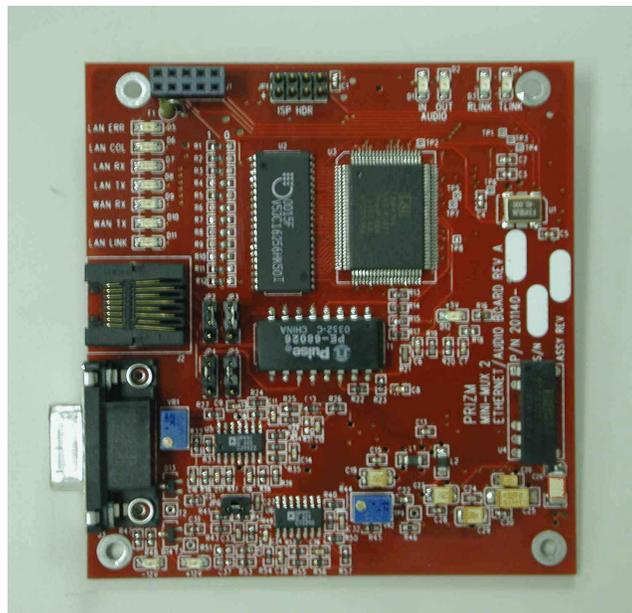




Mini-Mux 2 Ethernet and Audio Daughterboard

(201140-xxx)

User's Manual And Troubleshooting Guide



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Rev. D

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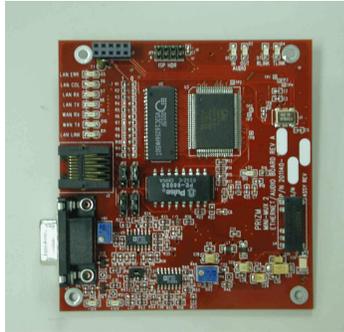
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1 Mini-Mux2 Ethernet and Audio Daughterboard, Part Number 201140-xxx



The Mini-Mux 2 Ethernet and Audio Daughterboard board provides the user with a single 10Base-T port and one bi-directional audio channel connectivity between the Mini-Mux2 pairs. The board integrates a WAN-LAN (wide area network-local area network) bridge and a single Ethernet port onto a single board. The daughterboard has a single RJ-45 connector for connectivity to 10BASE-T networks. Network traffic is converted from the LAN format to a more efficient WAN format before it is transferred over the fiber optic cable. At the other end of the link, the WAN traffic is converted back to LAN format and passed to Ethernet 10BASE-T port. The board also supplies a single bi-directional audio channel, which is capable of providing limited gain adjustment in each direction. The audio circuit may provide either individual input and output connectors or an integrated DB-9 interface and may accept either single ended or differential (balanced) input signals.

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Note: This board will ONLY support 10 Mbps Ethernet. 100 Mbps Ethernet will NOT work through this board.

10BASE-T Ethernet is typically specified to have a 100-meter maximum point-to-point segment length and a 2.8 kilometer (1.7 miles) maximum network span. With a fiber optic extension, such as provided by this board, the umbilical length is limited only by the optical budget provided by the Mini-Mux2 Video Input and Output board set.

The Mini-Mux2 Ethernet and Audio Daughterboard (hereafter referred to as MM2 Ethernet/Audio) connects to the Prizm Mini-Mux2 Video Input and Output Cards via a 10 pin header (J1) located at the top left of the board. This header contains power pins(4), data pins(2), clock pins (2), a pin for monitoring link status and a pin for future use.

1.1 MM2 Ethernet/Audio Daughterboard Revision History:

The MM2 Ethernet/Audio Daughterboard has gone through the following printed circuit board (PCB) and Assembly revisions:

PCB Revision A/Assembly Revision A Original design.

