SMX SERIES SWITCH CARDS

USER'S MANUAL

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VTI Instruments Corp.

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CERTIFICATION

VTI Instruments Corp. (VTI) certifies that this product met its published specifications at the time of shipment from the factory. VTI further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (formerly National Bureau of Standards), to the extent allowed by that organization's calibration facility, and to the calibration facilities of other International Standards Organization members. Note that the contents of this document are subject to change without notice.

WARRANTY

The product referred to herein is warranted against defects in material and workmanship for a period of one year from the receipt date of the product at customer's facility. The sole and exclusive remedy for breach of any warranty concerning these goods shall be repair or replacement of defective parts, or a refund of the purchase price, to be determined at the option of VTI.

For warranty service or repair, this product must be returned to a VTI Instruments authorized service center. The product shall be shipped prepaid to VTI and VTI shall prepay all returns of the product to the buyer. However, the buyer shall pay all shipping charges, duties, and taxes for products returned to VTI from another country.

VTI warrants that its software and firmware designated by VTI for use with a product will execute its programming when properly installed on that product. VTI does not however warrant that the operation of the product, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The warranty shall not apply to defects resulting from improper or inadequate maintenance by the buyer, buyer-supplied products or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

VTI Instruments Corp. shall not be liable for injury to property other than the goods themselves. Other than the limited warranty stated above, VTI Instruments Corp. makes no other warranties, express, or implied, with respect to the quality of product beyond the description of the goods on the face of the contract. VTI specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

RESTRICTED RIGHTS LEGEND

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subdivision (b)(3)(ii) of the Rights in Technical Data and Computer Software clause in DFARS 252.227-7013.

DECLARATION OF CONFORMITY

The declaration of conformity for the CMX09 and CMX18 mainframes applies to all of its available plug-in modules and options. For specifics, refer to the *CMX09* and *CMX18 Mainframe User's Manual*.

VTI Instruments Corp.
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GENERAL SAFETY INSTRUCTIONS

Review the following safety precautions to avoid bodily injury and/or damage to the product. These precautions must be observed during all phases of operation or service of this product. Failure to comply with these precautions, or with specific warnings elsewhere in this manual, violates safety standards of design, manufacture, and intended use of the product.

Service should only be performed by qualified personnel.

TERMS AND SYMBOLS

These terms may appear in this manual:

WARNING Indicates that a procedure or condition may cause bodily injury or death.

CAUTION Indicates that a procedure or condition could possibly cause damage to equipment or loss of data.

These symbols may appear on the product:

ATTENTION - Important safety instructions

Frame or chassis ground

Indicates that the product was manufactured after August 13, 2005. This mark is placed in accordance with *EN 50419, Marking of electrical and electronic equipment in accordance with Article 11(2) of Directive 2002/96/EC (WEEE).* End-of-life product can be returned to VTI by obtaining an RMA number. Fees for takeback and recycling will apply if not prohibited by national law.

WARNINGS

Follow these precautions to avoid injury or damage to the product:

Use Proper Power Cord To avoid hazard, only use the power cord specified for this product.

Use Proper Power Source To avoid electrical overload, electric shock, or fire hazard, do not use a power source that applies other than the specified voltage.

Power Consumption Prior to using the SMX series switch cards, it is imperative that the power consumption of all cards that will be installed in the mainframe be calculated on all power supply rails. Power consumption information is provided in Appendix A. ***Failure to do so may result in damaging the switch card and the mainframe***.

WARNINGS (CONT.)

Avoid Electric Shock

To avoid electric shock or fire hazard, do not operate this product with the covers removed. Do not connect or disconnect any cable, probes, test leads, etc. while they are connected to a voltage source. Remove all power and unplug unit before performing any service. ***Service should only be performed by qualified personnel.***

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground.

Operating Conditions

To avoid injury, electric shock or fire hazard:

- Do not operate in wet or damp conditions.
- Do not operate in an explosive atmosphere.
- Operate or store only in specified temperature range.
- Provide proper clearance for product ventilation to prevent overheating.
- DO NOT operate if any damage to this product is suspected. ***Product should be inspected or serviced only by qualified personnel.***

Improper Use

The operator of this instrument is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.
Conformity is checked by inspection.

SUPPORT RESOURCES

Support resources for this product are available on the Internet and at VTI Instruments customer support centers.

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SECTION 1

INTRODUCTION

OVERVIEW

Signal switching is at the heart of every automated test system. It is responsible for routing signals of interest between test system instruments and the device under test (DUT). The purpose of the testing is to improve product quality. The switch distributes instrument I/O, which can reduce overall system cost. Since switching is effectively an extension of the instrument, it should be transparent to the overall system. SMX switching products employ extensive signal shielding and high-quality relays to ensure that the test system is "minimally aware" of the switch's presence.

PLUG-IN MODULE INSTALLATION

All SMX series switch cards must be installed into an VTI's CMX series mainframe or cPCIe/PXIe mainframes to be used. The mainframe operates on 90 V to 250 V at 50 Hz/60 Hz which is used to supply the cards the dc voltages required for the cards to function properly. Before installing a plug-in module into an SMX series mainframe, make sure that the mainframe is powered down. Insert the module into the base unit by orienting the module so that the circuit board of the module can be inserted into the slot of the base unit. Position the cover so that it fits into the module's slot groove. Once the module is properly aligned, push the module back and firmly insert it into the backplane connector.

FIGURE 1-1: MODULE INSTALLATION (SMX-2002 SHOWN)

NOTE	To maximize air flow for cooling, blanking panels (P/N: 70-0463-901) should be installed into the empty slots of CMX mainframes. The maximum safe voltage for an CMX system is determined by the plug-in card with the lowest voltage rating.

MODULE SHIELDING/GROUNDING

Most SMX modules incorporate an integral shield into the design of the PCB that attenuates noise and crosstalk between adjacent channels/modules. To properly utilize this feature, tie the appropriate front panel connector pins to the mating cable's common shield and/or ground. If this feature is present on a module, the pins are identified in the module appendix in the *Connector Pins and Signals* table and the signal is noted as "SHIELD".

Leaving the SHIELD pins unconnected may have detrimental effects on signal crosstalk and isolation. If no cable shield connection is available, chassis ground may be used to attach the SHIELD pins.

Many plug-in modules also incorporate ground pins, labeled "GND_C" or simply "GND". These pins tie the module to chassis ground. Note that the SHIELD pins are not tied to ground and have no electrical connections.

APPLICATION ENVIRONMENTS

The SMX switching platform supports a wide variety of application environments. The switches can be manually controlled through the embedded, web-based soft front panel or programmatically on a Windows-based PC through the provided IVI VTEXSwitch driver controlled on most platforms through the C++ driver. The SMX also allows for integration into NI's Switch Executive for high-level configuration and control.

SECTION 2

SWITCHING OVERVIEW

GENERAL PURPOSE SWITCHING

When selecting switch cards for a test system, the following should be taken into consideration:

- Power Specifications
- Minimum Contact Rating
- Switching Time
- Bandwidth

The relay must be able to accommodate both the voltage, current, and total power that will be switched and all of these specifications should be checked before making a selection. The minimum contact rating and switching time specifications are important in systems where relays will be opened and closed many times throughout the test. The faster the switch performs, the faster the test will finish. The bandwidth specification indicates the frequencies the switch is able to switch. Interchannel isolation and crosstalk are also affected by the frequency of the signals being switched.

POWER SWITCHING

The SMX-2002 high-power switch cards provide high-power switching in a small form factor. The SMX-2002 are the only switch modules in their class with the ability to switch up to 16 A. As such, the high-power cards are an ideal solution for applications such as: ac line power switching, switching of dc or power supplies, controlling or driving relays for industrial machines (robotics, numerical control machines), automotive engine control, and solenoid switching. These switch cards also include a front panel interrupt line which will open all relays in the module to provide safety. They can also be used in the setup phase to switch power to and from a DUT.

MATRIX/MULTIPLEXER SWITCHING

Matrix and multiplexer cards gives the user the ability to combine multiple modules in the same chassis to create larger switching systems: For matrix cards, multiple cards can be combined by connecting either rows or columns of the relay together with external wiring.

To improve bandwidth specifications, it is important to utilize the stub breaking relays that are incorporated into most matrix and multiplexer cards. These relays typically separate banks of relays from each other. By keeping these relays open, the length a signal must travel, and the amount of resistance it will encounter, can be reduced, increasing the path's bandwidth. Examples of these relays are shown in Figure 2-1.

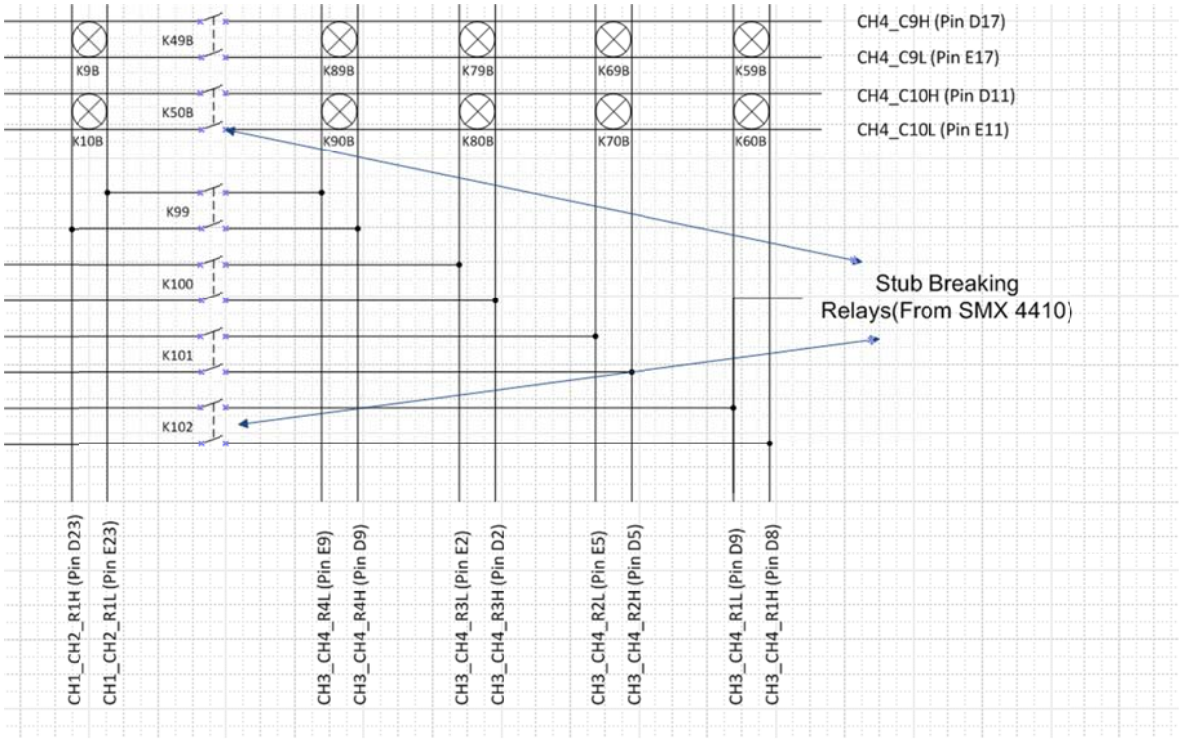

FIGURE 2-1: STUB BREAKING RELAYS

SECTION 3

SMX-2002 SWITCH MODULE

10-CHANNEL 16 A FORM C (SPDT) SWITCH

The SMX-2002 is a peripheral PXIe SPDT switch module capable of switching up to 16 A. As a high current switch module, possible applications include AC line power switching; switching AC or DC power supplies; controlling/driving relays for industrial machines, such as robotics and numerical control machines; automotive engine control; and solenoid switching.

