LeCroy

PE*Tracer* ML

Mid-Bus Probe

Installation Guide

Manual Version 1.30
February 18, 2005

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1   Introduction

The LeCroy Mid-Bus Probe is designed to tap and test inter-chip signaling on a PCI Express board. The LeCroy Mid-Bus Probe probes a small array of pads on the target link called a Mid-Bus "footprint" by the PCI Express specification. In the photo below, the footprint occurs on the target board at "B".

LeCroy makes two versions of its Mid-Bus Probe: a **Full-width probe** and a **Half-width probe**. The Full-width probe is shown below. It has two strand ribbon cable (D) and a x16 connection header (B). In contrast, a Half-width probe has a single strand ribbon cable and a x8 connection header.
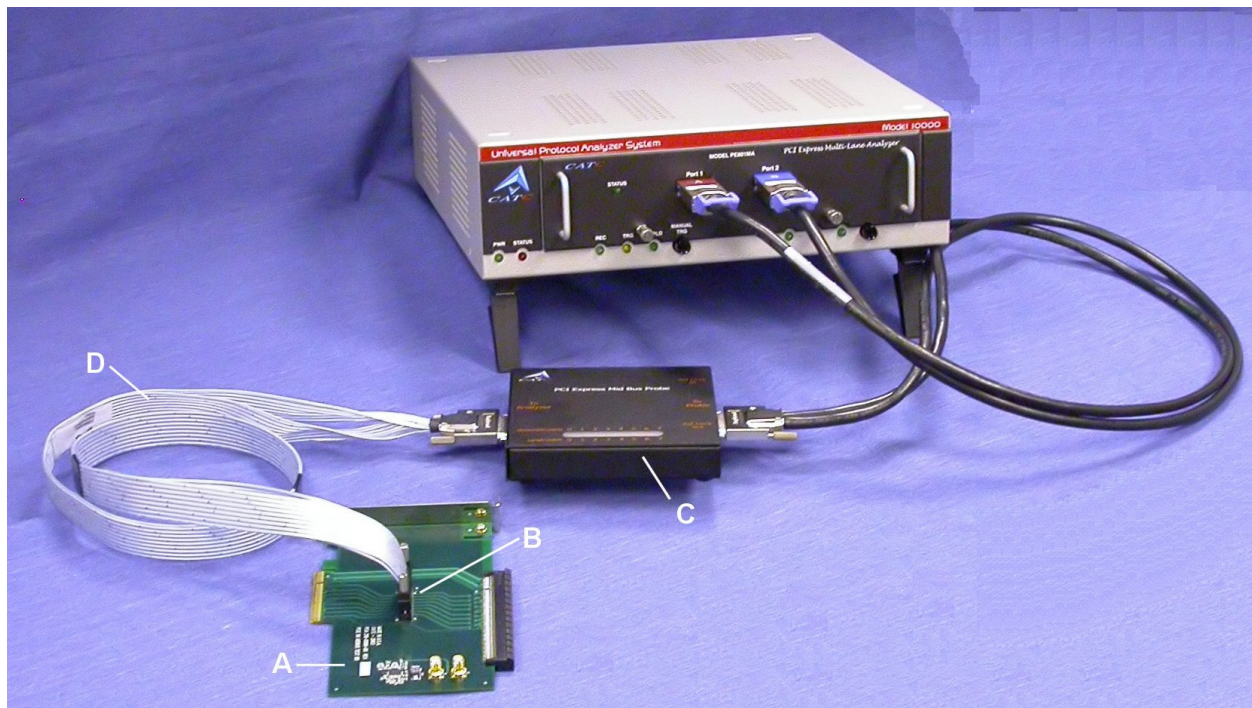
PCI Express target board (A) with LeCroy Mid-bus Probe (B, C and D)

2   Probe Components

- Retention Module **(a plastic guide located at B)**
- LeCroy Mid-Bus Probe Header**(the end of the cable that attaches at B**)
- Cable Assembly **(D)**
- Mid-Bus Probe Pod **(C)**
- Clocking Cable Assembly (Not shown - but described later)

3 Other Needed Components

- Interposer Cable Assembly, provided with the PE*Tracer* analyzer - shown connecting the Probe Pod (C) to the analyzer.

4 Mechanical Design

This section describes footprint dimensions, keepout volumes, and Probe Pin assignments of the LeCroy Full-width Mid-Bus Probe.

4.1 Full-Width Probe Footprint

The LeCroy Mid-Bus Probe is fully compatible with the standardized mid-bus footprint recommended by the Intel guideline, as shown below.

