VTI Instruments

AMETEK
ADVANCED MEASUREMENT TECHNOLOGY

# EX1200 SERIES SWITCH CARDS

## USER'S MANUAL

**P/N: 82-0127-001**
**Released on Nov 7th, 2022**

**VTI Instruments**

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## CERTIFICATION

VTI Instruments (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.

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## DECLARATION OF CONFORMITY

The declaration of conformity for the EX1200 Series Mainframe applies to all of its available plug-in modules and options. For specifics, refer to the *EX1200 Series Mainframe User's Manual*.

VTI Instruments
2031 Main Street
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 take_2ack 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**

The power cable provided with this instrument meets the required regulatory and statutory safety standards as indicated by this product's declaration of conformity. VTI recommends that the power cord provided be used with the instrument that it is provided with. If a different power cord is must to be used, however, it is the responsibility of the user to select a power cord that meets any and all regulatory and statutory requirements for their industry and country.

**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 EX1200 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. Information regarding power consumption calculations can be found in the EX1200 Series User's Manual (P/N: 82-0127-000). ***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. EX1200 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 EX1200 series switch cards must be installed into an EX1200 series mainframe 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 EX1200 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.

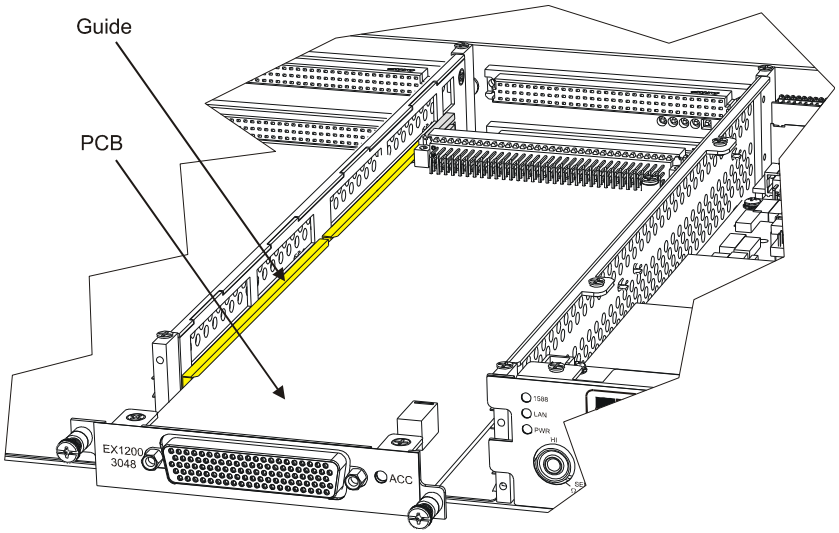



**FIGURE 1-1: MODULE INSTALLATION (EX1200-3048 SHOWN)**

| | |
|---|---|
| **NOTE** | To maximize air flow for cooling, blanking panels (P/N: 41-0472-012) should be installed into the empty slots of EX1200 mainframes. |

The maximum safe voltage for an EX1200 system is determined by the plug-in card with the lowest voltage rating.

## MICROWAVE MODULE INSTALLATION

For the EX1200-7100 Plug-in Module, microwave switch modules can be installed. Before installing a switch module into the EX1200-7100 carrier, ensure that the mainframe is powered down. Insert the switch module into the desired slot of the carrier. Slide the module into the mating connector at the rear of the carrier using the two guide pins to ensure proper orientation. Once the guide pins are aligned, push the module firmly mating connector. The module is then sMUXred to the front panel of the carrier using four socket head cap screws.

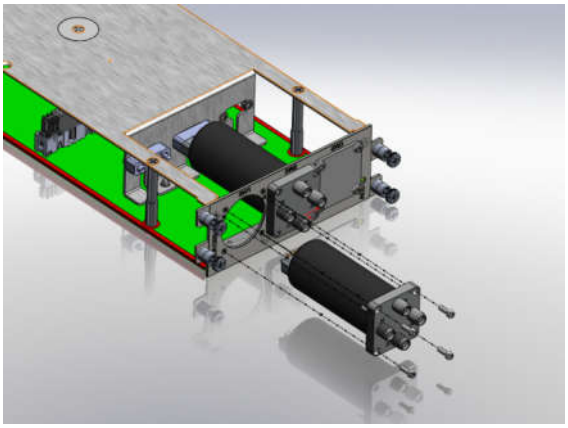


**FIGURE 1-2: MICROWAVE SWITCH INSTALLATION**

## MODULE SHIELDING/GROUNDING

Most EX1200 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.

## SCANNING

The EX1200 switch cards provide scanlist functionality to maximize measurement throughput. The scanlist allows the relay state to be advanced by a hardware trigger rather than requiring the state of the relay to be updated manually during program execution. Doing this eliminates the need to wait on the controller to wait for a state to be settled and send the command to update relays providing maximum throughput performance

## APPLICATION ENVIRONMENTS

The EX1200 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 EX1200 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 EX1200-200x high-power switch cards provide high-power switching in a small form factor. The EX1200-2001 and the EX1200-2002 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 of a scanlist to switch power to and from a DUT before reading data into a multiplexer to the DMM.

## MATRIX/MULTIPLEXER SWITCHING

Matrix and multiplexer cards allow the user the ability to combine multiple 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. For example, by placing six EX1200-4128's in a chassis and connecting all four rows of each module to the EX1200 backplane, a 4 x 768 can be formed is a 1U rack with no 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 or isolate the switch card from the DMM backplane. 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.

