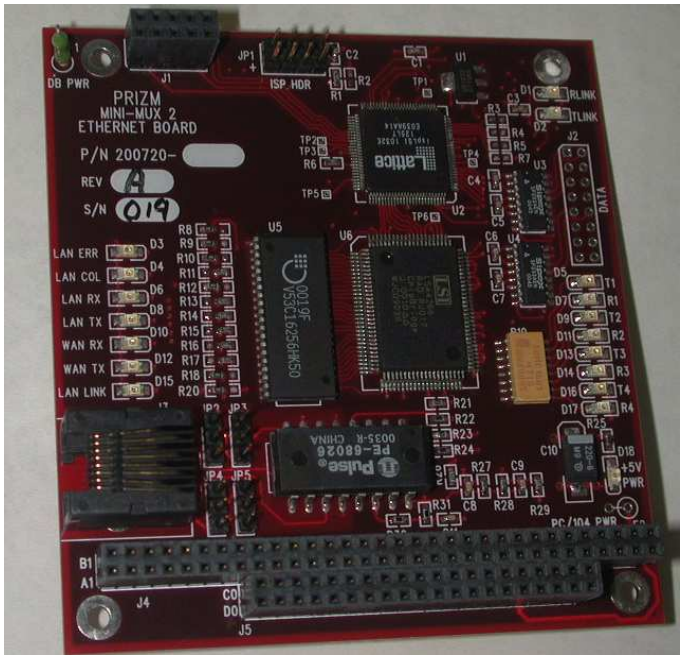
PRIZM™

Mini-Mux 2 Ethernet Daughterboard

(200720-xxx)

User's Manual And

Troubleshooting Guide



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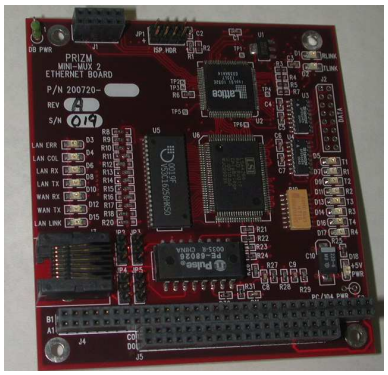


The Mini-Mux 2 Ethernet Daughterboard provides the user with a single 10Base-T port between the Mini-Mux2 pairs. The board integrates a WAN-LAN (wide area network-local area network) bridge and a single Ethernet port onto a single board. The daughterboard has a single RJ-45 connector for connectivity 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.

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 Daughterboard (hereafter referred to as MM2 Ethernet) 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.

If the Mini Mux 2 Ethernet board is purchased with the -002 configuration then 4 channels of RS-232 serial data are activated on the board in addition to the 10BASE-T Ethernet traffic. A 16-pin right-angle data header is provided to allow the user to utilize the additional data channels. Each RS-232 channel will support at least 115.2Kbaud.

Note: The Ethernet daughterboard currently has two PCB revisions. Revision B added a 16-pin header for remote display of the on-board LED status and is compatible with the Revision A board. This header is meant to connect only to the Prizm Mini-Mux 2 Display board for 1U rack applications.

1.1 Mini-Mux2 Ethernet Daughterboard Revision History:

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

PCB Revision A/Assembly Revision A and above: Original PCB design.

PCB Revision B/Assembly Revision A and above: Added LED display header for remote display of on-board LED status.

1.2 Mini-Mux2 Ethernet Daughterboard Manual Revision History:

The MM2 Ethernet daughterboard manual has gone through the following revisions:

Manual Revision A-C: Added new dash numbers.

Manual Revision D: Added new dash numbers and corrected dash number comments.

Manual Revision E: Added Moog Components Group contact info.