All dimensions in inches unless otherwise specified
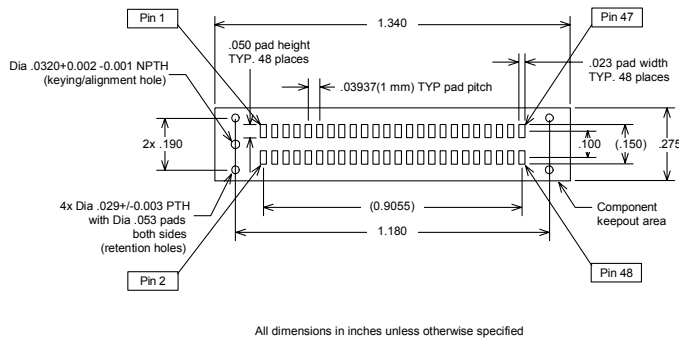
4.2 Full-Width Probe Keepout Volume
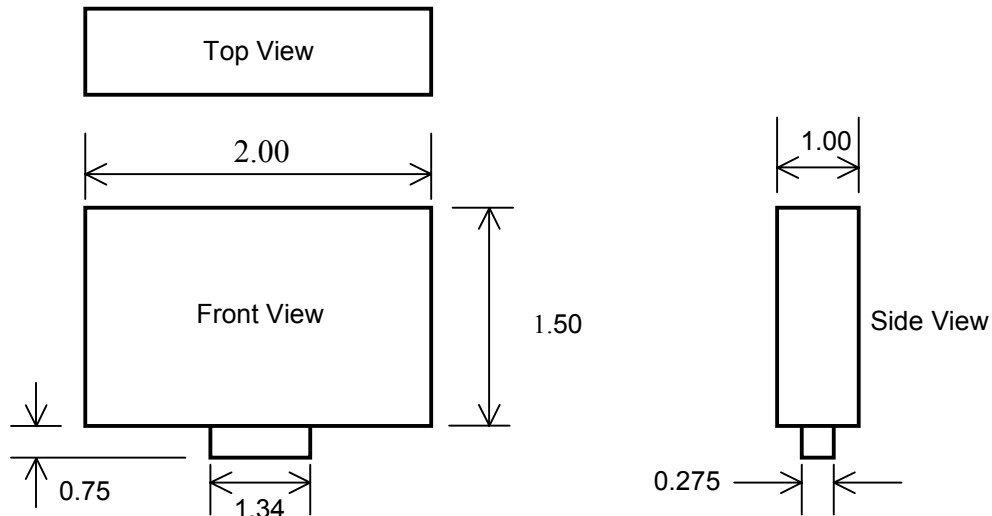
LeCroy mid-bus probe required keepout volume. (Unit in inches. Not to scale).

The CATC mid-bus probe requires a much smaller keepout volume than the generic keepout volume recommended by the Intel guideline. This feature allows the application of the CATC mid-bus probe in a tight space such as between add-in cards. Figure 3 shows the required keepout volume of the CATC mid-bus probe.

4.3 Full-Width Probe - Pin Assignments

Cross-references from the *PCI Express Mid-bus Probing Footprint and Pinout* (8/05/03)
Revision 1.0 are given in tables listed below. In the initial product release, the mid-bus probe
supports only bi-directional analyzer probe pinout.

A unique feature of the CATC mid-bus probe is that the probe pinout is deliberately grouped into
four quadrants. Quadrant A covers Pin 1, 3,…through Pin 23. Quadrant B covers Pin 2, 4,…
through Pin 24. Quadrant C covers Pin 25, 27,… through Pin 47. Quadrant D covers Pin 26,
28,… through Pin 48. With each quadrant assigned a dedicated connection to an individual port
of the analyzer, significant versatility is achieved in bus measurement configuration.

2	GND	1	C0p- Upstream
4	C0p- Downstream	3	C0n- Upstream
6	C0n- Downstream	5	GND
8	GND	7	C1p- Upstream
10	C1p- Downstream	9	C1n- Upstream
12	C1n- Downstream	11	GND
14	GND	13	C2p- Upstream
16	C2p- Downstream	15	C2n- Upstream
18	C2n- Downstream	17	GND
20	GND	19	C3p- Upstream
22	C3p- Downstream	21	C3n- Upstream
24	C3n- Downstream	23	GND
26	GND	25	C4p- Upstream
28	C4p- Downstream	27	C4n- Upstream
30	C4n- Downstream	29	GND
32	GND	31	C5p- Upstream
34	C5p- Downstream	33	C5n- Upstream
36	C5n- Downstream	35	GND
38	GND	37	C6p- Upstream
40	C6p- Downstream	39	C6n- Upstream
42	C6n- Downstream	41	GND
44	GND	43	C7p- Upstream
46	C7p- Downstream	45	C7n- Upstream
48	C7n- Downstream	47	GND

Table showing x8 (Bi-directional) specific PCI Express Analyzer Probe Pinout.