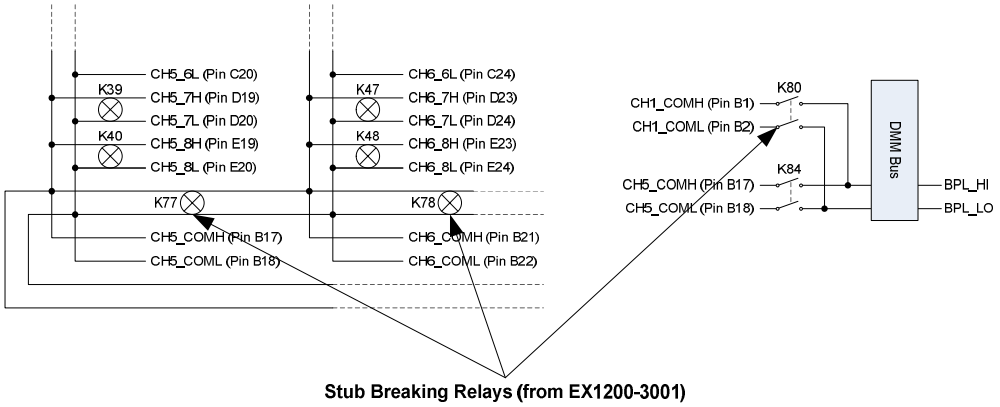



**FIGURE 2-1: STUB BREAKING RELAYS**

When programming switches to perform 2-wire and 4-wire measurements, the 2-wire and 4-wire channel names must be used. For "standard" matrix cards (i.e. 2-banks of paired H/L inputs), the 2- and 4-wire name, the 1-wire names is used as the base. The convention is illustrated in Table 2-1 below:

| 1-Wire Channel Name | 2-Wire Channel Name | 4-Wire Channel Name |
|---|---|---|
| CH1_1L | CH1_1 | CH_1 |
| CH1_1H | | |
| CH2_1L | CH2_1 | |
| CH2_1H | | |
| CH1_2L | CH1_2 | CH_2 |
| CH1_2H | | |
| CH2_2L | CH2_2 | |
| CH2_2H | | |

**TABLE 2-1: STANDARD 2- AND 4-WIRE NAMING CONVENTIONS**

For "non-standard" matrix cards, this convention cannot be used, however. For these switch cards, the full 2- and 4-wire names are provided following the 1-wire discussion for those cards.

## RF SWITCHING

The EX1200-6xxx cards can be used for high bandwidth applications such as switching to/from oscilloscopes and function generators. These modules provide a maximum of 10 W of switching power and the stub effects are terminated to ensure maximum signal fidelity.

# SECTION 3

# EX1200 SERIES TERMINAL BLOCKS

## INTRODUCTION

VTI offers differential and single-ended terminal blocks (TBs) for many of the EX1200 series switch cards. The terminal blocks can be used to simplify cabling. In addition to this, the differential terminal blocks also provide users an on-board thermistor for cold junction compensation (CJC) when making temperature measurements. Signal pin mapping is provided for the terminal blocks with its associated switch card.

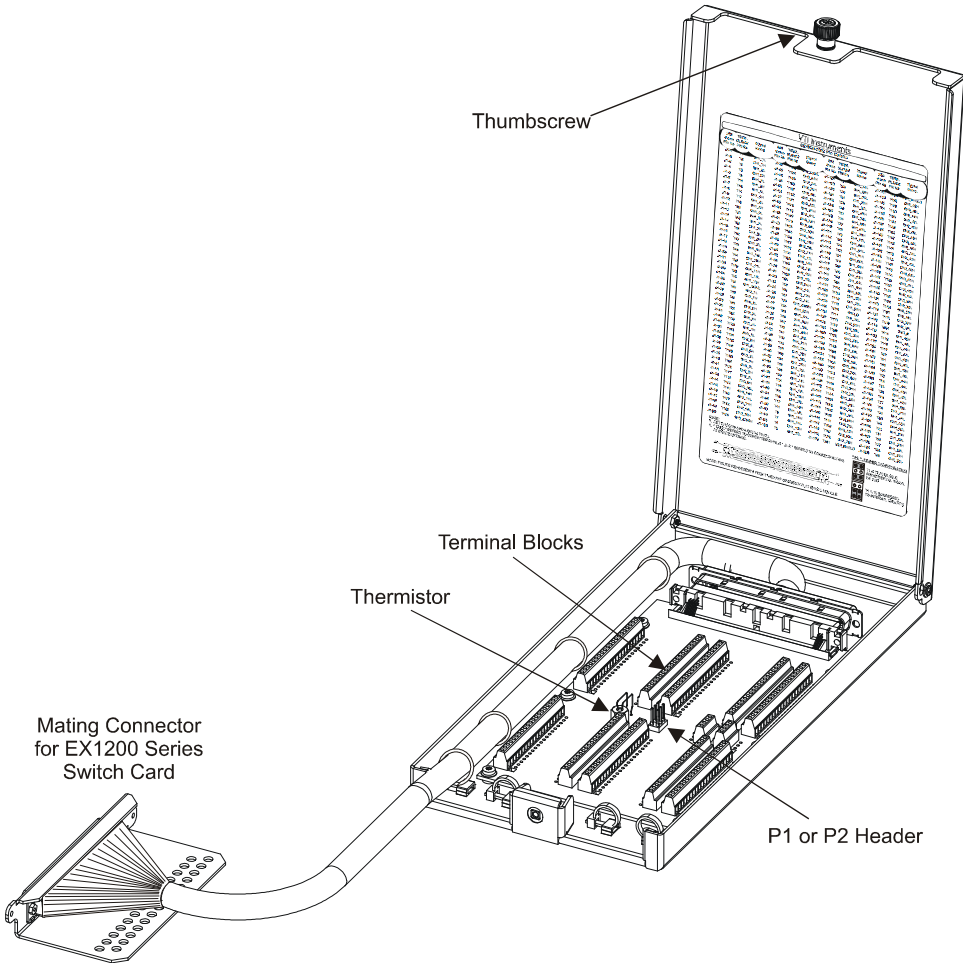



**FIGURE 3-1: EX1200-TB200**

## JUMPER CONFIGURATION

Differential TBs have the ability to use an on-board 10 kΩ thermistor (RT1) to connect to an instrument when temperature measurements are being made. Before doing so, the P2 header must be configured correctly. The function of this header is to make a connection between the T1 and T2 terminals on the terminal block, the CJC (RT1) sensor, and two other TB terminals.