1.3 Mini-Mux2 Ethernet Daughterboard Dash (-) Numbers*:*

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

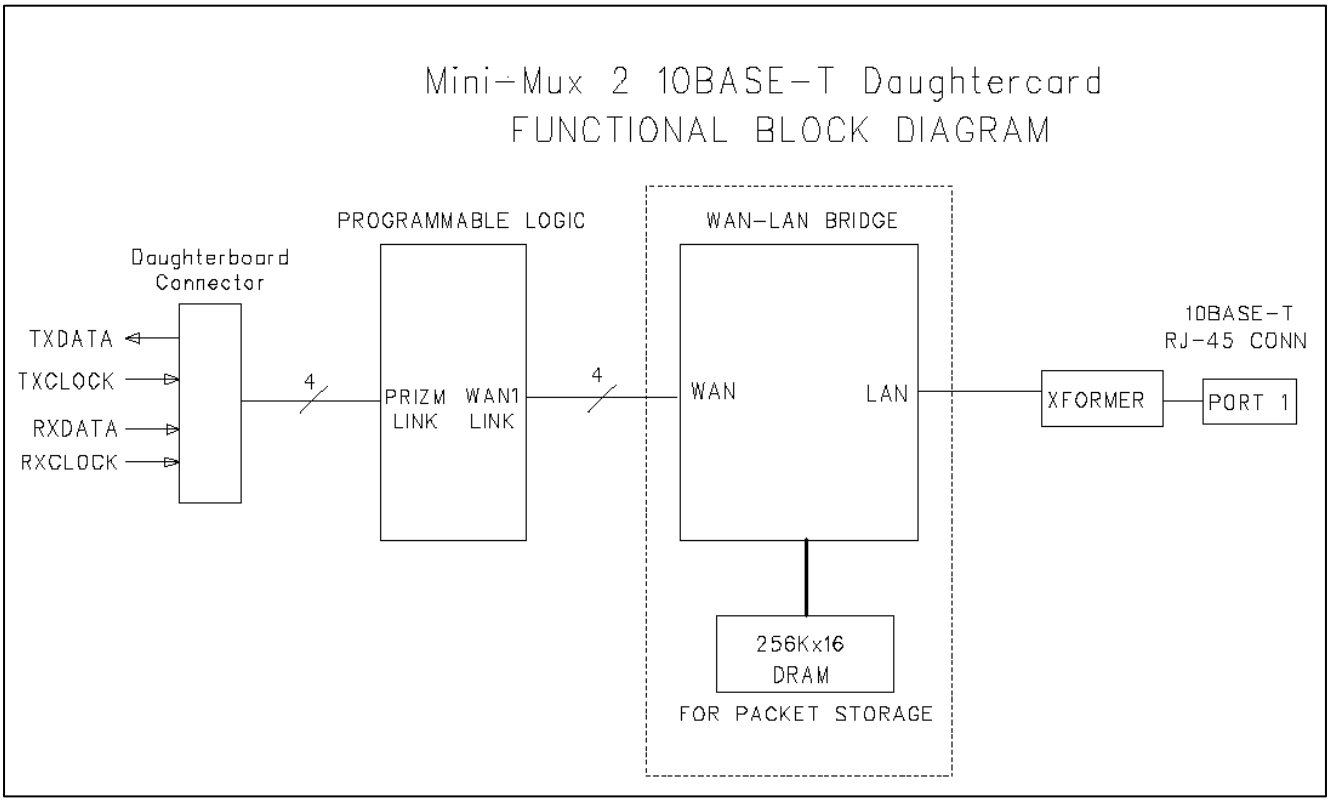
Configuration Dash Number	Comments	PCB Revision
-001A	Original configuration, only Ethernet port active	Rev A PCB
-002A	Ethernet port and 4xRS-232 channels active	Rev A PCB
-002B	Ethernet port and 4xRS-232 channels active, display header not active	Rev B PCB
-003A	Ethernet port and 4xRS-232 channels active, removed PC/104 connectors and added special right-angle data header	Rev A PCB
Wide Operating Temperature Range (all following boards):		
-200A	Only Ethernet Port active and 4xRS-232 channels not active	Rev A PCB
-201A	Ethernet port and 4xRS-232 channels active	Rev A PCB
-202A	No Ethernet port, only 4xRS-232 channels active	Rev A PCB
-202B	No Ethernet port and 4xRS-232 channels active, display header not active	Rev B PCB
-203A	Ethernet port and 4xRS-232 channels active, display header not active	Rev B PCB
-204A	Ethernet port and 4xRS-232 channels not active, display header not active	Rev B PCB
-205A	Ethernet port and 4xRS-232 channels active, display header active	Rev B PCB

1.4 Mini-Mux2 Ethernet Daughterboard Operation:

The programmable logic portion of the diagram provides the direct connection of the WAN-LAN bridge to the Mini-Mux 2 motherboard 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.

