



SMX SERIES SWITCH CARDS

USER'S MANUAL

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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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Irvine, CA 92614-6509 U.S.A.

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

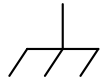
These terms may appear in this manual:

- 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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 ADVANCED MEASUREMENT TECHNOLOGY

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.

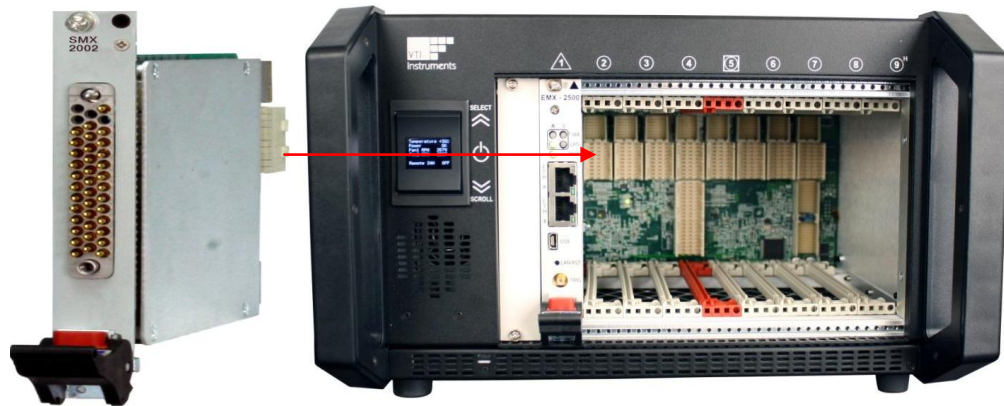


FIGURE 1-1: MODULE INSTALLATION (SMX-2002 SHOWN)

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.

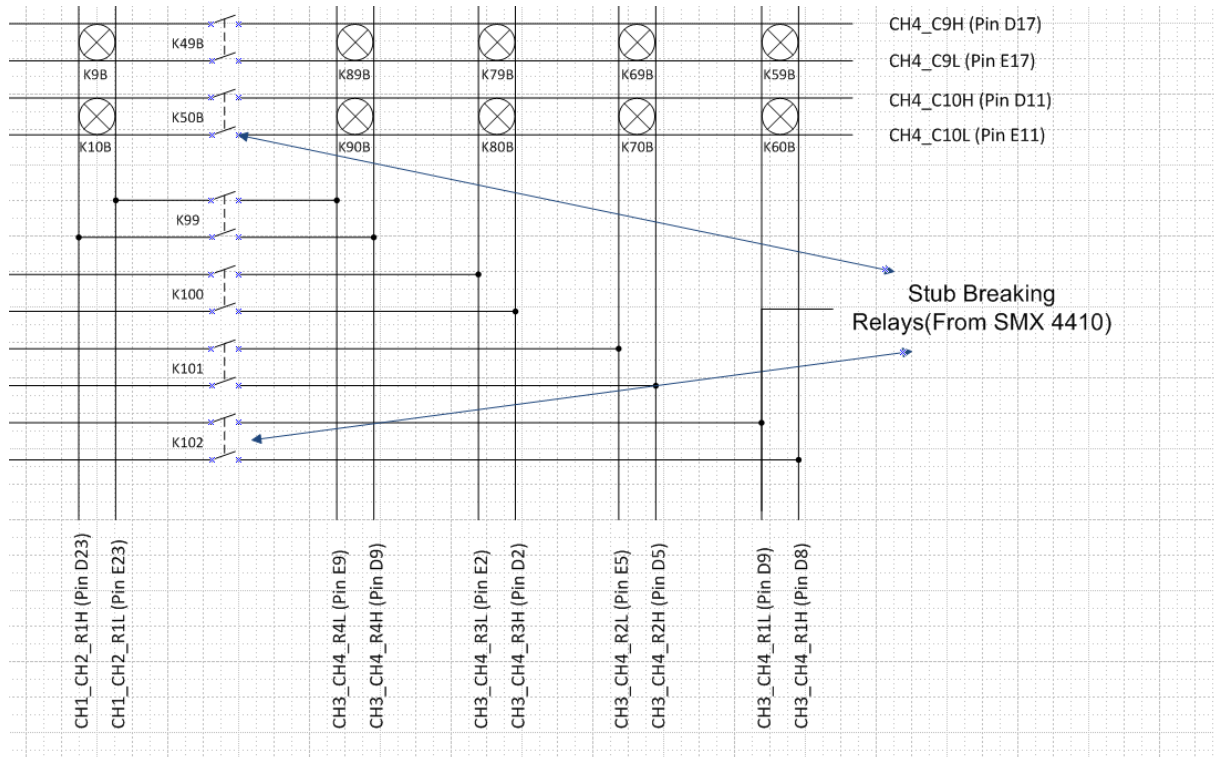


FIGURE 2-1: STUB BREAKING RELAYS

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-compliant 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