In the default position, pin 1 is shorted to pin 6 and pins 3 and 4 are shorted (see _Figure 3-2) on P2. This configuration allows T1 and T2 to be used in any type of measurement. When configured to one of the other two configurations, the channels associated with these terminals are dedicated to making temperature measurements and cannot be used in any other manner.

To use RT1 for CJC measurements, short pin 2 to pin 3 and pin 4 to pin 5. This will join T1 and T2 to L_VS and H_VS. The terminal numbers for L_VS and H_VS differ between TB modules and are documented with the terminal block pin mapping information for each switch card.

To use an external sensor for temperature measurements, short pin 1 to pin 2 and pins 5 and 6 on P2. This joins T1 and T2 to RL_I and RH_I. For the TB104 and TB160, the external sensor should be connected to T1 and T2 or T161 and T162 when in this configuration. For the TB200, the external sensor can be connected T1 and T2 or T181 and T182 when in this configuration.

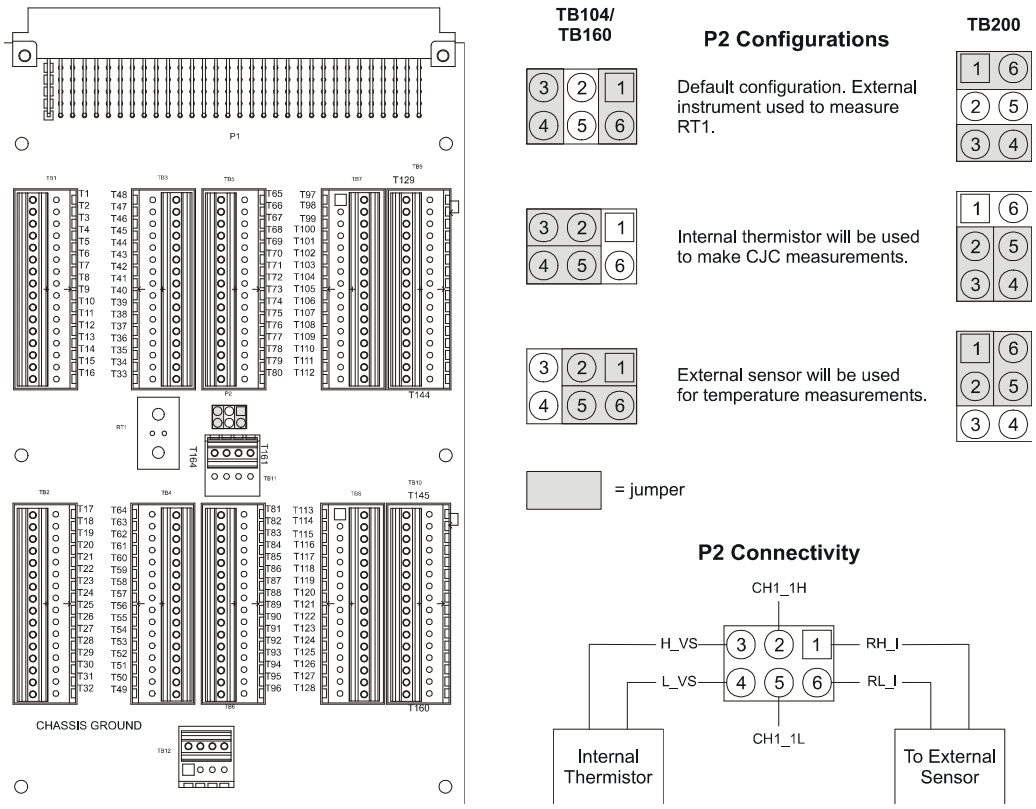



**FIGURE 3-2: P2 JUMPER CONFIGURATION DIAGRAM**

| NOTE | The actual switch card channel that is dedicated to temperature measurement through the P2 header is dependent on the channel to which T1 and T2 of the terminal block are connected. _Figure 3-2, an EX1200-TB160-1 is shown where T1 and T2 are connected to CH1_1L and CH1_1H, respectively. The channels are indicated in the Terminal Block Pin Mapping discussion for each switch card. |
|---|---|

## TERMINAL BLOCK RECEIVER

The EX1200-TBR chassis is a 1U receiver capable of housing six terminal blocks. The EX1200-TBR ships with rubber feet for table top installations, but may be fitted with rackmount ears for installation into a test rack (P/N: 70-0367-010).

To install a terminal block into the EX1200-TBR, insert the flanges on the side of the terminal block into the guide rails of the desired slot. Continue to push the terminal block into the receiver until it is sMUXred by the rear-locking latch of the receiver. To remove the terminal block from the EX1200-TBR, hold the center thumbscrew on the terminal block, then pull the terminal block from the receiver.

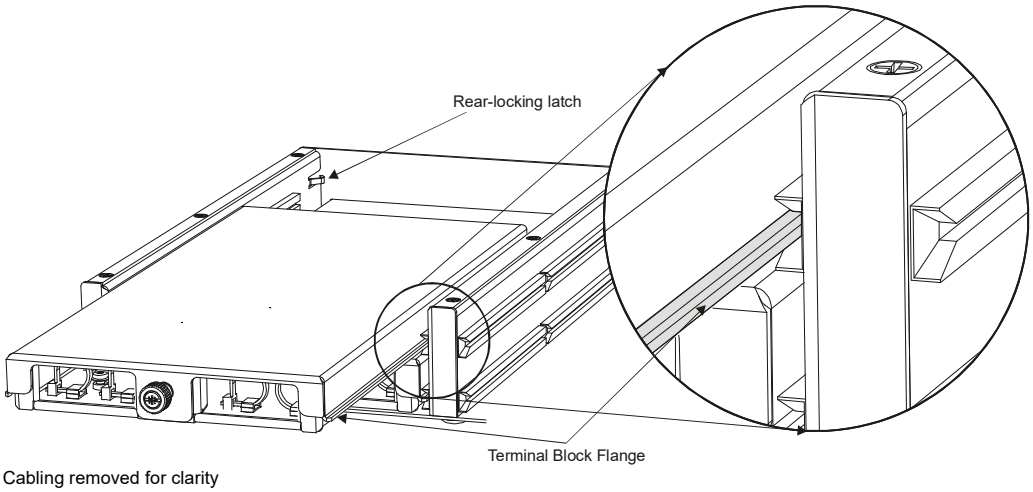



**FIGURE 3-3: TERMINAL BLOCK INSTALLATION INTO THE EX1200-TBR**

## PROGRAMMING OVERVIEW

To measure the thermistor temperature, first ensure that the P2 jumper has been configured properly (see *Jumper Configuration* for more detail). Next, a scan list is developed which scans CH1_1. In the following programming overview, a method for taking measurements using the on-board thermistor will be provided.

