PEX1IX-MINI
PCI EXPRESS X1 TO MINI-PCI EXPRESS Bus Isolation Extender

User's Manual
Rev A

PREFACE

PEX1IX-MINI is a single channel PCI Express to Mini-PCI Express bus isolation extender. It allows Mini-PCI Express (MPE) adapter boards to be added or removed from the PE X1 system bus without having to power down the system. It offers time and labor cost savings in product development and production board testing.

Operation of the PEX1IX-MINI extender can be controlled by an on-board toggle switch or by external TTL input signals. Users are required to provide their own re-initialization routines to restore the state of the adapter board under test, during successive testing.

Product Options:

- None -

Related Products:

PEXP1-SX	PE X1 wearout extender
PEXP1-RX1	PE X1 right angle riser, short
PEXP1-RX2	PE X1 right angle riser, medium
PEXP1-RX3	PE X1 right angle riser, tall
PE-FLEX1	PE X1 flexible extender

Made in USA.   Rev A, 1/2010

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All other products mentioned in this manual are trademarks of their respective manufacturers.

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Product Specifications:

Bus: PCI Express X1 bus, Mini-PCI Express Bus.

Power: +3.3V with 4.0 amp slow blow plug fuse.
    +3.3V_AUX with 0.5 amp slow blow plug fuse.
    +12V with 1.6 amp slow blow plug fuse.
    Plus short circuit sensing logic on +3.3V, +3.3_AUX and +12V.

Control: Single on-board toggle switch or external TTL controls.

Signal Delay: Approximately 350 picoseconds (150 picoseconds max. through the buffer).

Environment: 0-60 degree C (operating and storage).

Dimension: Length 5.4 inches; Height 4.76 inches; Width 0.6 inches (dimension not including the mounting bracket).

Product Features:

- Total power and signal isolation.
- No disturbance to the system bus during bus isolation and reconnection.
- Less than 350ps signal delay (isolation buffer + trace delay).
- Minimum voltage drop.
- Single switch operation or external TTL control signals.
- Allows external power input for voltage margin test.
- Over voltage and over current protection on all three powers.
- Pluggable fuse sockets allowing easy replacement of the fuses and allowing current measurement using an ampere meter.
- System power and isolated power, green LED indicators.
- Short circuit sensing on +3.3V, +3.3_AUX and +12V with auto power shut off.
- Reset pulse generation to Unit Under Test (UUT) during power on.
- Flashing operating status, red LED indicator.
- Dual speaker tones for normal operation and auto shut down mode.
- Jumper select voltage test point or Auto rotating voltage monitoring.
- Supports standby operation with 3.3V_AUX and Wake signal bypass.
- Direct Mini-PCI Express bus interface.
- Mini-PCI Express USB Test Points.
- Cut away backplate design for easy access of Mini-PCI Express card components on solder side.
- Quality multilayer construction.

PEX1IX-MINI OPERATING INSTRUCTIONS

1. Insert the extender into a PE X1 expansion slot on system motherboard. Secure the extender to the system enclosure with the installed offset mounting bracket.

2. Insert user adapter board (UUT) on top of the PEX1IX-MINI.

3. Power up the system with SW1 toggle switch in down (off) position. A green LED (5V), should light to show that power is on.

4. Test the extender by switching the SW1 switch up and down. The red LED should flash with SW1 in the up position, indicating bus connection. The speaker should buzz approximately once every two seconds, and the three isolated power LEDs should come on. Adjust the volume of the speaker via the trim pot by the speaker.

5. **Add or remove UUTs to the extender, only when the SW1 toggle switch is in the down position, the RED LED is not flashing, the three isolated power LEDs are off and the speaker is not buzzing.**

6. Run necessary test to the UUT with SW1 switch in the up position.

7. To make current measurement, remove the corresponding pluggable fuse and place an ampere meter across pin 1 and pin 3 of the fuse socket. Use pin 2 and pin 4 for external power current measurement.

8. To make voltage margin test, move the corresponding fuse to pin 2 and pin 4 of the socket and connect external power to the marked terminal block pins (see detail in Voltage Margin section).