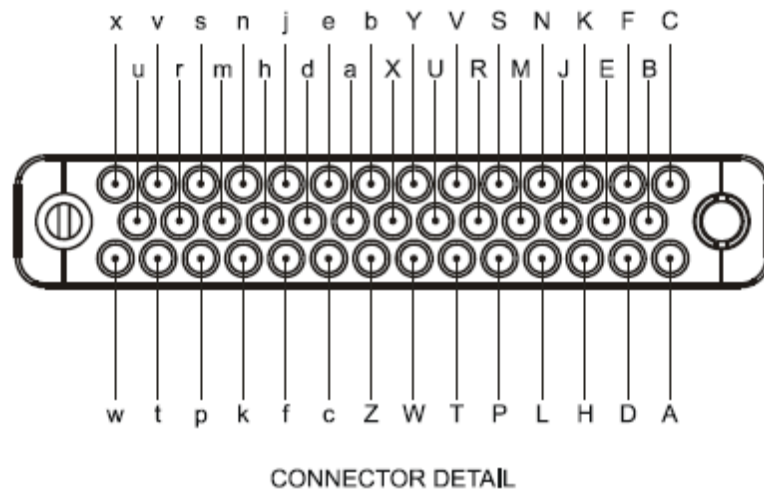


FIGURE 3-1: SMX-2002 FRONT PANEL (FRONT VIEW)

| 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

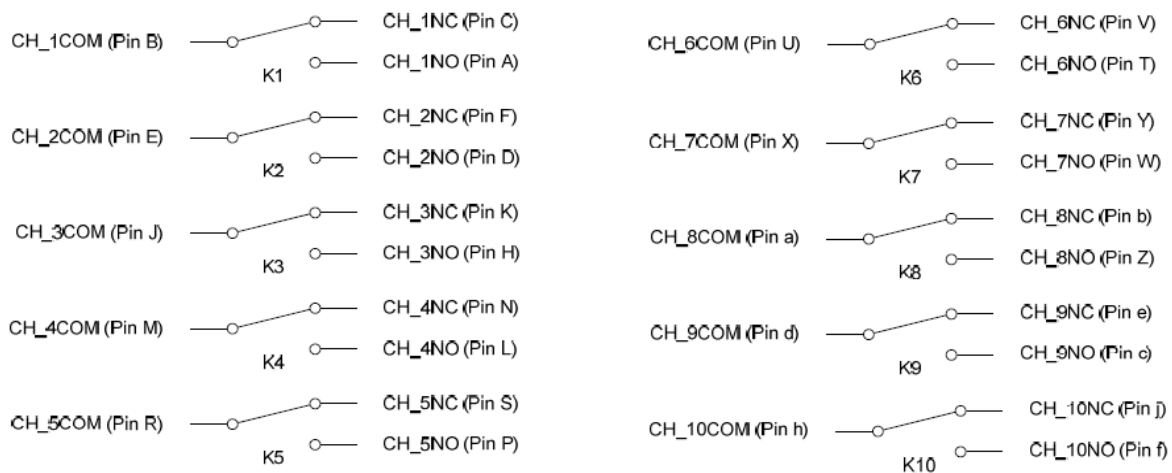


FIGURE 3-2 SMX-2002 LOGICAL DIAGRAM

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 |
| <i>*This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions</i> | |
| 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