1.2 M2 Ethernet/Audio Daughterboard Dash (-) Numbers:

The MM2 Ethernet/Audio Daughterboard has a Dash Number appended to the part number. This Dash Number identifies the specific board configurations:

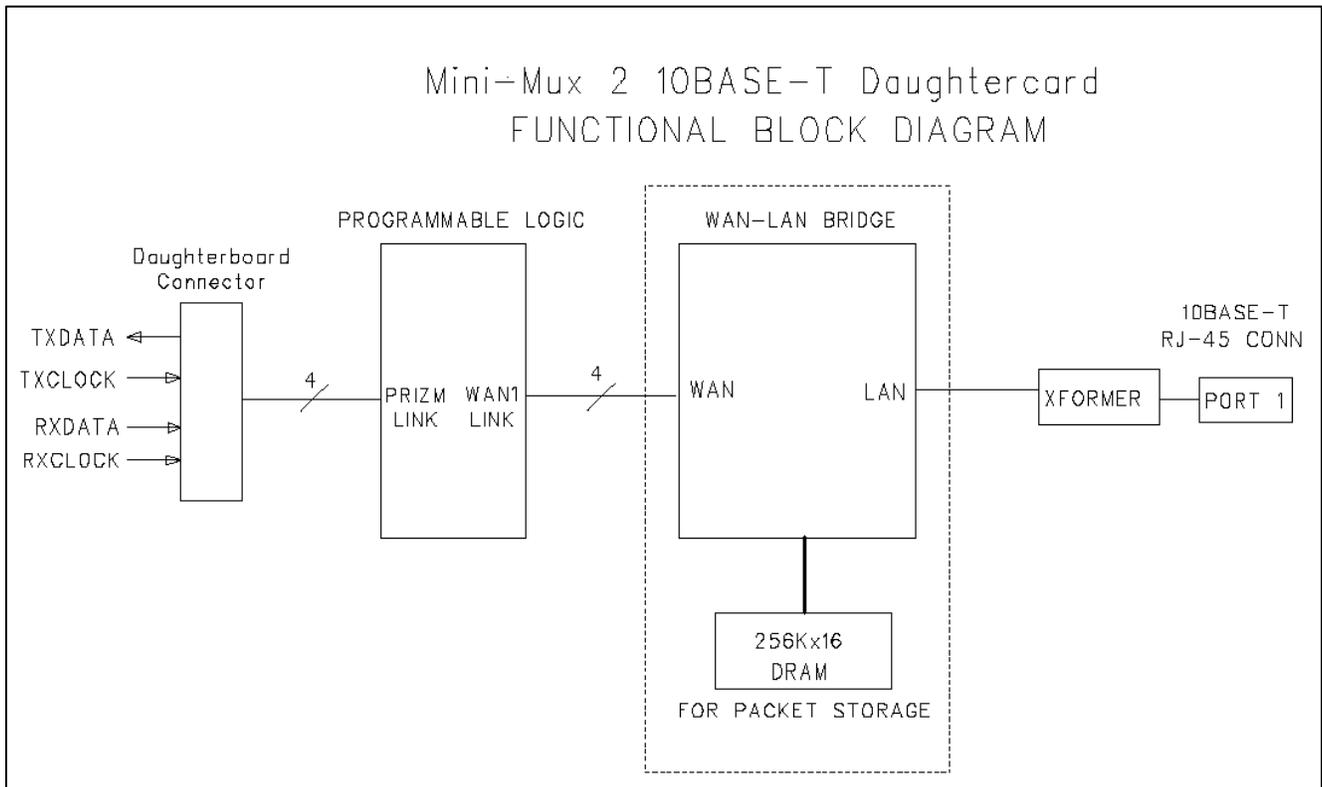
- 000 configuration Original Configuration. DB-9 audio connector.
- 001 configuration Phoenix audio connectors. Obsolete. Replaced by -004
- 002 configuration Remote operation. Conformal coating. Audio and Ethernet through DB9.
- 003 configuration Stacked operation. Conformal coating. Audio and Ethernet through DB9.
- 004 configuration Standard Phoenix audio connectors configuration.

1.3 MM2 Ethernet/Audio Daughterboard Operation:

The programmable logic portion of the diagram provides the direct connection of the WAN-LAN bridge to the Mini-Mux 2 base boards via the daughterboard connector. The WAN synchronous connection does not run directly at the full clock rate available on the Mini-Mux bus so the programmable logic is used to lower the WAN speed to 16.5 MHz.

The WAN-LAN Bridge

See the block diagram below.



The WAN-LAN bridge function takes the 10BASE-T Ethernet LAN traffic that is asynchronous and bursty by nature and converts the traffic to a format that is synchronous (specifically HDLC) for efficient transport over the WAN port. To convert the LAN to WAN, the LAN packets (frames) must be stored temporarily in DRAM (dynamic random access memory) to support the differences in data rates between the LAN and the WAN and for packet re-transmittal.