9. To remove the UUT from the extender, one should be careful not to lift the PEX1IX-MINI extender with it. Keep the extender down with one hand while removing the UUT with another hand. The adapter board should be removed only when the extender is turned off

10. **See Board re-initialization section for required SW for repeated testing operation.**

FUSE and PIN HEADER DEFINITION

Fuse Socket

4 EXTERNAL POWER
3
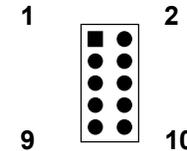   FUSED POWER
2
1 SYSTEM POWER
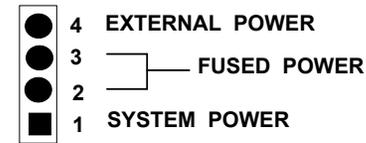
F3 +3.3V   **F3A** +3.3V_AUX   **F12** +12V

LV3A / LV3 / LV12 Low Isolated Voltage Detection
For isolated 3.3V_AUX / 3.3V / 12V. Note: Remove the LV jumper to disable detection of low voltage condition.

W1 Pin Headers

1   **2**

9   **10**

1   #Power_Control (Internal, Low enable)
2   +5V
3   #Signal_Control (External Input, Low enable)
4   Key
5   #Power_Control (External Input, Low enable)
6   Gnd
7   Gnd
8   Power_Control (External Input, High enable)
9   LED-
10   LED+ (5V at 12ma)
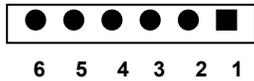
See LOCAL and EXTERNAL CONTROL section for detail.

W2, 3.3V_AUX Power Bypass
Position 1-2 = 3.3V_AUX power is bypassed, not controlled.
Position 2-3 = MOSFET controlled 3.3V_AUX power (default).

W4, Wake Signal Bypass
Position 1-2 = Wake signal is bypassed, not controlled.
Position 2-3 = Buffer controlled Wake signal (default).