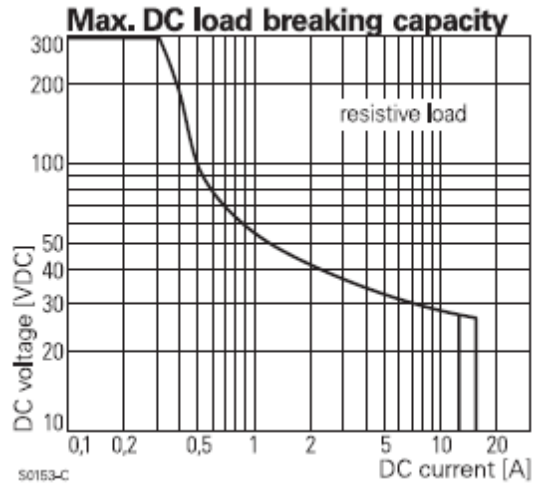


FIGURE 3-3: RELAY BREAKING CAPACITY

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 IviSwch-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

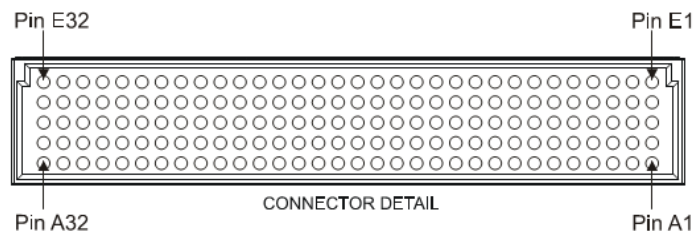


FIGURE 3-4: SMX-5001 FRONT PANEL (FRONT VIEW)

| 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 |
| <i>*Maximum switched power is at 30 V / 2 A dc. Max switched power is derated non-linearly as voltage is increased.</i> | |
| MINIMUM CONTACT RATING* | 10 mV dc, 10 μ A (resistive) |
| <i>*This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions</i> | |
| 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 m Ω |
| INSULATION RESISTANCE | > 1 x 10 ⁹ Ω |
| MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO) | < 1 μ V |
| 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

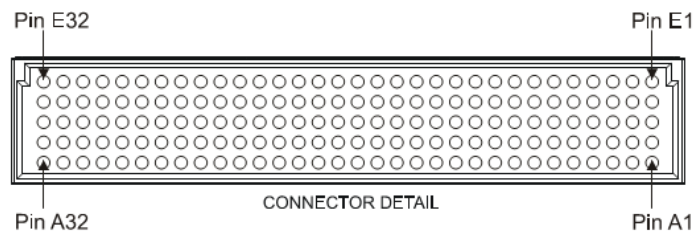


FIGURE 3-6: SMX-4410 FRONT PANEL (FRONT VIEW)