Two scenarios will be provided: one where only the thermistor temperature is measured and one where the RT1 is used as a reference junction and other channels make temperature measurements. In the first example, the user can only measure the thermistor temperature at CH1_1. In the second example, the user can measure the thermistor temperature at CH1_1 and can also measure temperature on another channel which uses the CH1_1 as a reference junction.

Note that, in these examples, it is assumed that the EX1200 DMM is being used and that the P2 jumper has been configured appropriately.

### *Measure Thermistor Temperature*

Either the VTEXScanner driver or the scanner soft front panel can be used to perform this sequence.

1) Set the DMM to measure temperature using the thermistor.
   a. Set the DMM function to **Temperature**.
   b. Set the transducer type to **Thermistor**.
   c. Set the thermistor resistance to **10000** (the thermistor is 10 kΩ).

2) Save and provide a name for the DMM configuration for the scanning purposes (here, **TEMP** is used).
3) Setup the scanlist
   a. Add a scan step with a sweep phase that scans CH1_1 using the previously saved configuration (e.g. CH1_1=**TEMP**)
   b. The setup phase can be ignored for this example.
4) Initiate & Read
   a. Initiate the scan
   b. Read back the data

***Use Thermistor as a Reference Junction***

1) Set the DMM to measure temperature using the thermistor.
   a. Set the DMM function to **Temperature**.
   b. Set the transducer type to **Thermistor**.
   c. Set the thermistor resistance to **10000** (the thermistor is 10 kΩ).
   d. Set the **isReferenceJunction** parameter to **True**.
2) Save and provide a name for the DMM configuration for the scanning purposes.
3) Set the DMM to measure temperature using a Type K thermocouple (any thermocouple type can be selected here, but Type K below).
   a. Set the DMM function to **Temperature**.
   b. Set the transducer type to **Thermocouple**.
   c. Set the thermocouple type to **Type K**.
   d. Set the reference type to **External**.
   e. Set the **isReferenceJunction** parameter to **False**.
4) Save and provide a name for the DMM configuration for the scanning purposes.
5) Setup the scanlist
   a. Add a scan step with a sweep phase that scans CH1_1 using the first saved configuration. (e.g. CH1_1=**RefJunction**).
   b. Add another scan step with a sweep phase that scans another channel (e.g. CH1_2=**TEMP**).
   c. The setup phase can be ignored for this example.
6) Initiate & Read
   a. Initiate the scan
   b. Read back the data

# SECTION 4

# EX1200-2001 PLUG-IN MODULE

## 20-CHANNEL 16 AMP SPST SWITCH

The EX1200-2001 and EX1200-2002 are the only switch modules in their class with the ability to switch up to 16 A. Some applications include: ac line power switching, switching of dc or ac power supplies, control or driving relays for industrial machines (robotics, numerical control machines), automotive engine control, and solenoid switching.

Since these modules typically switch power to the UUT or interface, the digital input lines on the EX1200 series mainframes support the ability to force all relays automatically to their normally open state if a fault condition occurs. This approach instantly removes all power to the UUT or interface. These modules can be automatically configured in the setup phase at the beginning of each scan step to facilitate test sequencing and control.

The EX1200-2001 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 4-2 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

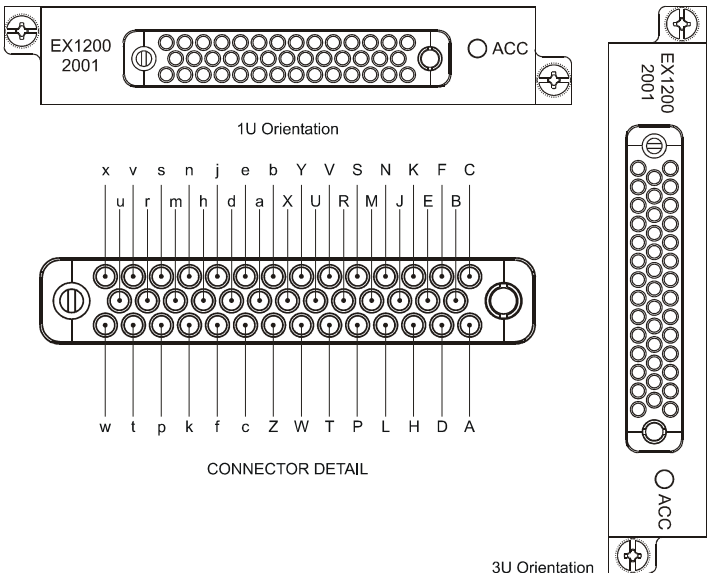



FIGURE 4-1: EX1200-2001 FRONT PANEL (FRONT VIEW)

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| **A** | CH_1NO | **Z** | CH_11COM |
| **B** | CH_1COM | **a** | CH_12NO |
| **C** | CH_2NO | **b** | CH_12COM |
| **D** | CH_2COM | **c** | CH_13NO |
| **E** | CH_3NO | **d** | CH_13COM |
| **F** | CH_3COM | **e** | CH_14NO |
| **H** | CH_4NO | **f** | CH_14COM |
| **J** | CH_4COM | **h** | CH_15NO |
| **K** | CH_5NO | **j** | CH_15COM |
| **L** | CH_5COM | **k** | CH_16NO |
| **M** | CH_6NO | **m** | CH_16COM |
| **N** | CH_6COM | **n** | CH_17NO |
| **P** | CH_7NO | **p** | CH_17COM |
| **R** | CH_7COM | **r** | CH_18NO |
| **S** | CH_8NO | **s** | CH_18COM |
| **T** | CH_8COM | **t** | CH_19NO |
| **U** | CH_9NO | **u** | CH_19COM |
| **V** | CH_9COM | **v** | CH_20NO |
| **W** | CH_10NO | **w** | CH_20COM |
| **X** | CH_10COM | **x** | SHIELD |
| **Y** | CH_11NO | | |

| | |
|---|---|
| **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 sMUXred to the chassis frame. |

