

Application Note:

How to Connect a Wired Ethernet Port to the WiPort™

Overview

This application note shows hardware engineers how to connect a wired Ethernet to a Lantronix WiPort module. It provides circuit diagrams, and references component part numbers for the magnetics and the RJ45 connector.

Connecting WiPort to a Wired Ethernet

The WiPort features both a wireless 802.11b and a wired Ethernet port. The wired Ethernet port is a fully integrated 100BASE-TX/10BASE-T Physical Layer. However, the addition of magnetics and an RJ45 connector are required to complete the interface.

There are two choices for the addition of magnetics and a connector. The first choice is to use an external magnetic isolation module and a regular RJ45 connector. If PC board space is critical, the second choice is to use an integrated RJ45 connector with built-in magnetics.

There is an option to implement Power-Over-Ethernet (POE) using the WiPort and the wired Ethernet channel. For more information, please refer to the Lantronix WiPort POE Application Note.

Selecting LAN Magnetics

For communications on a local area network (LAN), 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 utilizes 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 to filter out the noise, provide good signal integrity and good electrical isolation.

The recommended magnetics have 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 have been designed for use with 10/100 Base-T Ethernet networks.

The following are some additional 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 a WiPort 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.

Reference Components

The following vendor components and part numbers have been used by Lantronix in similar designs. Please review their data sheets carefully before using them in your design. They are shown 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 RJ-45 Connector Design

The following circuit diagram (Figure 1) provides an overview of an Ethernet design that requires external magnetics and a discrete RJ45 connector.

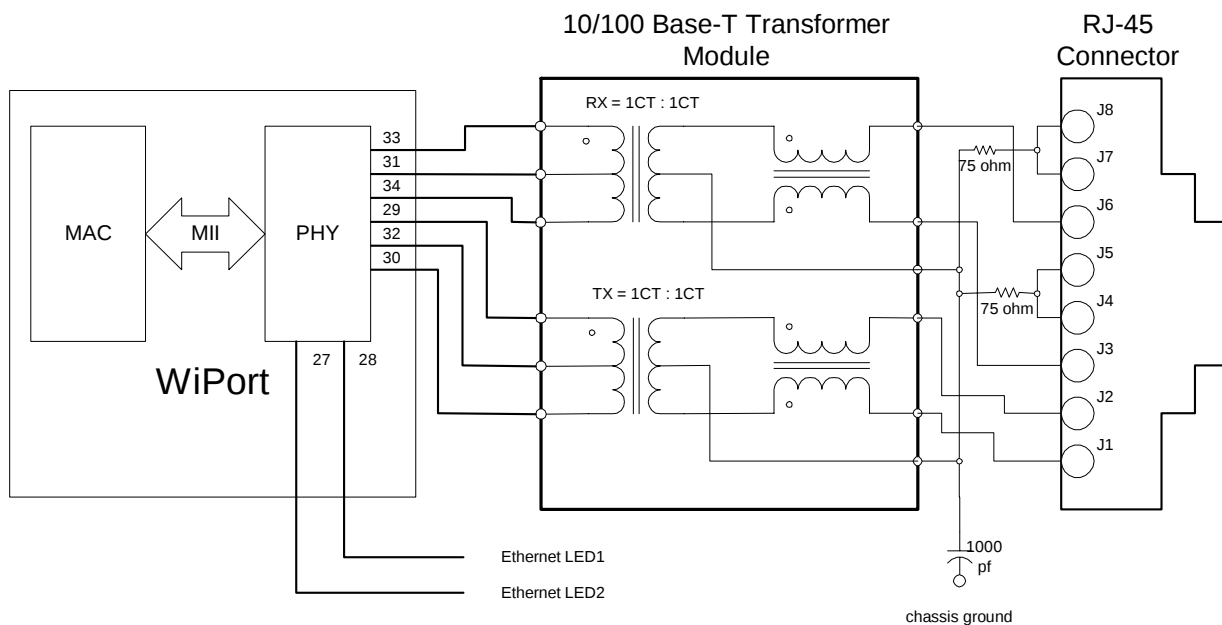


Figure 1

RJ-45 Connector with Integrated Magnetics Design

The following circuit diagram (Figure 2) provides an overview of an Ethernet design that utilizes an RJ45 connector with integrated magnetics.

