

USER'S GUIDE

SCSI Bus Expander Family:
LSI20101 Extender Board
LSI20102 Converter Board

Version 1.2

August 2001



Electromagnetic Compatibility Notices

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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Preface

This book is the primary reference and user's guide for the LSI Logic LSI20101/LSI20102 SCSI Bus Expander Family. It contains a complete functional description for the LSI20101 and LSI20102 boards as well as complete physical and electrical specifications.

Audience

This document assumes that you have some familiarity with SCSI protocol and related support devices and benefits people installing and using the LSI20101/LSI20102.

Organization

This document has the following sections:

- [Section 1, "Product Description,"](#) provides the features and specific characteristics associated with the LSI20101 Extender and the LSI20102 Converter boards.
- [Section 2, "LSI20101 SCSI Bus Extender Board,"](#) provides a mechanical drawing of the LSI20101 Extender and a detailed description of its components.
- [Section 3, "LSI20101 SCSI Bus Extender Board Installation Instructions,"](#) describes how to mount the LSI20101 Extender board into your selected enclosure.
- [Section 4, "LSI20102 SCSI Bus Converter Board,"](#) provides a mechanical drawing of the LSI20102 Converter and a detailed description of its components.
- [Section 5, "LSI20102 SCSI Bus Converter Board Installation Instructions,"](#) describes how to mount the LSI20102 Converter board into your selected enclosure.

Revision History

Revision	Date	Remarks
1.0	7/97	First release.
1.1	4/01	All product names changed to LSI.
1.2	8/01	Updated Table 1.8 with correct signal name information.

Contents

1	Product Description	1
1.1	Features	2
1.2	Physical Characteristics	2
1.3	Electrical Characteristics	2
1.4	Thermal, Atmospheric Characteristics	2
1.5	Electromagnetic Compliance	3
1.6	Safety Characteristics	3
1.7	Performance Characteristics	3
1.8	Compatibility	3
1.9	Operational Characteristics	3
2	LSI20101 SCSI Bus Extender Board	4
2.1	Connectors	5
2.2	Physical Characteristics	5
2.3	Board Mounting	5
2.4	Board Connectors	5
3	LSI20101 SCSI Bus Extender Board Installation Instructions	10
3.1	Software Requirements	10
3.2	Board Mounting	10
3.3	Setting Switches	10
3.4	Connecting Cables	10
4	LSI20102 SCSI Bus Converter Board	11
4.1	Connectors	12
4.2	Physical Characteristics	13
4.3	Board Mounting	13
4.4	Board Connectors	13
5	LSI20102 SCSI Bus Converter Board Installation Instructions	18
5.1	Software Requirements	18
5.2	Board Mounting	18

5.3	Setting Switches	18
5.4	Connecting Cables	18

Figures

1	LSI20101 SCSI Bus Extender Board	4
2	LSI20101 Board Installation	11
3	LSI20102 SCSI Bus Converter Board	12
4	LSI20102 Board Installation	19

Tables

1	Power Connector J1	6
2	SE SCSI 68-Pin Connectors J2 and J3	7
3	U4 Switches	8
4	Termination Control Connector J4	9
5	LED Description	9
6	LED Connector J4	10
7	Power Connector J1	13
8	DIFF SCSI 68-Pin HVD Connector J3	15
9	U8 Switches	16
10	Termination Control Connector J4	17
11	LED Description	17
12	LED Connector J4	18

LSI20101/LSI20102 SCSI Bus Boards

1 Product Description

This document describes the LSI20101/LSI20102 family of SCSI boards based on the LSI53C120 SCSI Bus Expander chip. The LSI20101 Extender and the LSI20102 Converter are wide (16-bit) SCSI bus boards. The LSI20101 board connects a Single-Ended (SE) SCSI bus segment to another SE bus segment. The LSI20102 board connects a SE SCSI bus segment to a differential SCSI bus segment. These boards provide electrical isolation between two SCSI bus segments, allowing for increased device connectivity and greater cable distances. The bus segments comprise one logical SCSI bus. The board attaches directly to the SCSI bus; target and initiator devices can be located on either the A or the B bus segments. Supporting SCSI-1, SCSI-2, and SCSI-3 standards, the boards work with any LSI Logic SCSI product, as well as any other industry-standard SCSI controllers and devices up to Wide Ultra SCSI with transfer rates of 40 Mbytes/s.