2	GND	1	C0p- Upstream1
4	C0p- Downstream1	3	C0n- Upstream1
6	C0n- Downstream1	5	GND
8	GND	7	C1p- Upstream1
10	C1p- Downstream1	9	C1n- Upstream1
12	C1n- Downstream1	11	GND
14	GND	13	C2p- Upstream1
16	C2p- Downstream1	15	C2n- Upstream1
18	C2n- Downstream1	17	GND
20	GND	19	C3p- Upstream1
22	C3p- Downstream1	21	C3n- Upstream1
24	C3n- Downstream1	23	GND
26	GND	25	C0p- Upstream2
28	C0p- Downstream2	27	C0n- Upstream2
30	C0n- Downstream2	29	GND
32	GND	31	C1p- Upstream2
34	C1p- Downstream2	33	C1n- Upstream2
36	C1n- Downstream2	35	GND
38	GND	37	C2p- Upstream2
40	C2p- Downstream2	39	C2n- Upstream2
42	C2n- Downstream2	41	GND
44	GND	43	C3p- Upstream2
46	C3p- Downstream2	45	C3n- Upstream2
48	C3n- Downstream2	47	GND

Table showing x4 (Bi-directional) specific PCI Express Analyzer Probe Pinout.

2	GND	1	C0p- Upstream1
4	C0p- Downstream1	3	C0n- Upstream1
6	C0n- Downstream1	5	GND
8	GND	7	C1p- Upstream1
10	C1p- Downstream1	9	C1n- Upstream1
12	C1n- Downstream1	11	GND
14	GND	13	nc
16	nc	15	nc
18	nc	17	GND
20	GND	19	nc
22	nc	21	nc
24	nc	23	GND
26	GND	25	C0p- Upstream2
28	C0p- Downstream2	27	C0n- Upstream2
30	C0n- Downstream2	29	GND
32	GND	31	C1p- Upstream2
34	C1p- Downstream2	33	C1n- Upstream2
36	C1n- Downstream2	35	GND
38	GND	37	nc
40	nc	39	nc
42	nc	41	GND
44	GND	43	nc
46	nc	45	nc
48	nc	47	GND

Table showing x2 (Bi-directional) specific PCI Express Analyzer Probe Pinout.

| 2	GND	1	C0p- Upstream1
4	C0p- Downstream1	3	C0n- Upstream1
6	C0n- Downstream1	5	GND
8	GND	7	nc
10	nc	9	nc
12	nc	11	GND
14	GND	13	nc
16	nc	15	nc
18	nc	17	GND
20	GND	19	nc
22	nc	21	nc
24	nc	23	GND
26	GND	25	C0p- Upstream2
28	C0p- Downstream2	27	C0n- Upstream2
30	C0n- Downstream2	29	GND
32	GND	31	nc
34	nc	33	nc
36	nc	35	GND
38	GND	37	nc
40	nc	39	nc
42	nc	41	GND
44	GND	43	nc
46	nc	45	nc
48	nc	47	GND

x1 (Bi-directional) specific PCI Express Analyzer Probe Pinout.