**TABLE 4-1: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

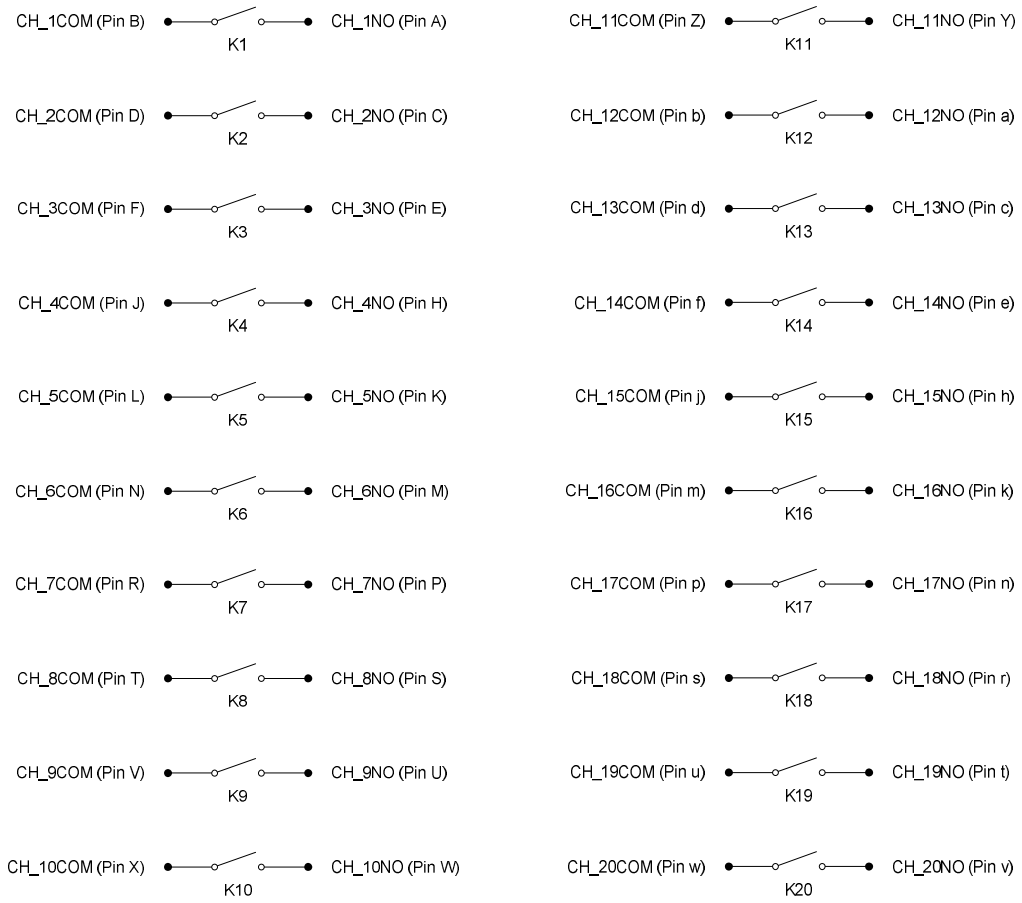



**FIGURE 4-2: EX1200-2001 LOGICAL DIAGRAM**

## EX1200-2001 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| CHANNEL COUNT | |
| | 20 SPST |
| RELAY TYPE | |
| | Electromechanical, fail-safe |
| MAXIMUM SWITCHING VOLTAGE | |
| | 250 V ac rms, 125 V dc |
| MAXIMUM SWITCHING CURRENT | |
| | 16 A |
| MAXIMUM SWITCHING POWER | |
| | 480 W dc, 2000 VA per channel (see the_Figure 4-3 for more information) |
| 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** | $5 \times 10^7$ |
| **Electrical** | $1 \times 10^5$ at full load |
| SWITCHING TIME | |
| | < 10 ms |
| PATH RESISTANCE | |
| | < 100 mΩ |
| INSULATION RESISTANCE | |
| | $>1x10^9$ Ω |
| MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO) | |
| | < 50 µV |
| CAPACITANCE | |
| **Open channel** | <20 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** | < -48 dB |
| **1 MHz** | < -33 dB |
| **10 MHz** | < -19 dB |

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

## RELAY BREAKING CAPACITY

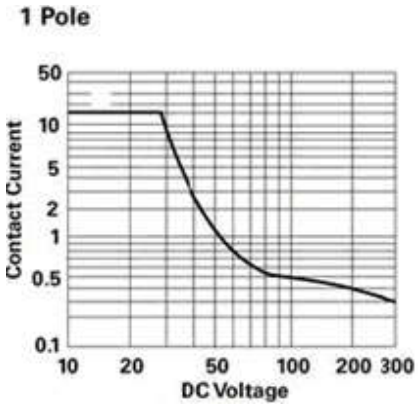



**FIGURE 4-3: RELAY BREAKING CAPACITY**

# EX1200-2002 PLUG-IN MODULE

## 12-CHANNEL 16 AMP FORM C (SPDT) SWITCH

The EX1200-2001 and EX1200-2002 are the only switch modules in their class with the ability to switch up to 16 A. Some applications include: ac line power switching, switching of dc or ac power supplies, control or driving relays for industrial machines (robotics, numerical control machines), automotive engine control, and solenoid switching.