The digital input lines on the SMX-2002 front panel allow the user to isolate the UUT and/or interface by forcing all relays to their normally open state when a fault condition occurs. This approach instantly removes all power to the switches and the UUT/interface is functionally disconnected from the switch module.

All relays are independently controlled. The SMX-2002 can be programmatically controlled using IviSwitch-complaint calls. Both path-level programming and individual relay control are available. Figure 3-1 provides the Front Panel Connector detail followed by the Pin outs. Logical diagram of Switch module is represented in Table . This information can be used for individual relay control through the driver.

CONNECTOR PINS AND SIGNALS

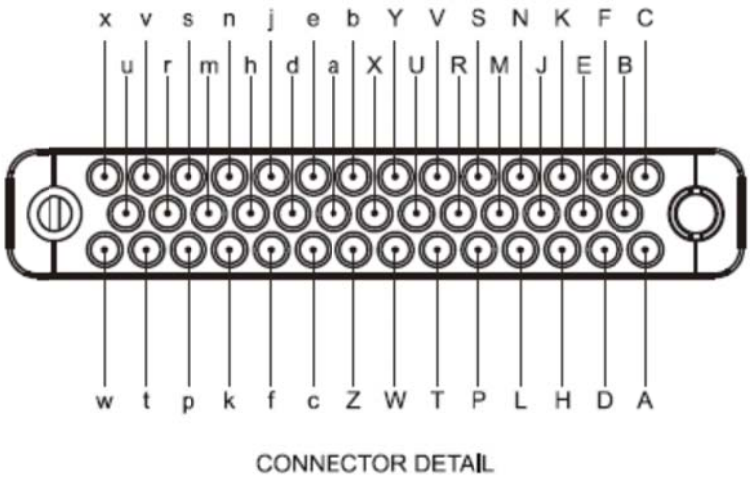

FIGURE 3-1: SMX-2002 FRONT PANEL (FRONT VIEW)

Pin	Signal	Pin	Signal
A	CH_1NO	**Z**	CH_8NO
B	CH_1COM	**a**	CH_8COM
C	CH_1NC	**b**	CH_8NC
D	CH_2NO	**c**	CH_9NO
E	CH_2COM	**d**	CH_9COM
F	CH_2NC	**e**	CH_9NC
H	CH_3NO	**f**	CH_10NO
J	CH_3COM	**h**	CH_10COM
K	CH_3NC	**j**	CH_10NC
L	CH_4NO	**k**	UNUSED
M	CH_4COM	**m**	UNUSED
N	CH_4NC	**n**	UNUSED
P	CH_5NO	**p**	UNUSED
R	CH_5COM	**r**	UNUSED
S	CH_5NC	**s**	UNUSED
T	CH_6NO	**t**	FP_OPEN
U	CH_6COM	**u**	UNUSED
V	CH_6NC	**v**	UNUSED
W	CH_7NO	**w**	GND
X	CH_7COM	**x**	CUS_SHIELD
Y	CH_7NC		

NOTE	Pin x is connected to a shield layer located directly under the relays and connecting wires. Optimum performance is obtained when Pin x is tied to system or chassis ground and the front panel mounting screws are secured to the chassis frame.

TABLE 3-1: CONNECTOR PINS & SIGNAL ASSIGNMENTS

LOGICAL DIAGRAM

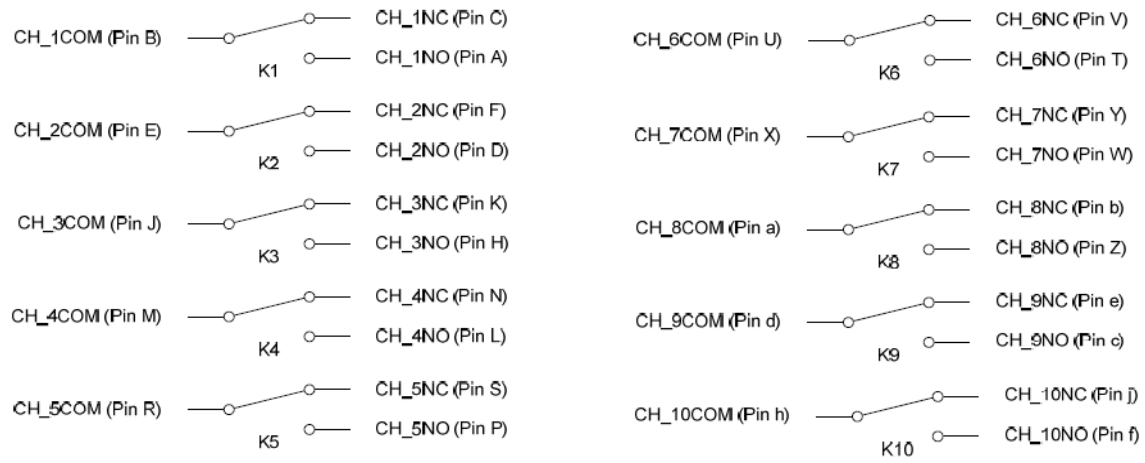

FIGURE 3-2 SMX-2002 LOGICAL DIAGRAM

SMX-2002 SPECIFICATIONS

GENERAL SPECIFICATIONS	
CHANNEL COUNT	
	10 SPDT
RELAY TYPE	
	Electromechanical, fail-safe
MAXIMUM SWITCHING VOLTAGE	
	220 V ac rms, 30 V dc
MAXIMUM SWITCHING CURRENT	
	16 A
MAXIMUM SWITCHING POWER	
	400 W dc, 3000 VA per channel
MINIMUM CONTACT RATING*	
	12 V dc, 0.1 A
**This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions*	
RATED SWITCH OPERATIONS	
Mechanical	>30 x 10^6
Electrical	1 x 10^5 at full load
SWITCHING TIME	
	< 12 ms (bounce time inclusive)
PATH RESISTANCE	
	< 100 mΩ
INSULATION RESISTANCE	
	>1x10^9 Ω
MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)	
	< 50 µV
CAPACITANCE	
Open channel	<60 pF
Channel-mainframe	<75 pF
BANDWIDTH (-3 dB)	
	40 MHz (typical)
INSERTION LOSS (TYPICAL)	
100 kHz	< 0.2 dB
1 MHz	< 0.5 dB
10 MHz	< 1.0 dB
CROSSTALK (TYPICAL)	
100 kHz	<-55 dB
1 MHz	<-55 dB
10 MHz	<-25 dB

FOR MATING CONNECTOR, CRIMP PINS, AND OTHER ACCESSORIES, PLEASE REFER TO *APPENDIX B*

RELAY BREAKING CAPACITY

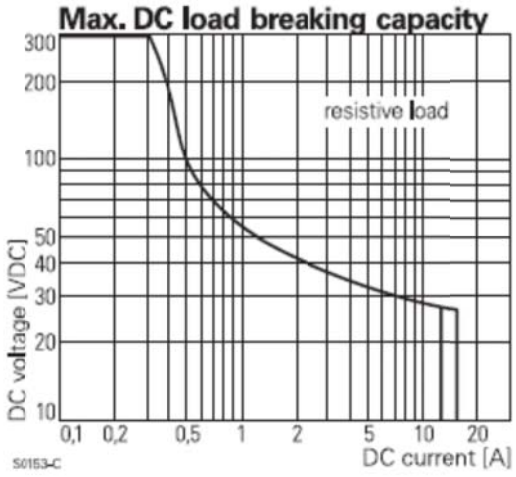

FIGURE 3-3: RELAY BREAKING CAPACITY

SMX-5001 PLUG-IN MODULE

80-CHANNEL 2 AMP FORM A (SPST) SWITCH

The SMX-5001 is a high-density general purpose 2 A switch modules designed for systems where individual relays can be used to route signals to/from the units under test (UUT), or combined externally to form user-defined configurations. These relays are commonly used to create complex signal distribution networks that can be reconfigured through different wiring in test adapters. The modules can also be configured with other SMX series switch modules as part of a flexible system switch design.

The SMX-5001 can be controlled programmatically using IviSwtch-compliant calls. Both path level programming and individual relay control are available. Refer to the host driver documentation for additional details. Figure provides a logical diagram of the switch module and identifies the switches used by the module. This information can be used for individual relay control through the driver.

CONNECTOR PINS AND SIGNALS

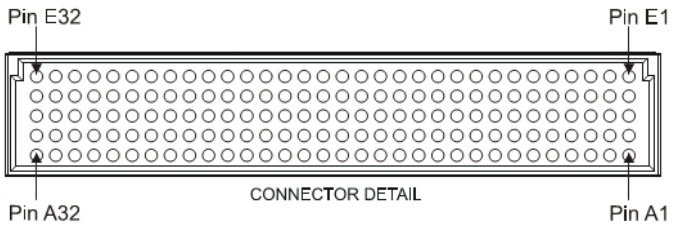

FIGURE 3-4: SMX-5001 FRONT PANEL (FRONT VIEW)

Row A		Row B		Row C		Row D		Row E	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	CH_1A	**1**	CH_2A	**1**	CH_3A	**1**	CH_4A	**1**	CH_5A
2	CH_1B	**2**	CH_2B	**2**	CH_3B	**2**	CH_4B	**2**	CH_5B
3	CH_6A	**3**	CH_7A	**3**	CH_8A	**3**	CH_9A	**3**	CH_10A
4	CH_6B	**4**	CH_7B	**4**	CH_8B	**4**	CH_9B	**4**	CH_10B
5	CH_11A	**5**	CH_12A	**5**	CH_13A	**5**	CH_14A	**5**	CH_15A
6	CH_11B	**6**	CH_12B	**6**	CH_13B	**6**	CH_14B	**6**	CH_15B
7	CH_16A	**7**	CH_17A	**7**	CH_18A	**7**	CH_19A	**7**	CH_20A
8	CH_16B	**8**	CH_17B	**8**	CH_18B	**8**	CH_19B	**8**	CH_20B
9	CH_21A	**9**	CH_22A	**9**	CH_23A	**9**	CH_24A	**9**	CH_25A
10	CH_21B	**10**	CH_22B	**10**	CH_23B	**10**	CH_24B	**10**	CH_25B
11	CH_26A	**11**	CH_27A	**11**	CH_28A	**11**	CH_29A	**11**	CH_30A
12	CH_26B	**12**	CH_27B	**12**	CH_28B	**12**	CH_29B	**12**	CH_30B
13	CH_31A	**13**	CH_32A	**13**	CH_33A	**13**	CH_34A	**13**	CH_35A
14	CH_31B	**14**	CH_32B	**14**	CH_33B	**14**	CH_34B	**14**	CH_35B
15	CH_36A	**15**	CH_37A	**15**	CH_38A	**15**	CH_39A	**15**	CH_40A
16	CH_36B	**16**	CH_37B	**16**	CH_38B	**16**	CH_39B	**16**	CH_40B
17	CH_41A	**17**	CH_42A	**17**	CH_43A	**17**	CH_44A	**17**	CH_45A
18	CH_41B	**18**	CH_42B	**18**	CH_43B	**18**	CH_44B	**18**	CH_45B
19	CH_46A	**19**	CH_47A	**19**	CH_48A	**19**	CH_49A	**19**	CH_50A
20	CH_46B	**20**	CH_47B	**20**	CH_48B	**20**	CH_49B	**20**	CH_50B
21	CH_51A	**21**	CH_52A	**21**	CH_53A	**21**	CH_54A	**21**	CH_55A
22	CH_51B	**22**	CH_52B	**22**	CH_53B	**22**	CH_54B	**22**	CH_55B
23	CH_56A	**23**	CH_57A	**23**	CH_58A	**23**	CH_59A	**23**	CH_60A
24	CH_56B	**24**	CH_57B	**24**	CH_58B	**24**	CH_59B	**24**	CH_60B
25	CH_61A	**25**	CH_62A	**25**	CH_63A	**25**	CH_64A	**25**	CH_65A
26	CH_61B	**26**	CH_62B	**26**	CH_63B	**26**	CH_64B	**26**	CH_65B
27	CH_66A	**27**	CH_67A	**27**	CH_68A	**27**	CH_69A	**27**	CH_70A
28	CH_66B	**28**	CH_67B	**28**	CH_68B	**28**	CH_69B	**28**	CH_70B
29	CH_71A	**29**	CH_72A	**29**	CH_73A	**29**	CH_74A	**29**	CH_75A
30	CH_71B	**30**	CH_72B	**30**	CH_73B	**30**	CH_74B	**30**	CH_75B
31	CH_76A	**31**	CH_77A	**31**	CH_78A	**31**	CH_79A	**31**	CH_80A
32	CH_76B	**32**	CH_77B	**32**	CH_78B	**32**	CH_79B	**32**	CH_80B