1.4.1 Mini-Mux 2 Ethernet Daughterboard Connectors:

The RJ-45 connector has the following signals:

Pin	Signal	Signal Direction
1	TXOb+	OUTPUT
2	TXOb-	OUTPUT
3	RXIb+	INPUT
4	not used	
5	not used	
6	RXIb-	INPUT
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 4 channels of RS-232 data in addition to the Ethernet channel. Each RS-232 channel can support data rates of at least 115.2Kbaud. No configuration is required to use any data rate up to 115.2Kbaud.

The RS-232 connector (J2) has the following signals:

RS-232 TXD1 (out)	1	o	o	2	RS-232 RXD1 (in)
GROUND	3	o	o	4	GROUND
RS-232 TXD2 (out)	5	o	o	6	RS-232 RXD2 (in)
GROUND	7	o	o	8	GROUND
RS-232 TXD3 (out)	9	o	o	10	RS-232 RXD3 (in)
GROUND	11	o	o	12	GROUND
RS-232 TXD4 (out)	13	o	o	14	RS-232 RXD4 (in)
GROUND	15	o	o	16	GROUND

If the PCB is a Revision B then an additional 16-pin header may be placed for LED display status.

Note: This header is meant for use only by the Prizm Mini-Mux 2 Display board for 1U rack applications. DO NOT attach a data plug to this header or damage to the daughterboard may result.

1.4.2 Mini-Mux 2 Ethernet Daughterboard Indicators:

1.4.2.1 Revision A Printed Circuit Board Indicators:

There are several surface mount diagnostic status LEDs on the Revision A daughterboard. The SMD LEDs are meant for board level troubleshooting but may be of some limited use to the user in diagnosing a problem.

LED Ref Designators	LED Label	LED Status
D1	"RLINK"	Green, ON if the board is receiving a high-speed link from the other Ethernet daughterboard at the other end of the fiber link
D2	"TLINK"	Green, ON if the board is transmitting a high-speed link to the other Ethernet board 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.***
D3	"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.
D4	"LAN COL"	Green, 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.***
D6	"LAN RX"	Green, ON if the bridge chip (U6) is receiving an Ethernet frame through the high-speed link from the remote Ethernet board.
D8	"LAN TX"	Green, ON if the bridge chip (U6) is sending an Ethernet frame through the high-speed link to the remote Ethernet board.
D10	"WAN RX"	Green, ON if the bridge chip (U6) is receiving an Ethernet frame through the high-speed link from the remote Ethernet board.
D12	"WAN TX"	Green, 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.***
D15	"LAN LNK"	Green, ON if there is an active network cable plugged in.
D5	"T1"	Green, ON if RS-232 data is being transmitted out of channel 1.
D9	"R1"	Green, ON if RS-232 data is being received into channel 1.
D11	"T2"	Green, ON if RS-232 data is being transmitted out of channel 2.
D13	"R2"	Green, ON if RS-232 data is being received into channel 2.
D14	"T3"	Green, ON if RS-232 data is being transmitted out of channel 3.
D15	"R3"	Green, ON if RS-232 data is being received into channel 3.
D16	"T4"	Green, ON if RS-232 data is being transmitted out of channel 4.

D17	"R4"	Green, ON if RS-232 data is being received into channel 4.
D18	"+5V POWER"	Green, ON if +5VDC is present on board, thru F1 or F2

1.4.2.2 Revision B Printed Circuit Board Indicators:

There are several surface mount diagnostic status LEDs on the Revision B daughterboard. The SMD LEDs are meant for board level troubleshooting but may be of some limited use to the user in diagnosing a problem.