The heart of the LSI20101 and LSI20102 boards is the LSI53C120 SCSI Bus Expander chip. The LSI53C120 chip checks SCSI signal tolerances as signals are received and, if necessary, realigns them to the SCSI specification. The LSI53C120 chip supports retiming logic, precision delay control, state machine control, and differential control for the SCSI signals. The additional circuitry on the LSI20101/2 boards provide electrical isolation, termination, and buffering of the signals. [Section 1](#) of this document describes the common characteristics of both boards. [Sections 2](#) through [5](#) describe the unique characteristics of each board.

1.1 Features

The LSI20101/LSI20102 boards include these features:

- Two 16-bit SCSI interfaces logically connected through the LSI53C120 Bus Expander chip
- Active termination on the SE buses
- Remote termination control
- 68-pin high density connectors
- Configuration switches for enabling termination power (TERMPWR)
- LEDs indicating SCSI bus activity and TERMPWR fault
- Wide Ultra SCSI data transfer capability

1.2 Physical Characteristics

The LSI20101/LSI20102 boards are palm-size rectangular boards each with opposing 68-pin connectors, a disk drive power connector, and a subsystem interface to control termination and indicate SCSI bus activity. The boards are mounted in an enclosure.

1.3 Electrical Characteristics

The LSI20101/LSI20102 boards' maximum power requirements, including SCSI TERMPWR, under normal operation are

+ 5 V DC 5% 3.1 A over the operating range of 5 °C to 55 °C

Under abnormal conditions such as a short on SCSI TERMPWR, + 5 V current may be higher. At temperatures of at least 25 °C, a current of 4.0 A is sustained no longer than 30 seconds before the self-resetting TERMPWR short circuit protection device opens.

1.4 Thermal, Atmospheric Characteristics

The boards operate in an environment defined by the following parameters:

- Temperature range: 5 °C to 55 °C (dry bulb)
- Relative humidity range: 5% to 90% noncondensing

- Maximum dew point temperature: 32 °C
- Storage Temperature
 - Temperature range: –45 °C to +105 °C (dry bulb) 10 °C per hour
 - Relative humidity range: 0% to 90% noncondensing

1.5 Electromagnetic Compliance

The boards minimize electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electromagnetic discharge. The boards meet the emission requirements of CISPR II, VCCI, and FCC Class B as well as the immunity requirements for CE mark, and carry the CE logo.

1.6 Safety Characteristics

The bare boards meet or exceed the requirements of UL flammability rating 94 V0. The bare boards are also marked with the supplier's name or trademark, type, and UL flammability rating. All voltages these boards use are below the SELV 42.4 V limit.

1.7 Performance Characteristics

The SCSI interface operates at a burst transfer rate of up to 40 Mbytes/s for wide SCSI. Actual transfer rates are a function of the attached SCSI host system and SCSI target devices.

1.8 Compatibility

The SCSI interface is compatible with the ANSI standard X3T9.2.