TABLE 3-2: CONNECTOR PINS & SIGNAL ASSIGNMENTS

LOGICAL DIAGRAM

FIGURE 3-5: SMX-5001 LOGICAL DIAGRAM

TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin
T158	CH_1A	A1	T156	CH_2A	B1	T160	CH_3A	C1	T77	CH_4A	D1	T96	CH_5A	E1
T62	CH_1B	A2	T20	CH_2B	B2	T19	CH_3B	C2	T2	CH_4B	D2	T1	CH_5B	E2
T61	CH_6A	A3	T18	CH_7A	B3	T17	CH_8A	C3	T48	CH_9A	D3	T3	CH_10A	E3
T60	CH_6B	A4	T22	CH_7B	B4	T21	CH_8B	C4	T64	CH_9B	D4	T5	CH_10B	E4
T59	CH_11A	A5	T24	CH_12A	B5	T23	CH_13A	C5	T8	CH_14A	D5	T7	CH_15A	E5
T58	CH_11B	A6	T26	CH_12B	B6	T25	CH_13B	C6	T10	CH_14B	D6	T96	CH_15B	E6
T57	CH_16A	A7	T28	CH_17A	B7	T27	CH_18A	C7	T12	CH_19A	D7	T11	CH_20A	E7
T56	CH_16B	A8	T30	CH_17B	B8	T29	CH_18B	C8	T14	CH_19B	D8	T13	CH_20B	E8
T55	CH_21A	A9	T32	CH_22A	B9	T31	CH_23A	C9	T16	CH_24A	D9	T15	CH_25A	E9
T45	CH_21B	A10	T63	CH_22B	B10	T64	CH_23B	C10	T46	CH_24B	D10	T47	CH_25B	E10
T50	CH_26A	A11	T49	CH_27A	B11	T48	CH_28A	C11	T34	CH_29A	D11	T33	CH_30A	E11
T44	CH_26B	A12	T51	CH_27B	B12	T52	CH_28B	C12	T35	CH_29B	D12	T36	CH_30B	E12
T43	CH_31A	A13	T53	CH_32A	B13	T54	CH_33A	C13	T37	CH_34A	D13	T38	CH_35A	E13
T42	CH_31B	A14	T82	CH_32B	B14	T81	CH_33B	C14	T39	CH_34B	D14	T40	CH_35B	E14
T41	CH_36A	A15	T84	CH_37A	B15	T83	CH_38A	C15	T66	CH_39A	D15	T65	CH_40A	E15
T126	CH_36B	A16	T86	CH_37B	B16	T85	CH_38B	C16	T68	CH_39B	D16	T67	CH_40B	E16
T127	CH_41A	A17	T88	CH_42A	B17	T87	CH_43A	C17	T70	CH_44A	D17	T69	CH_45A	E17
T124	CH_41B	A18	T90	CH_42B	B18	T89	CH_43B	C18	T72	CH_44B	D18	T71	CH_45B	E18
T125	CH_46A	A19	T92	CH_47A	B19	T91	CH_48A	C19	T74	CH_49A	D19	T73	CH_50A	E19
T123	CH_46B	A20	T94	CH_47B	B20	T93	CH_48B	C20	T112	CH_49B	D20	T111	CH_50B	E20
T78	CH_51A	A21	T76	CH_52A	B21	T75	CH_53A	C21	T79	CH_54A	D21	T80	CH_55A	E21
T121	CH_51B	A22	T114	CH_52B	B22	T113	CH_53B	C22	T108	CH_54B	D22	T107	CH_55B	E22
T122	CH_56A	A23	T116	CH_57A	B23	T115	CH_58A	C23	T106	CH_59A	D23	T105	CH_60A	E23
T119	CH_56B	A24	T118	CH_57B	B24	T117	CH_58B	C24	T100	CH_59B	D24	T99	CH_60B	E24
T120	CH_61A	A25	T144	CH_62A	B25	T143	CH_63A	C25	T109	CH_64A	D25	T110	CH_65A	E25
T149	CH_61B	A26	T147	CH_62B	B26	T148	CH_63B	C26	T98	CH_64B	D26	T97	CH_65B	E26
T150	CH_66A	A27	T145	CH_67A	B27	T146	CH_68A	C27	T102	CH_69A	D27	T101	CH_70A	E27
T151	CH_66B	A28	T141	CH_67B	B28	T142	CH_68B	C28	T104	CH_69B	D28	T103	CH_70B	E28
T152	CH_71A	A29	T139	CH_72A	B29	T140	CH_73A	C29	T132	CH_74A	D29	T131	CH_75A	E29
T153	CH_71B	A30	T136	CH_72B	B30	T135	CH_73B	C30	T130	CH_74B	D30	T129	CH_75B	E30
T154	CH_76A	A31	T138	CH_77A	B31	T137	CH_78A	C31	T134	CH_79A	D31	T133	CH_80A	E31
T157	CH_76B	A32	T159	CH_77B	B32	T95	CH_78B	C32	T128	CH_79B	D32	T155	CH_80B	E32

TABLE 3-3: EX1200-TB160SE TERMINAL BLOCK TO SMX-5001 PIN MAPPING

SMX-5001 SPECIFICATIONS

GENERAL SPECIFICATIONS	
CHANNEL COUNT	
	80 SPST / 40 DPST
RELAY TYPE	
	Electromechanically, fail-safe
MAXIMUM SWITCHING VOLTAGE	
	300 V dc, 300 V ac rms
MAXIMUM SWITCHING CURRENT	
	2 A
MAXIMUM SWITCHING POWER	
	60 W dc, 125 VA
**Maximum switched power is at 30 V/ 2 A dc. Max switched power is derated non-linearly as voltage is increased.*	
MINIMUM CONTACT RATING*	
	10 mV dc, 10 µA (resistive)
**This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions*	
RATED SWITCH OPERATIONS	
Mechanical	1 x 10^8 (no load)
Electrical	1 x 10^6 @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive)
SWITCHING TIME	
	< 3 ms
PATH RESISTANCE	
	< 300 mΩ
INSULATION RESISTANCE	
	> 1 x 10^9 Ω
MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)	
	< 1 µV
CAPACITANCE	
Open channel	< 50 pF
Channel-mainframe	< 80 pF
High-low	< 50 pF
BANDWIDTH (-3 dB)	
	80 MHz (typical)
CROSSTALK (TYPICAL)	
100 kHz	< -55 dB
1 MHz	< -45 dB
ISOLATION (TYPICAL)	
100 kHz	< -50 dB
1 MHz	< -35 dB

For mating connector, crimp pins, and other accessories, please refer to *Appendix B*.

SMX-4410, MATRIX MODULE

160-CHANNEL 2-WIRE MATRIX SWITCH

The SMX-4410 is a 3U, high-density PXIe matrix module that allows the user to connect any input row to any output column, with a DPST relay at every row/column cross point. This architecture provides the framework for flexible switch system designs where multiple test instruments need to be connected to common test points.

The SMX-4410 contains four (4X10) 2-wire matrix blocks that can be bussed together under software control to create 2 (8x10), or 1 (8x20), or 2 (4x20), or 1 (4x40) 2-wire matrix, providing the user flexibility and simplifying field wiring. The card is capable of switching up to 300V, 2A enabling it to be used over a wide range of applications. It also includes an embedded Self-Test mechanism that can be used to determine relay health.

The SMX-4410 incorporates extensive signal shielding and exposes shield pins on the front panel connector for tying to the cable shield. This preserves signal integrity throughout the signal path by maintaining the signals at the same reference level as the UUT. In addition, meticulous signal routing is done for signal shielding and cross talk reduction, allowing the SMX-4410 to achieve best in class switching performance. This performance allows the card to be used with high frequency signals, and signals that have fast rise times and narrow pulse widths

CONNECTOR PINS AND SIGNALS

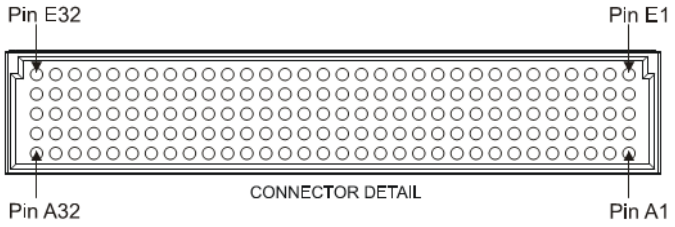

FIGURE 3-6: SMX-4410 FRONT PANEL (FRONT VIEW)

Row A		Row B		Row C		Row D		Row E	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	USR_SHIELD	**1**	USR_SHIELD	**1**	USR_SHIELD	**1**	USR_SHIELD	**1**	USR_SHIELD
2	CH3_C6L	**2**	CH4_R3H	**2**	CH4_R3L	**2**	CH3_CH4_R3H	**2**	CH3_CH4_R3L
3	CH3_C6H	**3**	CH3_R3H	**3**	CH3_R3L	**3**	CH4_R2H	**3**	CH4_R2L
4	CH3_C1L	**4**	CH3_C7H	**4**	CH3_C7L	**4**	CH3_R2H	**4**	CH3_R2L
5	CH3_C1H	**5**	CH3_C4H	**5**	CH3_C4L	**5**	CH3_CH4_R2H	**5**	CH3_CH4_R2L
6	CH4_C4L	**6**	CH4_C8H	**6**	CH4_C8L	**6**	CH4_C7H	**6**	CH4_C7L
7	CH4_C4H	**7**	CH3_C5H	**7**	CH3_C5L	**7**	CH3_R1H	**7**	CH3_R1L
8	CH3_C8L	**8**	CH4_R1H	**8**	CH4_R1L	**8**	CH3_CH4_R1H	**8**	CH3_CH4_R1L
9	CH3_C8H	**9**	CH4_R4H	**9**	CH4_R4L	**9**	CH3_CH4_R4H	**9**	CH3_CH4_R4L
10	CH3_C3L	**10**	CH2_C5H	**10**	CH2_C5L	**10**	CH3_R4H	**10**	CH3_R4L
11	CH3_C3H	**11**	CH2_C1H	**11**	CH2_C1L	**11**	CH4_C10H	**11**	CH4_C10L
12	CH1_C6L	**12**	CH3_C2H	**12**	CH3_C2L	**12**	CH3_C10H	**12**	CH3_C10L
13	CH1_C6H	**13**	CH3_C9H	**13**	CH3_C9L	**13**	CH4_C6H	**13**	CH4_C6L
14	CH4_C3L	**14**	CH1_C1H	**14**	CH1_C1L	**14**	CH4_C5H	**14**	CH4_C5L
15	CH4_C3H	**15**	CH2_C4H	**15**	CH2_C4L	**15**	CH2_C3H	**15**	CH2_C3L
16	CH1_C7L	**16**	CH1_C2H	**16**	CH1_C2L	**16**	CH4_C2H	**16**	CH4_C2L
17	CH1_C7H	**17**	CH2_R4H	**17**	CH2_R4L	**17**	CH4_C9H	**17**	CH4_C9L
18	CH1_R4L	**18**	CH2_C10H	**18**	CH2_C10L	**18**	CH1_CH2_R3H	**18**	CH1_CH2_R3L
19	CH1_R4H	**19**	CH1_C8H	**19**	CH1_C8L	**19**	CH1_C3H	**19**	CH1_C3L
20	CH1_R3L	**20**	CH2_C9H	**20**	CH2_C9L	**20**	CH1_CH2_R4H	**20**	CH1_CH2_R4L
21	CH1_R3H	**21**	UNUSED	**21**	UNUSED	**21**	CH1_CH2_R2H	**21**	CH1_CH2_R2L
22	CH1_C9L	**22**	CH2_C2H	**22**	CH2_C2L	**22**	CH2_R3H	**22**	CH2_R3L
23	CH1_C9H	**23**	CH1_C4H	**23**	CH1_C4L	**23**	CH1_CH2_R1H	**23**	CH1_CH2_R1L
24	UNUSED	**24**	CH2_R2H	**24**	CH2_R2L	**24**	CH2_C7H	**24**	CH2_C7L
25	UNUSED	**25**	UNUSED	**25**	UNUSED	**25**	USR_SHIELD	**25**	USR_SHIELD
26	UNUSED	**26**	CH2_C8H	**26**	CH2_C8L	**26**	CH4_C1H	**26**	CH4_C1L
27	UNUSED	**27**	UNUSED	**27**	UNUSED	**27**	CH1_R2H	**27**	CH1_R2L
28	UNUSED	**28**	CH1_C10H	**28**	CH1_C10L	**28**	CH1_R1H	**28**	CH1_R1L
29	UNUSED	**29**	CH2_R1H	**29**	CH2_R1L	**29**	CH2_C6H	**29**	CH2_C6L
30	UNUSED	**30**	UNUSED	**30**	UNUSED	**30**	CH1_C5H	**30**	CH1_C5L
31	UNUSED	**31**	UNUSED	**31**	UNUSED	**31**	UNUSED	**31**	UNUSED
32	USR_SHIELD	**32**	USR_SHIELD	**32**	USR_SHIELD	**32**	USR_SHIELD	**32**	USR_SHIELD