The bridge keeps a table of current IP addresses that are found on the LAN side and only transfers frames across the WAN connection that are NOT local to the LAN – in this case all traffic is transported. An address table is kept up-to-date by the bridge in the DRAM. An "aging" of the address automatically deletes the table entry if, after 5 minutes, no frames are received from an address. This filtering function can be disabled if needed by the application.

The WAN port is the synchronous Mini-Mux 2 daughterboard interface while the LAN port is the 10BASE-T network port.

The 10BASE-T interface requires an isolation transformer, as noted on the block diagram.

The RJ-45 connector has the following signals:

<u>PIN</u>	<u>Signal</u>	<u>Signal Direction</u>
1	RX+	INPUT
2	RX-	INPUT
3	TX+	OUTPUT
4	not used	
5	not used	
6	TX-	OUTPUT
7	not used	
8	not used	

Note: Pin 1 is located on each connector at the top of each connector if the board is positioned with the RJ-45 connector to the left.

The daughterboard also provides one bi-directional channel of audio data in addition to the Ethernet channel. The input signal may be single ended or differential (balanced), while the output signal is always single ended. The audio channel is sampled at approx. 670ksps. In both directions, the audio channel is equipped with a variable gain amplifier that allows for moderate gain adjustment of the analog signal. Typically, the audio circuit is tuned to provide a gain of 1/1 from end to end. This ratio can be modified through the use of the previously mentioned amplifiers, however care should be taken not to over amplify the signal as oscillations could occur.

The audio connectors (J3 or J4 and J5) have the following signals:

Connector J4 AUDIO OUTPUT

<u>PIN</u>	<u>Signal</u>	<u>Signal Direction</u>
1	AUDIO OUT+	OUTPUT
2	GROUND	

Connector J5 AUDIO OUTPUT

<u>PIN</u>	<u>Signal</u>	<u>Signal Direction</u>
1	AUDIO IN+	INPUT
2	GROUND	
3	AUDIO IN-	INPUT

Connector J3 AUDIOÐERNET INPUT/OUTPUT

<u>PIN</u>	<u>Signal</u>	<u>Signal Direction</u>
1	AUDIO IN+	INPUT
2	GROUND	
3	AUDIO IN-	INPUT
4	10BASE-T RX-	INPUT
5	10BASE-T RX+	INPUT
6	10BASE-T TX-	OUTPUT
7	10BASE-T TX+	OUTPUT
8	AUDIO OUT+	OUTPUT
9	GROUND	

1.4 MM2 Ethernet/Audio Daughterboard Jumper Configuration:

There are a total of five individual jumpers on the MM2 Ethernet/Audio Daughterboard. Four of these work in concert to allow for a straight or crossover connection for the 10Mbps Ethernet port. These jumpers are labeled JP2-5. All four of these jumpers should be in the same relative position. For a straight Ethernet cable connection, all four shunts should be across pins 1 and 2. For a crossover connection, all four shunts should be across pins 2 and 3.

JP6 is used to select between a single-ended and differential audio input signal. If the input source is single-ended (i.e. signal referenced to ground or un-balanced), JP6 should be shorted using a shunt. If the input is differential (i.e. a positive and a negative version of the signal or balanced) the shunt should be removed from JP6.

NOTE: If Single-ended selected then attach input signal to IN+ and its return to IN- (grounded by the jumper).

If Differential input is selected then attach positive input signal to IN+ and the negative input signal to IN-. Shield (if used) can be attached to any Ground pin.

1.5 MM2 Ethernet/Audio Daughterboard Indicators:

There are several surface mount diagnostic status LEDs on this board.

The SMD LEDs are meant for board level troubleshooting but may be of some limited use to the user in diagnosing a problem. The SMD LEDs are as follows:

D12 - labeled "+5V"

- ON if +5VDC is present on board

"+12V"

- ON if +12VDC is present from onboard supply

“-12V”

- ON if -12VDC is present from onboard supply.

D3 - labeled “RLINK”

- ON if the board is receiving a high-speed link from the other MM2 Ethernet/Audio daughterboard at the other end of the fiber link

D4 - labeled “TLINK”

- ON if the board is transmitting a high-speed link to the other MM2 Ethernet/Audio daughterboard at the other end of the fiber link

Note: The TLINK LED will always be ON. The RLINK LED will blink off during board power-up but then stay on constantly.

D5 - labeled “LAN ERR”

- Red, ON if the bridge chip (U6) detects an internal hardware error or if the DRAM packet storage gets full. This would happen on a board that has its LAN cable removed or is connected to a PC that is turned off.