W5, External Power Input Terminal Block

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┌─────────────────┐
│ ● ● ● ● ● ■ │
└─────────────────┘
  6  5  4  3  2  1
```

| **W5.1** | +3.3V | **W5.3** | +3.3V_AUX | **W5.5** | +12V |
| **W5.2** | GND | **W5.4** | GND | **W5.6** | GND |

W85, 1.5V Power selection
A jumper at W85.1 and W85.2 selects the 1.5V from the on-board voltage converter (default). If the jumper is removed, external power can be connected to W85.2, with Ground at W85.3.

W7, Speaker Jumper
Jumper Out / In = Disable / Enable (default) speaker in normal operating mode only.
Note: To adjust the volume of the speaker, turn the trim pot by the speaker. Turn it clockwise to increase the sound and turn it counter clockwise to decrease the sound. However, this adjustment does not apply to the short circuit condition, which will always generate a loud continuous sound regardless of the W7 jumper.

W8, Speaker beeping period selection
Position 1-2 = one second.
Position 2-3 = two second (default).

Voltage Test Points
TP- for voltmeter negative probe (GND).
TP+ for voltmeter positive probe.   Jumper selects only one voltage or the auto mode as below. In auto mode, all four voltages will take turns being displayed, at four-second intervals.

To TP+

XX ╱ ╲ 3.3V

Auto   5V

12V   3.3V_AUX
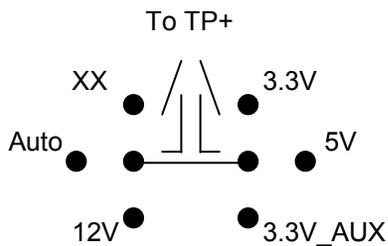
(Blank Page)
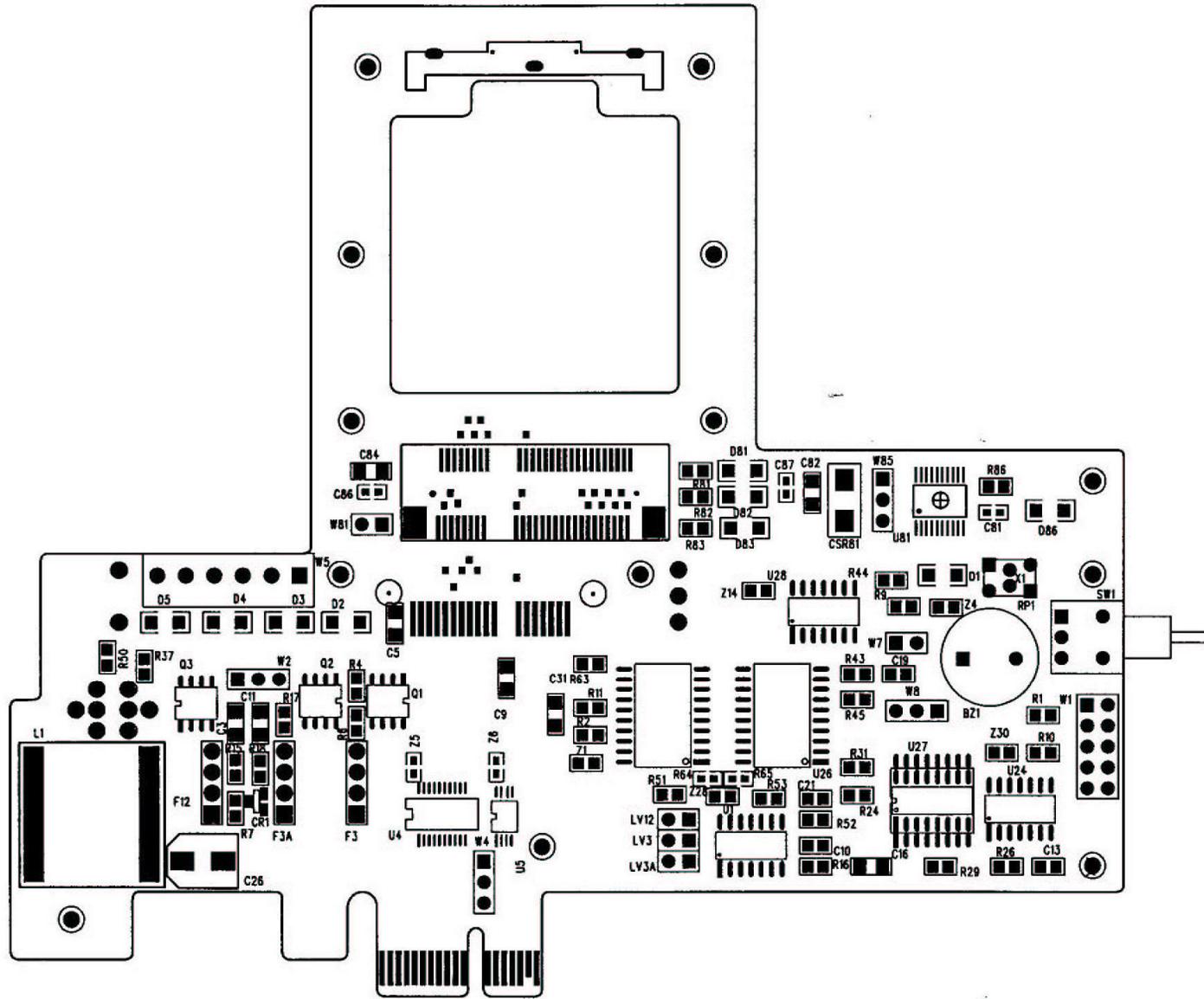
PEX1IX-MINI-A COMPONENT SIDE OUTLINE

PEX1IX-MINI-A SOLDER SIDE OUTLINE

THEORY OF OPERATION

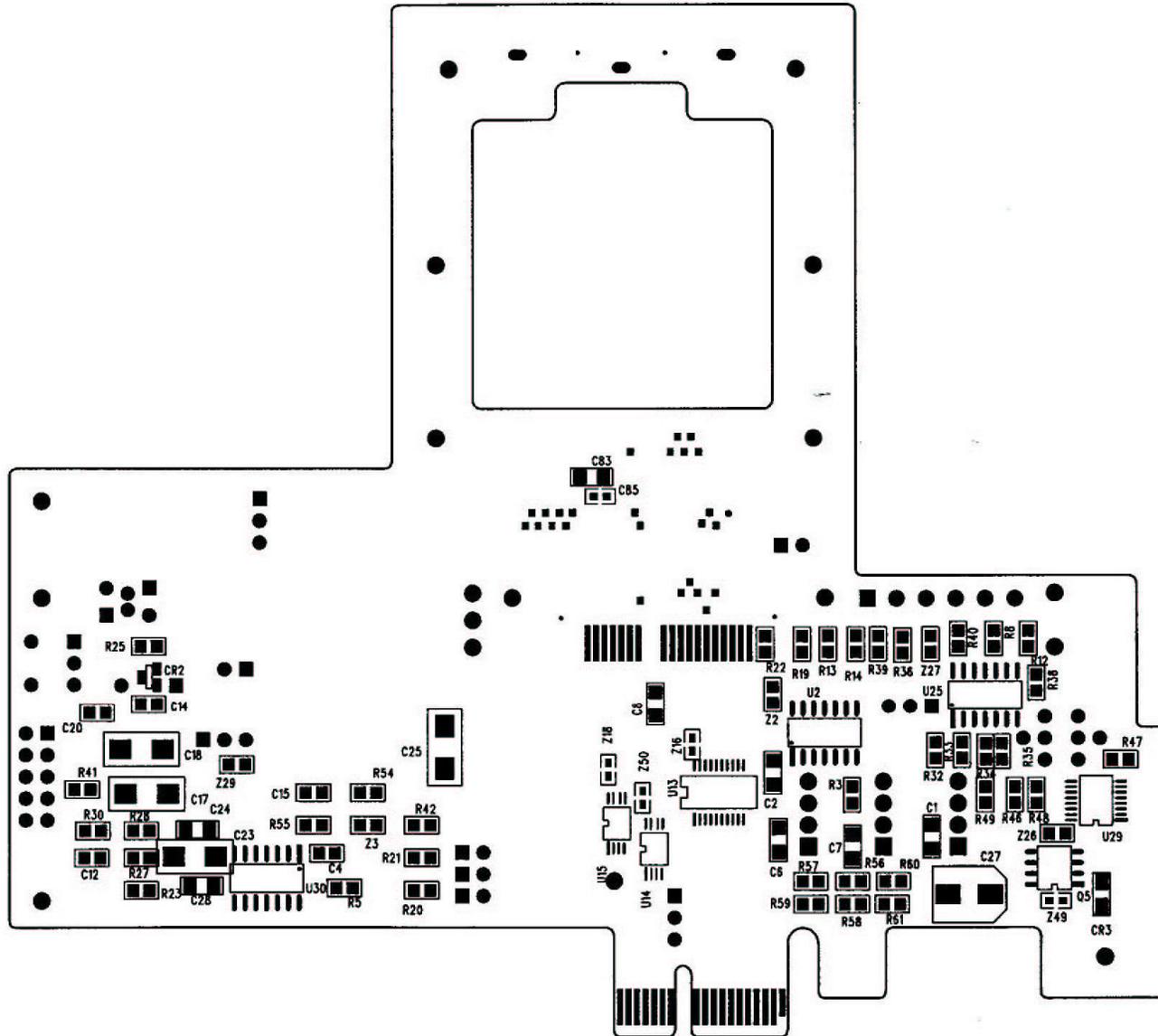The Bus Isolation Extender provides bus signals and power isolation, between the system motherboard and the unit under test (**UUT**). The signals are isolated using state of the art analog switches that allow bi-directional signal flow. When the analog switches are turned on, the bus signals are connected. The analog switch provides no signal "buffering". This means, the bus signals are not reconditioned at TTL levels, nor are they redriven by any active amplifier. Any AC/DC signal loading on the UUT will have a direct effect on the signal lines of the system motherboard. The analog switch introduces less than 150 picoseconds delay to the signals.

The power isolation is implemented using MOSFETs. The MOSFETs are biased to allow slow ramping up of current to the UUT, without causing a power surge or glitch to the system power. When the extender is turned on, a delay of approximately 47 ms is introduced to allow the powers on the UUT to reach within 10% of the rated voltages. The logic will then turn on the analog switches to connect the bus signals. When the Bus Isolation Extender is switched off, or if the voltage drops below 10%, or if the UUT is removed, the logic on the extender board will disconnect the bus signals and shut down the power immediately.

In normal operation, the signal buffers are connected approximately 50ms after power on, and the reset signal is deserted after another 80ms. During system cold boot or anytime the system issues a reset signal while the bus is connected, the extender will pass that reset pulse to the UUT, without disconnect or reconnect. In addition, each time the extender is turned off and then back on, the on-board logic will issue a 130ms reset signal to the UUT. When the power and the signals are completely connected between the UUT and the system bus, an on-board red LED will blink and the speaker will buzz about once every two seconds.