TABLE 3-4: CONNECTOR PINS & SIGNAL ASSIGNMENTS

LOGICAL DIAGRAM

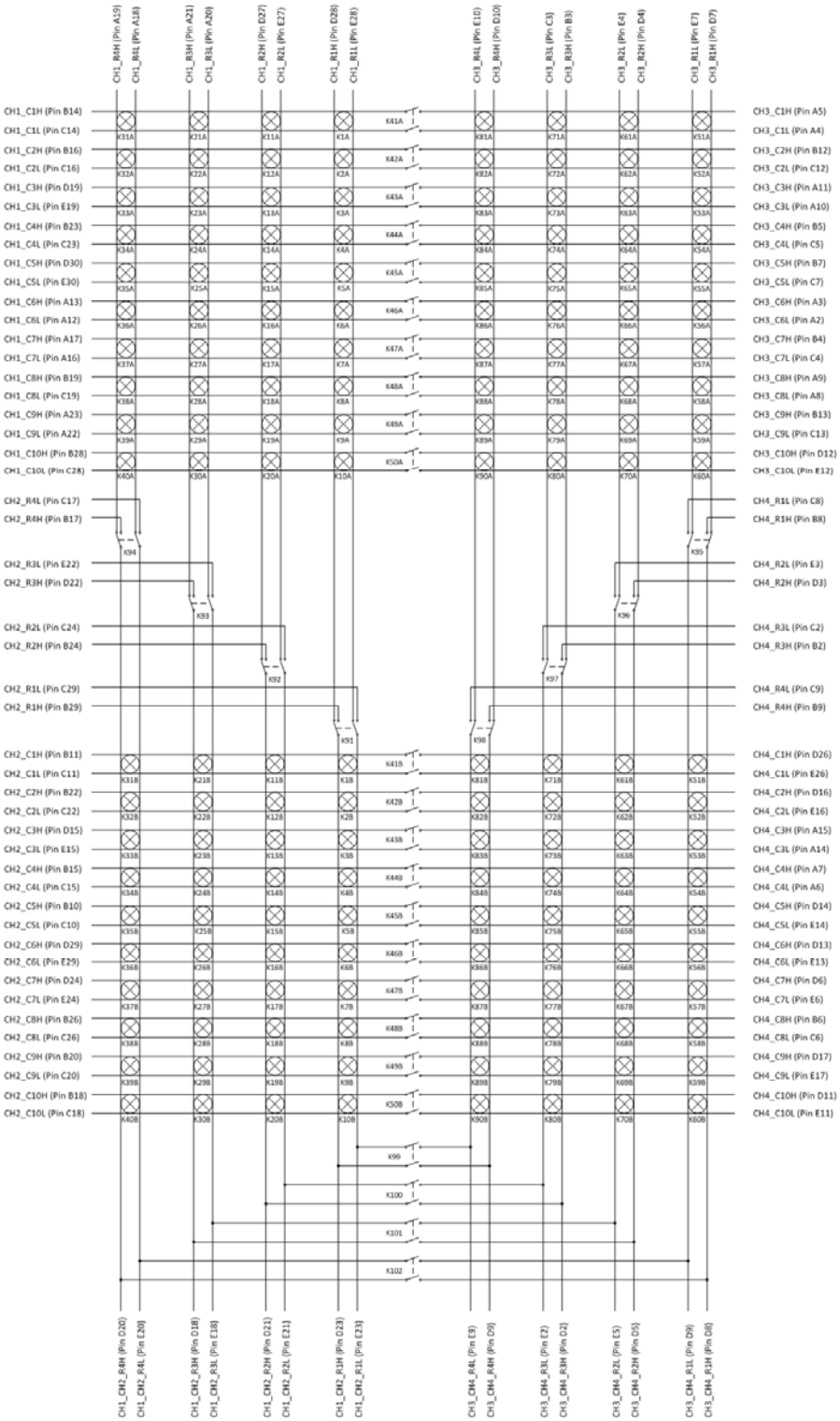

FIGURE 3-7: SMX-4410 LOGICAL DIAGRAM

TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin
T159	USR_SHIELD	A1	T80	USR_SHIELD	B1	T79	USR_SHIELD	C1	T78	USR_SHIELD	D1	T77	USR_SHIELD	E1
T51	CH3_C6L	A2	T20	CH4_R3H	B2	T19	CH4_R3L	C2	T2	CH3_CH4_R3H	D2	T1	CH3_CH4_R3L	E2
T52	CH3_C6H	A3	T18	CH3_R3H	B3	T17	CH3_R3L	C3	T4	CH4_R2H	D3	T3	CH4_R2L	E3
T53	CH3_C1L	A4	T22	CH3_C7H	B4	T21	CH3_C7L	C4	T6	CH3_R2H	D4	T5	CH3_R2L	E4
T54	CH3_C1H	A5	T24	CH3_C4H	B5	T23	CH3_C4L	C5	T8	CH3_CH4_R2H	D5	T7	CH3_CH4_R2L	E5
T55	CH4_C4L	A6	T26	CH4_C8H	B6	T25	CH4_C8L	C6	T10	CH4_C7H	D6	T9	CH4_C7L	E6
T56	CH4_C4H	A7	T28	CH3_C5H	B7	T27	CH3_C5L	C7	T12	CH3_R1H	D7	T11	CH3_R1L	E7
T57	CH3_C8L	A8	T30	CH4_R1H	B8	T29	CH4_R1L	C8	T14	CH3_CH4_R1H	D8	T13	CH3_CH4_R1L	E8
T58	CH3_C8H	A9	T32	CH4_R4H	B9	T31	CH4_R4L	C9	T16	CH3_CH4_R4H	D9	T15	CH3_CH4_R4L	E9
T35	CH3_C3L	A10	T50	CH2_C5H	B10	T49	CH2_C5L	C10	T34	CH3_R4H	D10	T33	CH3_R4L	E10
T36	CH3_C3H	A11	T64	CH2_C1H	B11	T63	CH2_C1L	C11	T48	CH4_C10H	D11	T47	CH4_C10L	E11
T37	CH1_C6L	A12	T62	CH3_C2H	B12	T61	CH3_C2L	C12	T46	CH3_C10H	D12	T45	CH3_C10L	E12
T38	CH1_C6H	A13	T60	CH3_C9H	B13	T59	CH3_C9L	C13	T44	CH4_C6H	D13	T43	CH4_C6L	E13
T39	CH4_C3L	A14	T82	CH1_C1H	B14	T81	CH1_C1L	C14	T42	CH4_C5H	D14	T41	CH4_C5L	E14
T40	CH4_C3H	A15	T84	CH2_C4H	B15	T83	CH2_C4L	C15	T66	CH2_C3H	D15	T65	CH2_C3L	E15
T127	CH1_C7L	A16	T86	CH1_C2H	B16	T85	CH1_C2L	C16	T68	CH4_C2H	D16	T67	CH4_C2L	E16
T128	CH1_C7H	A17	T88	CH2_R4H	B17	T87	CH2_R4L	C17	T70	CH4_C9H	D17	T69	CH4_C9L	E17
T125	CH1_R4L	A18	T90	CH2_C10H	B18	T89	CH2_C10L	C18	T72	CH1_CH2_R3H	D18	T71	CH1_CH2_R3L	E18
T126	CH1_R4H	A19	T92	CH1_C8H	B19	T91	CH1_C8L	C19	T74	CH1_C3H	D19	T73	CH1_C3L	E19
T123	CH1_R3L	A20	T94	CH2_C9H	B20	T93	CH2_C9L	C20	T112	CH1_CH2_R4H	D20	T111	CH1_CH2_R4L	E20
T124	CH1_R3H	A21	T96		B21	T95		C21	T110	CH1_CH2_R2H	D21	T109	CH1_CH2_R2L	E21
T121	CH1_C9L	A22	T114	CH2_C2H	B22	T113	CH2_C2L	C22	T108	CH2_R3H	D22	T107	CH2_R3L	E22
T122	CH1_C9H	A23	T116	CH1_C4H	B23	T115	CH1_C4L	C23	T106	CH1_CH2_R1H	D23	T105	CH1_CH2_R1L	E23
T119		A24	T118	CH2_R2H	B24	T117	CH2_R2L	C24	T100	CH2_C7H	D24	T99	CH2_C7L	E24
T120		A25	T144		B25	T143		C25	T75	USR_SHIELD	D25	T76	USR_SHIELD	E25
T149		A26	T147	CH2_C8H	B26	T148	CH2_C8L	C26	T98	CH4_C1H	D26	T97	CH4_C1L	E26
T150		A27	T145		B27	T146		C27	T102	CH1_R2H	D27	T101	CH1_R2L	E27
T151		A28	T141	CH1_C10H	B28	T142	CH1_C10L	C28	T104	CH1_R1H	D28	T103	CH1_R1L	E28
T152		A29	T139	CH2_R1H	B29	T140	CH2_R1L	C29	T132	CH2_C6H	D29	T131	CH2_C6L	E29
T153		A30	T136		B30	T135		C30	T130	CH1_C5H	D30	T129	CH1_C5L	E30
T154		A31	T138		B31	T137		C31	T134		D31	T133		E31
T160	USR_SHIELD	A32	T157	USR_SHIELD	B32	T158	USR_SHIELD	C32	T155	USR_SHIELD	D32	T156	USR_SHIELD	E32

TABLE 3-5: EX1200-TB160-2 TERMINAL BLOCK TO SMX-4410 PIN MAPPING

SELF TEST

The SFP (SMX-4410 Web Page) also provides a SELF TEST feature which can be used to find/monitor the health of the relays in specific and the card in general.

