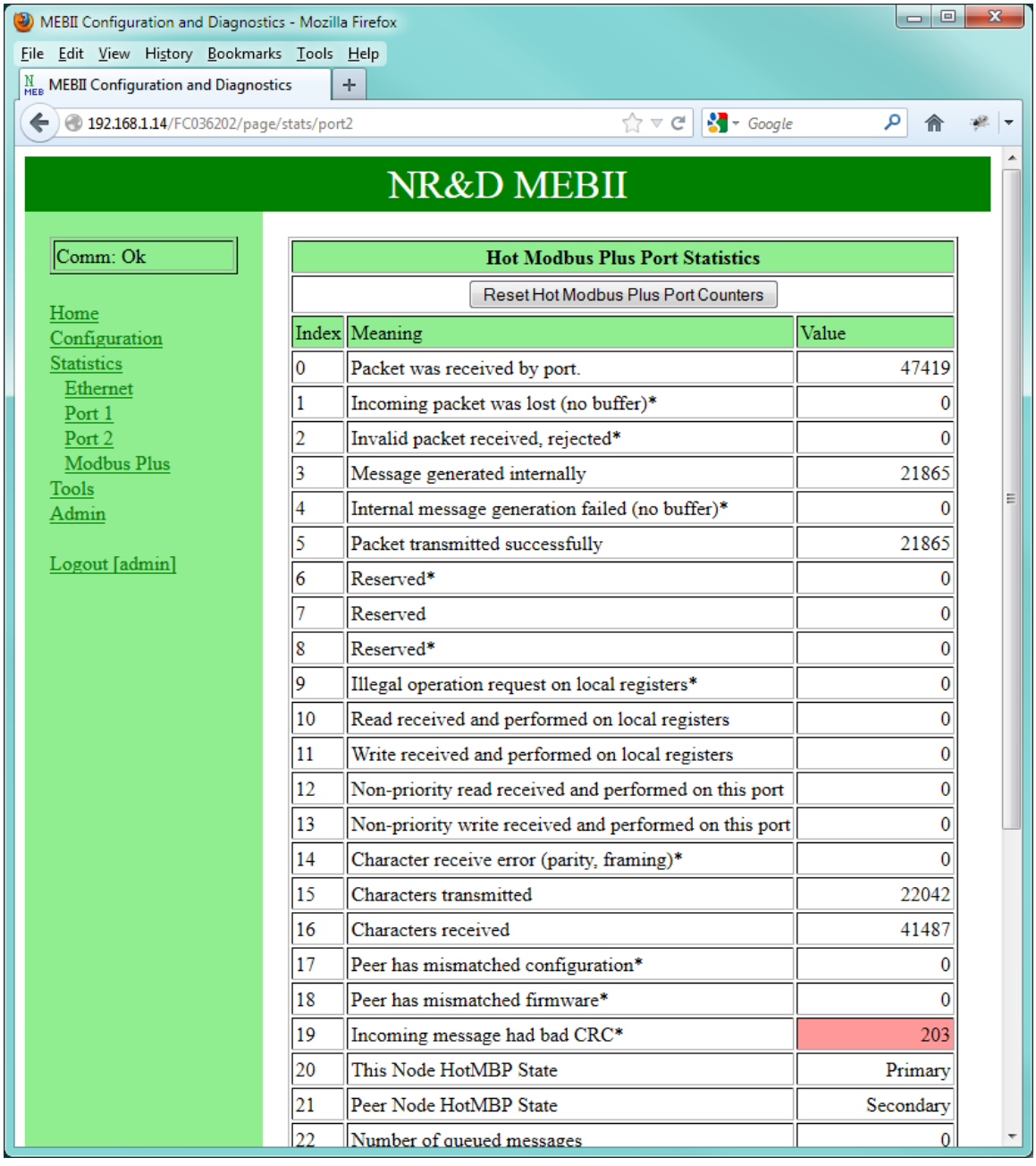
Serial Port

Serial ports 1-4 have counter pages to show the SY/MAX / Modbus router information associated with that port.



Port 2 Hot Modbus Statistics

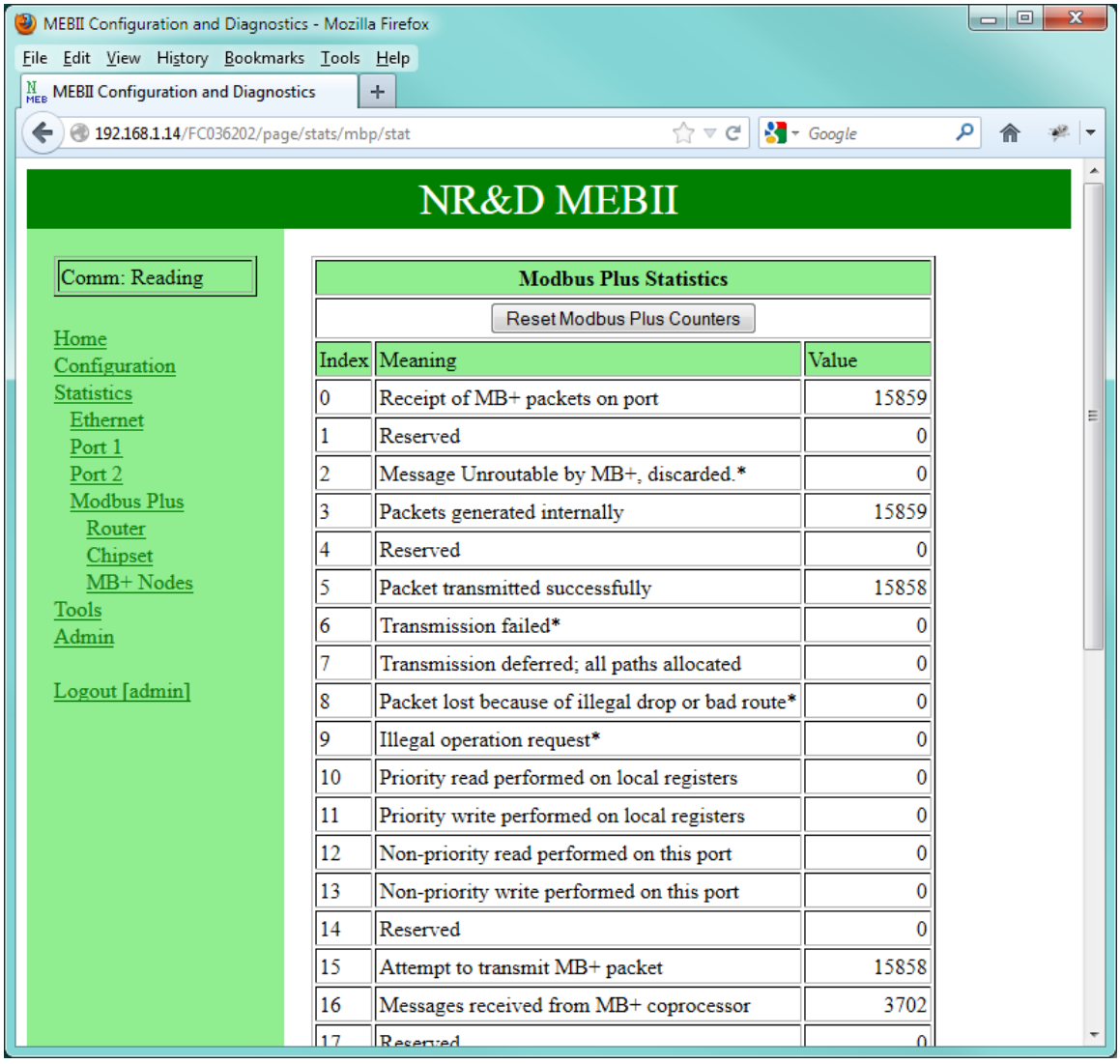
The statistics page for Port 2 is different when the EPE6 is configured for Hot Modbus Plus operation.



Index	Meaning	Value
0	Packet was received by port.	47419
1	Incoming packet was lost (no buffer)*	0
2	Invalid packet received, rejected*	0
3	Message generated internally	21865
4	Internal message generation failed (no buffer)*	0
5	Packet transmitted successfully	21865
6	Reserved*	0
7	Reserved	0
8	Reserved*	0
9	Illegal operation request on local registers*	0
10	Read received and performed on local registers	0
11	Write received and performed on local registers	0
12	Non-priority read received and performed on this port	0
13	Non-priority write received and performed on this port	0
14	Character receive error (parity, framing)*	0
15	Characters transmitted	22042
16	Characters received	41487
17	Peer has mismatched configuration*	0
18	Peer has mismatched firmware*	0
19	Incoming message had bad CRC*	203
20	This Node HotMBP State	Primary
21	Peer Node HotMBP State	Secondary
22	Number of queued messages	0

Modbus Plus Router

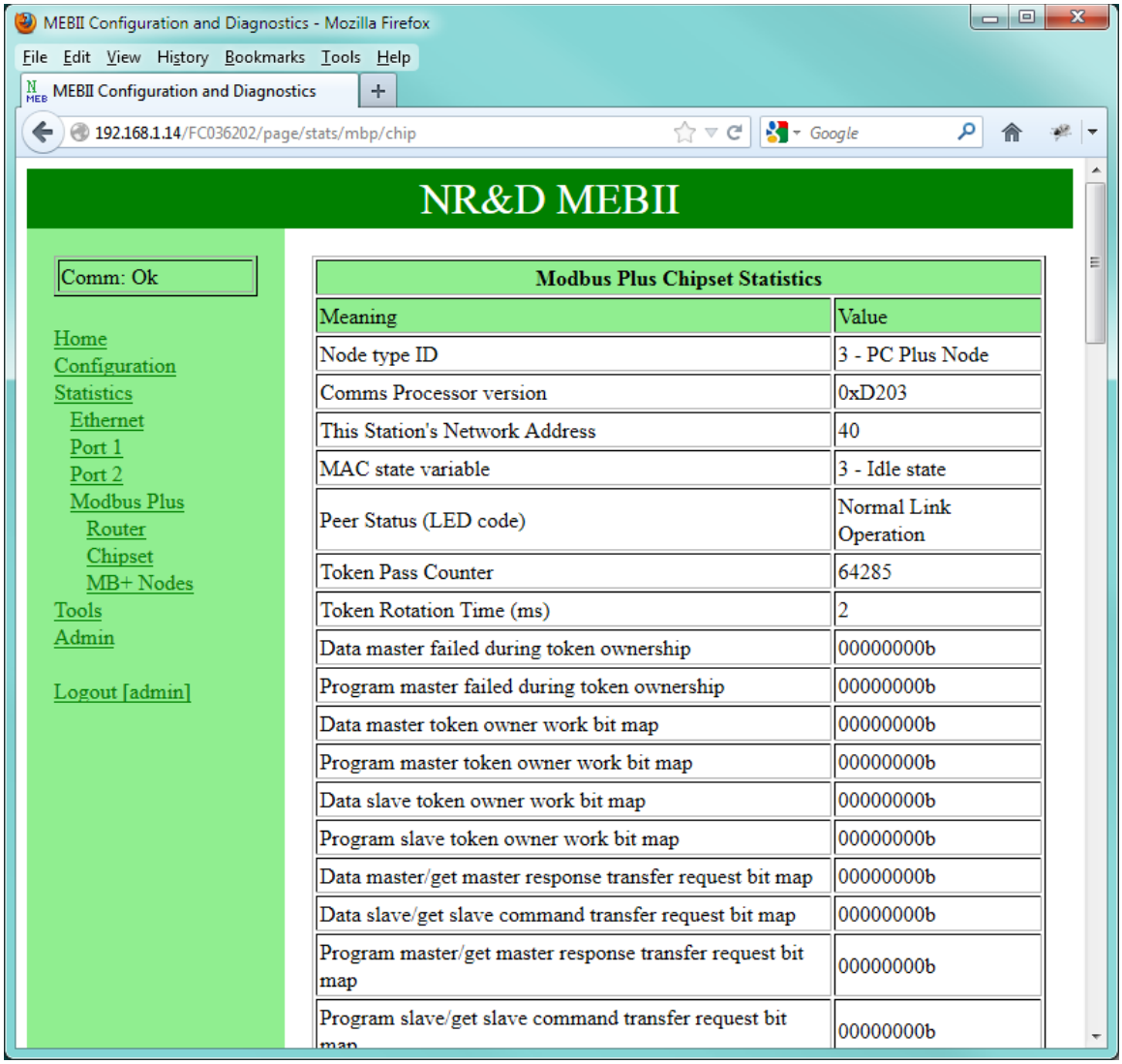
The Router statistics page shows the normal SY/MAX / Modbus router counters for the MB+ port.