Since these modules typically switch power to the UUT or interface, the digital input lines on the EX1200 series mainframes support the ability to force all relays automatically to their normally open state if a fault condition occurs. This approach instantly removes all power to the UUT or interface. These modules can be automatically configured in the setup phase at the beginning of each scan step to facilitate test sequencing and control.

The EX1200-2002 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 4-5 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

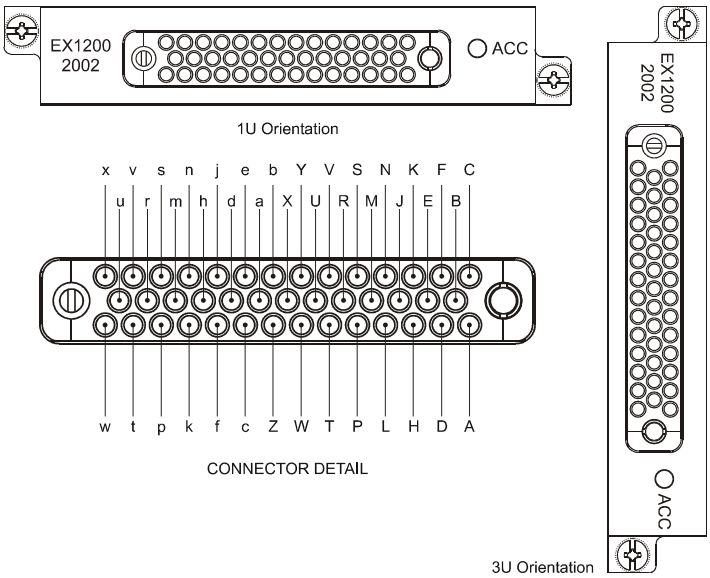



**FIGURE 4-4: EX1200-2002 FRONT PANEL (FRONT VIEW)**

| 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** | CH_11NO |
| **M** | CH_4COM | **m** | CH_11COM |
| **N** | CH_4NC | **n** | CH_11NC |
| **P** | CH_5NO | **p** | CH_12NO |
| **R** | CH_5COM | **r** | CH_12COM |
| **S** | CH_5NC | **s** | CH_12NC |
| **T** | CH_6NO | **t** | UNUSED |
| **U** | CH_6COM | **u** | UNUSED |
| **V** | CH_6NC | **v** | UNUSED |
| **W** | CH_7NO | **w** | UNUSED |
| **X** | CH_7COM | **x** | 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 sMUXred to the chassis frame.

**TABLE 4-2: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

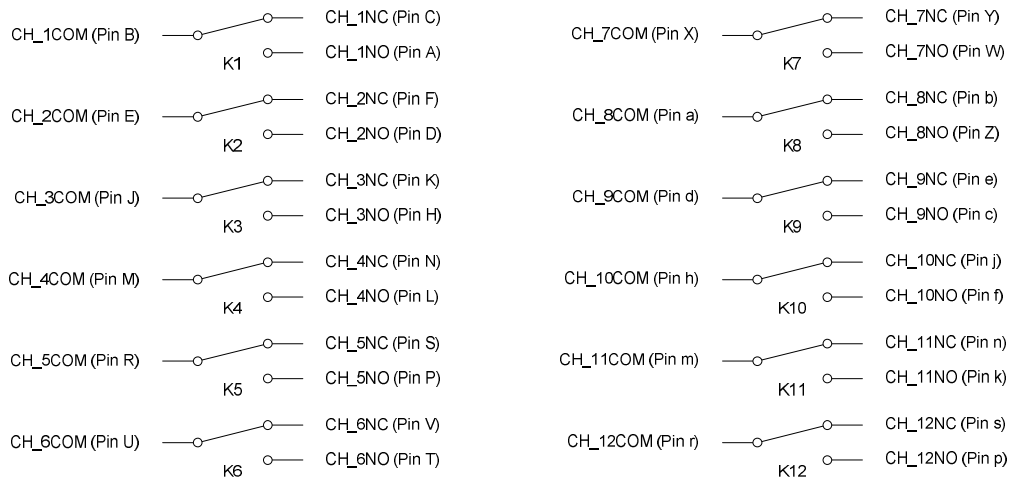



**FIGURE 4-5: EX1200-2002 LOGICAL DIAGRAM**

# EX1200-2002 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 12 SPDT |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 250 V ac rms, 125 V dc |
| **MAXIMUM SWITCHING CURRENT** | |
| | 16 A |
| **MAXIMUM SWITCHING POWER** | |
| | 480 W dc, 2000 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** | $5 \times 10^7$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | < 10 ms |
| **PATH RESISTANCE** | |
| | < 100 mΩ |
| **INSULATION RESISTANCE** | |
| | $>1x10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 50 µV |
| **CAPACITANCE** | |
| **Open channel** | <20 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** | <-48 dB |
| **1 MHz** | <-33 dB |
| **10 MHz** | <-19 dB |

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

# EX1200-2007A PLUG-IN MODULE

## 48-CHANNEL 1000 V MULTIPLEXER

The EX1200-2007A is designed for scanning multiple high-voltage points to a common bus in either 1- or 2- wire configurations. It consists of two individual (1 x 12) 2-wire multiplexers, or dual (1 x 24) 1-wire multiplexers that can be interconnected under program control (via bussing relays) to configure larger multiplexers as required. This reduces the need for external cabling and helps reduce unterminated stub effects.

When switching high voltages, the need for signal shielding becomes critical. The EX1200-2007A has been designed to include large shield planes that reduce crosstalk and voltage spikes to adjacent channels.

Up to 144 2-wire channels can be accommodated in a single EX1200 series mainframe for maximum density, or combined with other EX1200 series modules to create a flexible system switch.

