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Understanding Embedded - Microcontroller, Microprocessor, FPGA Modules

Embedded - Microcontroller, Microprocessor, and FPGA Modules are fundamental components in modern electronic systems, offering a wide range of functionalities and capabilities. Microcontrollers are compact integrated circuits designed to execute specific control tasks within an embedded system. They typically include a processor, memory, and input/output peripherals on a single chip. Microprocessors, on the other hand, are more powerful processing units used in complex computing tasks, often requiring external memory and peripherals. FPGAs (Field Programmable Gate Arrays) are highly flexible devices that can be configured by the user to perform specific logic functions, making them invaluable in applications requiring customization and adaptability.

Applications of Embedded - Microcontroller,

Details	
Product Status	Active
Module/Board Type	MPU Core
Core Processor	DSTni-EX
Co-Processor	XPort AR
Speed	25MHz
Flash Size	512KB
RAM Size	256KB
Connector Type	RJ45
Size / Dimension	0.57" x 0.72" (14.5mm x 18.3mm)
Operating Temperature	-40°C ~ 85°C
Purchase URL	https://www.e-xfl.com/product-detail/maestro-wireless/xp1002000-05r

Table of Contents

IP Address

Every device connected to an IP network must have a unique IP address. This address is used to reference the specific unit. The XPort is automatically assigned an IP address on DHCP-enabled networks, as it is DHCP-enabled by default.

Port Numbers

Every TCP connection and every UDP datagram is defined by a destination IP address and a port number. For example, a Telnet application commonly uses port number 23. A port number is similar to an extension on a phone system.

The unit's serial channel (port) can be associated with a specific TCP/UDP port number. Port number 9999 is reserved for access to the unit's Setup (configuration) Mode window. Ports 0-1024 are reserved as well. For more information on reserved port numbers, see to *Table 7-5. Reserved Port Numbers* on page *50*.

Product Information Label

The product information label on the unit contains the following information about the specific unit:

- Part Number
- Revision
- Manufacturing Date Code
- Country of Origin Manufacturing Location ID
- MAC Address/Serial Number Barcode
- MAC Address/Serial Number*

4. Configuration Using Web Manager

You must configure the unit so that it can communicate on a network with your serial device. For example, you must set the way the unit will respond to serial and network traffic, how it will handle serial packets, and when to start or close a connection.

The unit's configuration is stored in nonvolatile memory and is retained without power. You can change the configuration at any time. The unit performs a reset after you change and store the configuration.

In this chapter, we describe how to configure the XPort device server using Web Manager, Lantronix's browser-based configuration tool. (For information on using Setup Mode, our command line configuration interface, see *Chapter 5: Configuration via Telnet or Serial Port (Setup Mode).*

Note: *The examples in this section show a typical device. Your device may have different configuration options.*

Accessing Web Manager Using DeviceInstaller

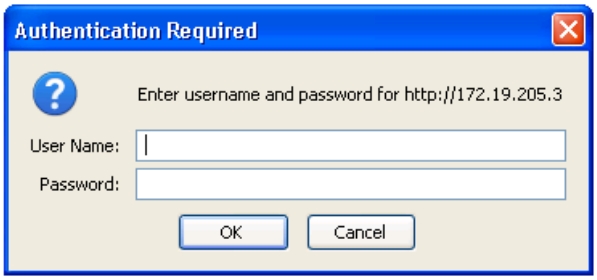
Note: *For more information on DeviceInstaller, see Chapter 3: Using DeviceInstaller.*

1. Run DeviceInstaller and search for the list of available Lantronix device servers.
2. Click on t**he XPort** folder. The list of available XPort modules displays.
3. Expand the list of XPort device servers by clicking the **+** symbol next to the XPort icon.
4. Select the XPort unit by clicking its hardware address.
5. In the right pane, click the **Web Configuration** tab.
6. To view the XPort module's Web Manager in the current DeviceInstaller window, click the **Go** button. To open the Web Manager in a web browser, click the **External Browser** button.