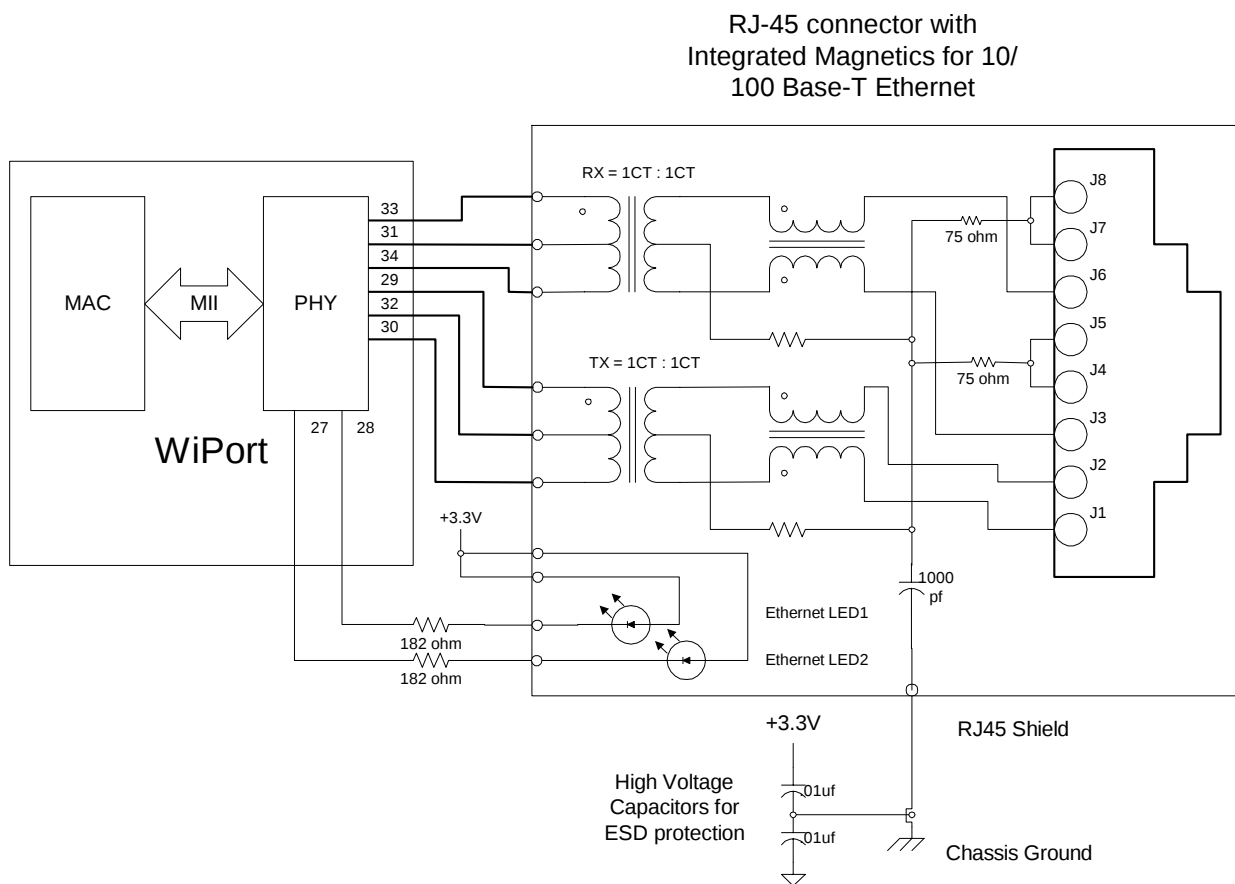


Figure 2