## CONNECTOR PINS AND SIGNALS

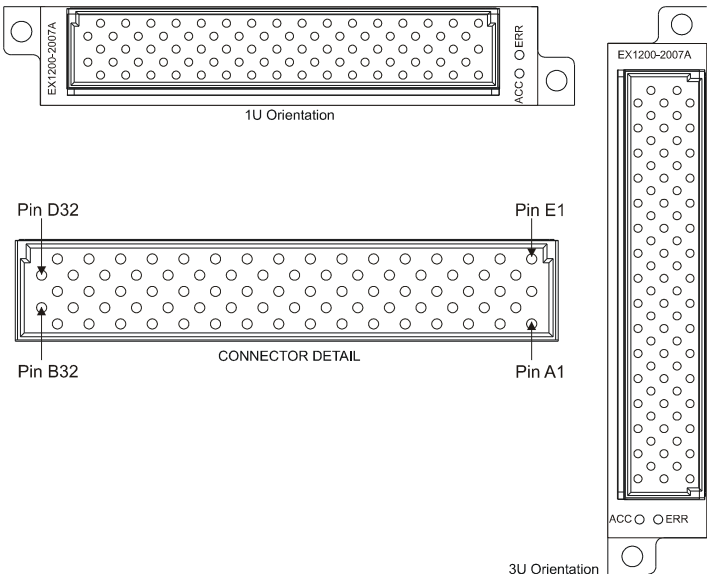



**FIGURE 4-6: EX1200-2007A FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | SHIELD | **2** | CH2_1L | **1** | CH2_1H | **2** | UNUSED | **1** | CH1_1W |
| **3** | SHIELD | **4** | CH2_2L | **3** | CH2_2H | **4** | CH1_COMH | **3** | CH1_COML |
| **5** | SHIELD | **6** | CH2_3L | **5** | CH2_3H | **6** | CH1_1H | **5** | CH1_1L |
| **7** | SHIELD | **8** | CH2_4L | **7** | CH2_4H | **8** | CH1_2H | **7** | CH1_2L |
| **9** | SHIELD | **10** | CH2_5H | **9** | CH2_5L | **10** | CH1_3H | **9** | CH1_3L |
| **11** | SHIELD | **12** | CH2_6H | **11** | CH2_6L | **12** | CH1_4H | **11** | CH1_4L |
| **13** | SHIELD | **14** | CH2_7H | **13** | CH2_7L | **14** | CH1_5H | **13** | CH1_5L |
| **15** | SHIELD | **16** | CH2_8H | **15** | CH2_8L | **16** | CH1_6H | **15** | CH1_6L |
| **17** | SHIELD | **18** | CH2_9H | **17** | CH2_9L | **18** | CH1_7H | **17** | CH1_7L |
| **19** | SHIELD | **20** | CH2_10H | **19** | CH2_10L | **20** | CH1_8H | **19** | CH1_8L |
| **21** | SHIELD | **22** | CH2_11H | **21** | CH2_11L | **22** | CH1_9H | **21** | CH1_9L |
| **23** | SHIELD | **24** | CH2_12H | **23** | CH2_12L | **24** | CH1_10L | **23** | CH1_10H |
| **25** | SHIELD | **26** | UNUSED | **25** | UNUSED | **26** | CH1_11L | **25** | CH1_11H |
| **27** | SHIELD | **28** | UNUSED | **27** | UNUSED | **28** | CH1_12L | **27** | CH1_12H |
| **29** | SHIELD | **30** | UNUSED | **29** | UNUSED | **30** | CH2_COMH | **29** | CH2_COML |
| **31** | SHIELD | **32** | GND_C | **31** | UNUSED | **32** | UNUSED | **31** | CH2_1W |