Note: *Alternatively, to open Web Manager, open your web browser and enter the IP address of the XPort device server. (With firmware 1.8 or earlier, your browser must be JAVA-enabled to use Web Manager. (With firmware 6.1.0.0 and later, your web browser does not need to be JAVA-enabled.)*

A dialog box appears to prompt for a **User name** and **Password.**

Figure 4-1. Web Manager Login Window



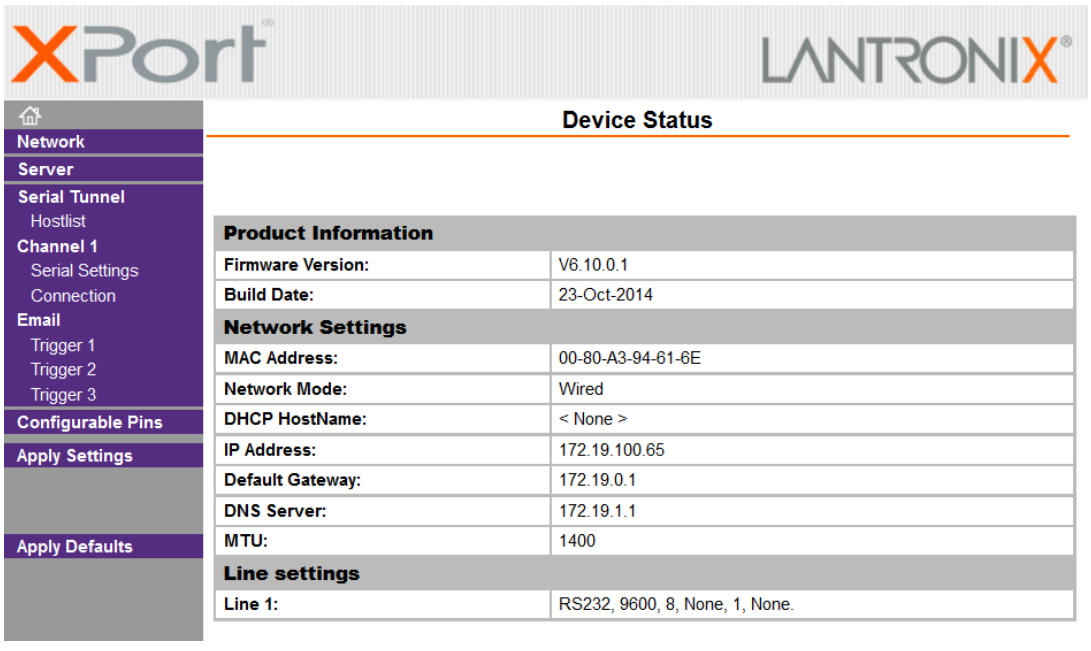
7. Perform one of the following:

   - If no Telnet password has been defined, leave both fields blank and click **OK**.
   - If a Telnet password has been defined, leave the username blank, type in the password, and then click **OK**.

   The Web Manager displays.

   Note: *We recommend that you always use the enhanced password setting and create a strong 16 character password. See* *Security Settings (Option 6) on page 69**.*

Figure 4-2. Lantronix Web Manager



The main menu is in the left pane of the Web Manager window.

2. In the available fields, enter or modify the following information:

Connect Protocol

Protocol	From the drop-down menu, select **TCP.**

Connect Mode: Passive Connection

Accept Incoming	Select **Yes** to accept incoming connections. The default is **Yes.**
Required	Determines whether a password is required for an incoming passive connection. This field is not available when a password is set for Telnet mode.
Password	If **Password Required** was set to **Yes**, enter the password for passive connections.

Connect Mode: Active Connection

Active Connect	**Select None to disable Active Connect. Otherwise, indicate the connection type from the drop-down list:** ◆ **With Any Character:** Attempts to connect when any character is received from the serial port. ◆ **With Active Mdm Ctrl In:** Accepts external connection requests only when the **Modem Control In** input is asserted. ◆ **With Start Character:** Attempts to connect when it receives a specific start character from the serial port. The default start character is carriage return. ◆ **Manual Connection:** Attempts to connect when directed by a command string received from the serial port. ◆ **Auto Start:** Automatically connects to the remote IP address and port after booting up.
Start Character	If Active Connect is set to **With Start Character**, enter the start character in this field.
Modem Mode	Indicates the on-screen response type when in Modem Mode (if **Modem Mode** is enabled).
Show IP Address After Ring	Indicates whether to display the remote IP address upon connection. The default setting is **Yes**.