Index	Meaning	Value
0	Receipt of MB+ packets on port	15859
1	Reserved	0
2	Message Unroutable by MB+, discarded.*	0
3	Packets generated internally	15859
4	Reserved	0
5	Packet transmitted successfully	15858
6	Transmission failed*	0
7	Transmission deferred; all paths allocated	0
8	Packet lost because of illegal drop or bad route*	0
9	Illegal operation request*	0
10	Priority read performed on local registers	0
11	Priority write performed on local registers	0
12	Non-priority read performed on this port	0
13	Non-priority write performed on this port	0
14	Reserved	0
15	Attempt to transmit MB+ packet	15858
16	Messages received from MB+ coprocessor	3702
17	Reserved	0

MB+ Chipset

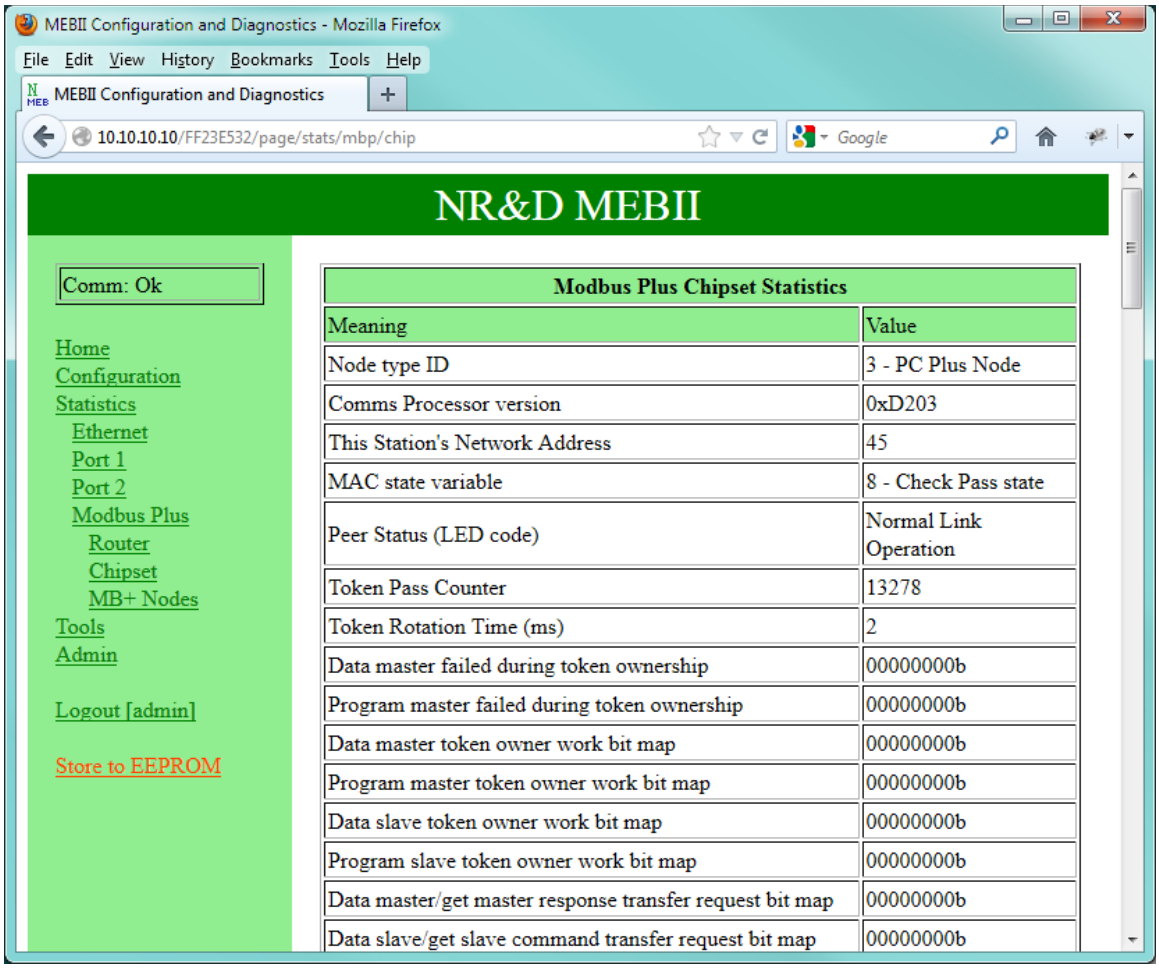
The MB+ Chipset page shows information provided by the MB+ chipset. These counters are not resettable.



Modbus Plus Nodes

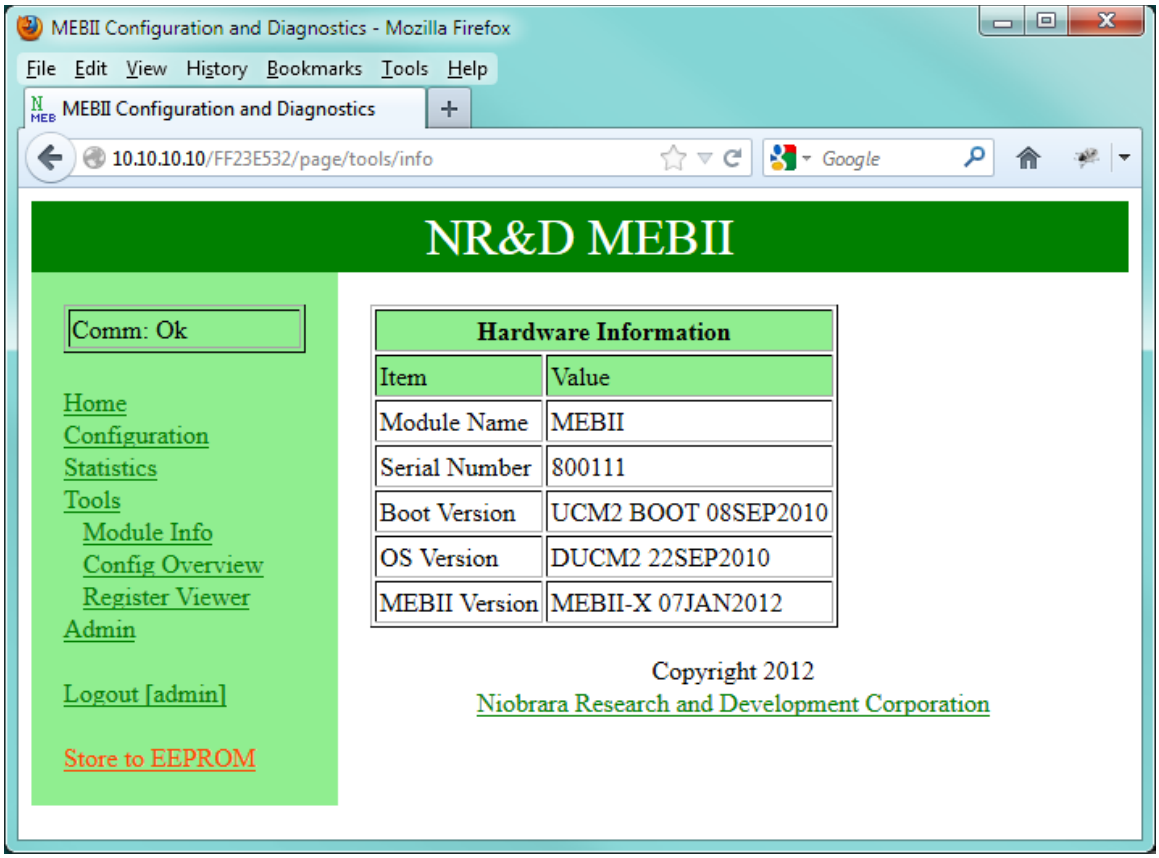
This table shows all possible 64 MB+ stations on the EPE6's local MB+ network. The EPE6's drop number is highlighted in green. All other visible nodes are highlighted in blue.

MEBII Configuration and Diagnostics - Mozilla Firefox
File Edit View History Bookmarks Tools Help
MEBII Configuration and Diagnostics
10.10.10.10/FF23E532/page/stats/mbp/r
Google
NR&D MEBII
Comm: Reading
Home
Configuration
Statistics
Ethernet
Port 1
Port 2
Modbus Plus
Router
Chipset
MB+ Nodes
Tools
Admin
Logout [admin]
Store to EEPROM
Modbus Plus Station List
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40
41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56
57 58 59 60 61 62 63 64
XX - No device at this address
XX - Address occupied by this device
XX - Address occupied by peer device
Copyright 2012
Niobrara Research and Development Corporation


MEBII Configuration and Diagnostics - Mozilla Firefox
File Edit View History Bookmarks Tools Help
MEBII Configuration and Diagnostics
10.10.10.10/FF23E532/page/stats/mbp/chip
Google
NR&D MEBII
Comm: Ok
Home
Configuration
Statistics
Ethernet
Port 1
Port 2
Modbus Plus
Router
Chipset
MB+ Nodes
Tools
Admin
Logout [admin]
Store to EEPROM
Modbus Plus Chipset Statistics
Meaning
Value
Node type ID
3 - PC Plus Node
Comms Processor version
0xD203
This Station's Network Address
45
MAC state variable
8 - Check Pass state
Peer Status (LED code)
Normal Link Operation
Token Pass Counter
13278
Token Rotation Time (ms)
2
Data master failed during token ownership
00000000b
Program master failed during token ownership
00000000b
Data master token owner work bit map
00000000b
Program master token owner work bit map
00000000b
Data slave token owner work bit map
00000000b
Program slave token owner work bit map
00000000b
Data master/get master response transfer request bit map
00000000b
Data slave/get slave command transfer request bit map
00000000b

Module Info

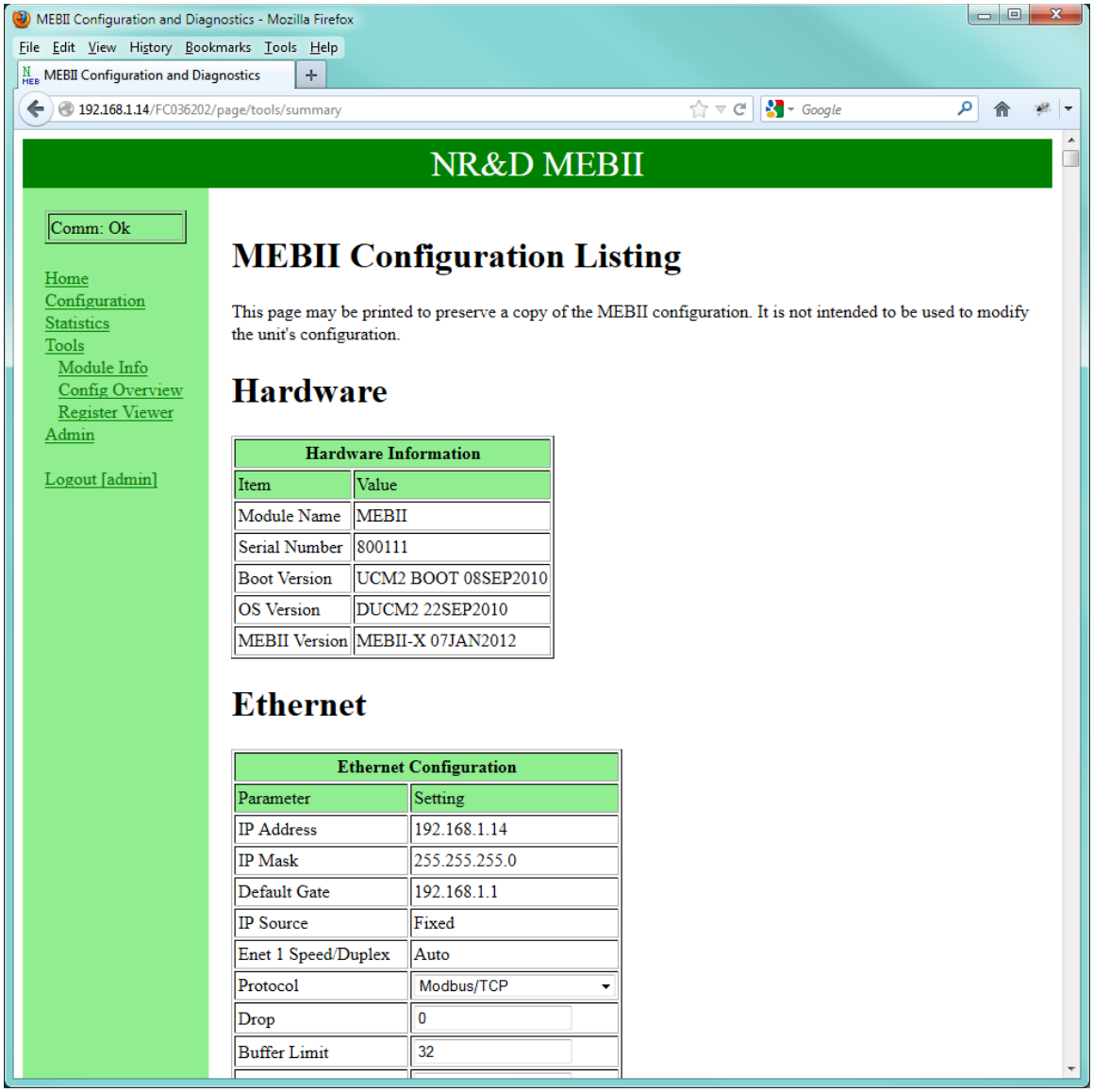
The Module Info page shows the EPE6's serial number and various firmware versions.



Config Overview

The Config Overview page provides a complete listing of all of the configuration of the EPE6. This page may be printed to provide a hard copy of the module's setup.

Note: This page takes several seconds to populate. At the end of the configuration is a text line “This is the end of the Configuration Listing.”