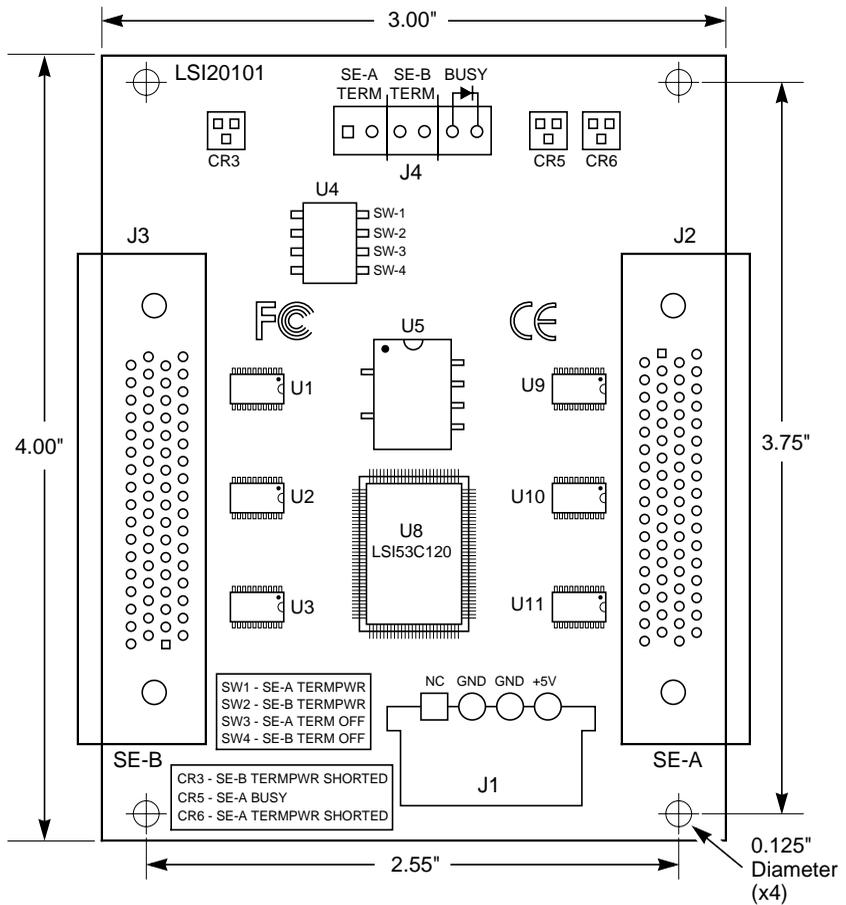
1.9 Operational Characteristics

The LSI20101/2 boards are designed for computer systems needing electrical isolation using extension or conversion of the SCSI bus. The operation is logically transparent to software, data, and bus protocol operations. It uses no software code and does not use a SCSI ID. The LSI53C120-based boards pass data and parity from a source bus to a load bus. The simplest model is that the LSI53C120 is just pieces of wire that allow corresponding SCSI signals to flow from side to side.

2 LSI20101 SCSI Bus Extender Board

The SCSI functionality for the LSI20101 Extender board is contained within the LSI53C120 SCSI Bus Expander chip. The LSI20101 physically isolates yet logically connects two SE SCSI bus segments, regenerates timing, and passes bus protocol in compliance with the SCSI standard. The LSI20101 board is designed for computer systems needing physical and/or electrical isolation, and/or extension of the SCSI bus. [Figure 1](#) illustrates the component location on the LSI20101 board.

Figure 1 LSI20101 SCSI Bus Extender Board



2.1 Connectors

The connectors for the LSI20101 Extender board are

- J1 is a standard disk drive power connector. (AMP 641737-1 or equivalent)
- J2 and J3 are 68-pin, high density, shielded, latching, right angle SCSI connectors. (AMP 787171-7 or equivalent)
- J4 is a 6-pin unshrouded header. (AMP 104427-4 or equivalent)

2.2 Physical Characteristics

The dimensions of the LSI20101 SCSI Bus Extender board are 3.00 x 4.00 inches. Power connection is made through connector J1. SCSI connection is made through high density connectors J2 and J3. Board mounted LEDs or an offboard LED connected to J4 can be used to display SCSI bus activity and TERMPWR status. Switch pack U4 is combination with external switches connected to J4 control termination. The component height on the top of the board is not greater than 0.5 inches.

2.3 Board Mounting

The LSI20101 SCSI Bus Extender board can be mounted in an enclosure or computer cabinet. The LSI20101 mounting holes are 0.125 inch in diameter. They are located 2.55 x 3.75 inches apart in relation to the 3.00 x 4.00 inch size of the board. The mounting holes are spaced equal distances from the edges of the board. (See [Figure 1.](#))

2.4 Board Connectors

There are four connectors on the LSI20101 board:

- Power Connector J1
- SCSI Connectors J2 and J3
- LED and SCSI Terminators Control Signals J4

2.4.1 Power Connector J1

The DC power interface receives a standard disk drive power plug. There is a fuse between the + 5 V connector and the SCSI bus TERMPWR connectors. See [Table 1](#) for J1 signal assignments.

Table 1 Power Connector J1

J1-Pin Number	Signal Name
1	Open
2	GND
3	GND
4	+5 V

2.4.2 SCSI Connectors J2 and J3

The SE SCSI interface on the LSI20101 board operates as a 16-bit, synchronous or asynchronous SCSI bus and accommodates 8-bit SCSI transfers. The signal definitions conform to the SCSI-2 SE standard. The SCSI interface connectors J2 and J3 are both 68-pin, high density, latching right-angle receptacles, and the pin definitions conform to the X3T9.90-048 SE P cable recommendation. SCSI TERMPWR can also be supplied by the board. [Table 2](#) shows the signal assignments for J2 and J3.