4.4 Half-Width Probe Footprint

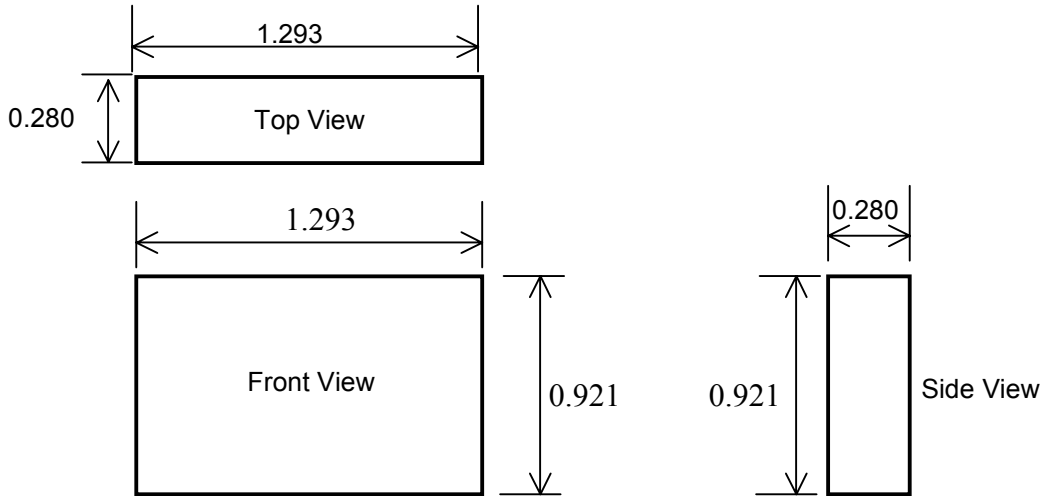The half width version of the LeCroy Mid-Bus Probe is shown below:
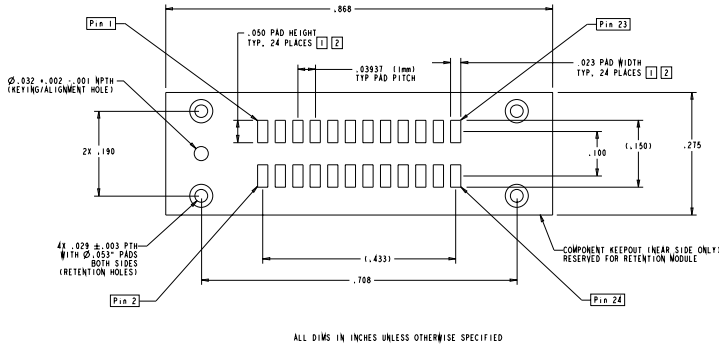
4.5 Half-Width Probe Keepout Volume

4.6

Half-Width Probe - Pin Assignments

x8 (unidirectional) specific 8-Channel PCI Express Pinout[1]

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	C0p- DirectionA
4	C1p- DirectionA	3	C0n- DirectionA
6	C1n- DirectionA	5	GND
8	GND	7	C2p- DirectionA
10	C3p- DirectionA	9	C2n- DirectionA
12	C3n- DirectionA	11	GND
14	GND	13	C4p- DirectionA
16	C5p- DirectionA	15	C4n- DirectionA
18	C5n- DirectionA	17	GND
20	GND	19	C6p- DirectionA
22	C7p- DirectionA	21	C6n- DirectionA
24	C7n- DirectionA	23	GND

Notes:

1. Polarity (p and n) of each differential pair may be swapped

x4 (Bi-directional) specific 8 Channel PCI Express Pinout[1]

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	C0p- Upstream
4	C0p- Downstream	3	C0n- Upstream
6	C0n- Downstream	5	GND
8	GND	7	C1p- Upstream
10	C1p- Downstream	9	C1n- Upstream
12	C1n- Downstream	11	GND
14	GND	13	C2p- Upstream
16	C2p- Downstream	15	C2n- Upstream
18	C2n- Downstream	17	GND
20	GND	19	C3p- Upstream
22	C3p- Downstream	21	C3n- Upstream
24	C3n- Downstream	23	GND

Notes:

1. Polarity (p and n) of the differential pair may be swapped

x2 (Bi-directional) specific 8 Channel PCI Express Pinout[1]

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	C0p- Upstream1
4	C0p- Downstream1	3	C0n- Upstream1
6	C0n- Downstream1	5	GND
8	GND	7	C1p- Upstream1
10	C1p- Downstream1	9	C1n- Upstream1
12	C1n- Downstream1	11	GND
14	GND	13	nc
16	nc	15	nc
18	nc	17	GND
20	GND	19	nc
22	nc	21	nc
24	nc	23	GND

or

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	nc
4	nc	3	nc
6	nc	5	GND
8	GND	7	nc
10	nc	9	nc
12	nc	11	GND
14	GND	13	C0p- Upstream1
16	C0p- Downstream1	15	C0n- Upstream1
18	C0n- Downstream1	17	GND
20	GND	19	C1p- Upstream1
22	C1p- Downstream1	21	C1n- Upstream1
24	C1n- Downstream1	23	GND

x1 (Bi-directional) specific 8 Channel PCI Express Pinout[1]