If a short circuit condition occurs, or if the isolated 3.3V, 3.3_AUX or 12 volts do not reach the operating voltage, within 47ms after the extender is turned on, the on-board logic will shut off the extender. The speaker will generate a loud continuous tone, and the red LED will go off. User will need to switch the extender off to reset the short circuit logic. The short circuit logic can be disabled for troubleshooting by removing the individual jumper, at LV3A, LV3, and LV12 location.

The UUT should be inserted or removed from the extender, only when the extender is switched off, the red LED is not blinking and the speaker is not buzzing. **Since there is no Present-detect signal specified in Mini-PCI Express card, the user must not remove the card when the powers and signals are still connected to the bus.**

The PEX1IX-MINI can also be used in X16, X8 or X4 system slots, if the system can detect the X1 present-detect signal in those slots.

LOCAL and EXTERNAL CONTROL

The Bus Isolation Extender has a unique external control feature. This feature is very useful in the production environment and can be easily implemented in many ways. It allows external toggle switch or TTL logic inputs to control the operation of the extender. When used with proper software, this feature helps to automate the test process, without requiring manual switching by the operator. The external control feature is accessible through the W1 header, located below the on-board toggle switch. The header is keyed for a ribbon type connector interface. The 2X5 header has the pins defined on the Fuse and Pin Header section, under W1 Pin headers.

ON-BOARD TOGGLE SWITCH OPERATION

The on-board toggle switch operation is the default operation mode, as configured by the factory. This configuration allows single toggle switch operation, without any external connection. A jumper is installed between pin 1 and pin 3 of the W1 header. It requires an operator to manually toggle the switch up, for bus connection and toggle it down, for bus isolation. When the switch is toggled up, both the power and the signals are connected by the on-board logic in proper sequence.

EXTERNAL TOGGLE SWITCH OPERATION

An external toggle switch can be connected between pin 5 and pin 6 of the W1 header to simulate the on-board toggle switch. In this configuration, the on-board toggle switch should be turned off (down position) and the jumper remains in pin 1 and pin 3 of the W1 header. The external switch can be mounted anywhere inside or outside the chassis, for easier access. An external LED can also be connected through pin 9 and pin 10 of the W1 header, which provides a status, outside the chassis. **The on-board LED and the toggle switch do not need to be removed** during this mode of operation.

EXTERNAL LOGIC CONTROL OPERATION

The Bus Isolation Extender can also be controlled by external TTL compatible signals. If the jumper remains on pin 1 and pin 3 of the W1 header, a single TTL low control line, connecting to pin 5 or a TTL high signal to pin 8 of the W1 header, can control both the power, signal isolation and connection. If the jumper on pin 1 and pin 3 of W1 header is removed then two TTL control lines can be used to control the bus signals and the power separately. The TTL control line that connects to pin 5 or pin 8 will control the power. The TTL control line that connects to pin 3 will control the signal. The TTL control lines can come from any digital output source, such as the output pins of the parallel printer port, in the CPU system. If the external TTL control lines are from sources outside the same CPU system, the ground pins on pin 6 or pin 7, of the W1 header should be connected to the signal ground, of the external sources. The power control should be asserted first, and then followed by the signal control.