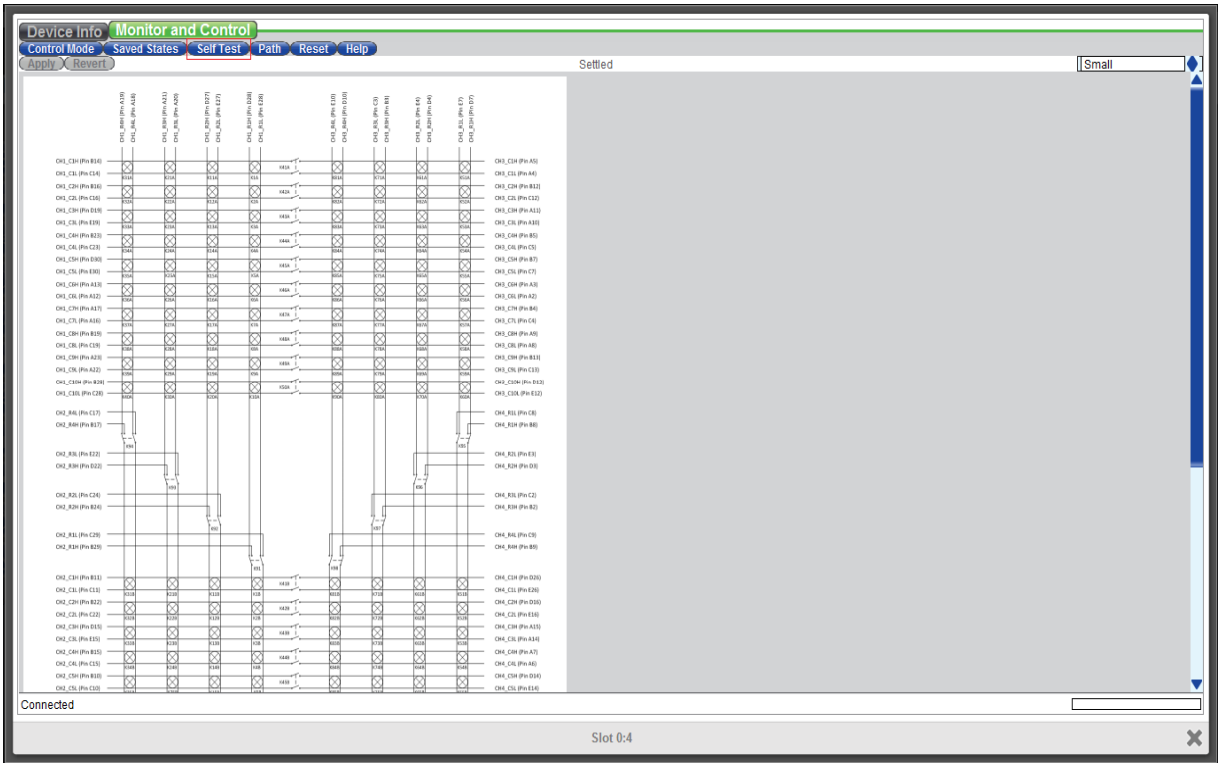

FIGURE 3-8: SELF TEST FEATURE ON THE SFP

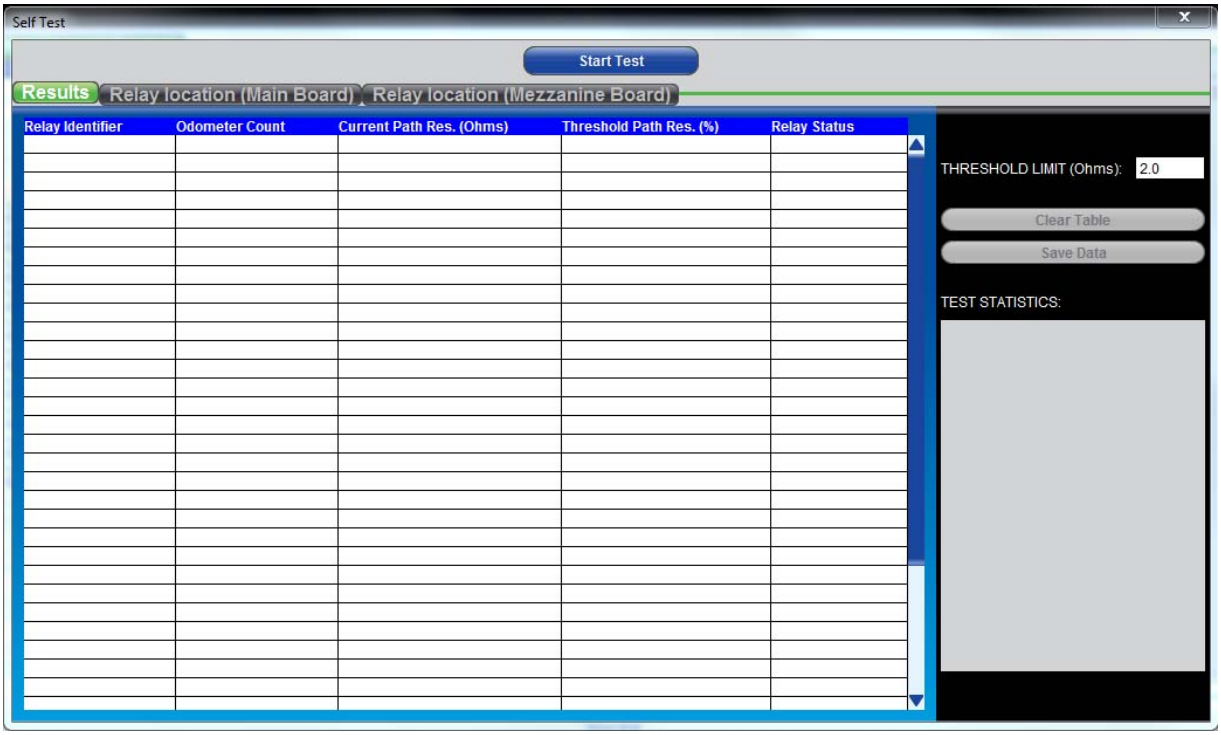

FIGURE 3-9: SELF TEST GUI – MAIN SCREEN

The Self Test Main Screen shows access to the Results Page, the Relay location pictorial pages pertaining to Main Board and the Mazzanine Board.

The Results Page has the following:

- Relay Identifier: Specifies the relay numbering as per the schematic.
- Odometer Count: Lists the relay odometer count.
- Current Path Resistance (Ohms) : Specifies values for each of the Relays including High and Low lines, for the successfully completed Self-test.
- Threshold Path resistance (%): Specifies the percentage increase in the path resistance from the user input threshold limit.
- Relay Status: Specifies relay Pass/Fail/Not Determined/Unknown result considering both functional and contact resistance test.
- Threshold limit (Ohms): User specifyable threshold limit. Before running the self test, the user can enter the threshold limit. The default value is 2 Ohms.
- Test Statistics: Specfies the Total Number of relays, total number of tested relays, total number of passed relays, total number of failed relays, total number of short relays, total number of open relays, total number of high resistance relays, total number of relays that could not be tested and total number of unknown relays.