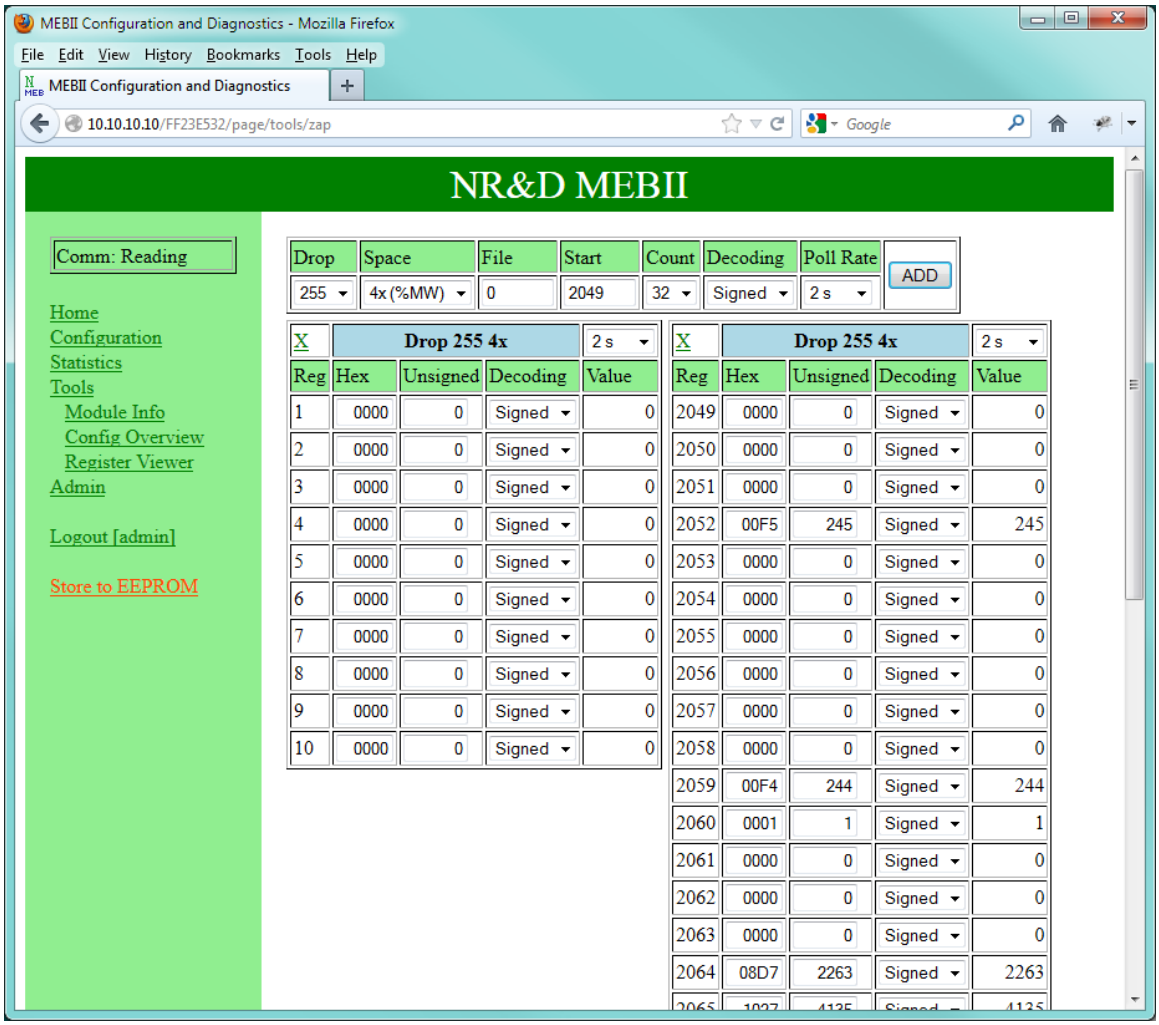
Register Viewer

The Register Viewer allows the User or Admin to view/modify register data in a target. The Target is determined using the Modbus Routing Table Index for the Ethernet Port.

NOTE: The present fimware only allows access to Modbus Index 255 (the EPE6 itself).

Access to 4x (Holding Registers) or 6x (Files) are supported.

Multiple viewing windows may be opened. Windows may be closed by clicking the "X" in the upper left corner of the window. The polling rate of each viewing window is adjustable with the pull-down in the upper corner of each window.

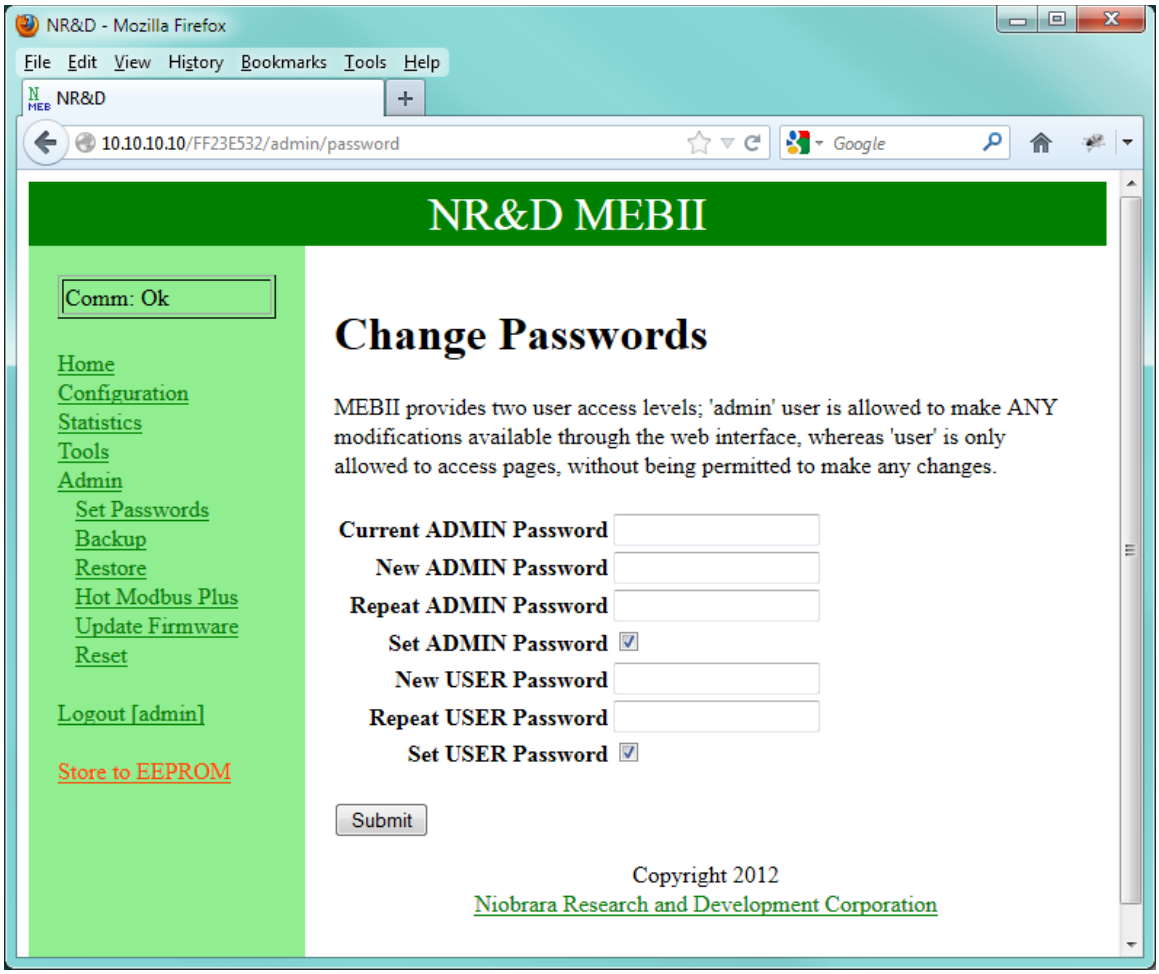


Admin Menu

The Admin menu heading is only shown when the “Admin” account is used for the web login.

Change Passwords

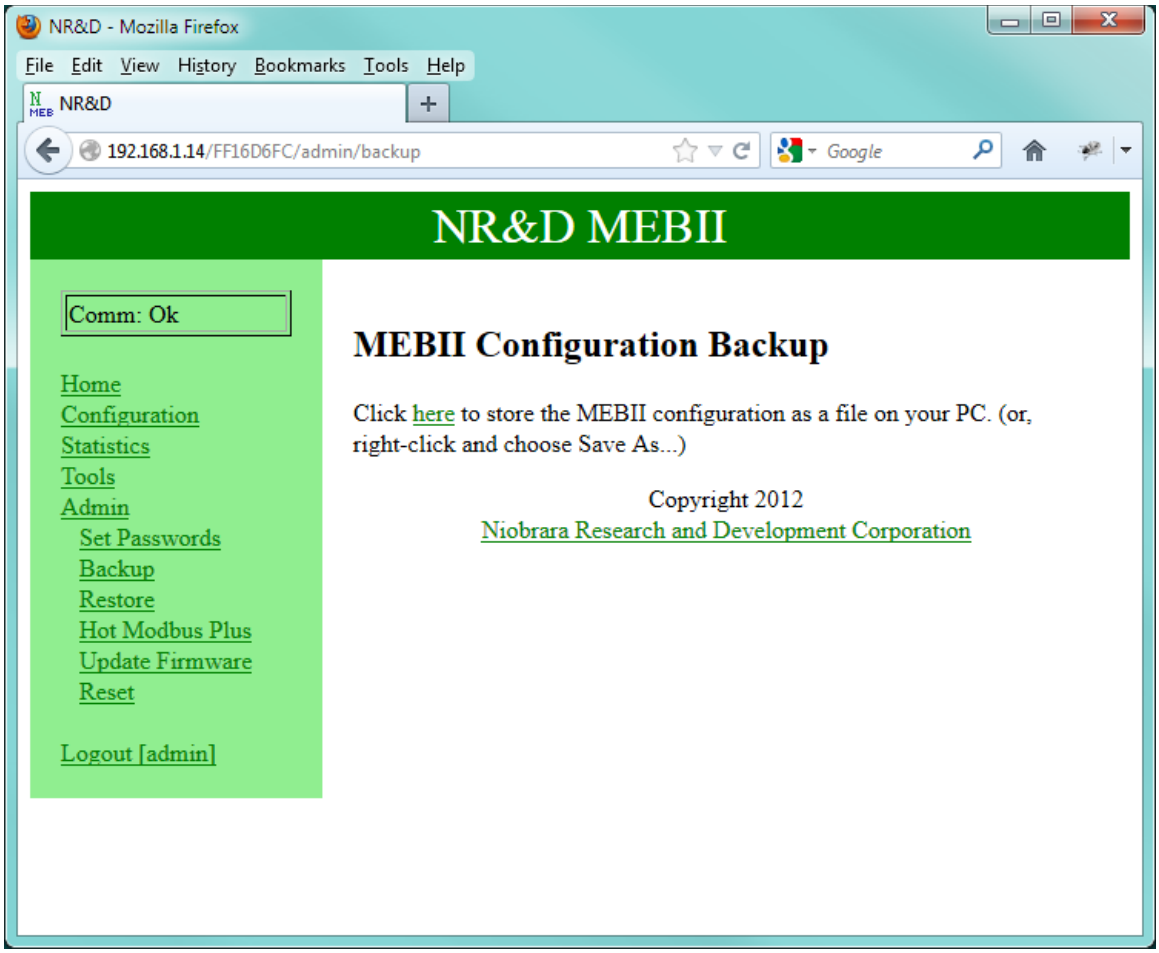
The Change Password page allows the Administrator to modify the “Admin” and/or “User” passwords.



Configuration Backup

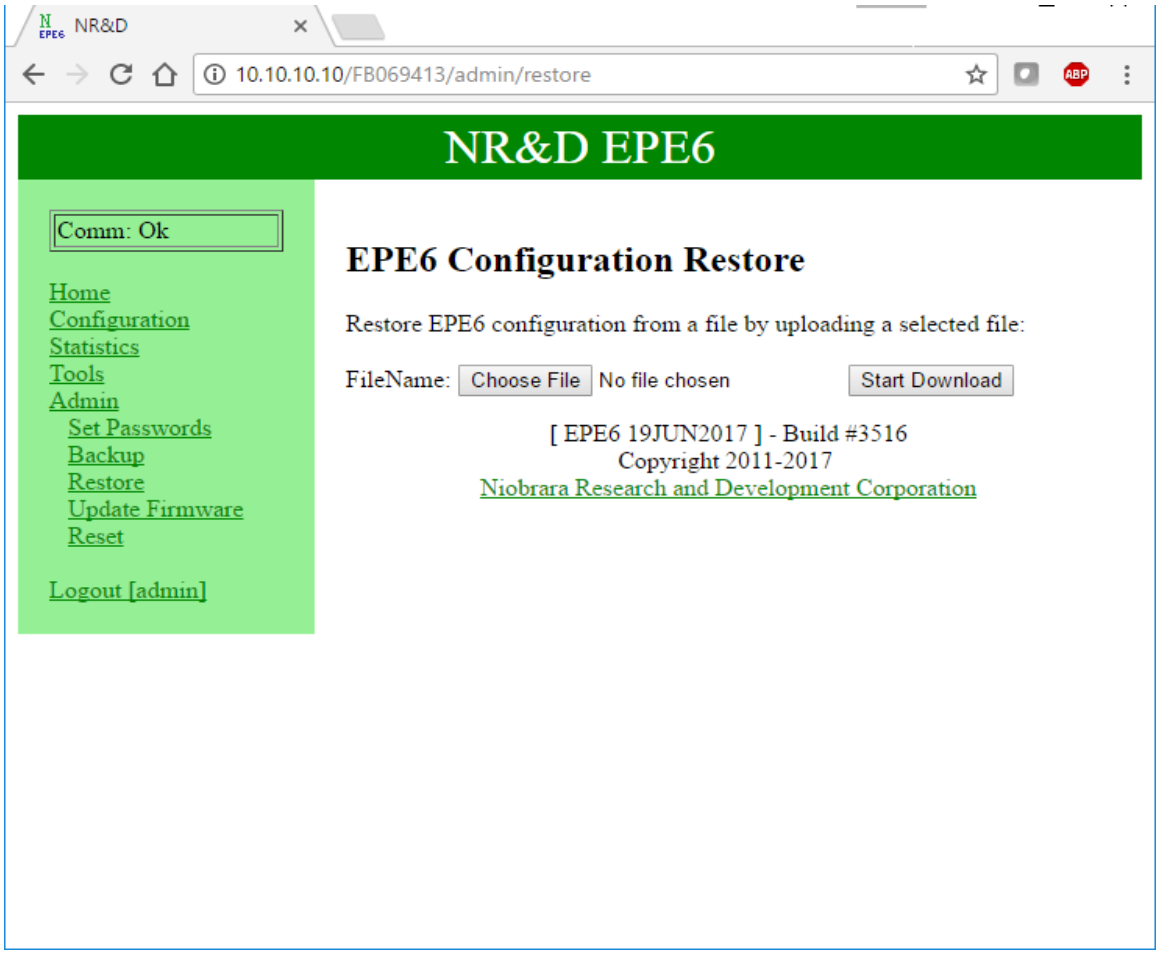
The configuration of the EPE6 may be pulled from the EPE6 and saved as an XML file on the PC. The common method is to right click the “here” link and choose “Save Link As...” or “Save Target As...” and then save the file.

The default filename is of the form: config_192_168_1_14.EPE6 where 192.168.1.14 is the IP Address of the MEB in question.