Note: The Revision B PCB has a single LED added: D3 labeled "DISP PWR". The labels for the remaining LEDs are the same as the Revision A PCB except the LED Reference Designators have been changed.

LED Ref Designators	LED Label	LED Status
D1	"RLINK"	Green, ON if the board is receiving a high-speed link from the other Ethernet daughterboard at the other end of the fiber link
D2	"TLINK"	Green, ON if the board is transmitting a high-speed link to the other Ethernet board 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.***
D3	"DISP PWR"	Green, ON if +5VDC is available to Display board, thru fuse F2
D4	"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.
D5	"LAN COL"	Green, 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.***
D6	"LAN RX"	Green, ON if the bridge chip (U6) is receiving an Ethernet frame through the high-speed link from the remote Ethernet board.
D7	"LAN TX"	Green, ON if the bridge chip (U6) is sending an Ethernet frame through the high-speed link to the remote Ethernet board.
D8	"WAN RX"	Green, ON if the bridge chip (U6) is receiving an Ethernet frame through the high-speed link from the remote Ethernet board.
D9	"WAN TX"	Green, 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.***
D10	"LAN LNK"	Green, ON if there is an active network cable plugged in.
D11	"T1"	Green, ON if RS-232 data is being transmitted out of channel 1.
D12	"R1"	Green, ON if RS-232 data is being received into channel 1.
D12	"T2"	Green, ON if RS-232 data is being transmitted out of channel 2.
D14	"R2"	Green, ON if RS-232 data is being received into channel 2.

D15	"T3"	Green, ON if RS-232 data is being transmitted out of channel 3.
D16	"R3"	Green, ON if RS-232 data is being received into channel 3.
D17	"T4"	Green, ON if RS-232 data is being transmitted out of channel 4.
D19	"R4"	Green, ON if RS-232 data is being received into channel 4.
D18	not labeled	Green, ON if +5VDC is present on board, thru F1 or F3

1.4.3 Mini-Mux 2 Ethernet Daughterboard Specifications:

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

Number of RS-232 Channels: 4 independent RS-232 channels
Data rates supported: at least 115.2Kbaud
Isolation provided: None

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

1.4.4 Mini-Mux 2 Ethernet 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

1.4.5 Mini-Mux 2 Ethernet Daughterboard Power Requirements:

The board requires +5VDC at 250 milliamps. 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. An optional 2Amp through-hole fuse (at F2) may be used in some specific applications (refer to the factory before placing this fuse in the field).

1.5 *Mini-Mux 2 Ethernet Daughterboard* INSTALLATION AND CHECKOUT

A typical 10BASE-T Ethernet network has at least two PCs either 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 daughterboard allows configuration as either a direct or crossover connection. If the jumpers on the board are left in the direct/straight setting, 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.