Endpoint Configuration

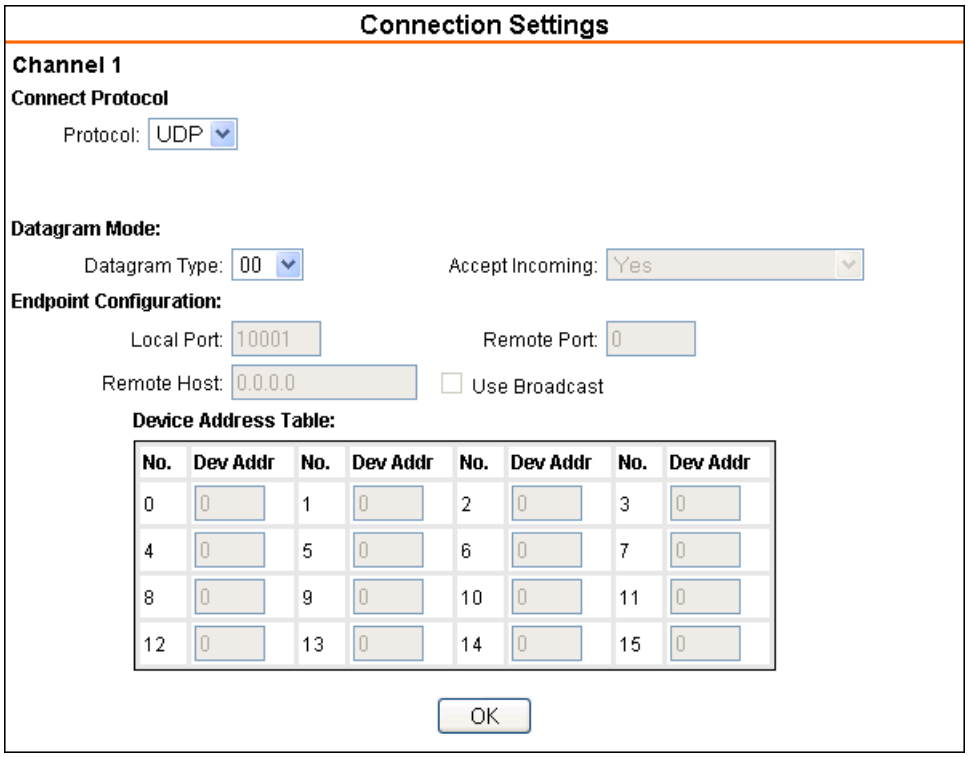
Local Port	Enter the local port number.
Auto increment for active connect	Select to auto-increment the local port number for new outgoing connections. The range of auto-incremented port numbers is **50,000** to **59,999** and loops back to the beginning when the maximum range is reached.
Remote Port	Enter the remote port number.
Remote Host	Enter the IP address of the remote device.

Connection Settings - UDP

To configure a channel's UDP settings:

1. On the main menu, click **Connection**. The Connection Settings window for the selected channel displays.
2. In the available fields, enter or modify the following information:

Figure 4-8. UDP Connection Settings



Connect Protocol

Protocol	Select **UDP** from the drop-down menu.

Datagram Mode

Datagram Type	Configures the remote IP or network broadcast address and the remote port. Enter **01** for directed or broadcast UDP. The default setting is **00**.
Accept Incoming	Select **Yes** to accept incoming UDP datagrams.

Endpoint Configuration

Local Port	Enter the local port number.
Remote Port	Enter the port number of the remote device.
Remote Host	Enter the IP address of the remote device.
Use Broadcast	Select to broadcast the UDP datagram. The default is not to

6. Setup Mode: Server Configuration

This chapter explains how to configure the network settings.

Note: *Current values appear in parentheses.*

Server Configuration (Option 0)

The unit's basic network parameters display when you select **Server configuration** (option **0**). The **IP Address**, **Set Gateway IP Address**, and **Netmask** fields display the current values.

```
IP Address : (000) .(000) .(000) .(000)

Set Gateway IP Address (N) ?

Netmask: Number of Bits for Host Part (0=default) (0)

Set DNS Server IP addr  (N) ?

Change Telnet/Web Manager password (N) ?

Change DHCP device name (not set) ? (N) ?

Enable DHCP FQDN option :  (N) ?
```

IP Address

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

```
IP Address : ( 0) ( 0) ( 0) ( 0) _
```

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

Table 6-1. BootP/DHCP/AutoIP options

Options	Bit
AutoIP	0
DHCP	1
BootP	2

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

Set Gateway IP Address

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

```
Set Gateway IP Address (N) ? Y

Gateway IP addr ( 0) ( 0) ( 0) ( 0)_
```

Netmask: Number of Bits for Host Part

A netmask defines the number of bits taken from the IP address that are assigned for the host part.

```
Netmask: Number of Bits for Host Part (0=default) (0) _
```

Note: *Class A: 24 bits; Class B: 16 bits; Class C: 8 bits*

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

Table 6-2. Standard IP Network Netmasks

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

Set DNS Server IP Address

The DNS server allows the name of a remote machine to be resolved automatically. The default is **N** (No), indicating the DNS server address has not been set. To set the DNS server address, type **Y**. At the prompt, enter the DNS server address. If the device is DHCP enabled, the DHCP server provides the DNS server IP address, which will override this configured value.