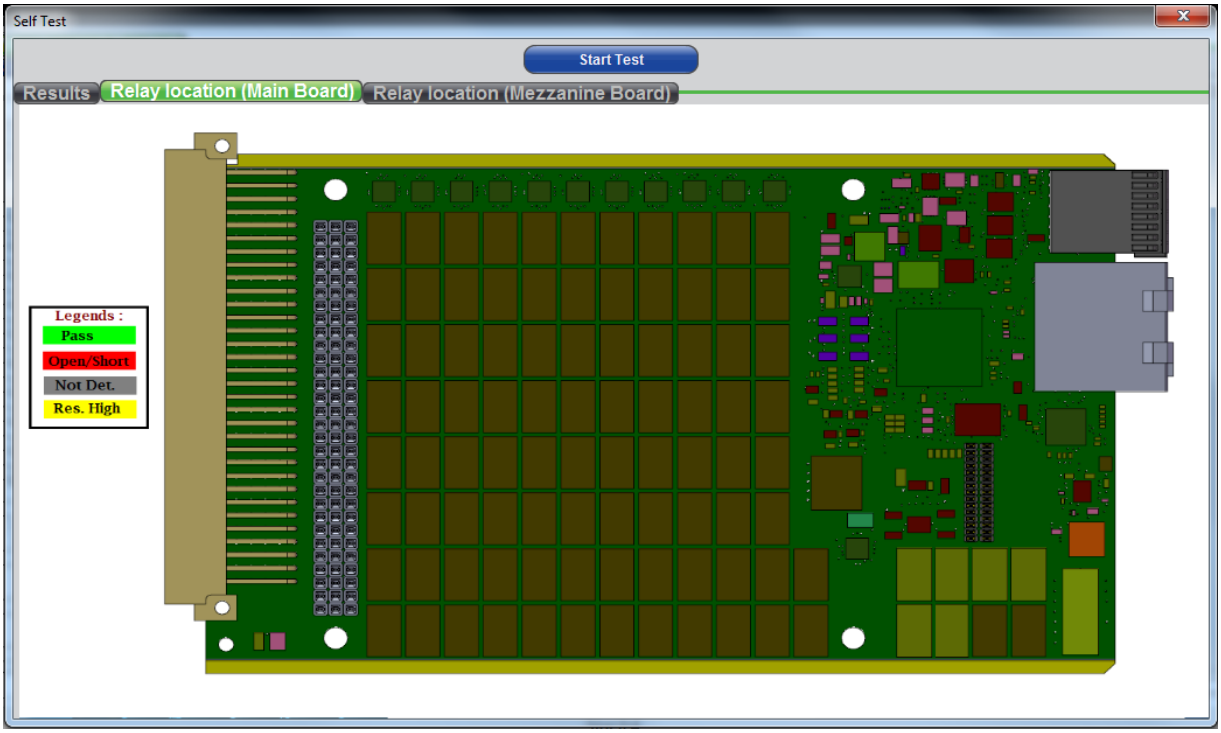

FIGURE 3-10: SELF TEST GUI – RELAY LOCATION (MAIN BOARD) SCREEN

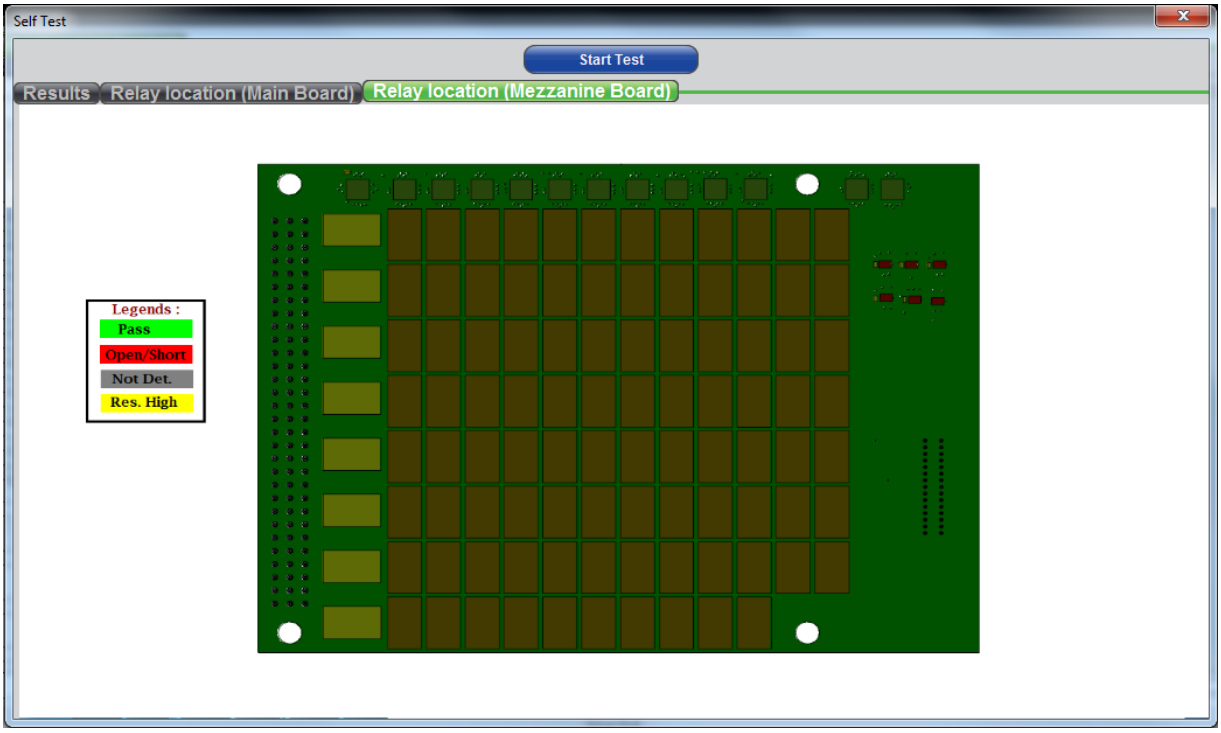

FIGURE 3-11: SELF TEST GUI – RELAY LOCATION (MEZZANINE BOARD) SCREEN

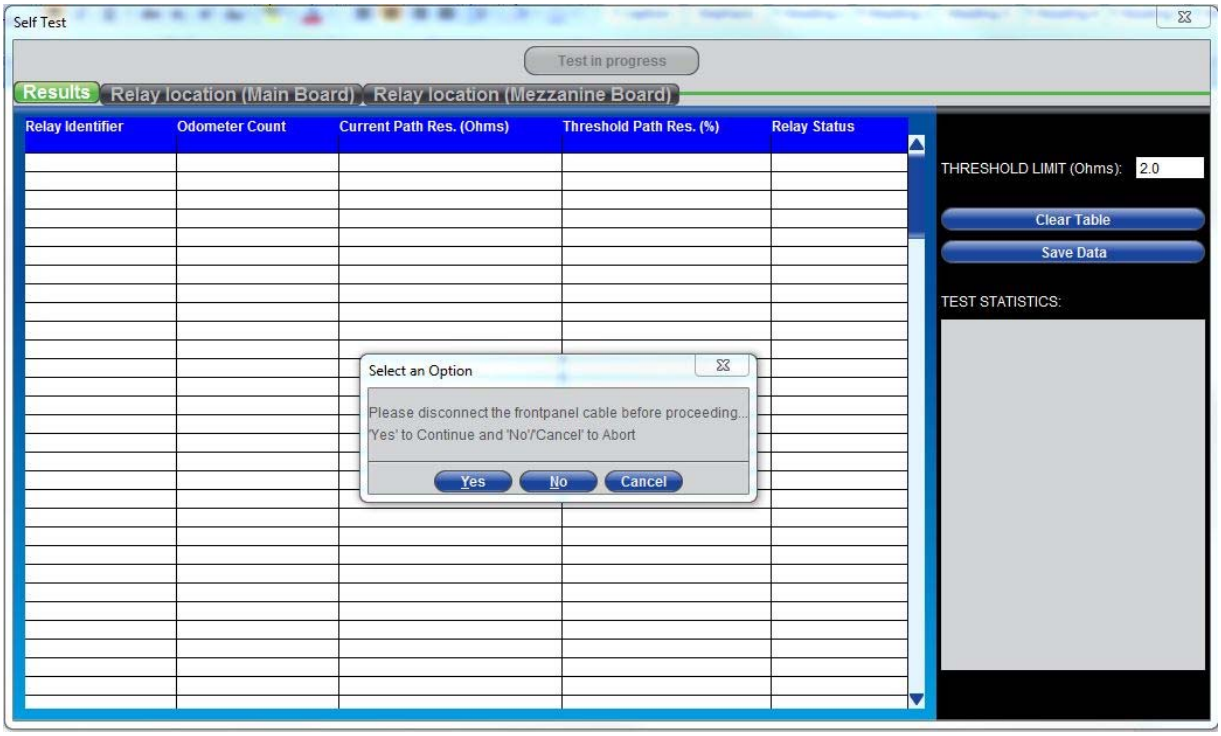

FIGURE 3-12: SELF TEST GUI - START PROCESS SCREEN

Note: The Front Panel Cable has to be disconnected before proceeding the Self Test.