Configuration Restore

The Restore link will allow the Admin to restore a previously saved backup file to the EPE6.

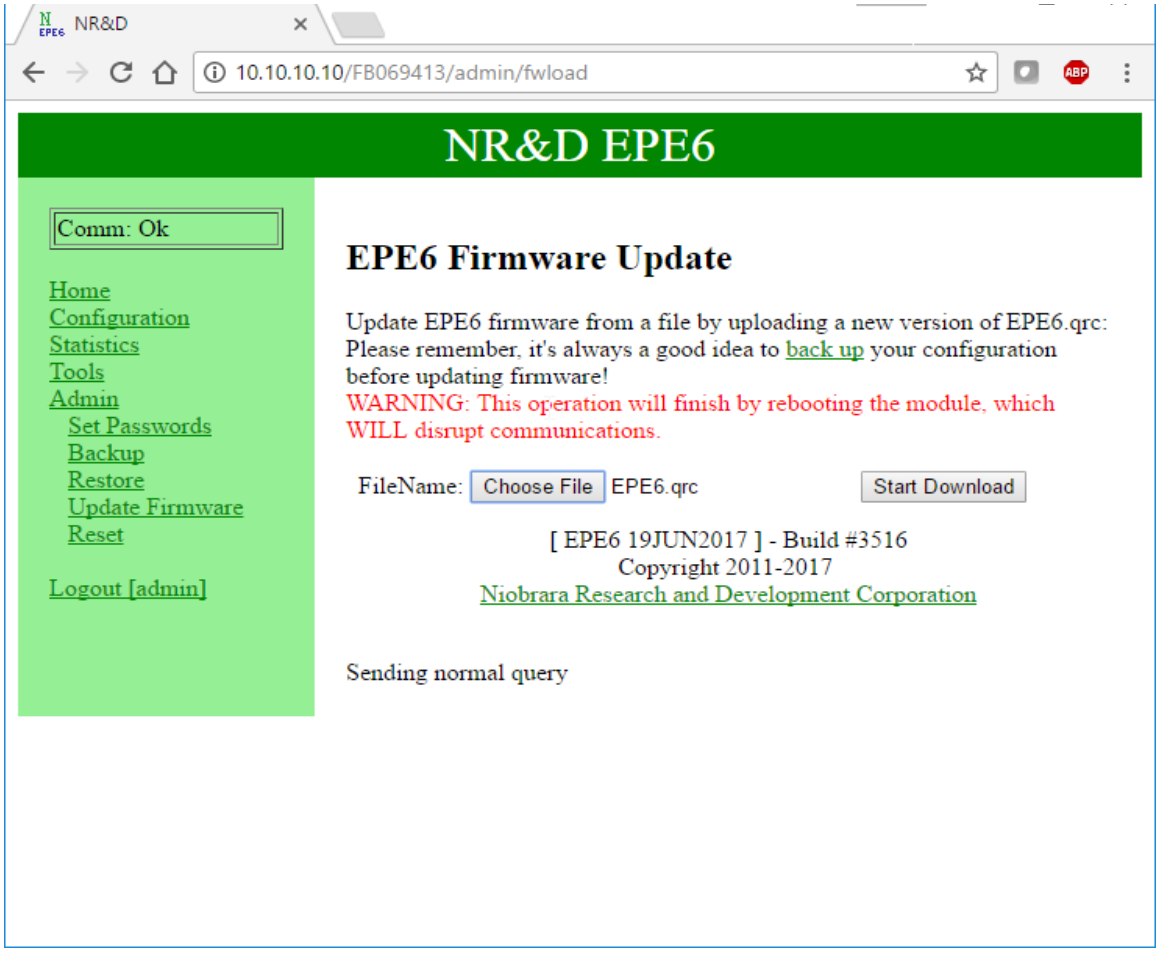


Firmware Update

The Firmware Update page allows the Admin to install a new version of the EPE6.qrc file.

NOTE: It is always recommended that a new backup of the EPE6 configuration be done before updating the firmware.

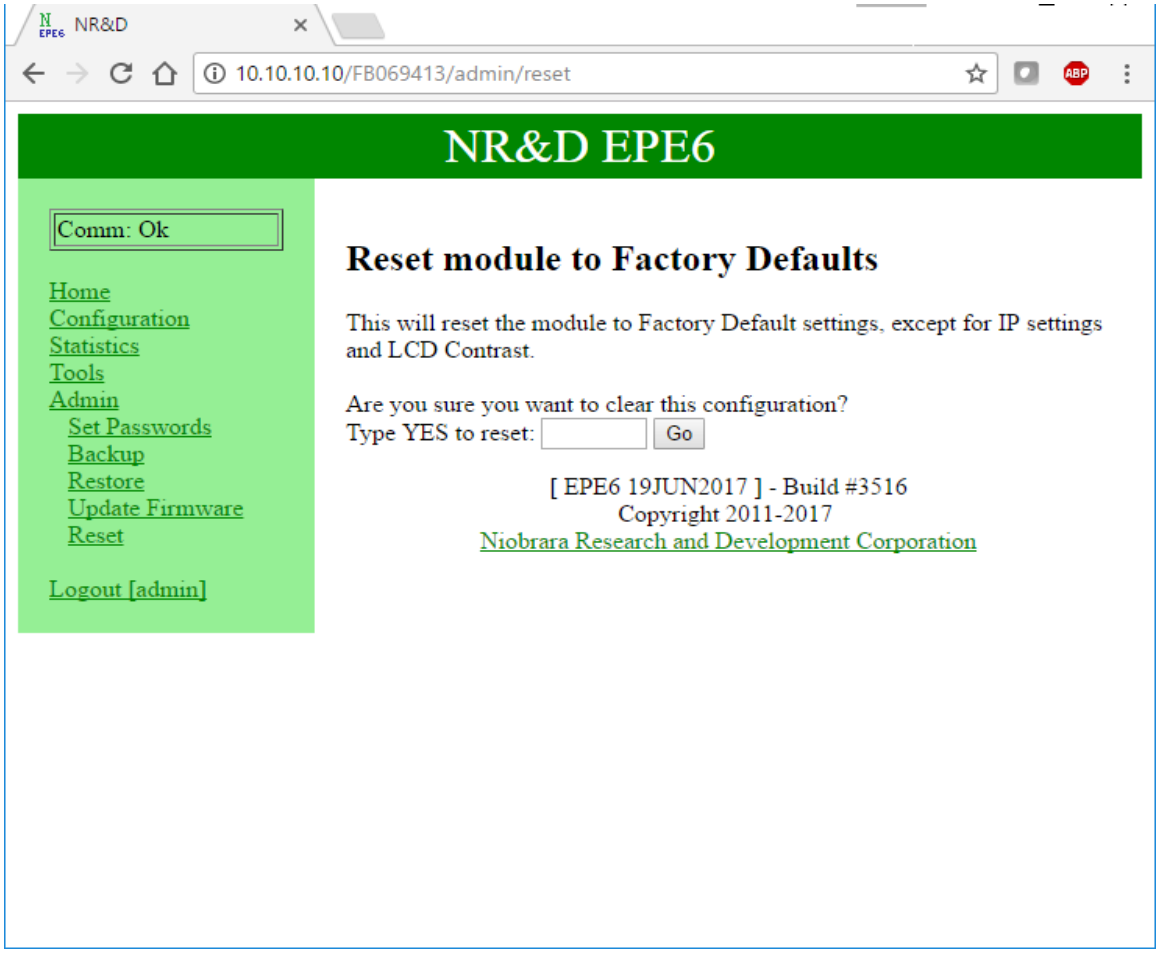
The new firmware is usually installed in the c:\Niobrara\Firmware\ folder.



Reset to Factory Defaults

The EPE6 may be reset to Factory Defaults by typing "YES" into the text field. Resetting to Factory using this web page will keep the current Ethernet settings (IP Address, Subnet Mask, and Default Gateway) but will revert all other settings to factory default.

NOTE: Resetting the EPE6 to Factory Default using the front panel LCD will also revert the IP settings to 10.10.10.10.



9 EPE5SW32

NOTE: EPE5SW32 does not offer full support of the features in the EPE6. The EPE6 features full 254 entry Modbus routing tables for Ethernet and both serial ports, as well as the I/O Scanner configuration.
Do not rely on the EPE5SW32 offline configuration for backup. Use the backup/restore feature of the web server.

EPE5SW32 is a MS Windows32 console application to allow online/offline configuration of the EPE6 and older EPE5 hardware.

Startup Screen

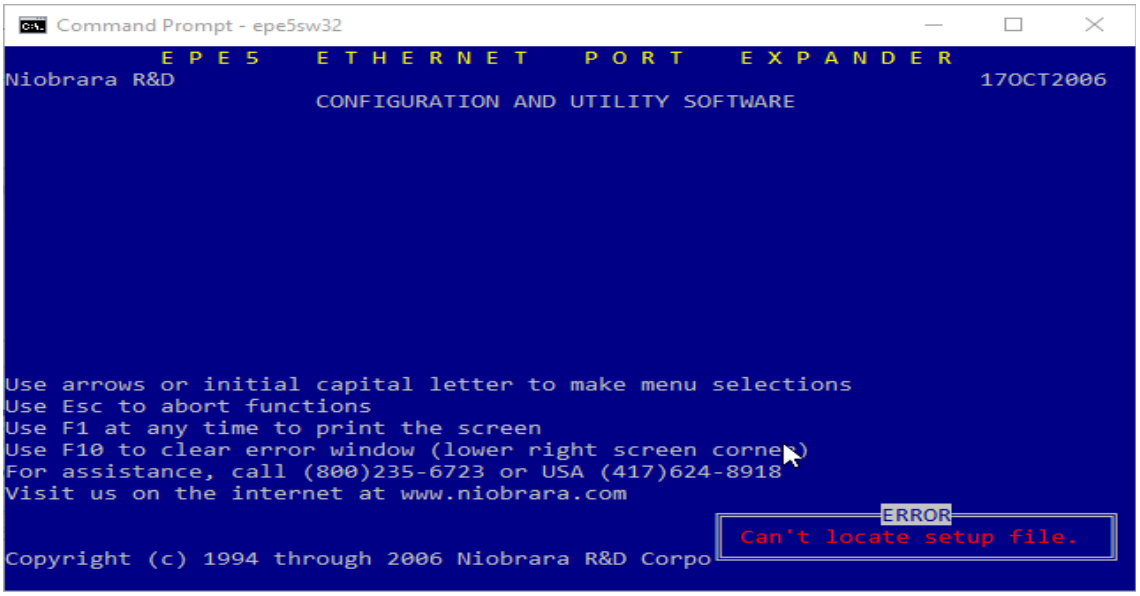


Figure 9.1: Startup Screen

The first time that EPE5SW32 is started, it will show a screen like Figure 9.1. The date in the upper right corner (17OCT2006) is the revision of EPE5SW32. The Error notification in the lower right corner indicates that the program is unable to locate the

setup file.

Note: Press the F10 key or the Escape (ESC) to move past an error notification.

This particular error will not be displayed if the setup file is saved. Clearing this error will immediately drop into the “Setup, Serial communication” screen.

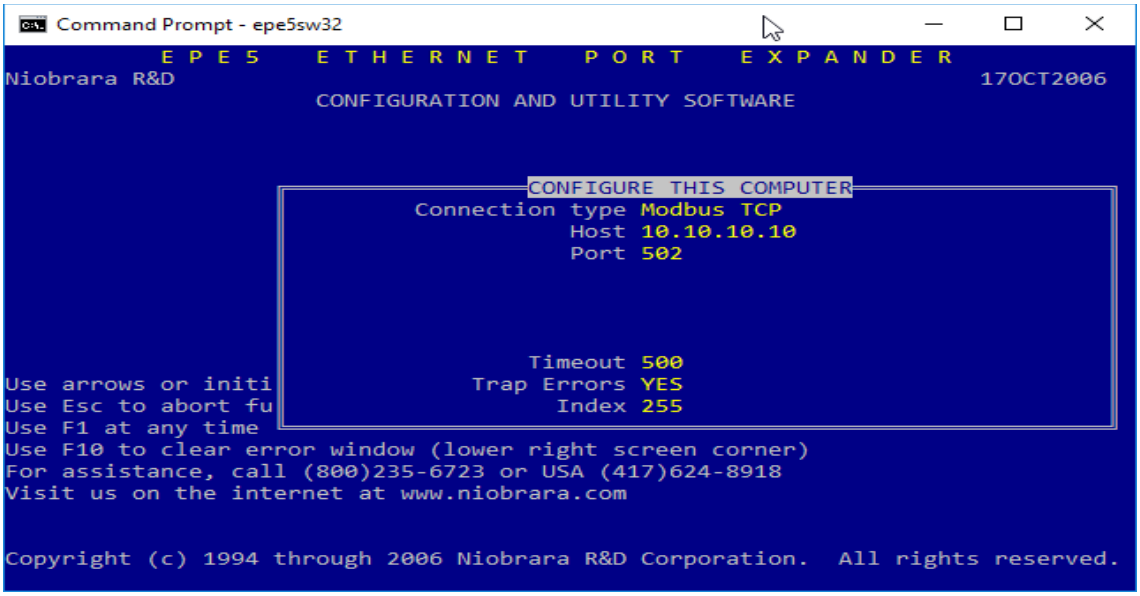


Figure 9.2: Setup Serial Screen

This screen is used to configure the connection between the PC and the target EPE6. In this case, the connection is Modbus/TCP Ethernet to the target 10.10.10.10 using index 255. See section Serial communication on page 118 for more information.

Pressing “Enter” after selecting the Index field will pop up the “Write setup to startup file?” window. Pressing “Enter” or “y” will save the file and avoid the error on the next startup.