| 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

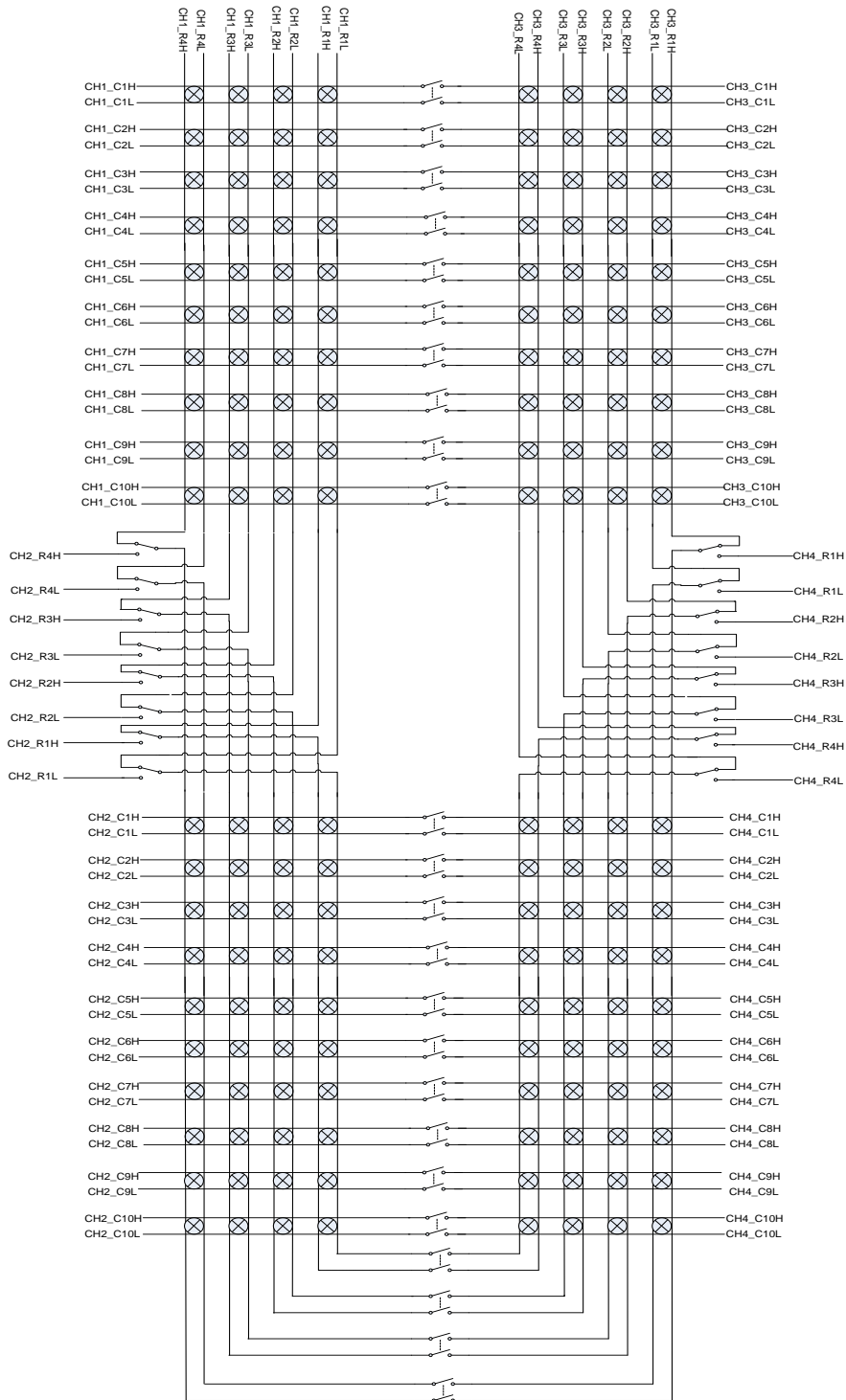


FIGURE 3-7: SMX-4410 LOGICAL DIAGRAM

| TB Ref | Signal | Con n Pin | TB Ref | Signal | Con n Pin | TB Ref | Signal | Con n Pin | TB Ref | Signal | Con n Pin | TB Ref | Signal | Con n Pin |
|--------|-------------|-----------|--------|-------------|-----------|--------|-------------|-----------|--------|-------------|-----------|--------|-------------|-----------|
| T159 | USR_SHIE LD | A1 | T80 | USR_SHIE LD | B1 | T79 | USR_SHIE LD | C1 | T78 | USR_SHIEL D | D1 | T77 | USR_SHIE LD | 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_SHIEL D | D25 | T76 | USR_SHIE LD | E25 |
| T149 | | A26 | T147 | CH2_C8H | B26 | T146 | CH2_C8L | C26 | T98 | CH4_C1H | D26 | T97 | CH4_C1L | E26 |
| T150 | | A27 | T145 | | B27 | T144 | | 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_SHIE LD | A32 | T157 | USR_SHIE LD | B32 | T158 | USR_SHIE LD | C32 | T155 | USR_SHIEL D | D32 | T156 | USR_SHIE LD | E32 |

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

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 |
| <i>*Maximum switched power is at 30 V/ 2 A dc. Max switched power is derated non-linearly as voltage is increased.</i> | |
| MINIMUM CONTACT RATING* | 10 mV dc, 10 μ A (resistive) |
| <i>*This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions</i> | |
| 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 m Ω |
| INSULATION RESISTANCE | > 1 x 10 ⁹ Ω |
| MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO) | < 1 μ V |
| 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

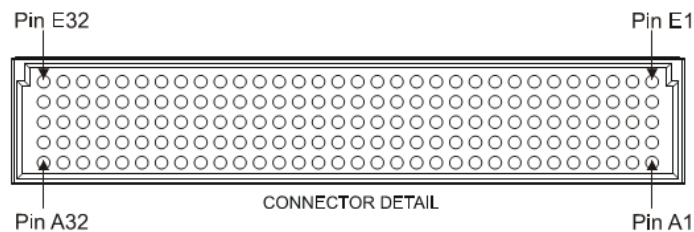


FIGURE 3-8: SMX-3276 FRONT PANEL (FRONT VIEW)