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	C0p- Upstream1
4	C0p- Downstream1	3	C0n- Upstream1
6	C0n- Downstream1	5	GND
8	GND	7	nc
10	nc	9	nc
12	nc	11	GND
14	GND	13	nc
16	nc	15	nc
18	nc	17	GND
20	GND	19	nc
22	nc	21	nc
24	nc	23	GND

or

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	nc
4	nc	3	nc
6	nc	5	GND
8	GND	7	C0p- Upstream1
10	C0p- Downstream1	9	C0n- Upstream1
12	C0n- Downstream1	11	GND
14	GND	13	nc
16	nc	15	nc
18	nc	17	GND
20	GND	19	nc
22	nc	21	nc
24	nc	23	GND

or

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	nc
4	nc	3	nc
6	nc	5	GND
8	GND	7	nc
10	nc	9	nc
12	nc	11	GND
14	GND	13	C0p- Upstream1
16	C0p- Downstream1	15	C0n- Upstream1
18	C0n- Downstream1	17	GND
20	GND	19	nc
22	nc	21	nc
24	nc	23	GND

or

Pin #	Signal Name	Pin #	Signal Name
2	GND	1	nc
4	nc	3	nc
6	nc	5	GND
8	GND	7	nc
10	nc	9	nc
12	nc	11	GND
14	GND	13	nc
16	nc	15	nc
18	nc	17	GND
20	GND	19	C0p- Upstream1
22	C0p- Downstream1	21	C0n- Upstream1
24	C0n- Downstream1	23	GND

Notes: 1.   Polarity (p and n) of the differential pair may be swapped

10

5 Installation

1. Install Retention module into PCI Express target system board.
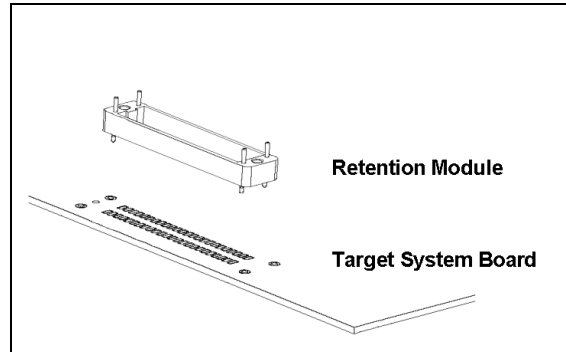

The Retention module is a connector that allows the LeCroy Mid Bus Probe to attach to the target system board. The Retention module is installed by aligning the module pins with the holes on the target system board. The Retention module is keyed - so be sure to orient it so that it matches the connector. Once installed, the pins from the Retention module will stick through the PCI Express board.

2. Solder the pins from the Retention module to the board.

3. Plug the LeCroy Mid-Bus Probe header into the Retention Module as shown below.
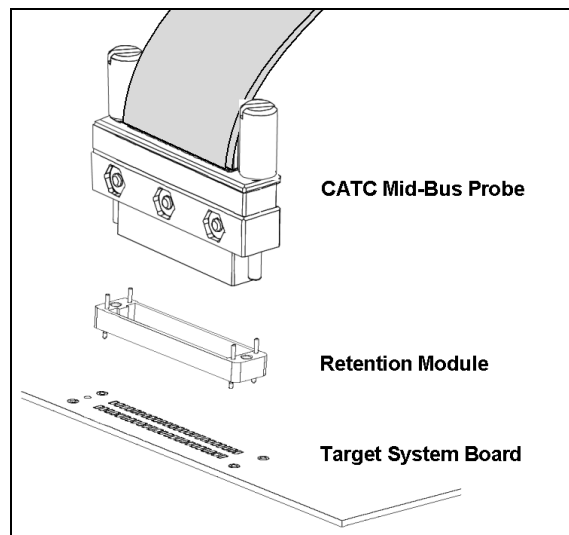
Note: *The probe design is un-keyed to allow probing of different mid-bus signal assignments. A small triangle on the side of the probe header housing (shown below) indicates the position of pin 1 of the mid-bus footprint (as indicated in the Mid-bus Probe Footprint specifications). Incorrect orientation of the probe header will result in bad recording.*
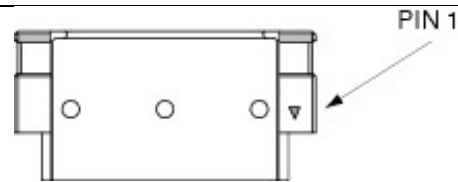
4.   Carefully tighten the probe to the target by using the two thumbscrews. The thumbscrews should be screwed in finger-tight.