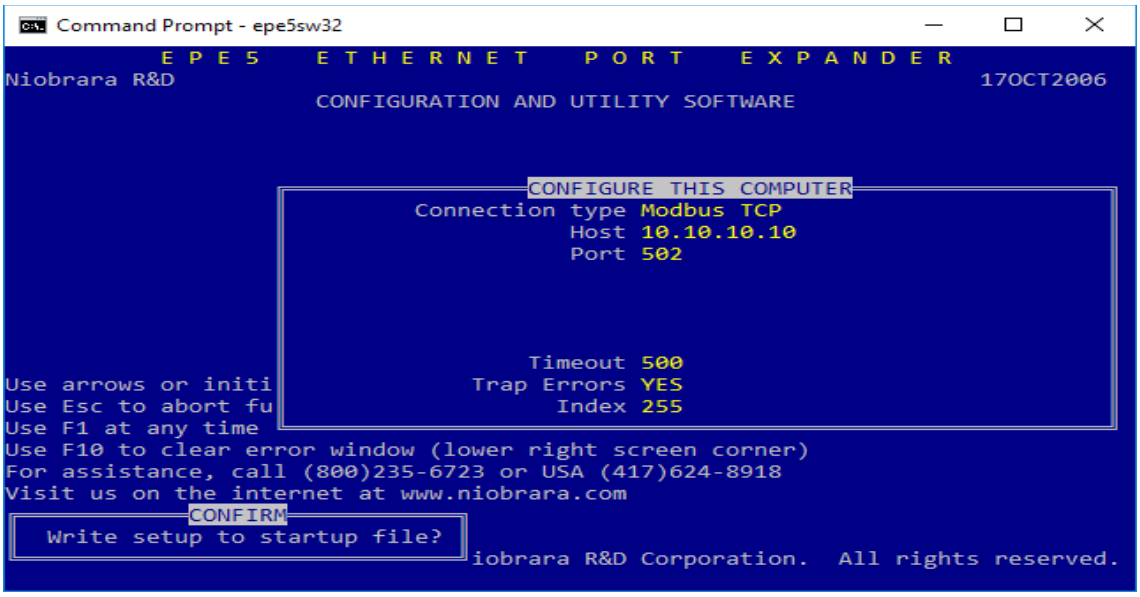


Figure 9.3: Setup Serial Screen

As of the writing of this manual, the current EPE5SW32 does not recognize the EPE6 as being an EPE5. This means that every time the user tries to perform a function of the software that reads data from the EPE6, an error will occur as below:

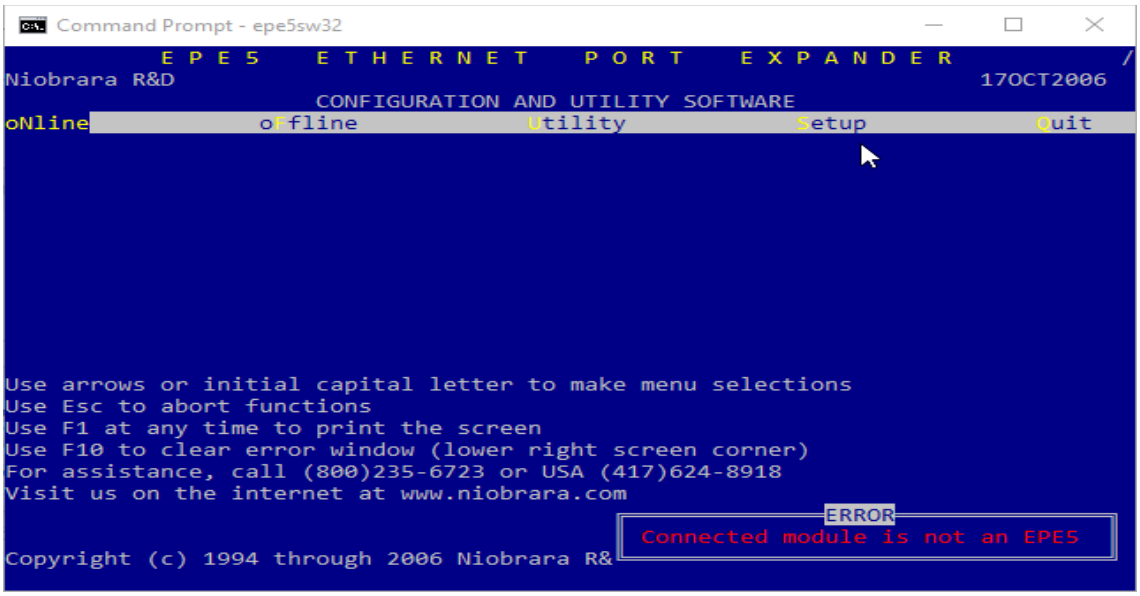


Figure 9.4: Not EPE5 Warning

Press F10 to clear that error and continue. The software will still honor most read and write functions.

Main Menu

The Main Menu is shown in Figure . All menu items may be selected by using the arrow keys to move around or by using the yellow shortcut letter.

- "N" for oNline – Edit the configuration directly in the EPE6 in real time.
- "F" for oFfline – Edit, Save, Print offline copies of the EPE6's configuration.
- "U" for Utility – View registers, statistics, MB+ station lists.
- "S" for Setup – Configure the PC connection.
- "Q" for Quit – Exit the EPE5SW32 program.

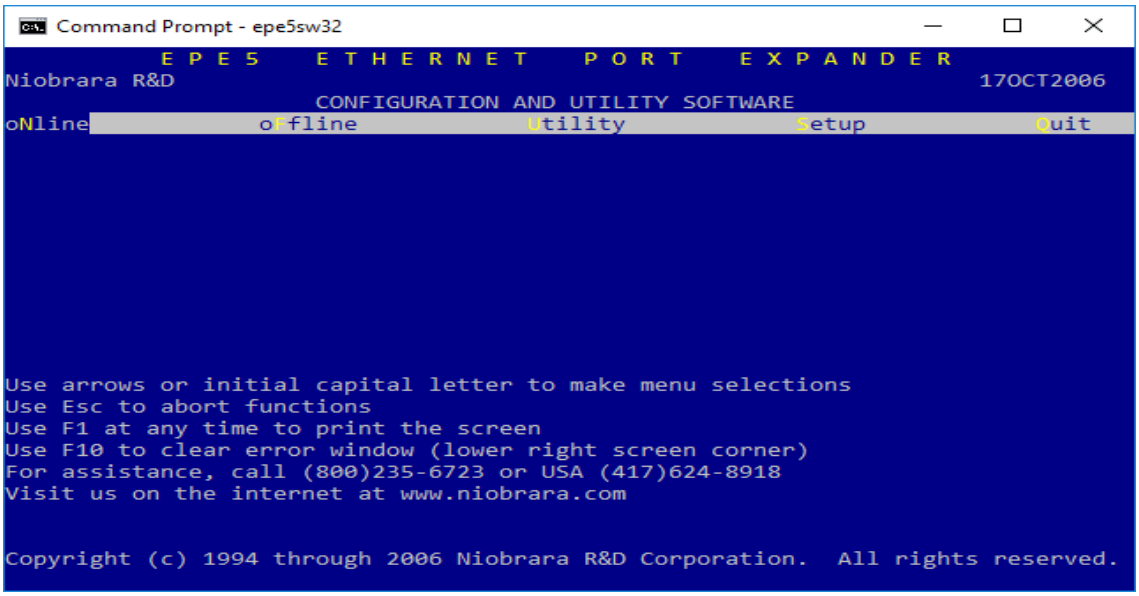


Figure 9.5: Main Menu Screen

oNline Menu

The oNline menu is used to directly edit parameters in the EPE6.

- Edit port parameters – Adjust settings for the Ethernet and Serial ports.
- edit Modbus routing – Configure routing tables for the Ethernet and serial ports.
- edit Auto scan table – Configure the automatic polling tables for the serial ports.
- edit TCP routing – Modify the Modbus/TCP client IP Address table.

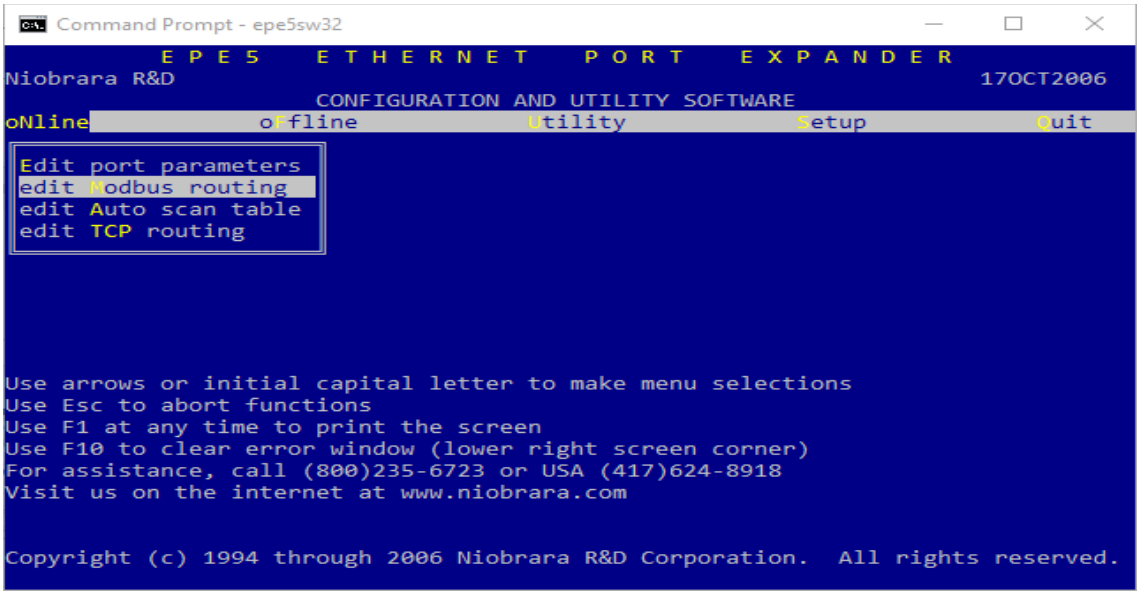


Figure 9.6: oNline Menu

Edit port parameters

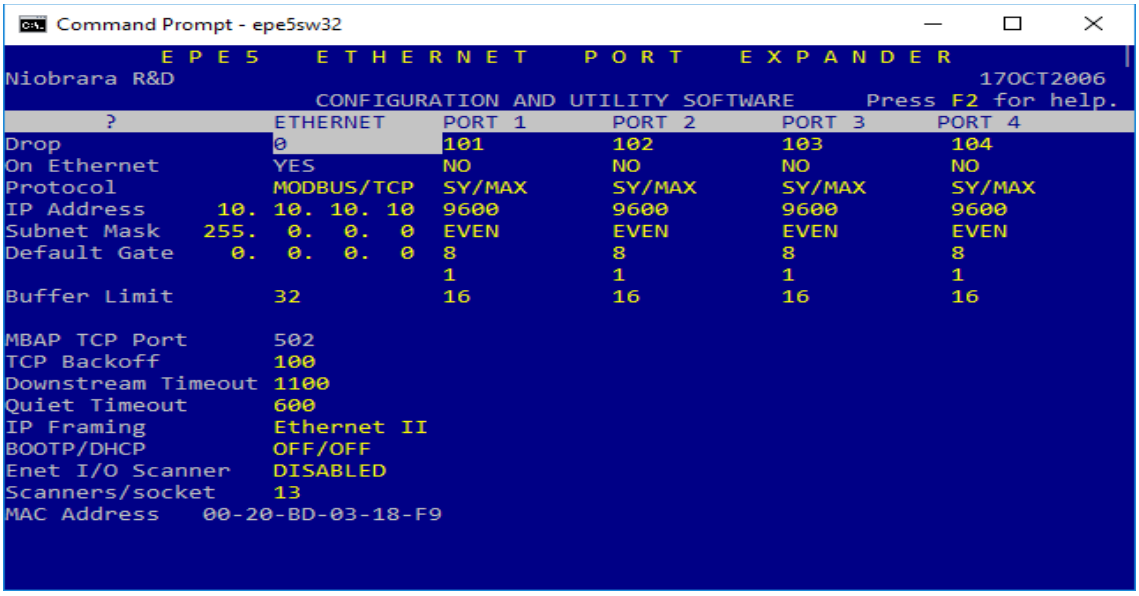


Figure 9.7: oNline edit port parameters Screen

The oNline edit port parameters screen has a column for the Ethernet port and each serial port. The arrow keys are used to move the highlighted cell around. The space bar and + and – keys are used to modify the values.

NOTE: Care must be exercised while editing online parameters. Changing settings on the port the computer is using will result in a loss of communication.

Edit Modbus routing

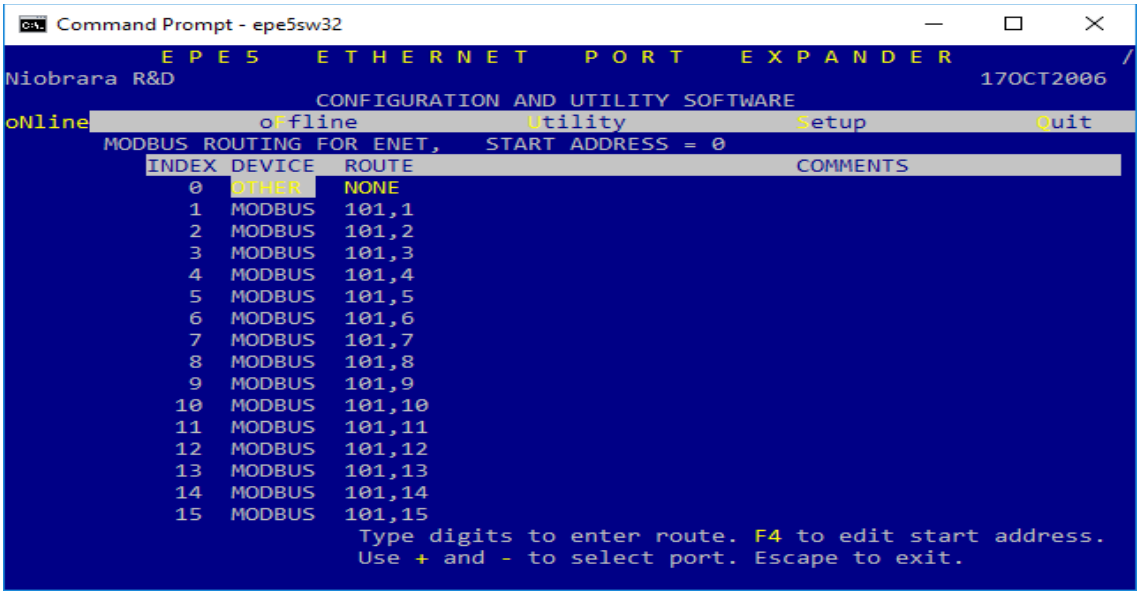


Figure 9.8: Modbus Routing Screen

The Modbus Routing screen is used to set the lookup tables for Ethernet clients and serial Modbus masters.