| 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

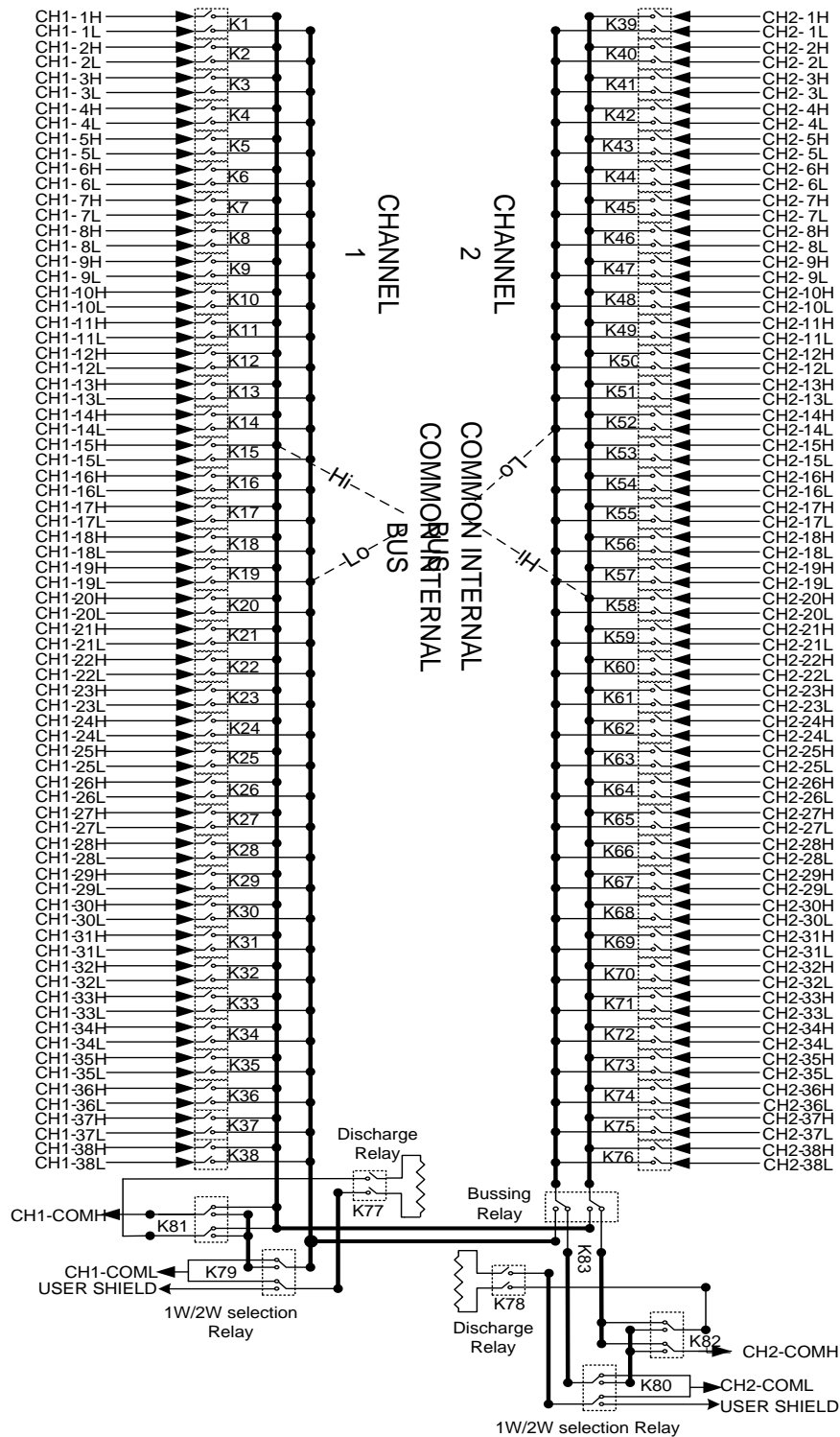


FIGURE 3-9: SMX-3276 LOGICAL DIAGRAM

| 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 |
| <i>*Maximum switched power is at 30 V/ 2 A dc. Max switched power is derated non-linearly as voltage is increased.</i> | |
| MINIMUM CONTACT RATING* | 10 mV dc, 10 μ A (resistive) |
| <i>*This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions</i> | |
| 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 m Ω |
| INSULATION RESISTANCE | > 1 x 10 ⁹ Ω |
| MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO) | < 1 μ V |
| 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 | |
|---|--|
| 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 |