Notice that pin 5 allows a TTL low signal to power up the extender, while pin 8 allows a TTL high signal to power up the extender. For a system that requires the extender to be powered up from cold start, the user can choose from available sources of either an initial high or an initial low signal to bring the extender up. The on-board toggle switch needs to be at off (down) position, when external TTL signals are used to control the extender.

There is a drawing on Adex's web site, under the FAQ, TQ11 (http://www.adexelec.com/faq.htm#adexcable), showing how a 2X5 ribbon cable can be used to connect the system parallel port to the W1 header, for external control under SW.

CURRENT MEASUREMENT and VOLTAGE MARGIN

The PEX1IX-MINI Bus Isolation Extender is provided with pluggable slow blow fuses. One each of the 4.0 amp, 1.6 amp and 0.5 amp fuses are used for the +3.3V, +12V and +3.3V_AUX power lines. In addition, a short circuit sensing logic is built-in to protect the system. The short circuit logic will sense shorts on +3.3V, +3.3V_AUX and +12V, which will automatically shut off the extender. The shorts can occur accidentally during test, or may already exist on the UUT. In short circuit condition, the speaker will generate a loud continuous tone to alert the user. In normal condition, the speaker and the red LED will come on once every two seconds, to alert the user that the Bus Isolation Extender is powered up and the bus is connected.

User can perform voltage margin to the UUT by connecting external power and Ground to the pins at location W5 (see pin definition on Fuse and Pin Header Definition section). The pluggable fuses need to be moved from position 1-3 to 2-4. The external power will flow through the fuses, and are still controlled by the MOSFETs, which regulate the ramping of the voltages. The on-board logic uses the power from the motherboard only and is not affected by the external power. Please notice that pin 2 and pin 3, of the fuse sockets are tied together.

User can remove the fuse and connect an ampere meter across the fuse socket pins to perform current measurement. Use socket pins 1-3 or 1-2 for current measurement from the motherboard and pin 2-4 or 3-4 for current measurement from the external power. The leads of the ampere meter should be kept as short as possible. This will avoid excessive voltage drop, which could cause the on-board short circuit logic to activate or cause the UUT to malfunction. User can also change the fuses to Current Sensing Resistors (CSR), and then measure the voltage drop across the CSR (using a precision voltmeter), to get the current measurement.

TROUBLESHOOTING AND SELF SERVICE

Since one of the primary uses of the Bus Isolation Extender is to protect the system's motherboard from being damaged by the UUT, it is common for the Bus Isolation Extender to be damaged during operation. This is especially true in a production environment. Our experience reflects, two of the most common problems associated with the Extenders are, blown fuses and blown buffer ICs. The following usually causes such failures:

1. *Users tend to accidentally pull the UUT while the bus is still connected.* This happens mostly when the user is not yet use to the procedure and occasionally forgets to switch the extender off, while removing the UUT. One must observe the red LED to make sure it is not blinking, or listen to the speaker, before adding or removing the UUT. Otherwise, the user may damage the fuses and the buffer ICs. In this situation, the buffer IC that is most likely being damaged is the one that has signals next to the power pins. This is caused by the UUT being removed at an angle, which shorts the power pins to the nearby signal pins.