The left column is the Modbus slave or Modbus/TCP Index. The Ethernet port has 255 possible entries. Each serial port supports 128 entries. The F4 key is used to alter the starting slave address for the serial port tables. The F4 key also allows the selection of "Micrologic Support." Micrologic support is a special feature that takes the route for each of the first 50 drop numbers in the table and automatically supports the same route for 50+x, 100+x, and 150+x drops.

The center column is either "MODBUS" or "OTHER". MODBUS is used when the target device is a Modbus slave. OTHER is used when the target slave is SY/MAX or some other device that is not Modbus.

The ROUTE field is used to define the path to the target. The first drop in the route should be the drop number of the EPE6 port heading towards the target slave. The example above shows routes of 101,x where 101 is the drop number of port 1 and x is the MB drop number of the target PLC.

Auto Scan Edit

The Auto Scan feature allows a serial port to automatically generate up to 48 sequential messages on a fixed time interval. The messages may be either a read or a write. Each

message includes the starting local mailbox register, the starting remote register, the count, the direction (READ or WRITE), and the route.

F4 edits the Status bit map registers. These registers provide 48 bits to indicate the success or failure of the scan.

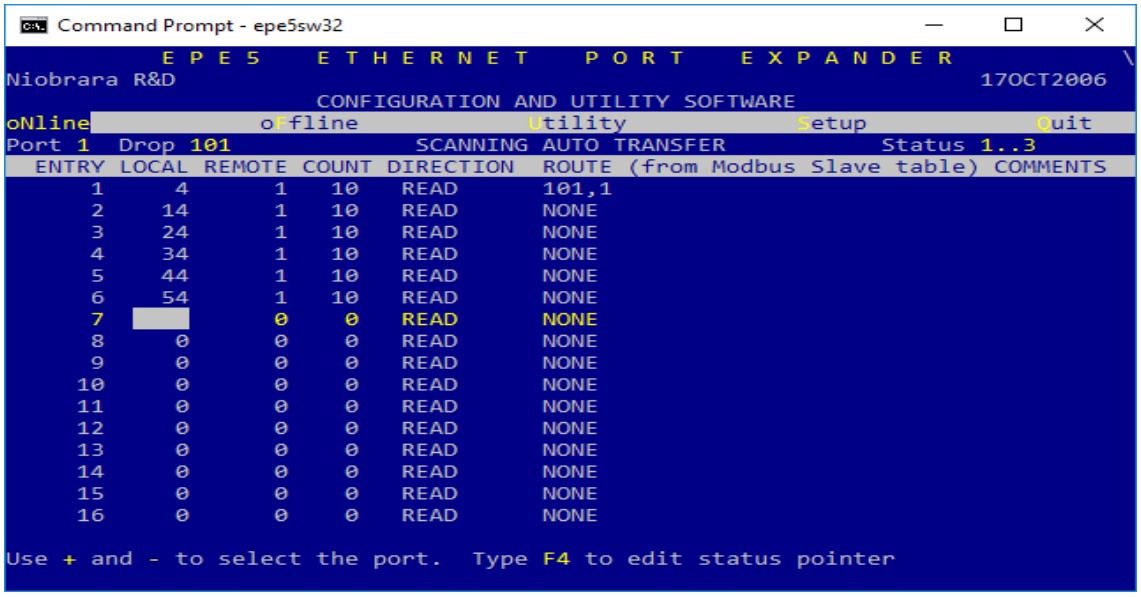


Figure 9.9: Auto Scan Screen

TCP Routing

As of the writing of this manual, this is one feature that EPE5SW32 will not support. The user should use the front panel, or the web page to take advantage of this feature.

offline Menu

The oFfline menu allows EPE6 configuration without a physical connection to the hardware.

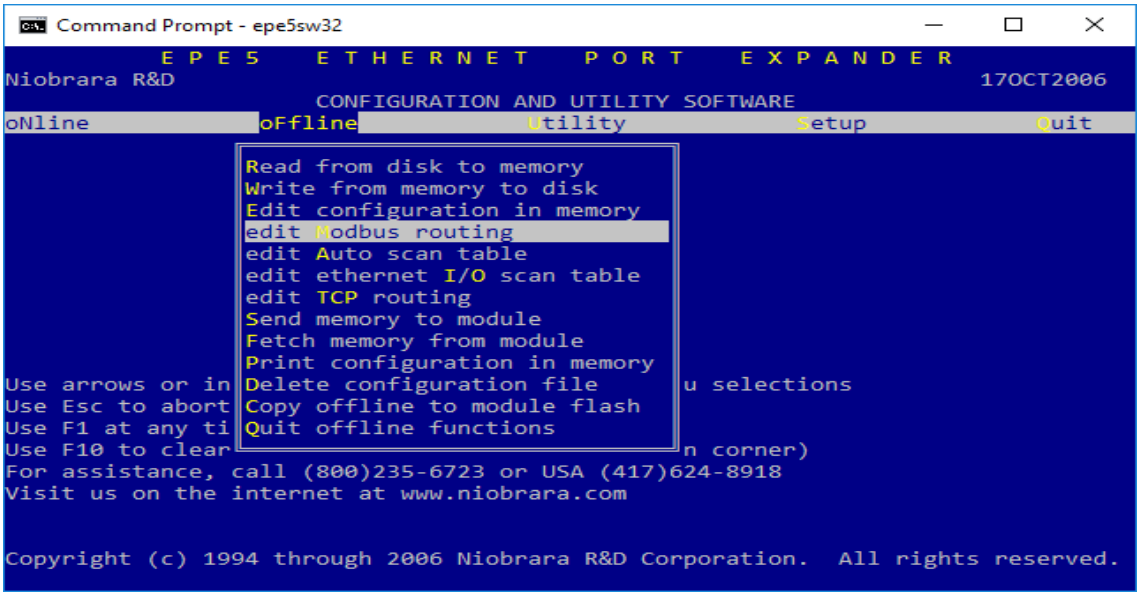


Figure 9.10: oFfline Menu

Read from disk to memory

The oFline, Read from disk to memory menu item allows the EPE5SW32 program to read a previously saved configuration file from the computer's hard disk into the offline memory. This file may then be viewed, modified, printed, saved, or sen to an EPE6. The filename must be a maximum of 8 characters and is chosen from files with the extension .EPE.

The arrow keys may be used to move around the list of stored files or the filename may be simply typed into the File to read: box. Moving the cursor around to an item encased by [] will choose that drive letter or folder name.

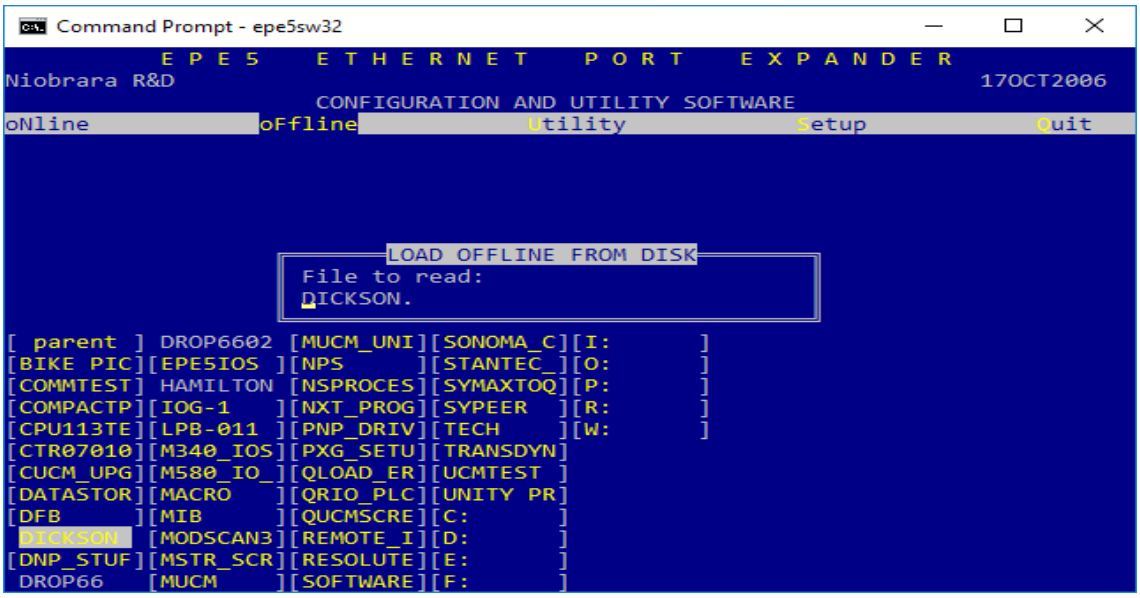


Figure 9.11: Read File from Disk Screen

Write from memory to disk

The oFfline, Write from memory to disk is used to save the current offline memory to a file on the PC. The navigation and file name operation is the same as the “Read from disk to memory”.

Edit configuration in memory

The oFfline, Edit configuration in memory screen works just like the oNline Edit port parameters version on page 107.

edit Modbus Routing

The oFfline, edit Modbus routing screen works just like the oNline Edit Modbus routing on page 108.

edit TCP routing table

The oFfline, edit TCP routing table screen works just like the oNline, TCP Routing on page 109

Send memory to module

The oFfline, Send memory to module screen sends all of the oFfline data to the EPE6.

> NOTICE: This action will overwrite all data in the EPE6 and may potentially cause the PC to lose communication with the EPE6.

Note: The data sent to the EPE6 will not be saved in the module until Utility, Write setup to EEPROM is completed.

Fetch memory from module

This menu item copies all of the configuration from the EPE6 to the oFfline section of EPE5SW32.

Print configuration in memory

A hard copy of the oFfline configuration may be created using the Print configuration in memory. Choose LPT1: to print directly to port LPT1. A text file name may also be entered to print directly to a file.

Delete configuration file

This screen is used to remove a .EPE file from the computer. Select the file and press enter to delete the file from the computer.

Copy offline to module flash

This menu item is not supported by the EPE6. It is only used with the older versions of the EPE5.

Quit offline functions

This menu item returns to the main menu. Pressing the ESC key performs the same task.

Utility Menu

The Utility menu offers several handy features to troubleshoot a system.

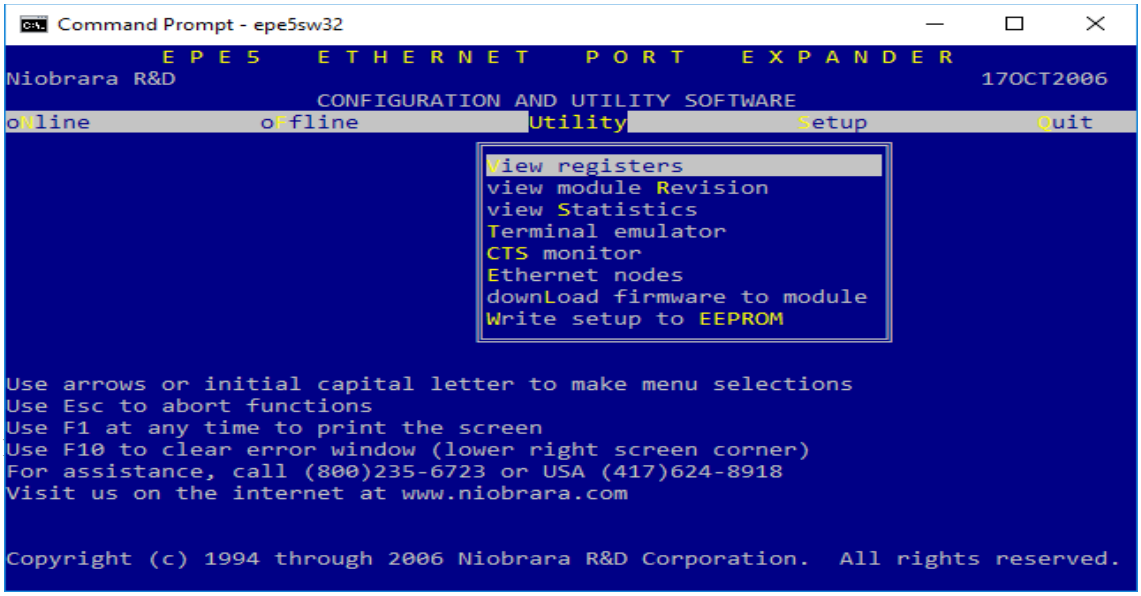


Figure 9.12: Utility Menu Screen

View registers

The View registers screen gives a Modbus register viewer/modifier screen that may access Holding (4x) or Analog Input (3x) registers in the target device. Use the Serial communication and Register viewer pages to choose the target device and viewable register type and range.

The register data is shown in Hex, unsigned, signed, and binary form. Use the arrow, page up and down, and home keys to move the cursor around. Use the number keys to modify the register's content. Pressing Enter will send the new data to the target.

> NOTE: Writing data to a target device may cause unexpected behavior, equipment damage, personal injury or death.

Jump to a particular register location by typing in a new number while the cursor is in the far left column.