> **Caution:**   *The probe is delicate equipment. Please tighten the thumbscrew carefully while watching the LEDs on the probe pod. Over-tightening the probe header might damage the miniature probing spring pins.*

5.   Connect the other side of the probe cable to the Mid Bus Probe Pod port marked "To Probe". The Mid-Bus Probe Pod amplifies the signal and sends it to the analyzer.
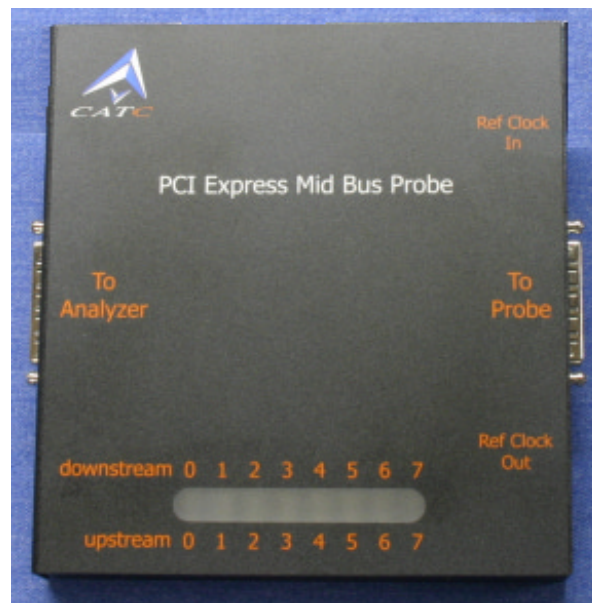
6.   If you intend to use the analyzer's reference clock, then connect the three pin Clocking Cable to the port marked "Ref Clock In" (Reference Clock In) on the Mid-Bus Probe Pod.

7.   Connect the other end of the Clocking Cable to the three-pin Reference Clock header on the PCI Express board. Orientation of the cable does not matter.

8.   Connect the Interposer cable to the Pod port marked "To Analyzer."

9.   Connect the other side of the cable to the PE*Tracer* analyzer as described in the following section.

6 Interposer Cable: Two Models

LeCroy ships two types of Interposer Cable assemblies: a two connector version and a four connector version. Both versions have a single, large connector on one end that connects to the Mid-Bus Probe pod and two or four smaller, 16 pin connectors on the other end that connect to the analyzer.

CAUTION: DO NOT ROCK the connectors up & down when inserting or removing them or the pins may bend. Press connectors into place. When removing, pull connectors straight out.
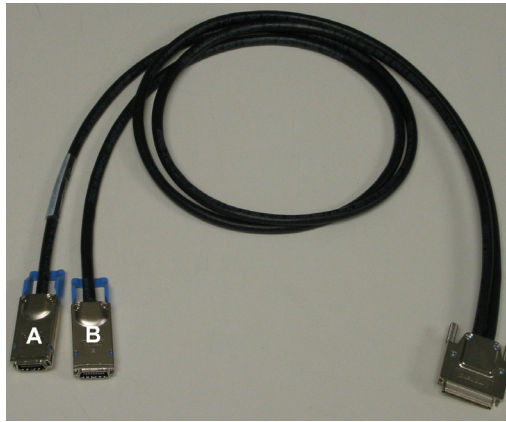
Four Connector Cable   **Two Connector Cable**

The four connector cable assembly - This cable assembly supports x8, x4, x2 and x1 links. The assembly has four small connectors labeled **A**, **B**, **C**, and **D**. Each connector transmits four physical lanes of traffic in one direction. **The pin assignments** are shown right.

The two connector cable - This cable supports x4, x2, and x1 links. The assembly has two small connectors labeled **A** and **B**.   Each small connector transmits four physical lanes of uni-directional traffic. **The pin assignments** are shown right.

Pinouts for the Interposer Cable Assemblies

7 Analyzer Setup

To record bi-directional traffic two sets of small connectors need to be used: one set to capture the transmit traffic and one set to capture the receive traffic (with respect to one of the devices). A set can be either a single connector or a pair of connectors. The various configurations of connectors and link widths are shown in the table below.

| Mid Bus Probe Configuration	System 1		System 2	
	Port 1	Port 2	Port 1	Port 2
1X, 2X, 4X	A	B		
	C	D		
8X	A	C	B	D

Key

A, B, C, D = Small cable connectors
System = Analyzer

8   Dual Probe Pod Setup Using External Clocking

The steps outlined above describe a single Probe/single analyzer configuration. In a dual analyzer setup, a second probe may need to be added depending on the type of link that is being recorded.

If the PE*Tracer* internal clock is to be used, then cable the target device to the Probe Pod as follows - however, omit the 3-pin Reference Clock cable shown in the illustration.