Table 2 SE SCSI 68-Pin Connectors J2 and J3

Pin	Signal Name	Pin	Signal Name
1	GND	35	SD(12)
2	GND	36	SD(13)
3	GND	37	SD(14)
4	GND	38	SD(15)
5	GND	39	SD(P1)
6	GND	40	SD(0)
7	GND	41	SD(1)
8	GND	42	SD(2)
9	GND	43	SD(3)
10	GND	44	SD(4)
11	GND	45	SD(5)
12	GND	46	SD(6)
13	GND	47	SD(7)
14	GND	48	SD(P0)
15	GND	49	GND
16	GND	50	GND
17	TERMPWR	51	TERMPWR
18	TERMPWR	52	TERMPWR
19	NC	53	NC
20	GND	54	GND
21	GND	55	SATN
22	GND	56	GND
23	GND	57	SBSY
24	GND	58	SACK
25	GND	59	SRST
26	GND	60	SMSG
27	GND	61	SSEL
28	GND	62	SC/D
29	GND	63	SREQ
30	GND	64	SI/O
31	GND	65	SD(8)
32	GND	66	SD(9)
33	GND	67	SD(10)
34	GND	68	SD(11)

2.4.3 Subsystem Interface Connector J4

A-Side and B-Side SE termination circuitry provides termination for the SCSI buses. Onboard termination for each of the two physical buses is controlled in one of two ways: by switches or by the subsystem interface (J4).

Switches – The LSI20101 board contains the following four switches at location U4. See [Table 3](#).

Table 3 U4 Switches

Switch	Position	Condition	Description
SW1	ON	Supplied by LSI20101	A-Side
	OFF	Not supplied by LSI20101	TERMPWR
SW2	ON	Supplied by LSI20101	B-Side
	OFF	Not supplied by LSI20101	TERMPWR
SW3	ON	Disabled	A-Side
	OFF	Enabled	Termination
SW4	ON	Disabled	B-Side
	OFF	Enabled	Termination

Termination Interface – The termination control on the LSI20101 board permits the connection of the subsystem harness for external control of the onboard SCSI terminators.

Connecting the Disable SE-A-TERM or Disable SE-B-TERM pins on J4 to ground turns off the onboard termination for the indicated physical bus. See [Table 4](#).

Table 4 Termination Control Connector J4

J4-Pin Number	Signal Name
1	Disable SE-A TERM
2	GND
3	Disable SE-B TERM
4	GND

2.4.4 LEDs and Connector J4

The LSI20101 board contains three LEDs: one bus activity LED and two SCSI TERMPWR status LEDs.

One green LED (CR5) indicates the state of the SCSI Bus Busy signal.

Two yellow LEDs (CR6 for A-side and CR3 for B-side) indicate when TERMPWR is shorted to ground. For instance, if TERMPWR is grounded somewhere in the subsystem while TERMPWR is supplied by the board (when U4 switches SW1 and/or SW2 are ON) the LED will light. See [Table 5](#).

Table 5 LED Description

LED	Color/Condition	Description
CR3	Yellow/ON	B-Side, TERMPWR shorted to ground
CR5	Green/ON	A-Side, BUSY (SCSI active on Side-A) ¹
CR6	Yellow/ON	A-Side, TERMPWR shorted to ground

1. If the SCSI busy signal is active on A-side, it will also be active on B-side and vice versa.

Connector J4, pins 5 and 6, is an LED interface that contains the signal and return for the SCSI active LED. An external LED harness can be connected to the board for external mounting of a SCSI active LED. See [Table 6](#).

Table 6 LED Connector J4

J4-Pin Number	Signal Name
5	BUSY LED+
6	BUSY LED-

3 LSI20101 SCSI Bus Extender Board Installation Instructions

3.1 Software Requirements

There are no software requirements for this board.

3.2 Board Mounting

Mount the board inside the selected enclosure using four fasteners in the 0.125 diameter mounting holes. (See [Figure 2.](#)) Be careful not to short from the mounting holes to any nearby signal traces with conductive mounting hardware.