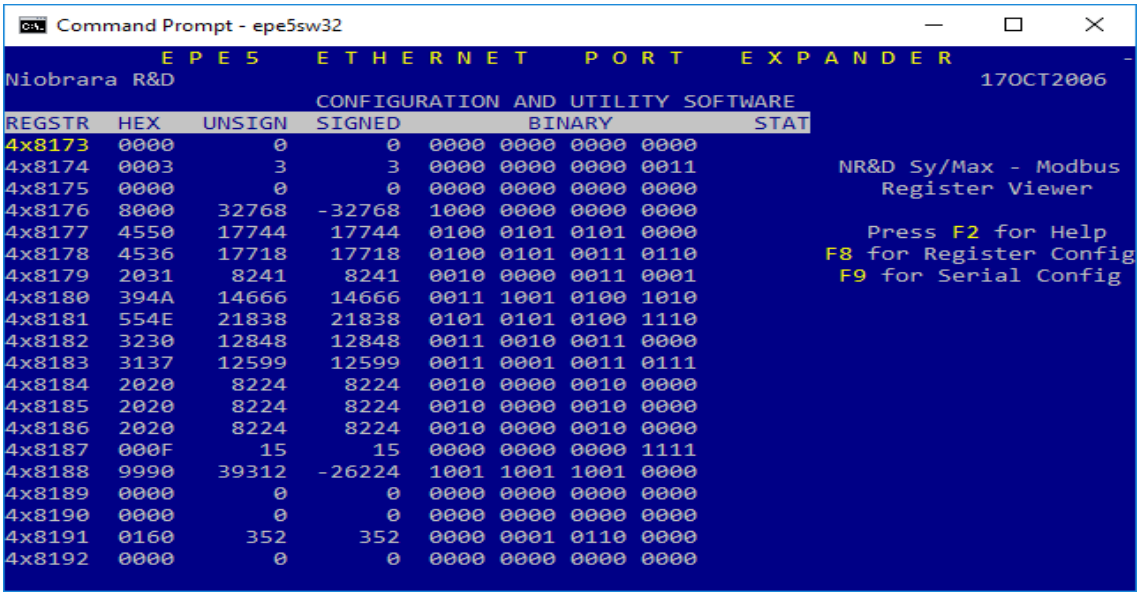


Figure 9.13: View Registers Screen

view module Revision

view Statistics

The EPE6 contains many pages of statistical information about the operation of its various ports. There are pages for the Ethernet port and all four serial ports. Most port pages include multiple screens accessed with the Page Up and Page Down buttons.

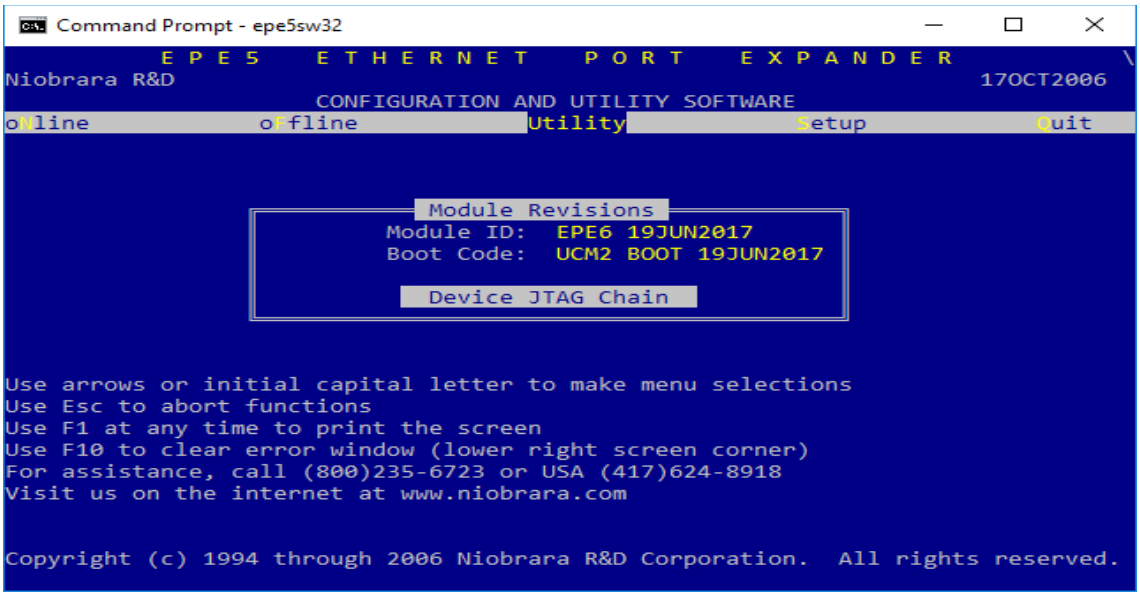


Figure 9.14: Utility View Module Revision Screen

Pressing the + and – or "space bar" buttons will move between port pages. Use the "z" or "0" key s to zero the counters for a given port.

various ports. There are pages for the Ethernet port and all four serial ports. Most port pages include multiple screens accessed with the Page Up and Page Down buttons. Pressing the + and – or "space bar" buttons will move between port pages. Use the "z" or "0" key s to zero the counters for a given port.

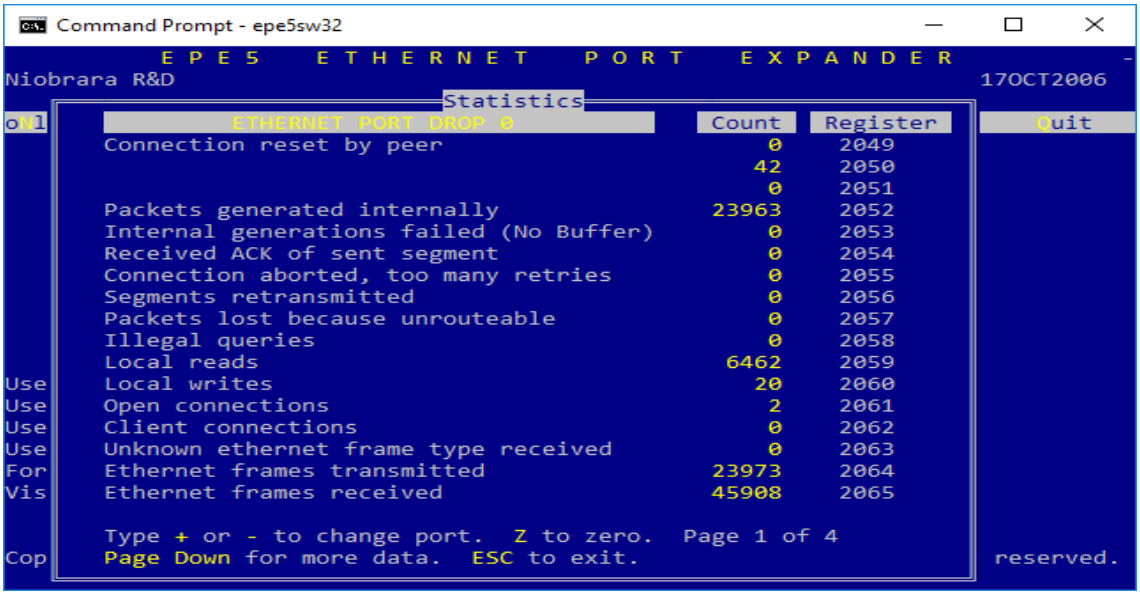


Figure 9.15: Ethernet Statistics Screen

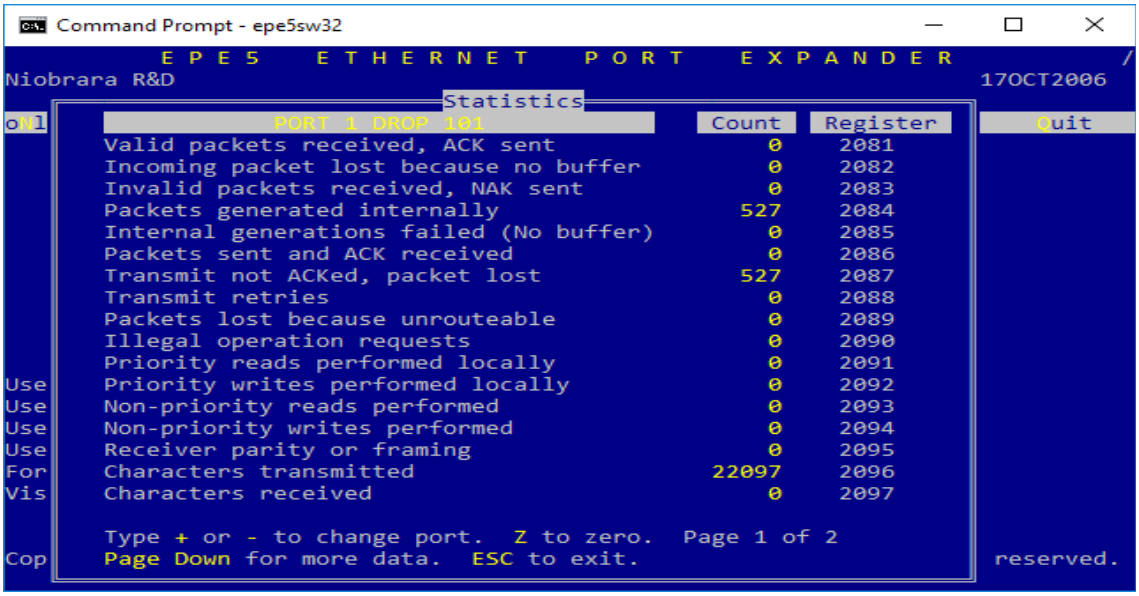


Figure 9.16: Serial Port Statistics Screen

Terminal emulator

EPE5SW32 includes a simple terminal emulator that works with the PC's serial ports. Characters typed on the screen are sent directly out the serial port. Characters received on the serial port are displayed on the screen. Non-printable characters are shown as their hexadecimal values enclosed in <xx> such as <0D> for a carriage return.

The terminal emulator may be exited by pressing Ctrl+End keys at the same time.

Use the F7 key to select a text file to capture all received characters.

F5 key will toggle the screen to hex only display mode.

The Insert key will prompt the user to type in two digit hex codes separated by space characters to send.

CTS monitor

This screen shows the state of the Clear To Send line of the RS-485 ports on the EPE6.

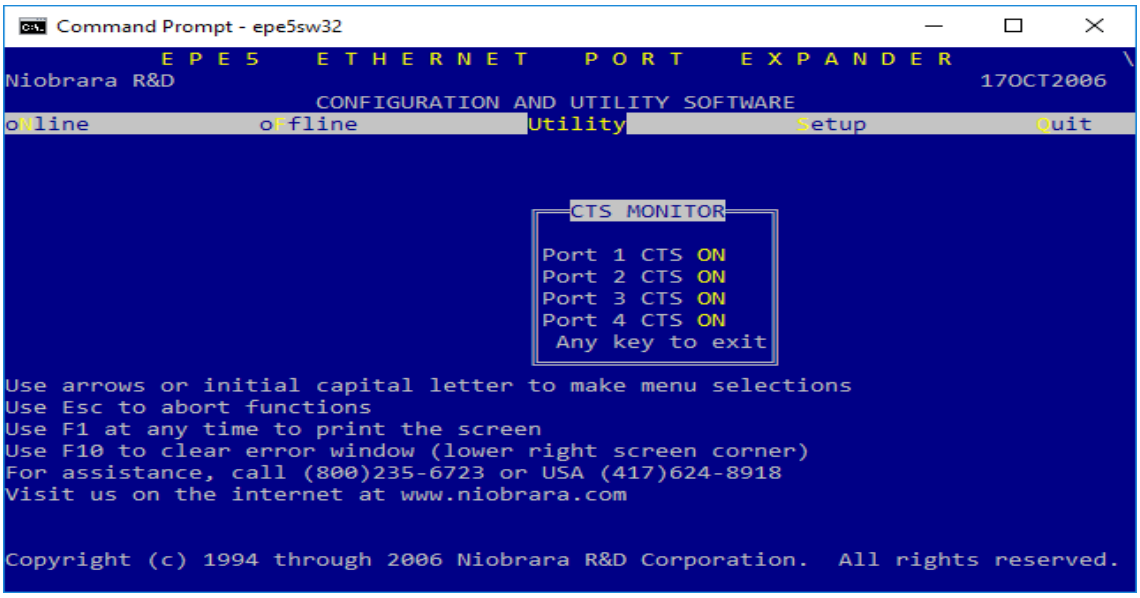


Figure 9.17: CTS Monitor Screen

Ethernet node list

This screen shows the connected SY/MAX 802.3 Ethernet drop numbers on on the local network. The possible nodes 0-99 are viewable.

NOTE: The Ethernet port must be set to MBTCP+SYMAX mode to enable the EPE6 to communicate with SY/MAX 802.3 devices.

Press the F2 key to generate a new global poll.

Nodes that are in the EPE6 are inverted. Note, this may include serial and MB+ ports set to "On Ethernet = YES".

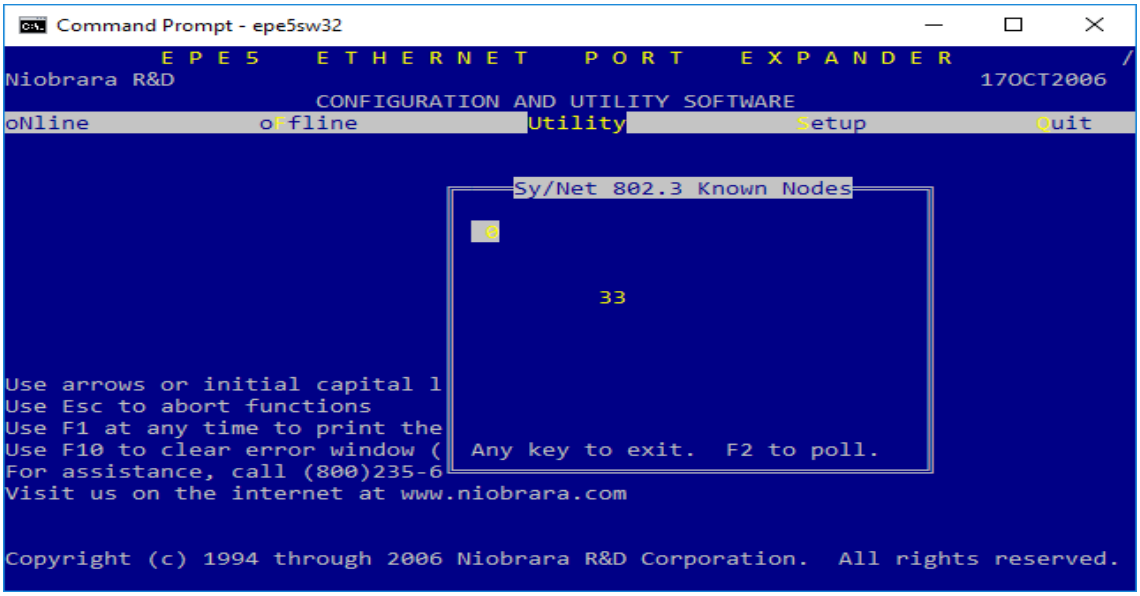


Figure 9.18: SY/MAX 802.3 Station List Screen

downLoad firmware to module

This menu item is not used with the EPE6 but is kept in the software for very old EPE5-D support. The web interface is the preferred method to upgrade the EPE6's software.