D6 - labeled “LAN COL”

- ON if the bridge chip (U6) detects an Ethernet LAN collision.

Note: Ethernet collisions happen on any network when the network traffic gets severe. If this LED becomes active the user may have to reduce the network traffic.

D7 - labeled “LAN RX”

- ON if the bridge chip (U6) is receiving an Ethernet frame through the high-speed link from the remote Ethernet board.

D8 - labeled “LAN TX”

- ON if the bridge chip (U6) is sending an Ethernet frame through the high-speed link to the remote Ethernet board.

D9 - labeled “WAN RX”

- ON if the bridge chip (U6) is receiving an Ethernet frame through the high-speed link from the remote Ethernet board.

D10 – labeled “WAN TX”

- ON if the bridge chip (U6) is sending an Ethernet frame through the high-speed link to the remote Ethernet board.

Note: If the WAN TX LED is ON then the LAN RX LED should also be ON. If the WAN RX LED is ON then the LAN TX LED should also be ON.

D11 - labeled “LAN LNK”

- ON if there is an active network cable plugged in.

The following LEDs are used to indicate audio channel data traffic status:

D1 - labeled "AUDIO IN"

- ON if an analog signal of approximately 1.2V p-to-p is being received into the audio input channel.

D2 - labeled "AUDIO OUT"

- ON if an analog signal of approximately 1.2V p-to-p is being transmitted out of the audio output channel.

1.6 MM2 Ethernet/Audio Daughterboard Specifications:

Ethernet

Number of Ethernet Channels:	A single 10BASE-T port
Cable type supported:	Category 5 (CAT 5) with RJ-45 connector
Data rates supported:	10.0Mbps
Isolation provided:	Transformer

Note: This board will ONLY support 10 Mbps Ethernet. 100 Mbps Ethernet will NOT work through this board.

Audio

Number of Channels:	1 bi-directional
Analog Resolution:	10-bit
Analog Sample Rate:	approx. 670 kilosamples per second (ksps), typically
Analog Bandwidth:	20 – 20KHz audio bandwidth
Audio Levels (In/Out):	1Vp-p, typically 0.1Vp-p to 10Vp-p range
Analog Adjustment:	adjustable input and output audio gain via trimpots
Analog Input:	selectable single-ended or differential (balanced)

1.7 MM2 Ethernet/Audio Daughterboard Dimensions:

PC/104 printed circuit board (PCB): 3.55 in x 3.775 in x 0.60 in board-to-board
90.17 mm x 95.88 mm x 15.24 mm

1.8 MM2 Ethernet/Audio Daughterboard Power Requirements:

The board requires +5VDC at 750 milliamps (max). It is powered off of the Mini-Mux 2 Video Input or Output board via a daughterboard connector. A 2Amp through-hole fuse (F1) is provided to protect the board from inadvertent electrical shorts.

1.9 MM2 Ethernet/Audio Daughterboard Installation and Checkout

A typical 10BASE-T Ethernet network has at least two PCs linked directly together with a single Category 5 (CAT 5) cable (refer to Figure 4). The CAT 5 cable has four twisted pairs: one for 10BASE-T transmit, one for 10BASE-T receive and two unused pairs. The CAT 5 cable will have an RJ-45 (8-pin) jack at each end. There are two types of CAT 5 cables: a straight cable and a cross-over cable. The straight cable has the RJ-45 connector's transmit pair at one cable end connected to the transmit pair at the other end and the receive pair connected to the receive pair. The cross-over cable has the RJ-45 connector's transmit pair at one cable end connected to the receive pair at the other end and the receive pair connected to the transmit pair. If a PC is directly connected to another PC a cross-over cable must be used to connect the transmit signal from one PC to the receive pins of the other PC. If a PC is connected directly to a hub then a straight cable is used as the hub's port connector is wired to cross the transmit and receive signals.

The MM2 Ethernet/Audio Daughterboard allows configuration as either a direct or crossover connection. If the jumpers on the board are left in the direct/straight setting (all four jumpers placed between pins 1 and 2), use the following as a guide:

- If you are connecting to a PC, use a straight cable
- If you are connecting to a hub, use a cross-over cable.