3.3 Setting Switches

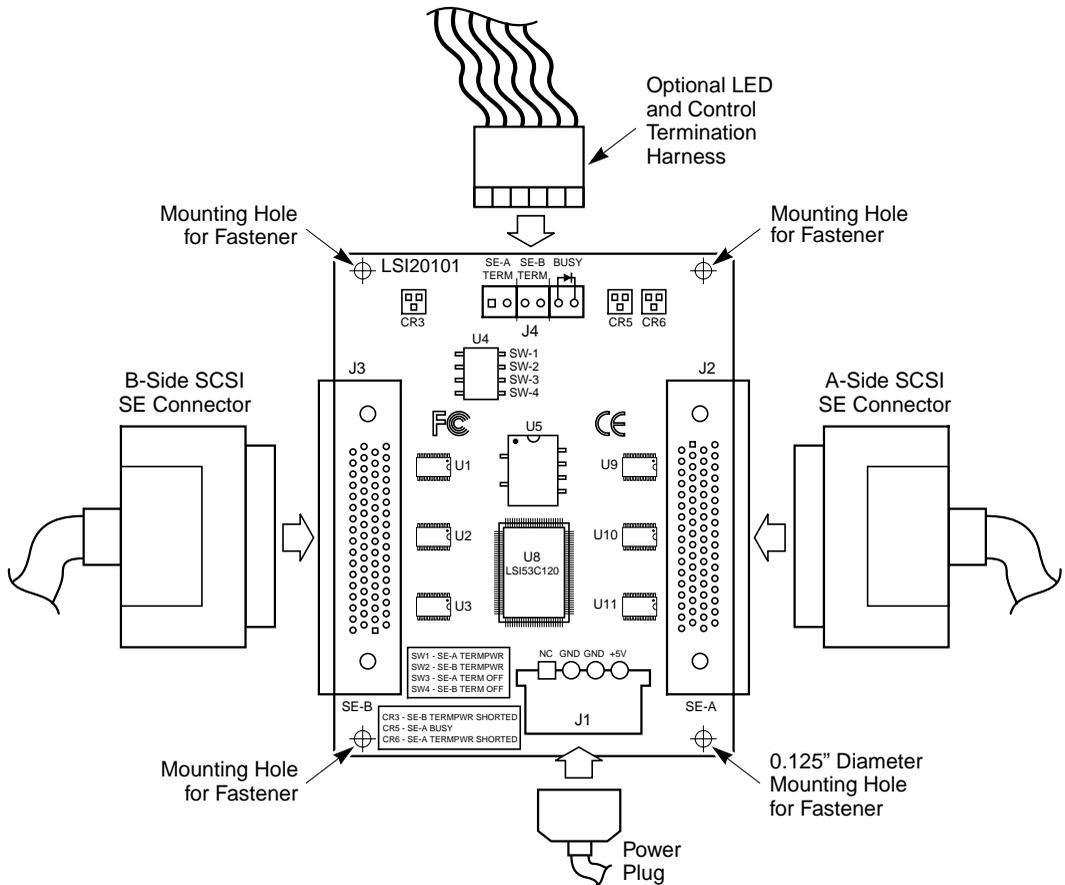
Use the information under the [subsection entitled “Switches”](#) or the information on the board to properly set the switches at board location U4.

3.4 Connecting Cables

To connect your cables, follow these instructions:

- Connect power plug to connector J1
- Connect SCSI cables to connectors J2 and J3
- Connect the optical harness to connector J4 for external control of SCSI terminators that use external switches and to view SCSI bus activity on offboard LED.

Figure 2 LSI20101 Board Installation



4 LSI20102 SCSI Bus Converter Board

The SCSI functionality for the LSI20102 Converter board is contained within the LSI53C120 SCSI Bus Expander chip. The LSI20102 physically isolates yet logically connects one SE SCSI bus segment and one differential SCSI bus segment, regenerates timing, and passes bus protocol in compliance with the SCSI standard. The LSI20102 board is designed for computer systems needing physical and/or electrical isolation, and extension along with transceiver translation of the SCSI

4.2 Physical Characteristics

The dimensions of the LSI20102 Extender board are 3.95 x 4.50 inches. Power connection is made through connector J1. SCSI connection is made through high density connectors J2 and J3. Board-mounted LEDs or an offboard LED connected to J4 can be used to display SCSI bus activity and TERMPWR status. Switch pack U4 is a combination of external switches connected to J4 control termination. The component height on the top of the board is not greater than 0.5 inches.

4.3 Board Mounting

The LSI20102 Converter board is mounted in an enclosure or computer cabinet. The LSI20102 mounting holes are 0.125 inch in diameter. They are located 2.55 x 3.75 inches apart in relation to the 3.95 x 4.50 inch size of the board. (See [Figure 3](#).)