2. *The extender is lifted or wiggled side to side, while the UUT is being removed or added*. This will happen if the extender is not tied down firmly. It is very important for the user to find an appropriate way to hold down the extenders, using brackets or fixtures in an open or closed chassis environment. Since the Bus Isolation Extender is still connected to the system bus, it may cause sparking in both power and signal pins. This will most likely damage the buffer ICs.

3. *Shorted power to signal pins or signal to signal pins on the UUT.* This condition will usually cause a current overload to the buffer ICs and damage them. **Do not test the failed UUT on the Bus Isolation Extender again until the cause is corrected.** However, if the shorts are very tiny, they may be burned away, and become undetectable later.

4. *Extender connector pins are damaged or not making good contact due to wearout or rough handling.* We strongly recommend the use of Wearout Extenders, especially in the production environment.

We recommend the following steps for the user's self-troubleshooting and field-testing, before returning the extender for factory service.

1) Check the extender connector pins for any physical damage and correct them if possible.

2) Check the fuses for continuity and replaced them, if needed.

3) Check for all isolated power to ground short.

4) Visually inspect the buffer ICs for physical cracks, burn marks, etc. When the buffer IC is damaged, it will usually smoke while the bus is being connected. Sparking or ESD could cause the damage from previous operation. Replace the damaged buffer ICs and try again.

5) Check the extender power up sequence with a different UUT, to isolate whether the problem is in the extender itself, or with the UUT. Make sure the buzzer and the red LED is operating properly.

6) Inspect the connector on the extender and wearout extender for physical wearout conditions, especially at the plastic key position. If the key is narrower due to repeated operation, it will lose its ability to keep the contacts in proper alignment.

Adex Electronics, will assist its customers over the phone, to locate the damaged components and recommend further actions. Adex Electronics can also provide the components as spare parts to the customers. Each bus isolation extender is provided with a bag of spare parts, including 1 fuse of each type and 1 each of the buffer ICs, for on-site repair. For further service information and updates, please refer to our Service section, at our web site: **http://www.adexelec.com/service.htm**.

BOARD RE-INITIALIZATION

Bus Isolation Extender isolates power and bus signals between the UUT and the motherboard. Each time the toggle switch is turned off, the power to the UUT is lost. Therefore, the information in the configuration registers and memory, on the UUT will also be lost. For the next UUT to be tested, the UUT will need to be re-initialized, after the power is reconnected. User will need to develop an initialization routine to restore the information back to the UUT, before running the test. It can be done in a batch file, where the initialization routine is placed, before the test routine. The initialization routine can search for a previous saved configuration file and use it to re-initialize the UUT. The test software should display the test results and messages. This will tell the operator when to remove and add another board for test and how to restart the test. **The extender itself does not require any software to operate. It is totally hardware controlled**.