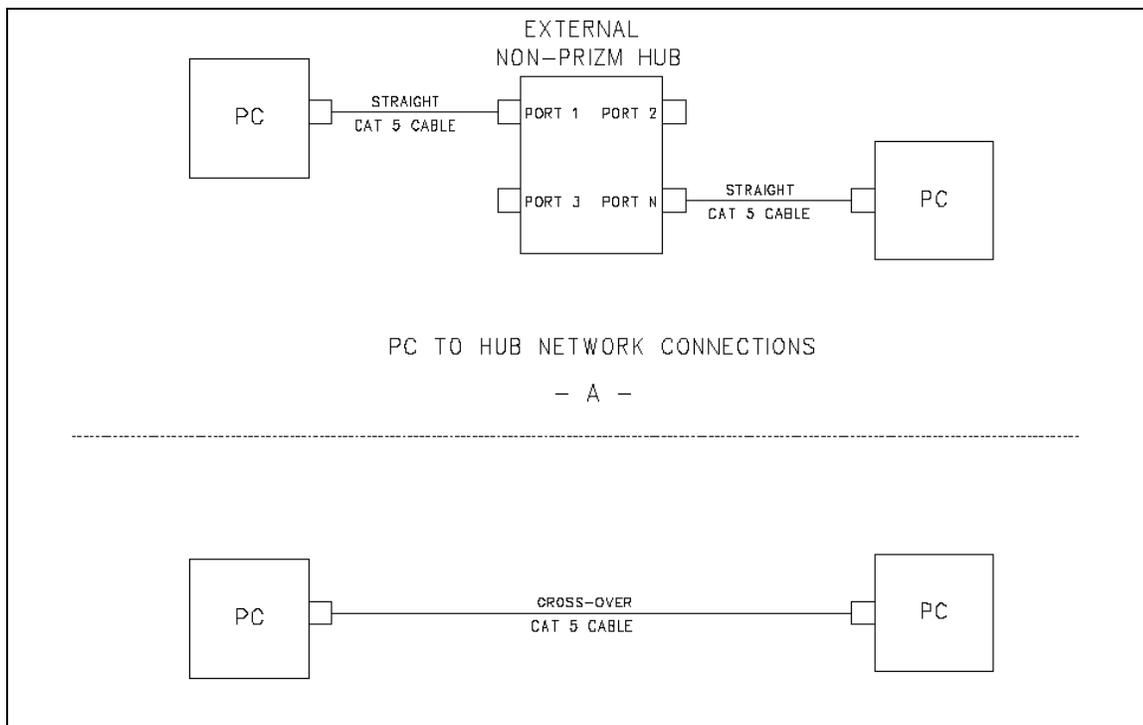


Figure 1 Typical Ethernet Network Connections

NOTE: When connecting network cables to this board the user must remember to use the correct CAT 5 cable as shown.

To begin the checkout of the MM2 Ethernet/Audio Daughterboard, ensure that the MM2 Video In and Out pair are functioning properly (i.e. fiber is connected, the boards are linked without optical errors, etc.).

To properly check out the MM2 Ethernet/Audio Daughterboard the user must have at two PCs with 10BASE-T boards installed and operational. These PCs must be correctly configured to communicate via 10BASE-T with each other (correct IP addresses, etc.) and have the appropriate network software installed (Windows 98 for example). Verify that the PCs can communicate between themselves by attaching them through your own hub or switch or directly. 10BASE-T test software is helpful but simply PINGing at the DOS level is adequate for checking network connectivity. Once you are sure your test network is operational follow these steps to insert the Prizm System into your network and to prove that the Prizm System is correctly carrying the network traffic.

1. Install the Mini-Mux 2 boards with the daughterboard in your system.
2. Install the appropriate fiber optic cables between the Mini-Mux 2 optics.
3. Power up the Mini-Mux2 Surface Video Out and Vehicle Video In cards.
4. Verify that all boards power up correctly and show the appropriate status LED indications.
5. Verify that the Mini-Mux 2 boards are linked via the fiber cables and that no optical errors are being reported.
6. With no Ethernet cables attached to either of the Mini-Mux 2 Ethernet Daughteboards, verify that both boards have the top right two LEDs lit (RLINK and TLINK), the right middle LED lit (+5V), and the bottom left two LED's lit (+12V and -12V).
7. Plug the Ethernet cables from two of the test PCs into the RJ-45 connectors on each board. The LAN LNK LEDs should now be lit.
8. Attempt to PING from one test PC to another test PC. The PING program should show that there was a reply from the PINGed PC and the round-trip time in milliseconds. If the PING was unsuccessful, the displayed message will be that the request timed-out. If successful, the round-trip time will be displayed and should be in the range of 3 milliseconds to 5 milliseconds with small PING data packets.
9. Connect an audio source with a 1V p-to-p signal to the Audio In connection of one of the daughterboards and adjust the trimpot at VR2 as necessary to yield a 1V p-to-p signal at TP9.
10. Verify a 1V p-to-p output signal at the Audio Output connection of the daughterboard at the opposite end of the link. (Adjust VR1 on the output channel as necessary.)