If external clocking is to be used, connect the 3-pin reference clock cable from the 3-pin header on the system board to the Reference Clock In port ("Ref Clock In") on one Probe Pod, then connect the Reference Clock Out port ("Ref Clock Out") on that same Pod and connect it to the Reference Clock In port on the second pod. The setup is shown below.
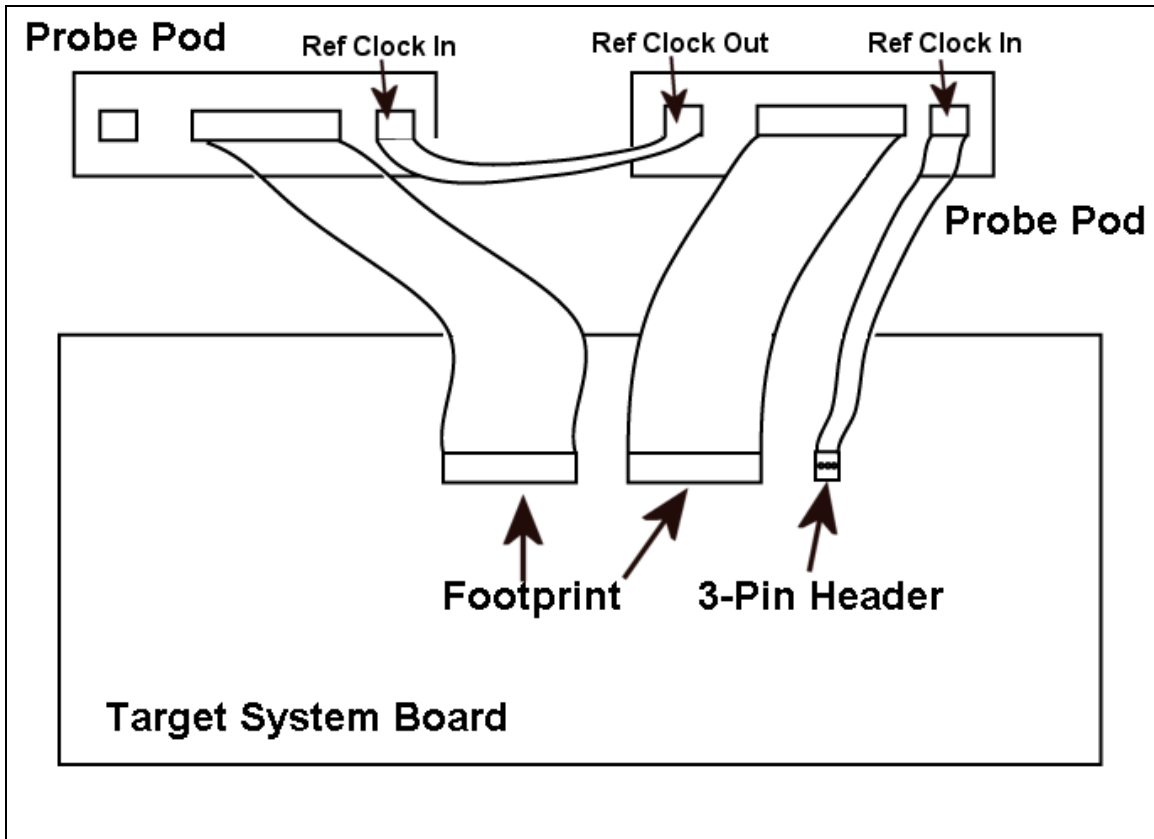
9 Recording Traffic

Once you have set up the Mid-Bus Probe, please note that the Break Connection button in the PE*Tracer* ML software will not function. This button is intended for use with the LeCroy Interposer and allows a link to be broken.

For instructions on setting up and implementing a recording, please refer to the PE*Tracer* ML User Manual.

Appendix A
How to Contact LeCroy

Type of Service	Contract
Call for technical support…	US and Canada: 1 (800) 909-2282 Worldwide: 1 (408) 727-6600
Fax your questions…	Worldwide: 1 (408) 727-6622
Write a letter …	LeCroy Customer Support 3385 Scott Blvd. Santa Clara, CA 95054
Send e-mail…	support@lecroy.com
Visit LeCroy's web site…	http://www.lecroy.com/

Limited Hardware Warranty

So long as you or your authorized representative ("you" or "your"), fully complete and return the registration card provided with the applicable hardware product or peripheral hardware products (each a "Product") within fifteen days of the date of receipt from LeCroy ("LeCroy") or one of its authorized representatives, LeCroy warrants that the Product will be free from defects in materials and workmanship for a period of three years (the "Warranty Period"). You may also complete your registration form via the internet by visiting http://www.catc.com/support/register/. The Warranty Period commences on the earlier of the date of delivery by LeCroy of a Product to a common carrier for shipment to you or to LeCroy's authorized representative from whom you purchase the Product.