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

```
Set DNS Server IP addr (N) ? _
```

Baudrate

The unit and attached serial device, such as a modem, must agree on a speed or baud rate to use for the serial connection. Valid baud rates are 300, 600, 1200, 2400, 4800, 9600 (default), 19200, 38400, 57600, 115200, and 230400 bits per second. XPort module also supports high-performance baud rates of 460800 and 921600 bits per second. (See *CPU Performance* on page *67*).

```
Baudrate (9600) ? _
```

Connect Mode Option	7	6	5	4	3	2	1	0
Data Echo & Modem Response (Numeric)			0	1		1	1	1
Data Echo & Modem Response (Verbose)			0	1		1	1	0
Modem Response Only (Numeric)			0	0	1	1	1	1
Modem Response Only (Verbose)			0	0	1	1	1	0

a) Incoming Connection

Never Accept Incoming	Rejects all external connection attempts.
Accept with active Modem Control In	Accepts external connection requests only when the **Modem Control In** input is asserted. Cannot be used with Modem Mode.
Always Accept	Accepts any incoming connection when a connection is not already established. Default setting.

b) Response

Character Response	A single character is transmitted to the serial port when there is a change in connection state: **C** = connected, **D** = disconnected, **N** = host unreachable. The IP address of the host connecting to the CoBos device will be provided when you use verbose mode. This option is overridden when the **Active Start Modem Mode** or **Active Start Host List** is in effect. Default setting is Nothing (quiet).

c) Active Startup

No Active Startup	Does not attempt to initiate a connection under any circumstance. Default setting.
With Any Character	Attempts to connect when any character is received from the serial port.
With active Modem Control In	Attempts to connect when the **Modem Control In** input changes from not asserted to asserted.
With a Specific Start Character	Attempts to connect when it receives a specific start character from the serial port. The default start character is carriage return.

Manual Connection	Attempts to connect when directed by a command string received from the serial port. The first character of the command string must be a C (ASCII 0x43), and the last character must be either a carriage return (ASCII 0x0D) or a line feed (0x0A). No blanks or space characters may be in the command string. Between the first and last command string characters must be a full or partial destination IP address and may be a destination port number. The IP address must be in standard decimal-dot notation and may be a partial address, representing the least significant 1, 2, or 3 bytes of the remote IP address. The period is required between each pair of IP address numbers. If present, the port number must follow the IP address, must be presented as a decimal number in the range **1-65535**, and must be preceded by a forward slash (ASCII 0x2F). The slash separates the IP address and the port number. If you omit the port number from a command string, the internally stored remote port number starts a connection. If a partial IP address is presented in a command string, it is interpreted to be the least significant bytes of the IP address and uses the internally stored remote IP address to provide the most significant bytes of the IP address. If the IP address entered is 0.0.0.0/0, the device server enters Monitor Mode. For example, if the remote IP address already configured in the unit is 129.1.2.3, then an example command string would be C3/7. (This would connect to 129.1.2.3 and port 7.) You may also use a different ending for the connection string. For example, C50.1/23 would connect you to 129.1.50.1 and port 23. If an IP address does not follow the first command string character (which is "C"), the subsequent character string is interpreted as the host name and domain to be used in DNS lookup. This character string can include a destination port number as well. The port number can be preceded by either a forward slash (/) or a colon (:).

Table 7-7. Manual Connection Address Example

Command String	Result if remote IP is 129.1.2.3 and remote port is 1234
C121.2.4.5/1	Complete override; connection is started with host 121.2.4.5, port 1
C5	Connects to 129.1.2.5, port 1234
C28.10/12	Connects to 129.1.28.10, port 12
C0.0.0.0/0	Enters Monitor Mode
Cwww.lantronix.com/80	Tries to connect to the Lantronix web server if the `<hostname:domain> (www.lantronix.com)` is configured in the DNS server database.
Autostart (Automatic Connection)	If you enable **Autostart**, the unit automatically connects to the remote IP address and remote port specified when the firmware starts.
Hostlist	If you enable this option, the device server scrolls through the hostlist until it connects to a device listed in the hostlist table.