1.10 MM2 Ethernet/Audio Daughterboard Troubleshooting

In normal operation the following LED status should be observed with the Ethernet daughterboard plugged into MM2 main board with no network or audio cables attached:

1.10.1 DC Power Troubleshooting

The SMD LEDs are as follows:

D12 – ON (+5VDC available)

+12V & -12V –ON (+/- 12VDC available)

D3 – On (RLINK)

D4 – On (TLINK)

The remaining LEDs will be off.

The LED status conditions of the Ethernet/Audio boards are detailed for several scenarios. The statuses are as follows:

1.10.2 10BASE-T Ethernet Troubleshooting

Note: The "Local" board denotes the Ethernet/Audio board on one end of the Prizm MM2 System and "Remote" board refers to the other end of the Prizm MM2 System. The "Local" and "Remote" identifiers are arbitrary.

1. The Prizm Mini-Mux 2 system is fully functional and each PC is plugged into one of the Ethernet/Audio boards:

At the "Local" end (with the PC connected and PINGing):

When PINGing from this PC:

RLINK LED - ON green

TLINK LED - ON green

LAN ERR LED – OFF

LAN COL - OFF

WAN TX LED - Blinks ON green with PING

WAN RX LED - Blinks ON green with response

LAN TX LED - Blinks ON green with response

LAN RX LED - Blinks ON green with PING

LAN LNK LED - ON green

At the "Remote" end (with the PC connected):

When PINGing that PC:

- RLINK LED - ON green
- TLINK LED - ON green
- LAN ERR LED - OFF
- LAN COL LED - OFF
- WAN TX LED - Blinks ON green with response
- WAN RX LED - Blinks ON green with PING
- LAN TX LED - Blinks ON green with PING
- LAN RX LED - Blinks ON green with response
- LAN LNK LED – On green

2. The Prizm System is fully functional but at the "Remote" end the Ethernet cable is not plugged in or the PC is not powered up:

At the "Local" end (with the PC connected and PINGing):

When PINGing from this PC:

- RLINK LED - ON green
- TLINK LED - ON green
- ERR LED - OFF
- LAN COL LED - OFF
- WAN TX LED - Blinks ON green with PING
- WAN RX LED - OFF
- LAN TX LED - OFF
- LAN RX LED - Blinks ON green with PING
- LAN LNK LED – ON green

At the "Remote" end (with the PC NOT connected):

When PINGing that PC:

- RLINK LED - ON green
- TLINK LED - ON green
- ERR LED – OFF initially, but will blink ON red after DRAM fills up
- LAN COL LED - OFF
- WAN TX LED - OFF
- WAN RX LED - Blinks ON green with PING
- LAN TX LED - ON green
- LAN RX LED - OFF
- LAN LNK LED – On green

3. The fiber at the "Local" end is unplugged from the MM2's receive (RX) optical port but each PC is plugged into one of the Ethernet daughterboards:

At the "Local" end (with the PC connected and PINGing):

The MM2 FIBER LED is OFF , RCV LINK is OFF and RMT LNK LED is ON.

When PINGing from this PC:

- RLINK LED - ON green
- TLINK LED - ON green
- ERR LED - Blinks ON red with PING
- LAN COL LED - OFF
- WAN TX LED - OFF
- WAN RX LED - OFF
- LAN TX LED - OFF
- LAN RX LED - Blinks ON green with PING
- LAN LNK LED – ON green

At the "Remote" end (with the PC connected):

The MM2 FIBER LED is ON, RCV LINK is ON but and RMT LNK is OFF

When PINGing that PC:

- RLINK LED - ON green
- TLINK LED - ON green
- ERR LED - OFF
- LAN COL LED - OFF
- WAN TX LED - OFF
- WAN RX LED - OFF
- LAN TX LED - OFF
- LAN RX LED - OFF
- LAN LNK LED – ON green