What this Warranty Does Not Cover

This warranty does not cover damage due to external causes including accident, damage during shipment after delivery to a common carrier by LeCroy, abuse, misuse, problems with electrical power, including power surges and outages, servicing not authorized by LeCroy, usage or operation not in accordance with Product instructions, failure to perform required preventive maintenance, software related problems (whether or not provided by LeCroy), problems caused by use of accessories, parts or components not supplied by LeCroy, Products that have been modified or altered by someone other than LeCroy, Products with missing or altered service tags or serial numbers, and Products for which LeCroy has not received payment in full.

Coverage During Warranty Period

During the Warranty Period, LeCroy or its authorized representatives will repair or replace Products, at LeCroy's sole discretion, covered under this limited warranty that are returned directly to LeCroy's facility or through LeCroy's authorized representatives.

How to Obtain Warranty Service

To request warranty service, you must complete and return the registration card or register via the internet within the fifteen day period described above and report your covered warranty claim by contacting LeCroy Technical Support or its authorized representative.

LeCroy Technical Support can be reached at 800-909-7112 or via email at support@lecroy.com. You may also refer to LeCroy's website at http://www.lecroy.com/ for more information on how to contact an authorized representative in your region. If warranty service is required, LeCroy or its authorized representative will issue a Return Material Authorization Number. You must ship the Product back to LeCroy or its authorized representative, in its original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. LeCroy must receive the Product prior to expiration of the Warranty Period for the repair(s) to be covered. LeCroy or its authorized representative will thereafter ship the repaired or replacement Product to you freight prepaid by LeCroy if you are located in the continental United States. Shipments made outside the continental United States will be sent freight collect.

Please remove any peripheral accessories or parts before you ship the Product. LeCroy does not accept liability for lost or damaged peripheral accessories, data or software.

LeCroy owns all parts removed from Products it repairs. LeCroy may use new and/or reconditioned parts, at its sole discretion, made by various manufacturers in performing warranty repairs. If LeCroy repairs or replaces a Product, the Warranty Period for the Product is not extended.

If LeCroy evaluates and determines there is "no trouble found" in any Product returned or that the returned Product is not eligible for warranty coverage, LeCroy will inform you of its determination. If you thereafter request LeCroy to repair the Product, such labor and service shall be performed under the terms and conditions of LeCroy's then current repair policy. If you chose not to have the Product repaired by LeCroy, you agree to pay LeCroy for the cost to return the Product to you and that LeCroy may require payment in advance of shipment.

General Provisions

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY HAVE ADDITIONAL RIGHTS THAT VARY BY JURISDICTION. LECROY'S RESPONSIBILITY FOR DEFECTS IN MATERIALS AND WORKMANSHIP IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS LIMITED WARRANTY STATEMENT. EXCEPT AS EXPRESSLY STATED IN THIS WARRANTY STATEMENT, LeCroy DISCLAIMS ALL EXPRESS AND IMPLIED WARRANTIES FOR ANY PRODUCT INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES THAT MAY ARISE FROM ANY COURSE OF DEALING, COURSE OF PERFORMANCE OR TRADE USAGE. SOME JURISDICTIONS MAY NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE PRECEDING LIMITATION MAY NOT APPLY TO YOU.

LECROY DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, ANY LIABILITY FOR THIRD PARTY CLAIMS AGAINST YOU FOR DAMAGES, PRODUCTS NOT BEING AVAILABLE FOR USE, OR FOR LOST DATA OR SOFTWARE. LECROY'S LIABILITY TO YOU MAY NOT EXCEED THE AMOUNT YOU PAID FOR THE PRODUCT THAT IS THE SUBJECT OF A CLAIM. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE PRECEDING EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

The limited warranty on a Product may be transferred for the remaining term if the then current owner transfers ownership of the Product and notifies LeCroy of the transfer. You may notify LeCroy of the transfer by writing to Technical Support at LeCroy, 3385 Scott Blvd., Santa Clara, CA 95054 USA or by email at: support@catc.com. Please include the transferring owner's name and address, the name and address of the new owner, the date of transfer, and the Product serial number.