5. For **Retrytimeout**, enter the number of milliseconds the unit should wait before failing an attempted connection. The time is stored as units of milliseconds in the range of **10-65535**. The default is **250**.

d) Datagram Type

Directed UDP	When selecting this option, you are prompted for the Datagram type. Enter 01 for directed or broadcast UDP. Datagrams of type 01 can be sent as a broadcast by enabling the **Send as Broadcast** option. The default is not to broadcast. When the UDP option is in effect, the unit never attempts to initiate a TCP connection because it uses UDP datagrams to send and receive data.

e) Modem Mode

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

Normally, there is a modem connected to a local PC and a modem connected to a remote machine. A user must dial from the local PC to the remote machine, accumulating phone charges for each connection. Modem Mode allows you to replace modems with XPort modules, and to use an Ethernet connection instead of a phone call. By not having to change communications applications, you avoid potentially expensive phone calls.

To select Modem Mode, set the Connect Mode to **C6** (no echo), **D6** (echo with full verbose), **D7** (echo with numeric response), **CF** (modem responses only, numeric response), or **CE** (modem responses only, full verbose).

Note: *If the unit is in Modem Mode, and the serial port is idle, the unit can still accept network TCP connections to the serial port if Connect Mode is set to* **C6** *(no echo),* **D6** *(echo with full verbose),* **D7** *(echo with numeric response,* **CF** *(modem responses only, numeric response), or* **CE** *(modem responses only, full verbose).*

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

Table 7-8. Modem Mode Messages

Message	Meaning
Full Verbose	

Domain Name

Enter the email server's domain name. The current value is displayed in parentheses.

```
Domain name () ? _
```

Recipient 1

Enter the full email address of the trigger email recipient. The current value is displayed in parentheses.

```
Recipient 1 () ? _
```

Recipient 2

Enter the full email address of the trigger email recipient. The current value is displayed in parentheses.

```
Recipient 2 () ? _
```

Trigger 1

A trigger event occurs when the unit receives the specified trigger input because of a specified combination of conditions on the configurable pins.

```
Enable serial trigger input (N) ?

Trigger input1 [A/I/X] (X) ?

Trigger input1 [A/I/X] (X) ?

Trigger input1 [A/I/X] (X) ?

Message () ?

Priority (L) ?

Minimum notification interval (1 s) ?

Re-notification interval (0 s) ?
```

Set the configurable pins to **A** = Active, **I** = Inactive, or **X** = Don't Care. Active can mean active low or active high. If the configurable pins are all set to b (Don't Care), then they are disabled. If both the serial sequence and the configurable pins are disabled, the trigger is disabled.

To change the configurable pins' settings, send setup records to Port 77FE.

Message	The subject line of the trigger event email to the specified recipient(s).
Priority	The priority level for the trigger even email. Enter L for normal priority or H for high priority.

Minimum notification interval	The minimum time allowed between individual triggers. If a trigger event occurs within the minimum interval since the last trigger, it is ignored.
Re-notification interval	Indicates the time interval at which a new email message is sent to the recipient(s) when a single trigger event remains active.

Trigger 2

Refer to *Trigger 1* for details on completing these fields.

Note: *Each trigger is independent of the others. Each condition within an individual trigger must be met before the unit sends the email.*

Trigger 3

Refer to *Trigger 1* for details on completing these fields.

Note: *Each trigger is independent of the others. Each condition within an individual trigger must be met before the unit sends the email.*

Expert Settings (Option 5)

Note: *You can change the Enable alternate MAC setting using telnet or serial connections only. It is not available through the Web Manager.*

CAUTION: *Only an expert should change these parameters. You must definitely know the consequences the changes might have.*

Figure 8-2. Expert Settings

```
TCP Keepalive time in s (1s - 65s; 0s=disable):  (45) ?

ARP Cache timeout in s (1s - 600s) :  (600) ?

CPU performance (0=Regular, 1=Low, 2=High):  (0) ?

Disable Monitor Mode @ bootup (N) ?

RS485 tx enable active level (0=low; 1=high):  (0) ?

HTTP Port Number :  (80) ?

SMTP Port Number :  (25) ?

MTU Size (512 - 1400):  (1400) ?

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

Enable alternate MAC (N) ?

Ethernet connection type:  (0) ?
```

The default settings are listed below:

TCP Keepalive time in s (1s – 65s; 0s=disable)	45
ARP Cache timeout in s (1s – 600s)	600
CPU Performance	Regular
Disable Monitor Mode @ bootup	No
RS485 tx enable	Active low
HTTP Port Number (1-65535)	80
SMTP Port Number (1-65535)	25
MTU Size (512 – 1400)	0 (resulting in an operational value of 1400)
TCP Re-transmission Timeout (500-4000) (ms)	500
Enable alternate MAC	No (OEM use only)
Ethernet connection type	0 (resulting in auto-negotiation)