Write setup to EEPROM

Select this menu item to store the current settings to EEPROM.

NOTE: This operation is required when values are changed using this software. Otherwise the new settings will be lost on a power cycle.

Setup Menu

The Setup menu allows the user to configure the PC's connection to the EPE6.

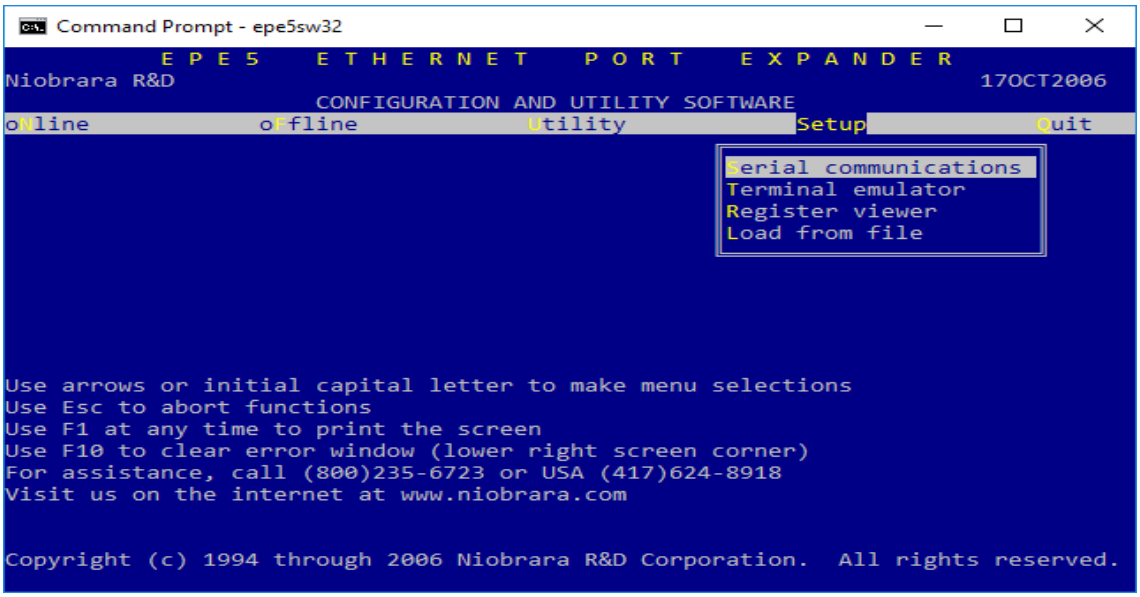


Figure 9.19: Setup Menu Screen

Serial communication

The Setup, Serial communication screen configures the Modbus or SY/MAX connection between the PC and the EPE6 or other target device.

The PC must have its serial port configured to match the attached port of the EPE6 or other network device.

The default serial port connection to an EPE6 would be SY/MAX at 9600,EVEN,8,1 with a route of NONE.

Modbus/TCP connections use the IP Address of the EPE6 in the “Host” field and Index 255.

A typical Modbu RTU serial direct connection to an EPE6 port in Modbus mode will be at 9600,EVEN,8,1 with a drop of 255.

A typical Net-to-Net connection will be at 9600,EVEN,8,1 with a route of the drop number of the Net-to-Net port.

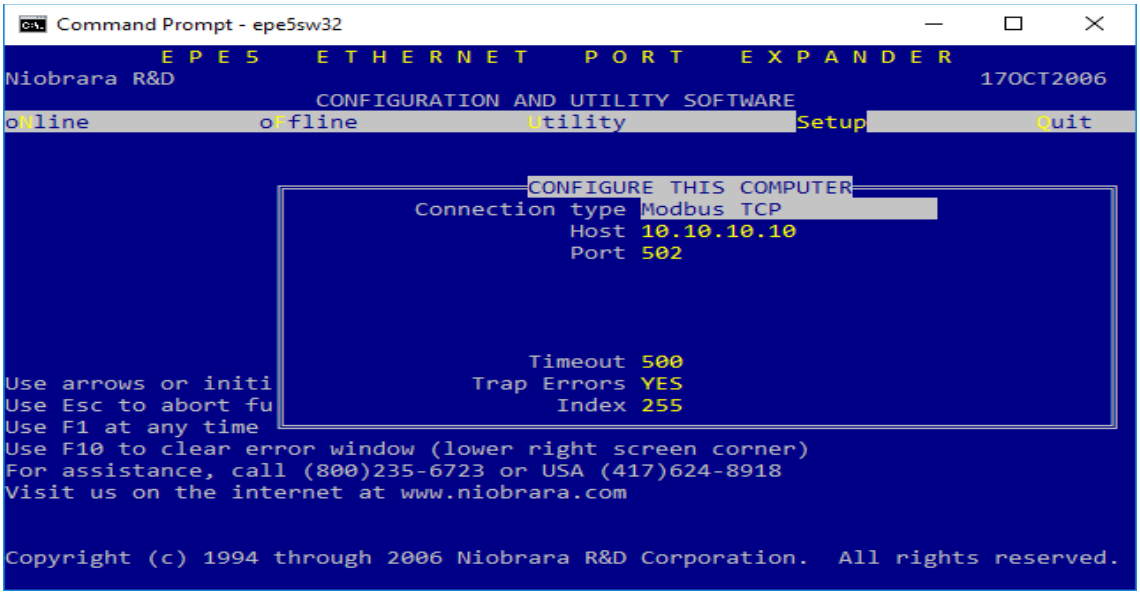


Figure 9.20: Setup Serial Screen for Modbus/TCP connection

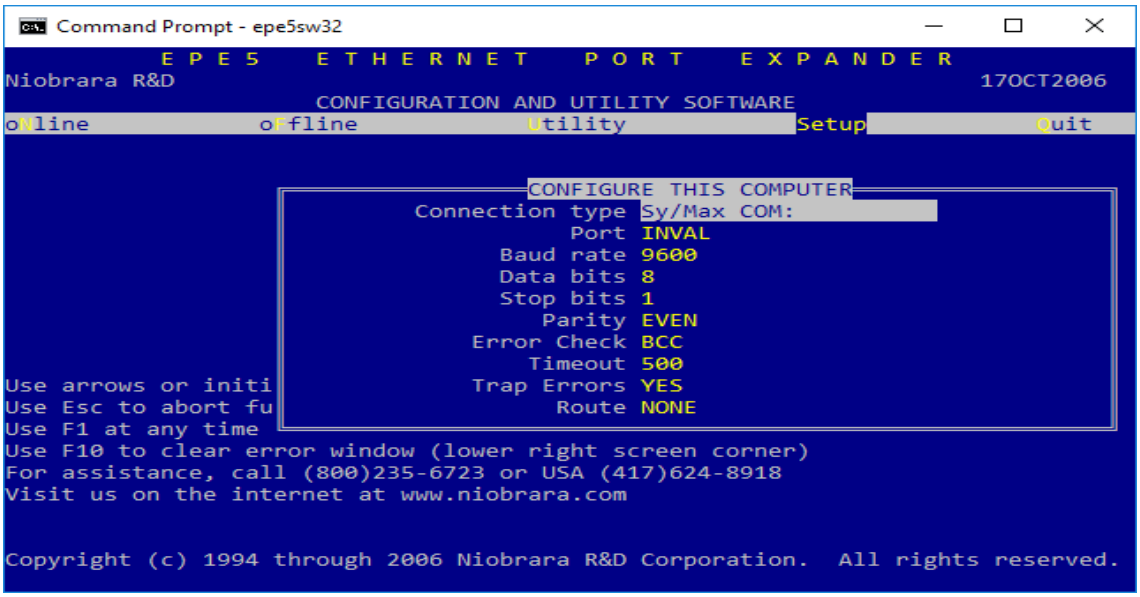


Figure 9.21: Setup Serial Screen for SY/MAX connection

Terminal emulator

The setup screen for the terminal emulator configures the PC's serial port for use with the Utility, Terminal emulator.

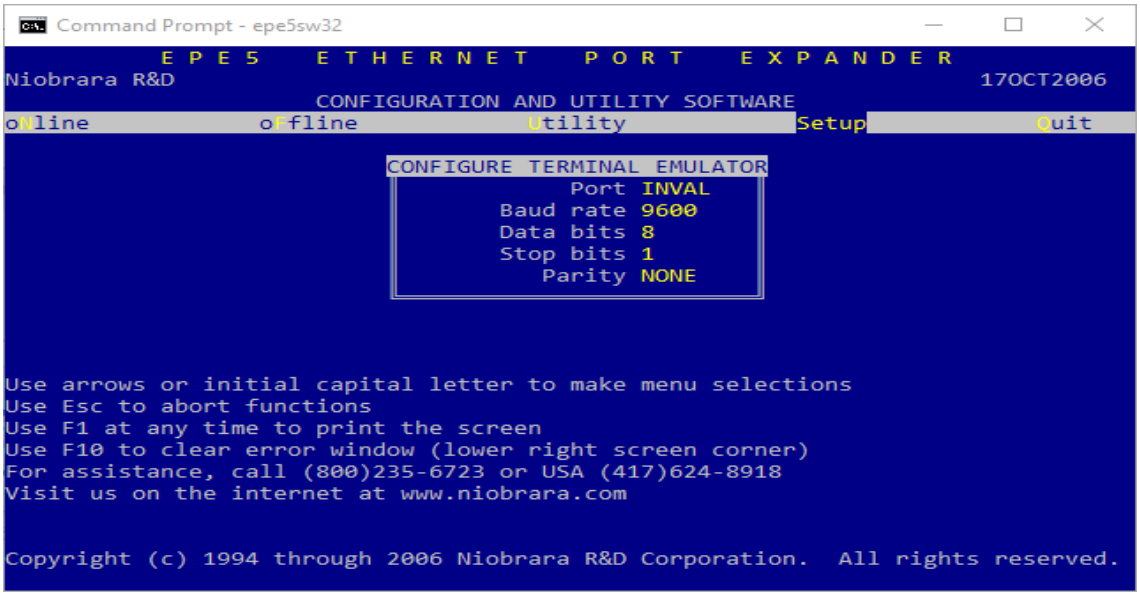


Figure 9.22: Setup Terminal emulator connection

Register viewer

The Utility Register Viewer setup screen allows the configuration of several aspects of the the viewer.

- Priority – SY/MAX mode messages may be Priority or Non-Priority
- Status Registers – Yes or No for SY/MAX PLCs
- Screen Size – Number of registers queried (default = 20)
- Starting Register – defaults to 1
- Register Set – 4x = Modbus Holding Registers, 3x = Modbus Analog Inputs
- Identify Module – Poll register 8188 and show the value at the top of the screen

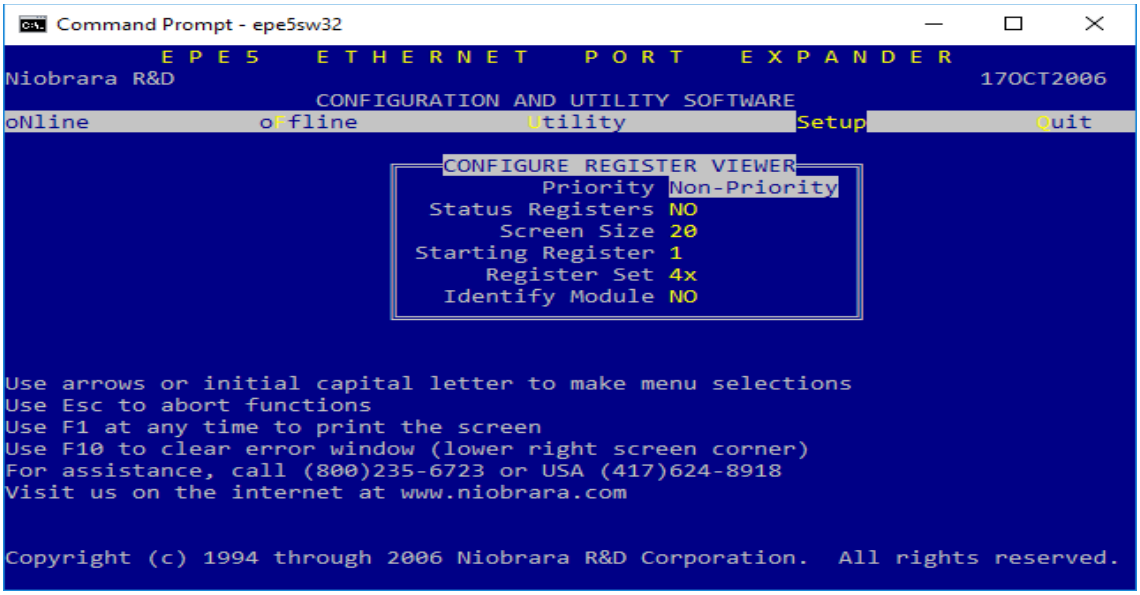


Figure 9.23: Setup Register Viewer

Quit Menu

Press Enter to exit the EPE5SW32 program.