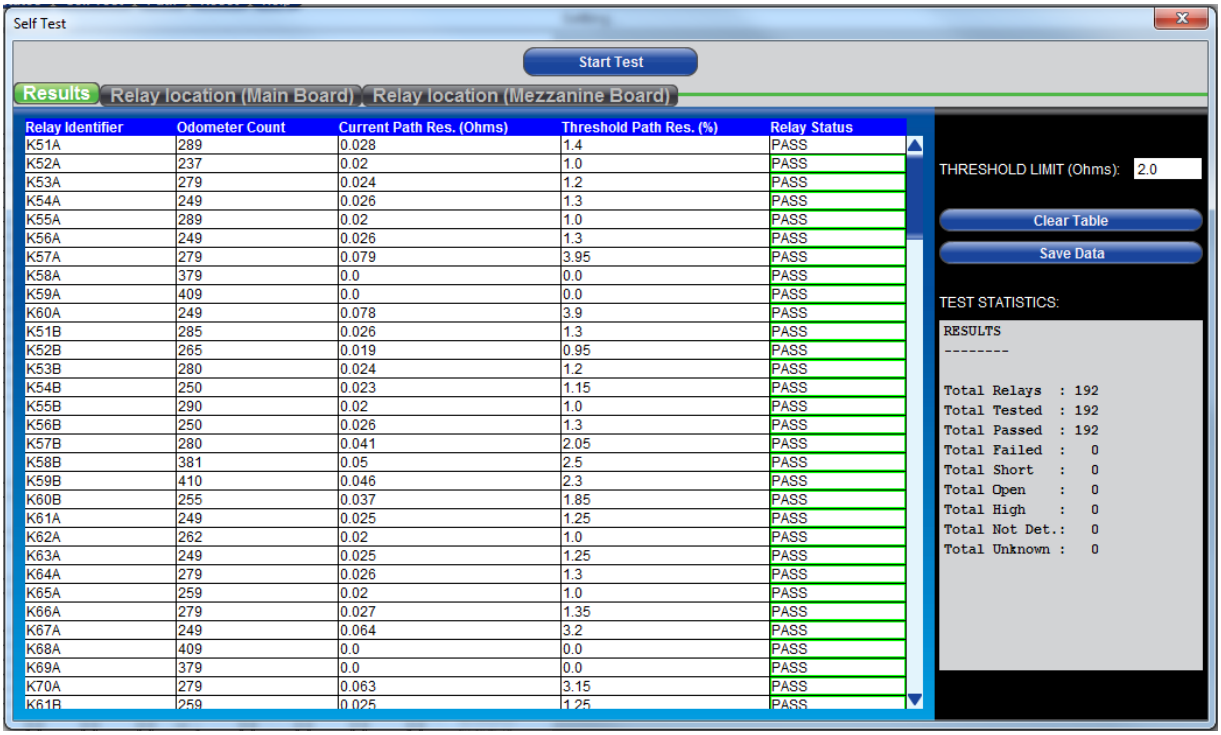

FIGURE 3-13: SELF TEST GUI – POST SELF TEST COMPLETION, SCREEN SHOWING THE TEST STATISTICS

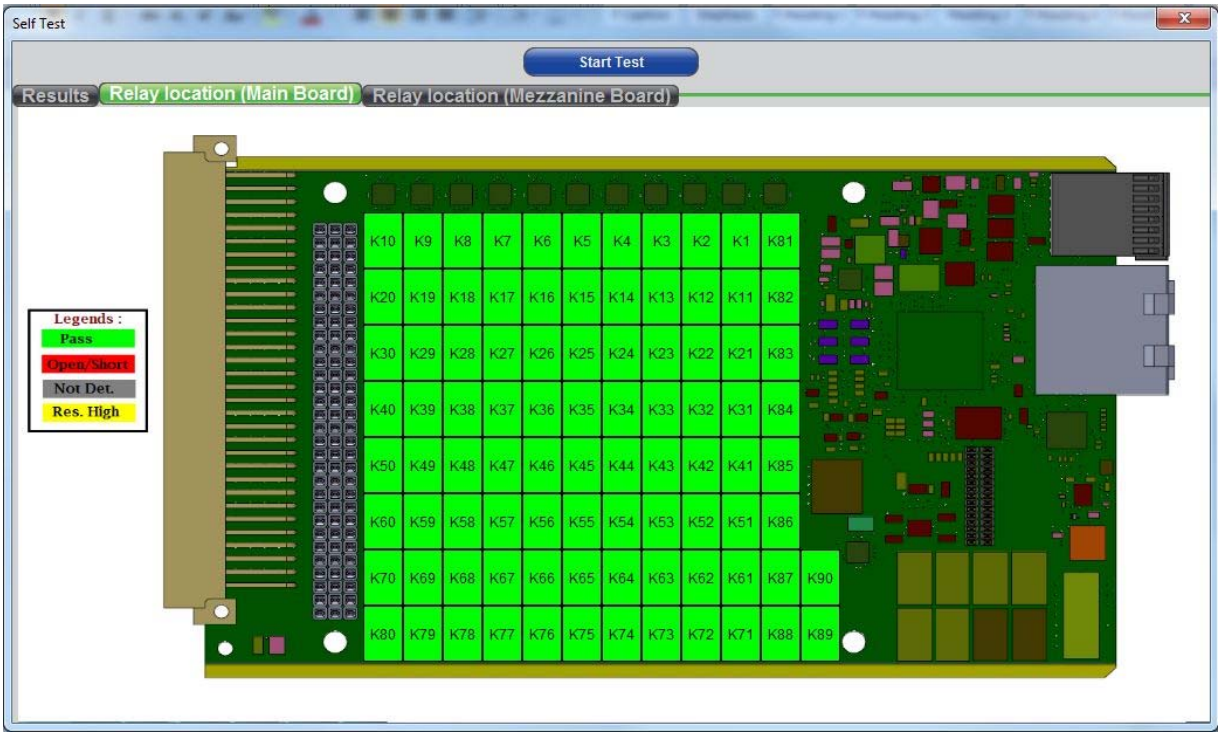

FIGURE 3-14: SELF TEST - RELAY LOCATION (MAIN BOARD) SCREEN, POST SELF TEST INDICATING THE STATUS

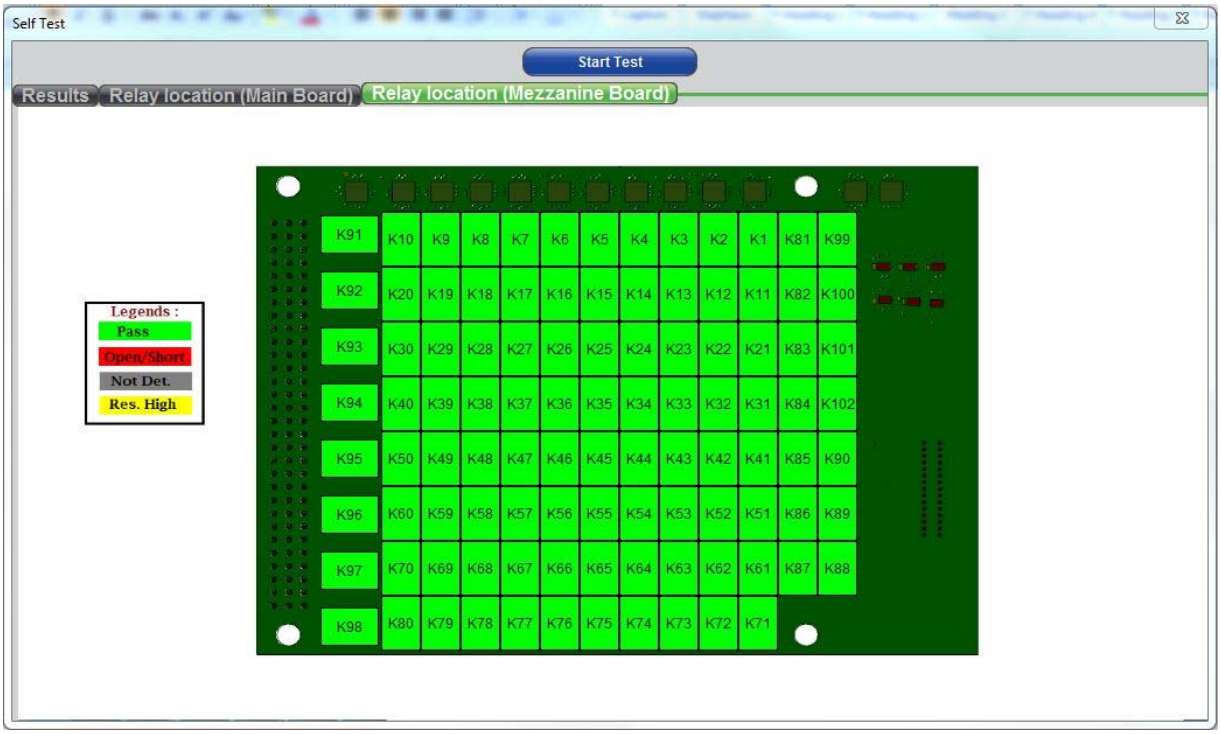

FIGURE 3-15: SELF TEST - RELAY LOCATION (MEZZANINE BOARD) SCREEN, POST SELF TEST INDICATING THE STATUS

SMX-4410 SPECIFICATIONS

GENERAL SPECIFICATIONS	
CHANNEL COUNT	
	80 SPST / 40 DPST
RELAY TYPE	
	Electromechanically, fail-safe
MAXIMUM SWITCHING VOLTAGE	
	300 V dc, 300 V ac rms
MAXIMUM SWITCHING CURRENT	
	2 A
MAXIMUM SWITCHING POWER	
	60 W dc, 62.5 VA
**Maximum switched power is at 30 V/ 2 A dc. Max switched power is derated non-linearly as voltage is increased.*	
MINIMUM CONTACT RATING*	
	10 mV dc, 10 µA (resistive)
**This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions*	
RATED SWITCH OPERATIONS	
Mechanical	1 x 10^8 (no load)
Electrical	1 x 10^6 @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive)
SWITCHING TIME	
	< 3 ms
PATH RESISTANCE	
	< 300 mΩ
INSULATION RESISTANCE	
	> 1 x 10^9 Ω
MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)	
	< 1 µV
CAPACITANCE	
Open channel	< 50 pF
Channel-mainframe	< 20 pF
High-low	< 50 pF
BANDWIDTH (-3 dB)	
	80 MHz (typical)
CROSSTALK (TYPICAL)	
1 MHz	< -55 dB
10 MHz	< -40 dB
ISOLATION (TYPICAL)	
100 kHz	< -50 dB
1 MHz	< -35 dB

For mating connector, crimp pins, and other accessories, please refer to *Appendix B*.

SMX-3276, MULTIPLEXER MODULE

152-CHANNEL, 300V 2A MULTIPLEXER

The SMX-3276, 3U PXIe high-density multiplexer modules designed for scanning of multiple points to a common bus, in 1, 2, or 4-wire configurations. The SMX-3276 consists of two individual (1 x 76) 1-wire, or two (1x38) 2-wire multiplexers or one 1x76 2-wire mux, that can be interconnected under program control (via bussing relays) to configure larger multiplexers as required. This eliminates external wiring and helps reduce unterminated stubs.

The SMX-3276 has an internal residual voltage discharge relays which can be enabled to momentarily short out the measurement path when changing from one input channel to the next. This dissipates any voltage held by the wiring and instrument input capacitance and protects sensitive devices, such as CMOS circuits, from residual voltages caused by previous high-voltage measurements. This feature can also be disabled in low-voltage applications where maximum throughput speed is important.

The SMX-3276 incorporates extensive signal shielding and exposes shield pins on the front panel connector for tying to the cable shield. This preserves signal integrity throughout the signal path by maintaining the signals at the same reference level as the UUT. In addition, meticulous signal routing is done for impedance matching, signal shielding and cross talk reduction, allowing the SMX-3276 to achieve best in class switching performance with a bandwidth of > 30 MHz. This performance allows the card to be used with high frequency signals, and signals that have fast rise times and narrow pulse widths.

CONNECTOR PINS AND SIGNALS

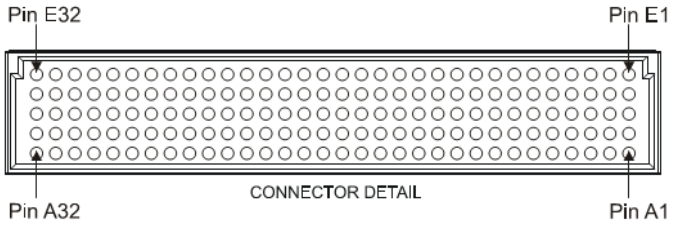

FIGURE 3-16: SMX-3276 FRONT PANEL (FRONT VIEW)

Row A		Row B		Row C		Row D		Row E	
Pin	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**	**Pin**	**Signal**
1	USR_SHIELD	**1**	CH1_37L	**1**	CH1_37H	**1**	CH1_38L	**1**	CH1_38H
2	CH1_3L	**2**	CH1_4L	**2**	CH1_8L	**2**	CH1_7L	**2**	CH1_1L
3	CH1_3H	**3**	CH1_4H	**3**	CH1_8H	**3**	CH1_7H	**3**	CH1_1H
4	CH1_5L	**4**	CH1_6L	**4**	CH1_2L	**4**	CH1_9L	**4**	CH1_11L
5	CH1_5H	**5**	CH1_6H	**5**	CH1_2H	**5**	CH1_9H	**5**	CH1_11H
6	CH1_10L	**6**	CH1_15L	**6**	CH1_13L	**6**	CH1_17L	**6**	CH1_18L
7	CH1_10H	**7**	CH1_15H	**7**	CH1_13H	**7**	CH1_17H	**7**	CH1_18H
8	CH1_14L	**8**	CH1_26L	**8**	CH1_12L	**8**	CH1_27L	**8**	CH1_16L
9	CH1_14H	**9**	CH1_26H	**9**	CH1_12H	**9**	CH1_27H	**9**	CH1_16H
10	CH1_24L	**10**	CH1_19L	**10**	CH1_21L	**10**	CH1_25L	**10**	CH1_22L
11	CH1_24H	**11**	CH1_19H	**11**	CH1_21H	**11**	CH1_25H	**11**	CH1_22H
12	CH1_36L	**12**	CH1_20L	**12**	CH1_30L	**12**	CH1_23L	**12**	CH1_31L
13	CH1_36H	**13**	CH1_20H	**13**	CH1_30H	**13**	CH1_23H	**13**	CH1_31H
14	CH1_COML	**14**	CH1_28L	**14**	CH1_29L	**14**	CH1_35L	**14**	CH1_34L
15	CH1_COMH	**15**	CH1_28H	**15**	CH1_29H	**15**	CH1_35H	**15**	CH1_34H
16	CH1_33L	**16**	CH1_32L	**16**	CH2_5L	**16**	CH2_4L	**16**	CH2_COML
17	CH1_33H	**17**	CH1_32H	**17**	CH2_5H	**17**	CH2_4H	**17**	CH2_COMH
18	CH2_1L	**18**	CH2_8L	**18**	CH2_3L	**18**	CH2_2L	**18**	CH2_9L
19	CH2_1H	**19**	CH2_8H	**19**	CH2_3H	**19**	CH2_2H	**19**	CH2_9H
20	CH2_7L	**20**	CH2_14L	**20**	CH2_13L	**20**	CH2_6L	**20**	USR_SHIELD
21	CH2_7H	**21**	CH2_14H	**21**	CH2_13H	**21**	CH2_6H	**21**	USR_SHIELD
22	CH2_11L	**22**	CH2_12L	**22**	CH2_17L	**22**	CH2_10L	**22**	CH2_18L
23	CH2_11H	**23**	CH2_14H	**23**	CH2_17H	**23**	CH2_10H	**23**	CH2_18H
24	CH2_23L	**24**	CH2_16L	**24**	CH2_15L	**24**	CH2_19L	**24**	CH2_22L
25	CH2_23H	**25**	CH2_16H	**25**	CH2_15H	**25**	CH2_19H	**25**	CH2_22H
26	CH2_27L	**26**	CH2_20L	**26**	CH2_26L	**26**	CH2_29L	**26**	CH2_21L
27	CH2_27H	**27**	CH2_20H	**27**	CH2_26H	**27**	CH2_29H	**27**	CH2_21H
28	CH2_30L	**28**	CH2_25L	**28**	CH2_34L	**28**	CH2_24L	**28**	CH2_32L
29	CH2_30H	**29**	CH2_25H	**29**	CH2_34H	**29**	CH2_24H	**29**	CH2_32H
30	CH2_31L	**30**	CH2_33L	**30**	CH2_28L	**30**	CH2_36L	**30**	CH2_35L
31	CH2_31H	**31**	CH2_33H	**31**	CH2_28H	**31**	CH2_36H	**31**	CH2_35H
32	USR_SHIELD	**32**	CH2_37L	**32**	CH2_37H	**32**	CH2_38L	**32**	CH2_38H