4.4 Board Connectors

There are four connectors on the LSI20102 board:

- Power Connector J1
- SCSI Connectors J2 and J3
- LED and SCSI terminator signals J4

4.4.1 Power Connector J1

The DC power interface is receives a standard disk drive power plug. There is a fuse between the + 5 V connector and the SCSI bus TERMPWR connectors. See [Table 7](#) for J1 signal assignments.

Table 7 Power Connector J1

J1-Pin Number	Signal Name
1	Open
2	GND
3	GND
4	+5 V

4.4.2 SCSI Connectors J2 and J3

The SCSI interfaces on the LSI20102 board operate as a 16-bit, synchronous or asynchronous SCSI bus and accommodates 8-bit SCSI transfers. The SCSI interface connectors J2 and J3 are 68-pin, high density, latching, right-angle receptacles and the pin definitions conform to the X3T9.2/90-048 SE P cable recommendation. SCSI TERMPWR can also be supplied by the board. Connector J2 is a SE only connector and its pinout is the same as shown in [Table 2](#). [Table 8](#) shows the signal assignments for J3, which is a High Voltage Differential (HVD) connection.

Table 8 DIFF SCSI 68-Pin HVD Connector J3

Signal Name	Pin	Signal Name	Pin
+DB(12)	1	-DB(12)	35
+DB(13)	2	-DB(13)	36
+DB(14)	3	-DB(14)	37
+DB(15)	4	-DB(15)	38
+DB(P1)	5	-DB(P1)	39
GND	6	GND	40
+DB(0)	7	-DB(0)	41
+DB(1)	8	-DB(1)	42
+DB(2)	9	-DB(2)	43
+DB(3)	10	-DB(3)	44
+DB(4)	11	-DB(4)	45
+DB(5)	12	-DB(5)	46
+DB(6)	13	-DB(6)	47
+DB(7)	14	-DB(7)	48
+DB(P)	15	-DB(P)	49
DIFFSENS	16	GND	50
TERMPWR	17	TERMPWR	51
TERMPWR	18	TERMPWR	52
RESERVED	19	RESERVED	53
+ATN	20	-ATN	54
GND	21	GND	55
+BSY	22	-BSY	56
+ACK	23	-ACK	57
+RST	24	-RST	58
+MSG	25	-MSG	59
+SEL	26	-SEL	60
+C/D	27	-C/D	61
+REQ	28	-REQ	62
+I/O	29	-I/O	63
GND	30	GND	64
+DB(8)	31	-DB(8)	65
+DB(9)	32	-DB(9)	66
+DB(10)	33	-DB(10)	67
+DB(11)	34	-DB(11)	68

4.4.3 Subsystem Interface Connector J4

A-Side and B-Side SE termination circuitry provides termination for the SCSI buses. Onboard termination for each of the two physical buses is controlled in one of two ways: by switches or by the subsystem interface (J4).

Switches – The LSI20102 board contains the following four switches at location U8. See [Table 9](#).

Table 9 U8 Switches

Switch	Position	Condition	Description
SW1	ON	Supplied by LSI20102	SE
	OFF	Not supplied by LSI20102	TERMPWR
SW2	ON	Supplied by LSI20102	DIFF
	OFF	Not supplied by LSI20102	TERMPWR
SW3	ON	Disabled	SE
	OFF	Enabled	Termination
SW4	ON	Disabled	DIFF
	OFF	Enabled	Termination

Termination Interface – The termination control on the LSI20102 board permits the connection of a subsystem harness for external control of the onboard SCSI terminators.

Connecting the Disable SE-A TERM or Disable SE-B TERM pins on J5 to ground turns off the onboard termination for the indicated physical bus. See [Table 10](#).

Table 10 Termination Control Connector J4

J4-Pin Number	Signal Name
1	Disable SE-A TERM
2	GND
3	Disable SE-B TERM
4	GND

4.4.4 LEDs and Connector J4

The LSI20102 board contains three LEDs: one bus activity LED and two SCSI TERMPWR status LEDs.

One green LED reflects the status of the SCSI bus busy signal.

Two yellow LEDs, one for each bus, indicate when TERMPWR is shorted to ground. For instance, if TERMPWR is grounded somewhere in the subsystem while TERMPWR is supplied by the board (when U8 switches SW1 and/or SW2 are ON), the LED will light. See [Table 11](#).