Every time the Bus Isolation Extender is powered back on, the on-board logic will generate a reset signal to the UUT, during reconnection. There will be a delay of approximately 500ms to 1 sec from switch-on before the reset signal is deactivated. For manual toggle switch operation, the user should wait until the red LED is blinking, before re-initialization. In an automated system, the initialization software should sense the **LED- signal (at W1.9)** at logic low state, for at least twice contiguously to confirm the bus is reconnected, before re-initializing the UUT.

During disconnect, the user should wait for the red LED to stop blinking, before removing the UUT. In a software control operation, the LED- signal should be sensed high at least twice contiguously, before putting out messages to remove the UUT.

Please note: In Rev A board, in order to use W1.9 as a steady H/Lo sense signal, the user will need to remove the 0 ohm resistor at R64 (near PAL U3, pin1). However, in doing so, the on-board red LED will not blink once a second, unless the LED is replaced with a blinking LED. If R64 is not removed, the signal at W1.9 will be switching between Hi and Lo once a second as the red LED.

MOUNTING OF BUS ISOLATION EXTENDER

The Bus Isolation Extender incorporates very fast CMOS buffers for isolation of bus signals, between the UUT and the motherboard. These CMOS buffers are extremely sensitive to voltage spikes and can be easily damaged by Electrostatic Discharge (ESD) or any sparking due to intermittent contacts. It is necessary for users in the production environment to mount the Bus Isolation Extender, firmly against a common platform where the motherboard is mounted. For in-chassis testing, a fixture or a bracket should be developed to hold the Bus Isolation Extender to the chassis. For an out of chassis environment, the user should tie the motherboard and the Bus Isolation Extender down, against a common platform. Whatever fixture or bracket design is used, one should not allow the Bus Isolation Extender to be lifted with the UUT. Also, the extender should not be allowed to wiggle from side to side.

User should exercise ESD precautions in handling the Bus Isolation Extender. Please do not touch the on-board components, unless the hands are totally discharged. The static discharge can easily damage the components. Simply touching the system chassis first, before handling the Bus Isolation extender, will discharge the hands or the body. When transporting or storing the Bus Isolation Extender, it must be enclosed in an anti-static bag.

USING PARALLEL PORT as EXTERNAL TTL CONTROL

The following information on the PC/AT parallel ports is provided for users, who wish to use the parallel port pins as the TTL control lines to the Bus Isolation Extenders.

1st Parallel Port: Data Register = 378; Status Register = 379;
　　　　　　　Control Register = 37A;　　IRQ = 7

2nd Parallel Port: Data Register = 278; Status Register = 279;
　　　　　　　 Control Register = 27A;　　IRQ = 5

Data Register:　　Bit 0 - 7 = Data Bit 0 - 7

Status Register:**Control Register:**

Bit 7 = /BUSYBit 7 = N/A
Bit 6 = /ACKBit 6 = N/A
Bit 5 = PEBit 5 = N/A
Bit 4 = SLCTBit 4 = IRQ_ENABLE
Bit 3 = /ERRORBit 3 = SLCT_IN
Bit 2 = N/ABit 2 = /INIT
Bit 1 = N/ABit 1 = AUTO_FEED
Bit 0 = N/ABit 0 = STROBE

The female 25 pin parallel port pin outs:

1	/STROBE (output)	14	/AUTO_FEED(output)
2	Data 0(I/O)	15	/ERROR(Input)
3	Data 1(I/O)	16	/INIT(output)
4	Data 2(I/O)	17	/SLCT_IN(output)
5	Data 3(I/O)	18	Gnd
6	Data 4(I/O)	19	Gnd
7	Data 5(I/O)	20	Gnd
8	Data 6(I/O)	21	Gnd
9	Data 7 (I/O)	22	Gnd
10	/ACK(Input)	23	Gnd
11	BUSY(Input)	24	Gnd
12	PE(Input)	25	Gnd
13	SLCT(Input)		

Appendix

Note:

1. /STROBE, BUSY, /AUTO_FEED, /SLCT_IN are inverted by Hardware (logic 1 in software will appear as low at pin).