TABLE 3-6: CONNECTOR PINS & SIGNAL ASSIGNMENTS

LOGICAL DIAGRAM

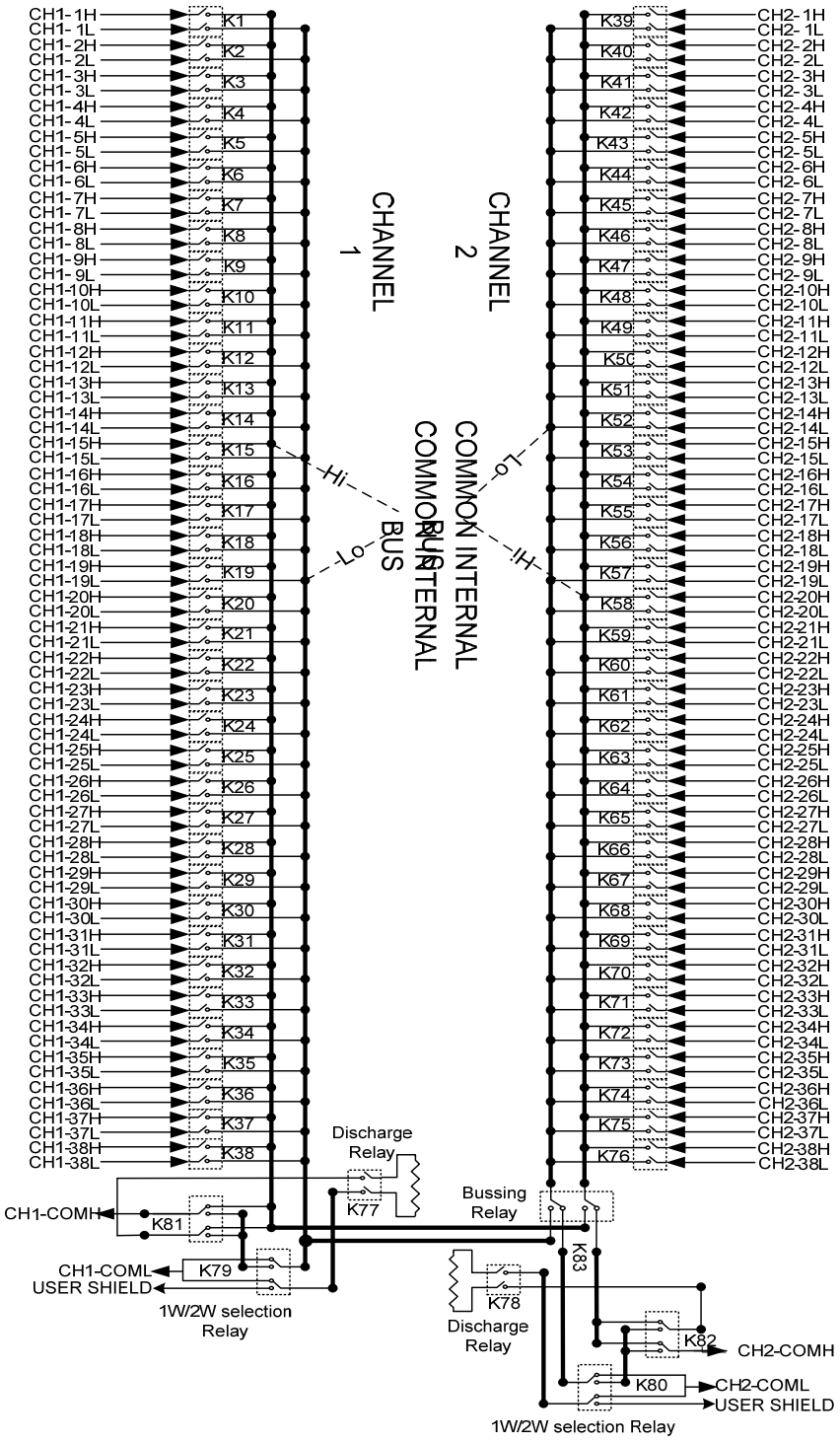

FIGURE 3-17: SMX-3276 LOGICAL DIAGRAM

TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin
T159	USR_SHIELD	A1	T80	CH1_37L	B1	T79	CH1_37H	C1	T78	CH1_38L	D1	T77	CH1_38H	E1
T5	CH1_3L	A2	T7	CH1_4L	B2	T15	CH1_8L	C2	T13	CH1_7L	D2	T1	CH1_1L	E2
T6	CH1_3H	A3	T8	CH1_4H	B3	T16	CH1_8H	C3	T14	CH1_7H	D3	T2	CH1_1H	E3
T9	CH1_5L	A4	T11	CH1_6L	B4	T3	CH1_2L	C4	T17	CH1_9L	D4	T21	CH1_11L	E4
T10	CH1_5H	A5	T12	CH1_6H	B5	T4	CH1_2H	C5	T18	CH1_9H	D5	T22	CH1_11H	E5
T19	CH1_10L	A6	T29	CH1_15L	B6	T25	CH1_13L	C6	T33	CH1_17L	D6	T35	CH1_18L	E6
T20	CH1_10H	A7	T30	CH1_15H	B7	T26	CH1_13H	C7	T34	CH1_17H	D7	T36	CH1_18H	E7
T27	CH1_14L	A8	T51	CH1_26L	B8	T23	CH1_12L	C8	T53	CH1_27L	D8	T31	CH1_16L	E8
T28	CH1_14H	A9	T52	CH1_26H	B9	T24	CH1_12H	C9	T54	CH1_27H	D9	T32	CH1_16H	E9
T47	CH1_24L	A10	T37	CH1_19L	B10	T41	CH1_21L	C10	T49	CH1_25L	D10	T43	CH1_22L	E10
T48	CH1_24H	A11	T38	CH1_19H	B11	T42	CH1_21H	C11	T50	CH1_25H	D11	T44	CH1_22H	E11
T71	CH1_36L	A12	T39	CH1_20L	B12	T59	CH1_30L	C12	T45	CH1_23L	D12	T61	CH1_31L	E12
T72	CH1_36H	A13	T40	CH1_20H	B13	T60	CH1_30H	C13	T46	CH1_23H	D13	T62	CH1_31H	E13
T73	CH1_COML	A14	T55	CH1_28L	B14	T57	CH1_29L	C14	T69	CH1_35L	D14	T67	CH1_34L	E14
T74	CH1_COMH	A15	T256	CH1_28H	B15	T58	CH1_29H	C15	T70	CH1_35H	D15	T68	CH1_34H	E15
T65	CH1_33L	A16	T63	CH1_32L	B16	T89	CH2_5L	C16	T87	CH2_4L	D16	T153	CH2_COML	E16
T66	CH1_33H	A17	T64	CH1_32H	B17	T90	CH2_5H	C17	T88	CH2_4H	D17	T154	CH2_COMH	E17
T81	CH2_1L	A18	T95	CH2_8L	B18	T85	CH2_3L	C18	T83	CH2_2L	D18	T97	CH2_9L	E18
T82	CH2_1H	A19	T96	CH2_8H	B19	T86	CH2_3H	C19	T84	CH2_2H	D19	T98	CH2_9H	E19
T93	CH2_7L	A20	T107	CH2_14L	B20	T105	CH2_13L	C20	T91	CH2_6L	D20	T75	USR_SHIELD	E20
T94	CH2_7H	A21	T108	CH2_14H	B21	T106	CH2_13H	C21	T92	CH2_6H	D21	T76	USR_SHIELD	E21
T101	CH2_11L	A22	T103	CH2_12L	B22	T113	CH2_17L	C22	T99	CH2_10L	D22	T115	CH2_18L	E22
T102	CH2_11H	A23	T104	CH2_12H	B23	T114	CH2_17H	C23	T100	CH2_10H	D23	T116	CH2_18H	E23
T125	CH2_23L	A24	T111	CH2_16L	B24	T109	CH2_15L	C24	T117	CH2_19L	D24	T123	CH2_22L	E24
T126	CH2_23H	A25	T112	CH2_16H	B25	T110	CH2_15H	C25	T118	CH2_19H	D25	T124	CH2_22H	E25
T133	CH2_27L	A26	T119	CH2_20L	B26	T131	CH2_26L	C26	T137	CH2_29L	D26	T121	CH2_21L	E26
T134	CH2_27H	A27	T120	CH2_20H	B27	T132	CH2_26H	C27	T138	CH2_29H	D27	T122	CH2_21H	E27
T139	CH2_30L	A28	T129	CH2_25L	B28	T147	CH2_34L	C28	T127	CH2_24L	D28	T143	CH2_32L	E28
T140	CH2_30H	A29	T130	CH2_25H	B29	T148	CH2_34H	C29	T128	CH2_24H	D29	T144	CH2_32H	E29
T141	CH2_31L	A30	T145	CH2_33L	B30	T135	CH2_28L	C30	T151	CH2_36L	D30	T149	CH2_35L	E30
T142	CH2_31H	A31	T146	CH2_33H	B31	T136	CH2_28H	C31	T152	CH2_36H	D31	T150	CH2_35H	E31
T160	USR_SHIELD	A32	T157	CH2_37L	B32	T158	CH2_37H	C32	T155	CH2_38L	D32	T156	CH2_38H	E32

TABLE 3-7: EX1200-TB160-3 TERMINAL BLOCK TO SMX-3276 PIN MAPPING

SMX-3276 SPECIFICATIONS

GENERAL SPECIFICATIONS	
CHANNEL COUNT	
	80 SPST / 40 DPST
RELAY TYPE	
	Electromechanically, fail-safe
MAXIMUM SWITCHING VOLTAGE	
	300 V dc, 300 V ac rms
MAXIMUM SWITCHING CURRENT	
	2 A
MAXIMUM SWITCHING POWER	
	60 W dc, 62.5 VA
**Maximum switched power is at 30 V/ 2 A dc. Max switched power is derated non-linearly as voltage is increased.*	
MINIMUM CONTACT RATING*	
	10 mV dc, 10 µA (resistive)
**This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions*	
RATED SWITCH OPERATIONS	
Mechanical	1 x 10^8 (no load)
Electrical	1 x 10^6 @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive)
SWITCHING TIME	
	< 3 ms
PATH RESISTANCE	
	< 300 mΩ
INSULATION RESISTANCE	
	> 1 x 10^9 Ω
MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)	
	< 1 µV
CAPACITANCE	
Open channel	< 50 pF
Channel-mainframe	< 20 pF
High-low	< 50 pF
BANDWIDTH (-3 dB)	
	80 MHz (typical)
CROSSTALK (TYPICAL)	
1 MHz	< -55 dB
10 MHz	< -40 dB
ISOLATION (TYPICAL)	
100 kHz	< -50 dB
1 MHz	< -35 dB

For mating connector, crimp pins, and other accessories, please refer to *Appendix B*.

APPENDIX A

POWER CONSUMPTION AND WEIGHT

REFERENCE TABLES

Please refer CMX series manual for power specifications and weight information for mainframes. All the SMX plugin cards size are as per 3U CPCIe/PXIe form factor.

APPENDIX B

SWITCH CARD ACCESSORIES

LIST OF ACCESSORIES

The following tables provide mating connector, strain relief, crimp pin, and other related accessories for the connectors used with the SMX series switch cards.

41-PIN CONNECTOR

These accessories should be used with the SMX-2002.

ACCESSORIES	
CONNECTOR KIT	
Description	Connector kit (includes 1 each connector and backshell plus 44 pins)
VTI Part Number	70-0190-001
CONNECTOR INFORMATION	
Description	Connector, power, female with backshell, insulated, 41 PLC
VTI Part Number	27-0087-041
Manufacturer/Part Number	Positronics GMCT41F0E100J0
CRIMP PIN	
Description	Contact, female, crimp, power connector, 14 - 16 GA (Order qty: 44 per board)
VTI Part Number	27-0087-000
Manufacturer/Part Number	Positronics FC114N2/AA
CRIMP TOOL INFORMATION	
Description	Crimp tool and turret head
VTI Part Number	46-0012-000
Manufacturer/Part Number	Positronics 9501 and 9502-1
INSERTION TOOL	
Description	Tool, contact insertion, size 16 contact, AMP M series
VTI Part Number	46-0014-000
EXTRACTION TOOL	
Description	Tool, pin extractor, power/coaxial
VTI Part Number	46-0015-000
UNTERMINATED CABLE ASSEMBLY	
Description	41-pin, unterminated cable assembly, 3 ft
VTI Part Number	70-0363-506

160-PIN CONNECTOR

These accessories should be used with the SMX-3276, SMX-4410, SMX-5001.

ACCESSORIES	
STRAIN RELIEF BRACKET KIT (WITHOUT CONNECTOR)	
VTI Part Number	70-0409-160
CRIMP PIN	
VTI Part Number	52-0109-000 (includes 100 crimp pins)
Manufacturer/Part Number	ERNI 234064
MATING CONNECTOR	
VTI Part Number	27-0088-160 (one per board)
Manufacturer/Part Number	ERNI 024070
CRIMP TOOL (DIN)	
VTI Part Number	46-0010-000
Manufacturer/Part Number	ERNI 014374
EXTRACTION TOOL (DIN)	
VTI Part Number	46-0011-000
Manufacturer/Part Number	ERNI 471555
UNTERMINATED CABLE ASSEMBLY (ALL 160-PIN CONNECTORS)	
Description	160-pin, unterminated cable assembly, 3 ft
UNTERMINATED CABLE ASSEMBLY (ALL 80-PIN CONNECTORS – HIGH-VOLTAGE)	
Description	160-pin to 80-pin, unterminated cable assembly, 3 ft
TERMINAL BLOCK INFORMATION (SMX-3276 ONLY)	
Description	EX1200-TB160-1, differential module
TERMINAL BLOCK INFORMATION (SMX-4410, SMX-5001 ONLY)	
Description	EX1200-TB160SE, single-ended module