Table 11 LED Description

LED	Color/Condition	Description
CR1	Yellow/ON	DIFF, TERMPWR shorted to ground
CR7	Green/ON	A-Side, BUSY (SCSI active on Side-A) ¹
CR10	Yellow/ON	SE, TERMPWR shorted to ground

1. If the SCSI busy signal is active on A-side, it is also active on B-side and vice versa.

Connector J4, pins 5 and 6, is an LED interface that contains the signal and return for the SCSI active LED. An external LED harness can be connected to the board for external mounting of a SCSI active LED. See [Table 12](#).

Table 12 LED Connector J4

J4-Pin Number	Signal Name
5	BUSY LED+
6	BUSY LED-

5 LSI20102 SCSI Bus Converter Board Installation Instructions

5.1 Software Requirements

There are no software requirements for this board.

5.2 Board Mounting

Mount the board inside the selected enclosure using four fasteners in the 0.125 diameter mounting holes. (See [Figure 4](#).) Be careful not to short from the mounting holes to any nearby signal traces with conductive mounting hardware.

5.3 Setting Switches

Use the information under the [subsection entitled “Switches”](#) or the information on the board to properly set the switches at board location U8.

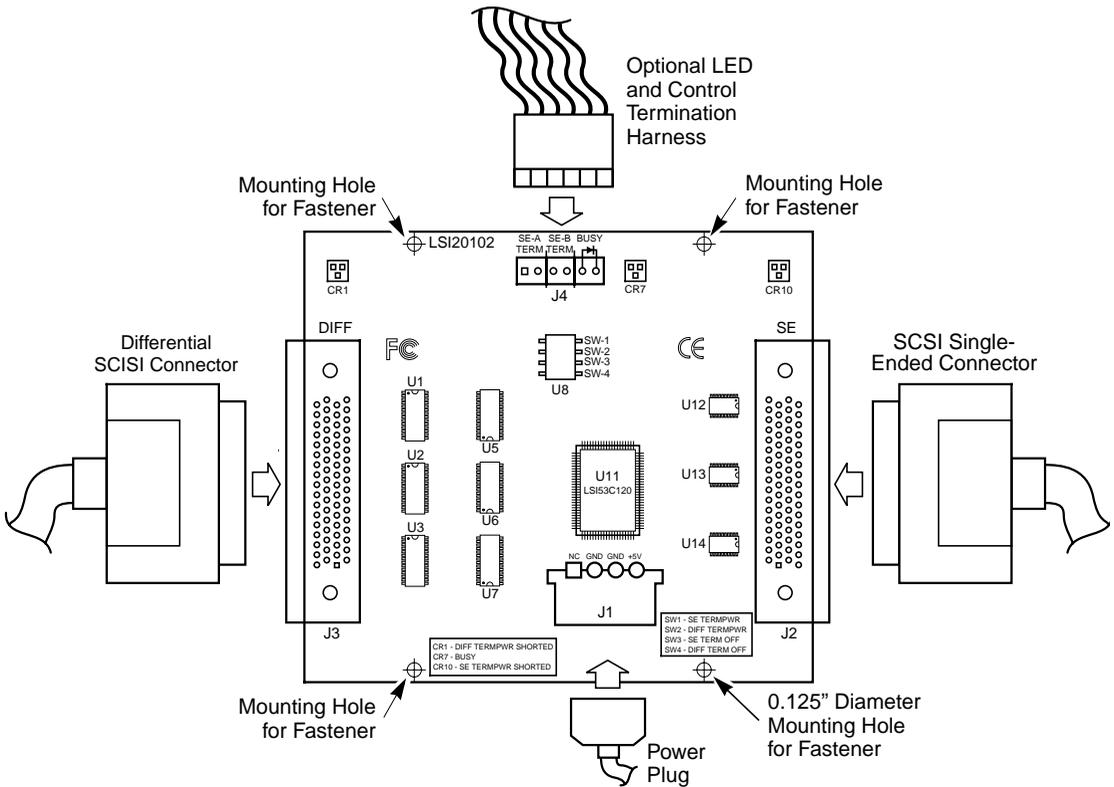
5.4 Connecting Cables

To connect your cables, follow these instructions:

- Connect power plug to connector J1
- Connect SCSI cables to connectors J2 and J3

- Connect optional harness to connector J4 for external control of active SCSI terminators that use external switches and to view SCSI bus activity on an LED

Figure 4 LSI20102 Board Installation



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