2. During power up, parallel port pins /STROBE, /AUTO_FEED, /SLCT_IN are reset to logic high; and /INIT is reset to logic low. After BIOS initialization, /INIT is toggled to high and /SLCT_IN is toggled to low.

3. Depending on the sequence of the BIOS initialization in each CPU system, one can use any of the signal pins (low or high) to bring the extender up during cold boot. In some systems, an extra soft reboot by Ctrl Alt Del, after the first power up, may be necessary to get the plug and play boards to be recognized by BIOS.

4. The LED- pin on the W1 header on the Bus Isolation Extender could be connected to the SLCT pin, on the parallel port (pin 13) as status input. The LED- at low, will indicate successful bus connection and at high, indicates no signal connection. The #Power_Control at pin 1 of the W1 header can also be used as a positive indication of cable connection and power connection. It may also be connected to the BUSY pin, of the printer port.

5. Some CPU systems may relocate the parallel port I/O addresses or may use 3BC-3BF as the 1st parallel port I/O addresses. One may verify the I/O addresses by looking at memory location, 0:408, ROM BIOS data areas, using the DOS debug command.

6. For detail operation using the parallel port, as the TTL control for the PEX1IX-MINI extender, please visit the FAQ, TQ11 section of our web pages on http://www.adexelec.com. There is cabling information between the PC's parallel port and the W1 header in addition to some examples of the controlling software.

PCI EXPRESS X1 BUS PINOUT

COMPONENT SIDE B		PIN NO.	SOLDER SIDE A	
	12V	01		PRSNT1#
	12V	02	12V	
	12V	03	12V	
	GND	04	GND	
SMCLK		05		TCK
SMDAT		06		TDI
	GND	07		TDO
	3.3V	08		TMS
TRST#		09	3.3V	
	3.3V_AUX	10	3.3V	
WAKE#		11		PERST#
	-KEY-	XXXXX	-KEY-	
RSVD		12	GND	
	GND	13		REFCLK+
PETp0		14		REFCLK-
PETn0		15	GND	
	GND	16		PERp0
PRSNT2# (x1)		17		PERn0
	GND	18	GND	

Mini-PCI EXPRESS X1 BUS PINOUT

TOP SIDE	PIN NO.	PIN No.	BOTTOM SIDE
WAKE#	1	2	3.3V
RESERVED	3	4	GND
RESERVED	5	6	1.5V
CLKREQ#	7	8	RESERVED
GND	9	10	RESERVED
REFCLK-	11	12	RESERVED
REFCLK+	13	14	RESERVED
GND	15	16	RESERVED
-KEY-	XXXXX	XXXXX	-KEY-
RESERVED	17	18	GND
RESERVED	19	20	RESERVED
GND	21	22	PERST#
PERn0	23	24	+3.3VAux
PERp0	25	26	GND
GND	27	28	+1.5V
GND	29	30	SMB_CLK
PETn0	31	32	SMB_DATA
PETp0	33	34	GND
GND	35	36	USB_D-
RESERVED	37	38	USB_D+
RESERVED	39	40	GND
RESERVED	41	42	LED_WWAN#
RESERVED	43	44	LED_WLAN#
RESERVED	45	46	LED_WPAN#
RESERVED	47	48	+1.5V
RESERVED	49	50	GND
RESERVED	51	52	+3.3V

WARRANTY

Adex Electronics, Inc. warrants this product against defects in material and workmanship for a period of 90 days, from the date of purchase. During the warranty period, Adex Electronics, Inc. will repair or replace this product at no charge. This warranty does not apply if the product has been damaged by accident, abuse, misuse or misapplication, nor as a result of service or modification made by others.

Adex Electronics, Inc. is not responsible for incidental or consequential damages resulting from use of this product. This includes damages to property and personal injury. The information in this manual has been carefully checked and is believed to be accurate. However, if there are any inaccuracies in this manual, Adex Electronics, Inc. assumes no responsibility for any damages resulting from any omission or defects in this manual.

Caution! Handle and store this product in an electrostatic   safe environment. ESD could damage this product.

Adex Electronics, Inc. reserves the right to make changes in future product design, without reservation and without notification to its users.

For technical assistance, contact:

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