LANTRONIX®

XPort® Direct™+

XPort Direct+ NC Addendum

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Contents

Overview

The XPort Direct+ NC is an XPort Direct with no RJ45 connector on the module itself. This addendum to the XPort Direct+ User Guide shows hardware engineers how to connect an external Ethernet RJ45 to a Lantronix XPort Direct+ NC module. It provides circuit diagrams and references component part numbers for the magnetics and the RJ45 connector.

Note: *This document does not apply to the XPort Direct+, which already has an RJ45 Ethernet jack mounted on the module. The standard unit does not have the Ethernet signals routed to the header pins, and therefore you cannot use it with an external RJ45 connector.*

AES encryption is a feature available in the XPort Direct+ NC. This addendum provides users with instructions for entering AES encryption settings.

PCB Interface Signals

Following is the pin listing for the XPort Direct+ NC.

Table 1. PCB Interface Signals

Signal Name	Direct Pin #	Primary Function
GND	1,2	Circuit ground
3.3V	3	+3.3V power in
Reset#	5	External reset in
Data Out	7	Serial data out (driven by DSTni's built-in UART)
Data In	9	Serial data in (read by DSTni's built-in UART)
RTS	11	Flow control out: RTS (Request to Send) output driven by DSTni's built-in UART for connection to CTS of attached device. RTS is used as transmit enable in RS485 mode.
DTR	13	Modem control: DTR (Data Terminal Ready) output driven by DSTni's built-in UART for connection to DCD of attached device.
CTS	15	Flow control in: CTS (Clear to Send) input read by DSTni's built-in UART for connection to RTS of attached device.
NC	17	Reserved
CP3 (DATA)	19	General Purpose IO pin
CP2	21	General Purpose IO pin
CP1	23	General Purpose IO Pin
Chassis	24	Chassis Ground Pin

Signal Name	Direct Pin #	Primary Function
	10,22	No Connect Pins
Ethernet TX+/TX-	4,6	Ethernet Transmit differential pair, TX+ pin 4, TX- pin 6.
Ethernet RX+/RX-	14,16	Ethernet Receive differential pair, RX+ pin 14, RX- pin 6.
TX_CT	8	Center Tap pin for Transmit differential pair
RX_CT	18	Center Tap pin for Receive differential pair.
LED1	12	Active low Link indicator for driving LED.
LED2	20	Active low Activity indicator for driving LED.

Connecting XPort Direct+ NC to an Ethernet Port

The XPort Direct+ NC features an Ethernet port routed to the header pins. The Ethernet port is a fully integrated 10BASE-T /100BASE-TX port. However, you must add magnetics and an RJ45 connector to complete the interface.

You have two options for adding magnetics and a connector:

- Use an external magnetic isolation module and a regular RJ45 connector.
- If PC board space is critical, use an integrated RJ45 connector with built-in magnetics.

There is an option to implement Power-Over-Ethernet (POE) using the XPort Direct+ NC and the wired Ethernet channel. For more information, please refer to Lantronix POE Application notes on www.lantronix.com for examples.

Selecting LAN Magnetics

For communications on a local area network, a magnetic filter module is required. The magnetics provide impedance matching, signal shaping and conditioning, high voltage isolation, and common-mode noise reduction. 10/100 Base-T Ethernet uses Unshielded Twisted Pair (UTP) transmission cable. The UTP wiring is prone to noise pickup that leads to conducted and radiated noise emission. The magnetics help filter out the noise and provide good signal integrity and electrical isolation.

The recommended magnetic module has a 1:1 transmit turns ratio, 1,500 volts isolation, center taps on both sides of the transformer, a choke on both the transmit/receive channels, and is for 10/100 Base-T Ethernet networks. The following are some factors to consider when selecting the magnetics for LAN communications.

Common-Mode Choke

For 10/100 Mbps communications, a common-mode choke is necessary for a system to pass FCC testing. The choke presents a high impedance to common-mode noise but a low impedance for differential-mode signals. For an XPort Direct+ NC application, both

transmit and receive channels must have a choke, and both chokes should be wired directly to the RJ-45 connector (see Figure 1).

Crosstalk

Another consideration is crosstalk between the transmit and receive channels. This crosstalk can cause trouble during EMC testing. Magnetics with a shield between the two channels can minimize crosstalk and provide an additional 10dB of rejection.

Insertion Loss

Insertion loss is the loss of the transfer energy from the source to the load.

Return Loss

Return loss defines the level of matching between the source and load impedance.

Common-Mode Rejection

Common-mode rejection is the ability to reject a signal, which, referenced to ground, has the same amplitude and phase on both inputs. This signal, which is usually the result of noise or a small impedance mismatch, produces a small differential error voltage at the input terminals of the Ethernet. Subsequently, this error gets amplified right along with the desired communications signal. The magnetics play a major role in knocking down this common-mode noise down to an acceptable level.

Signal Routing

The receive and transmit Ethernet pairs should be routed as 100 ohm differential from the XPort Direct+ NC module to the magnetic module (and from the magnetic module to RJ45 in the case of separate RJ45 and magnetics).The signal pairs should be routed on a layer adjacent to the signal ground plane and should be kept away from high speed, clock, analog, or power signals. Attempt to minimize vias as much as possible. If layer transitions are necessary, we recommend using ground-stitching vias near the signal vias.