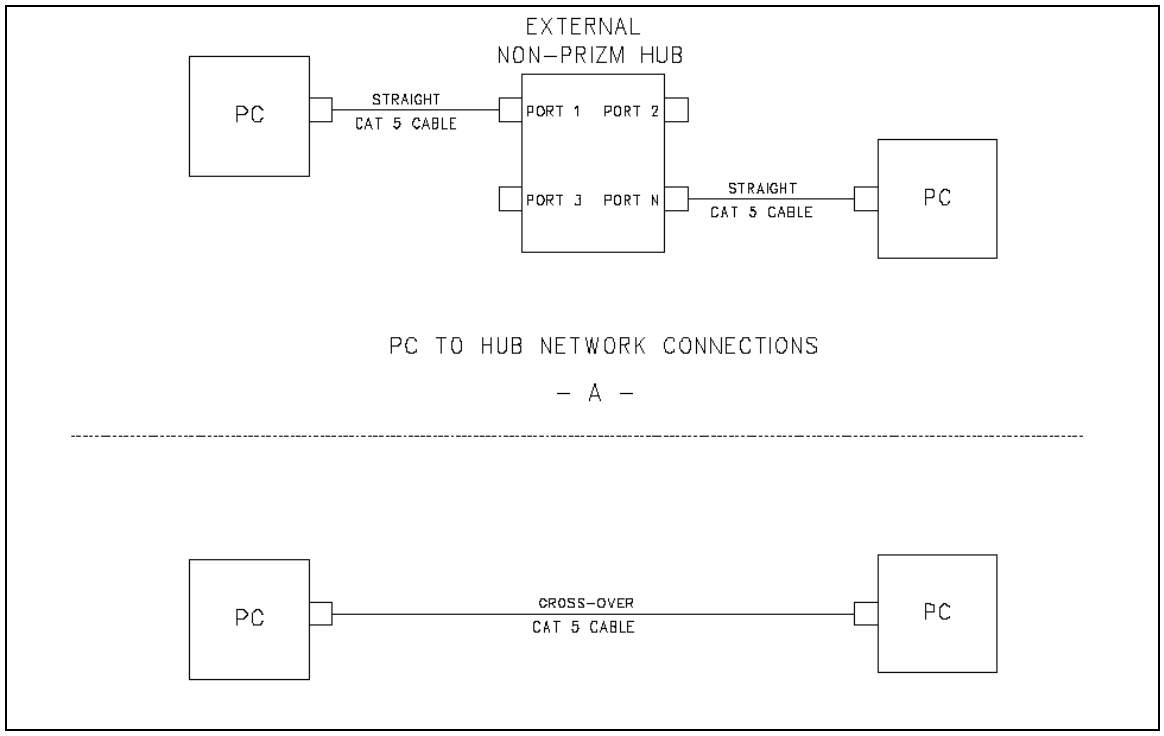


Figure 1 Typical Ethernet Network Connections

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 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 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 Daughtecards, verify that both boards have the top right two LEDs lit (RLINK and TLINK) and the bottom right LED lit (+5V PWR).
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.

1.6 Mini-Mux2 Ethernet 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 RS-232 cables attached:

1.6.1 DC Power Troubleshooting

The SMD LEDs are as follows:

D18 – ON (+5VDC available)

D1 – On (RLINK)

D2 – On (TLINK)

The remaining LEDs will be off.

The LED status conditions of the Ethernet boards are detailed for several scenarios assuming two test PCs. The statuses are as follows:

1.6.2 10BASE-T Ethernet Troubleshooting

Note: The "Local" board denotes the Ethernet 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 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

1.6.3 RS-232 Channel Troubleshooting

Note: The RS-232 channels are only enabled in -003 versions. -001 and -002 version will typically not have a data header installed at J2.

Note: The "Local" board denotes the Ethernet 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 a PC that is running a serial communications program (i.e. terminal or hyperterminal) is plugged into RS-232 channel 1 of the "Local" Ethernet board. A loop-back cable is plugged into the "Remote" MM2 data header to loop RS-232 data back to the "Local" MM2 board set:

At the "Local" end (with the PC connected and serial data being generated):

RLINK LED (D1)- ON green
TLINK LED (D2)- ON green
T1 LED (D5) - ON red or blinking ON with RS-232 traffic from "Remote" end
R1 LED (D7) - ON green or blinking ON with RS-232 traffic into board
T2 LED (D9) - OFF
R2 LED (D1) - OFF
T3 LED (D13) - OFF
R3 LED (D14) - OFF
T4 LED (D16) - OFF
R4 LED (D17) - OFF
T2 LED (D9) - OFF

At the "Remote" end:

RLINK LED (D1)- ON green
TLINK LED (D2)- ON green
T1 LED (D5) - ON red or blinking ON/OFF with RS-232 traffic from "Local" end
R1 LED (D7) - ON green or blinking ON/OFF with RS-232 traffic (looped back)
T2 LED (D9) - OFF
R2 LED (D1) - OFF
T3 LED (D13) - OFF
R3 LED (D14) - OFF
T4 LED (D16) - OFF
R4 LED (D17) - OFF

2. Now move the data cable connection from RS-232 channel 1 to channels 2, 3 and then 4. Also move the loop-back cable follow the channel under test. The same LED statuses should be observed as above except moved from channel 1 to 2 to 3 and then to 4, as appropriate.