TCP Keepalive time in seconds

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

```
TCP Keepalive time in s (1s - 65s; 0s=disable): (45)? _
```

ARP Cache Timeout in Seconds

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

```
ARP Cache timeout in s (1s - 600s) : (600) ?
```

CPU Performance

This option allows you to increase the CPU performance required to use the higher baud rates on the serial interface (460800 bps and 921600 bps). The standard CPU performance mode supports up to 230400 bps.

```
CPU performance (0=Regular, 1=Low, 2=High):  (0) ?
```

Notes:

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

- *Increasing CPU clock speed consumes more power and generates more heat. This reduces the maximum operating temperature specification. See the appropriate product brief for details.*

Disable Monitor Mode at bootup

This option allows you to disable all entries into Monitor Mode during startup, except for the 'xxx' sequence. This prevents entry using **yyy**, **zzz**, **xx1**, and **yy1** key sequences (only during the bootup sequence). The default for Monitor Mode at bootup is **N** (No). (See *11 Monitor Mode*.)

```
Disable Monitor Mode @ bootup (N) ? _
```

HTTP Port Number

This option allows the configuration of the web server port number. The valid range is 1-65535. The default HTTP port number is 80.

```
HTTP Port Number : (80) ? _
```

SMTP Port Number

This option allows the configuration of the email port number. The valid range is 1-65535. The default SMTP port number is 25.

```
SMTP Port Number : (25) ? _
```

Note: *When configuring the HTTP or SMTP port number, take note of the 'reserved' port numbers on page 50.*

RS-485 TX Enable Active Level

Note: *The following applies to XPort model XP1004000-03 (XPort-485).*

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

This setting only applies if one of the configurable pins for the RS485_TXEN functionality is selected. For the RS-485 interface mode to operate correctly, configure one of the configurable pins to RS485_TXEN. To change the configurable pins' settings, use DeviceInstaller or send setup records to port 77FE.

MTU Size

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

```
MTU Size (512 - 1400):  (1400) ?
```

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

Enable Enhanced Password

The Enhanced Password setting allows you to set a password of up to 16 characters for protecting Telnet and Web Page access. We recommend that you select the **Y** (Yes) option and enable the enhanced password setting.

Avoid using either the 4 character basic password setting or no password at all as they are not secure options.

```
Enable Enhanced Password (Y) ? _
```

Disable Port 77F0 (Hex)

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

```
Disable Port 77F0h ? _
```

Default Settings (Option 7)

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

Channel 1 Configuration Defaults

Baudrate	9600
I/F Mode	4C (1 stop bit, no parity, 8 bit, RS-232C)
Flow	00
Port number	10001
Connect Mode	C0 (always accept incoming connection; no active connection startup)
Send '+++' in Modem Mode	Enabled
Show IP addr after 'RING'	Enabled
Auto increment source port	Disable
Hostlist retry counter	3
Hostlist retry timeout	250 (msec)

Email Settings

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

9. GPIO Interface

Configurable Pins

The *XPort module* has three pins (CP1-3) that you can configure for General Purpose I/O (GPIO).

Note: *You can also configure the pins for serial port control lines, such as hardware control, modem control (CTS, RTS, DTR, and DCD), and diagnostic outputs to LED, using DeviceInstaller.*

You can use these GPIO pins to control devices such as relays, servers, lights, monitor switches, sensors, and even processes such as data transfer.

You can set the functions for the three pins independently and in any combination. The initial directions (input/output) and active levels (active low or high) at boot up can also be configured through 77FE, for example, by using DeviceInstaller.

This chapter describes how the directions, active levels, and states can be dynamically controlled and probed through special port 77F0.

The configurable pins default configuration is:

Function: General Purpose Input

Active Level: Active Low

Features

- TCP and UDP can be used.
- The protocol supports up to 32 GPIO for future products.
- Function configuration can be retrieved.
- Input or output selection can be retrieved and controlled.
- Active low or high selection can be retrieved and controlled.
- Active or inactive selection can be retrieved and controlled.
- 77F0 can be disabled.

Every change of state (active/inactive) requires a command over TCP or UDP, and thus is not very fast. If you use this port for data transfer, the throughput is low, usually up to 1 Kbps.

Control Protocol

The GPIO control protocol is a simple, proprietary protocol.