Reference Components

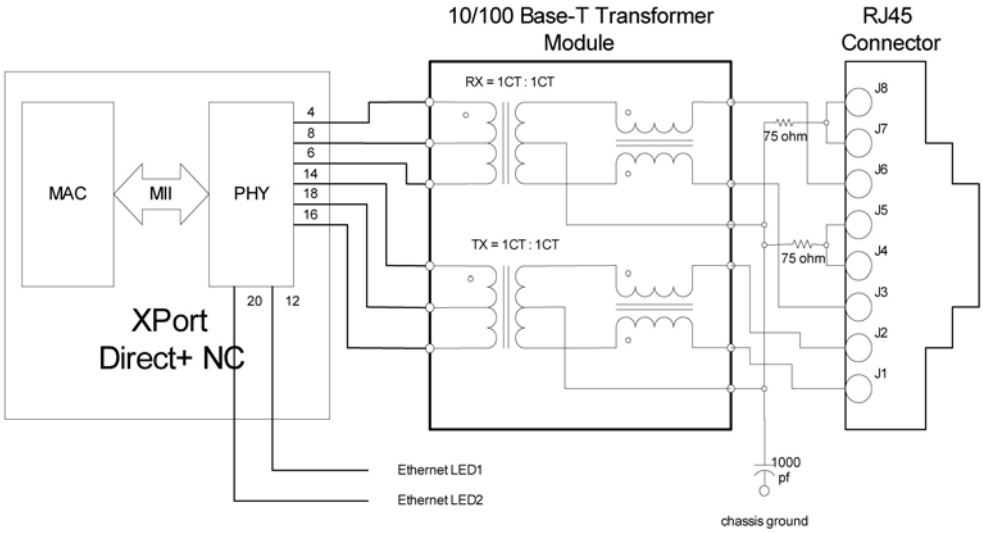
Lantronix has used the following vendor components and part numbers in similar designs. Please review their data sheets carefully before using them in your design. They are here for reference only.

Description	Vendor	Vendor part number
RJ45 connector with integrated magnetics	Bothhand LAN-Mate Series	LU1T041C-43
RJ45 connector with integrated magnetics	XFMRS Inc	XFATM2G-COMBO1-4MS
RJ45 connector without magnetics	Stewart Connector	SS-700810S-A-NF-1-BB
10/100 Base-TX magnetic module	Halo Electronics Ultra Series	TG110-S055N2
Capacitors – high voltage 250 V AC rated for ESD	Murata Erie	GHM2143B103MAC250 or GA252DB3E2103MY02L

External Magnetics and RJ45 Connector Design

For an Ethernet design that requires external magnetics and a discrete RJ45 connector, the following circuit diagram provides an overview.

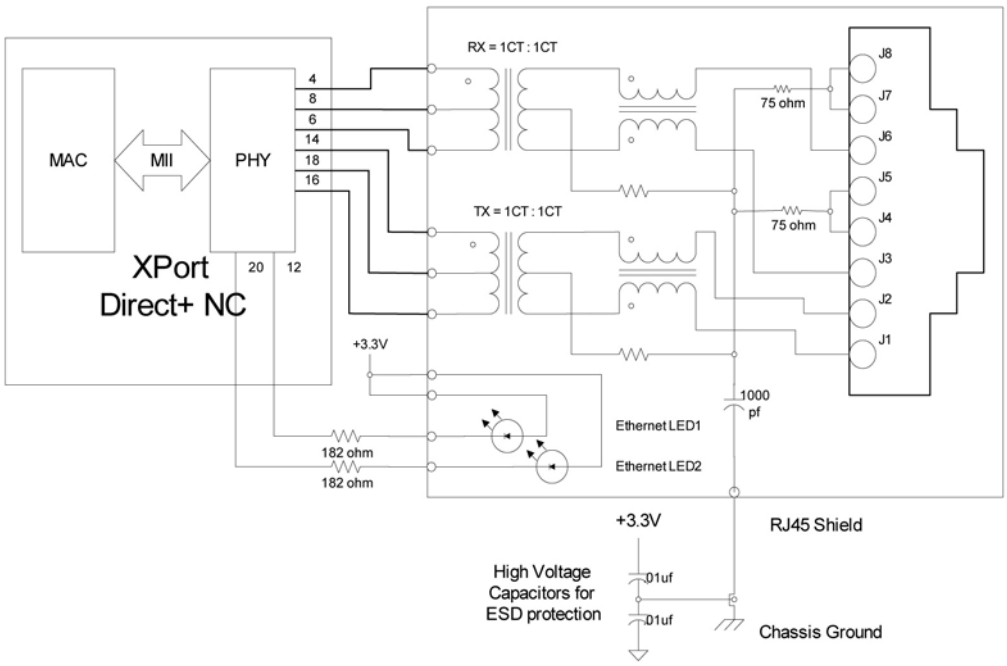
Figure 1. External Magnetics with Discrete RJ45 Connector



RJ-45 Connector with Integrated Magnetics Design

For an Ethernet design that uses an RJ45 connector with integrated magnetics, the following circuit diagram provides an overview.

Figure 1. RJ45 Connector with Integrated Magnetics for 10/100 Base-T Ethernet



Configuring AES Encyption

In Setup Mode, the option **6 Security** contains the configurable parameter for AES encryption.

Enable Encryption

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

Note: *Configure encryption through a local connection to the serial port of the XPort Direct+ NC or via a secured network connection. Initial configuration information, including the encryption key, is sent in clear text over the network.*

```
Enable Encryption (N) ? _
Key length in bits (256): _
Change Key (N) ? _
Enter Key: _
```

Enable Encryption	Select **Y** (Yes) to enable AES encryption (for tunneling only).
Key length in bits	Valid options are 128, 192 and 256 bits.
Change Key	Select to modify the current AES encryption key. The default is **N** (No).
Enter Key	If you selected **Change Key**, enter the key (at the **Enter Key** prompt) in hexadecimal numbers. Enter 32 characters for 128 bits key length, 48 characters for 192 bits key length, or 64 characters for 256 bits key length.