**TABLE 4-3: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

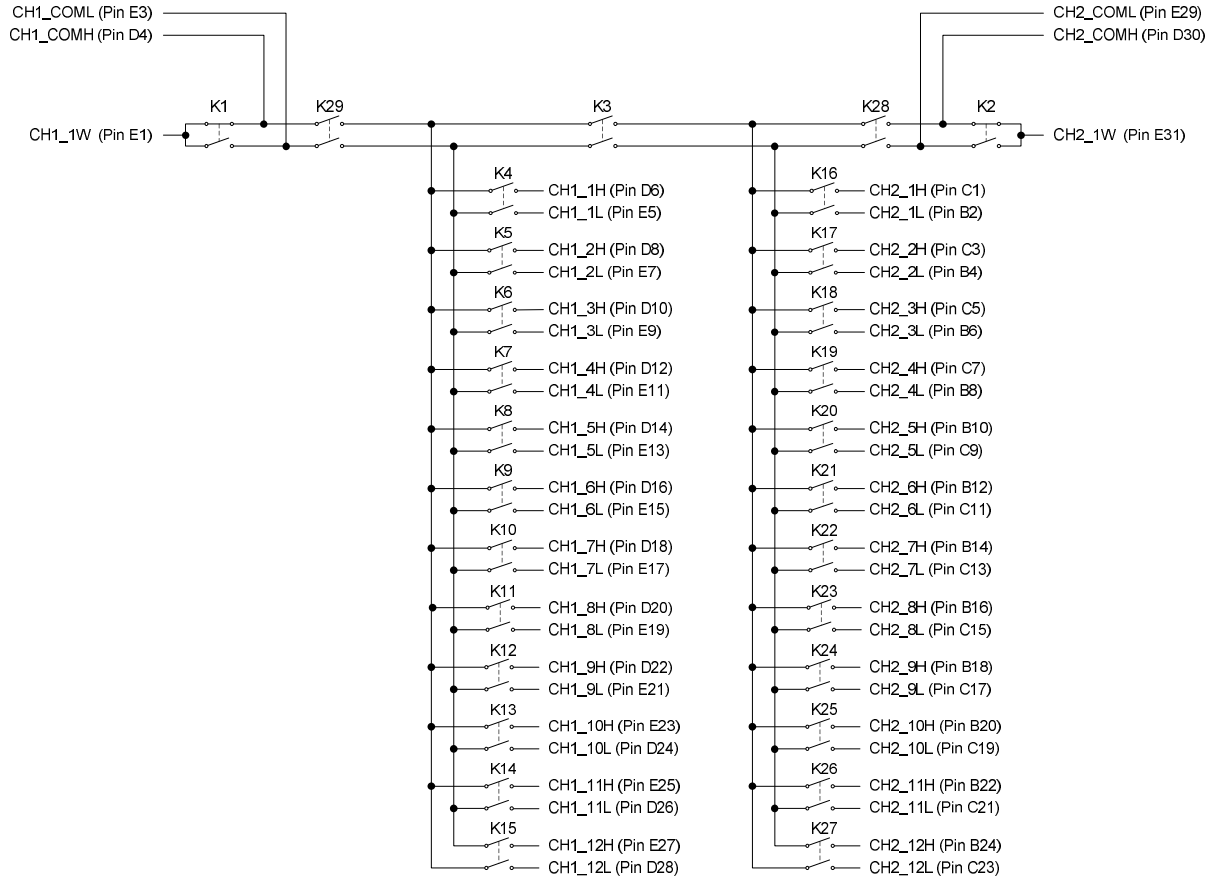



**FIGURE 4-7: EX1200-2007A LOGICAL DIAGRAM**

# EX1200-2007A SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | (1 x 24) 2-wire, dual (1 x 12) 2-wire, or dual (1 x 24) 1-wire |
| **RELAY TYPE** | |
| | Reed |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 1000 V dc / 700 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 1 A |
| **MAXIMUM CARRY CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 25 W (resistive load) |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ |
| **Electrical** | $1 \times 10^6$ (full load) |
| **SWITCHING TIME** | |
| | < 1 ms |
| **PATH RESISTANCE** | |
| | < 1 Ω |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^7$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 65 MHz (typical) |

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

**Application Note**
The EX1200-2007A is intended to be used as a multiplexer only and not as a splitter (i.e. split a single input signal into multiple paths). Use of the EX1200-2007A as a splitter may cause damage to its circuitry.

# EX1200-2008H PLUG-IN MODULE

## 30-CHANNEL 3 (1 X 10) HIGH-VOLTAGE MULTIPLEXER

The EX1200-2008H high-voltage, 1 A single-pole, single-throw relay multiplexer with three banks containing ten channels each. All relays are independently controllable. It is the highest density module in its class capable of switching signals to 1000 V. The EX1200-2008 can be mixed and matched with other EX1200 series plug-in modules in a single mainframe to construct a flexible mixed-signal switching subsystem.

The EX1200-2008H has been designed for applications requiring high-voltage signal switching. When switching high voltages, the need for signal shielding becomes critical. This module has been designed to include large shield planes to reduce crosstalk and voltage spikes to adjacent channels.

## CONNECTOR PINS AND SIGNALS

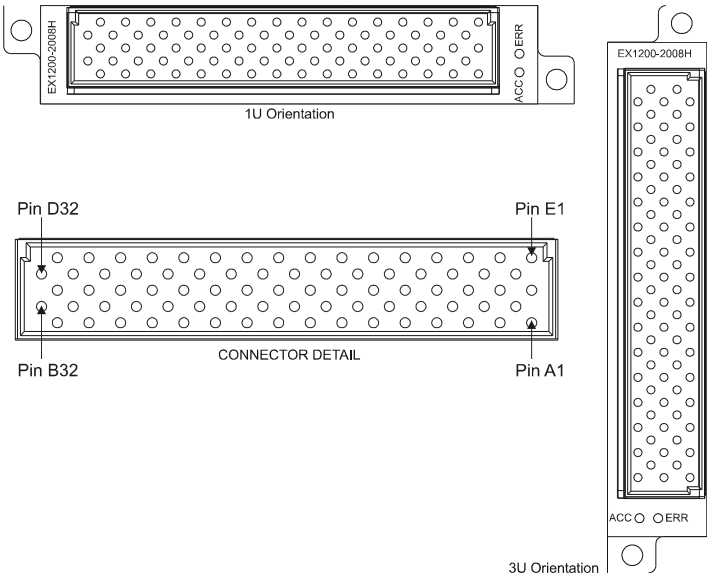



**FIGURE 4-8: EX1200-2008H FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | SHIELD | **2** | CH1_1 | **1** | CH1_2 | **2** | UNUSED | **1** | CH1_COM |
| **3** | SHIELD | **4** | CH1_3 | **3** | CH1_4 | **4** | UNUSED | **3** | SHIELD |
| **5** | SHIELD | **6** | CH1_5 | **5** | CH1_6 | **6** | UNUSED | **5** | SHIELD |
| **7** | SHIELD | **8** | CH1_7 | **7** | CH1_8 | **8** | UNUSED | **7** | SHIELD |
| **9** | SHIELD | **10** | CH1_9 | **9** | CH1_10 | **10** | UNUSED | **9** | SHIELD |
| **11** | SHIELD | **12** | CH2_1 | **11** | CH2_2 | **12** | UNUSED | **11** | CH2_COM |
| **13** | SHIELD | **14** | CH2_3 | **13** | CH2_4 | **14** | UNUSED | **13** | SHIELD |
| **15** | SHIELD | **16** | CH2_5 | **15** | CH2_6 | **16** | UNUSED | **15** | SHIELD |
| **17** | SHIELD | **18** | CH2_7 | **17** | CH2_8 | **18** | UNUSED | **17** | SHIELD |
| **19** | SHIELD | **20** | CH2_9 | **19** | CH2_10 | **20** | UNUSED | **19** | SHIELD |
| **21** | SHIELD | **22** | UNUSED | **21** | UNUSED | **22** | UNUSED | **21** | SHIELD |
| **23** | SHIELD | **24** | CH3_1 | **23** | CH3_2 | **24** | UNUSED | **23** | CH3_COM |
| **25** | SHIELD | **26** | CH3_3 | **25** | CH3_4 | **26** | UNUSED | **25** | SHIELD |
| **27** | SHIELD | **28** | CH3_5 | **27** | CH3_6 | **28** | UNUSED | **27** | SHIELD |
| **29** | FP_OPEN | **30** | CH3_7 | **29** | CH3_8 | **30** | UNUSED | **29** | SHIELD |
| **31** | FP_GND | **32** | CH3_9 | **31** | CH3_10 | **32** | UNUSED | **31** | SHIELD |

**TABLE 4-4: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

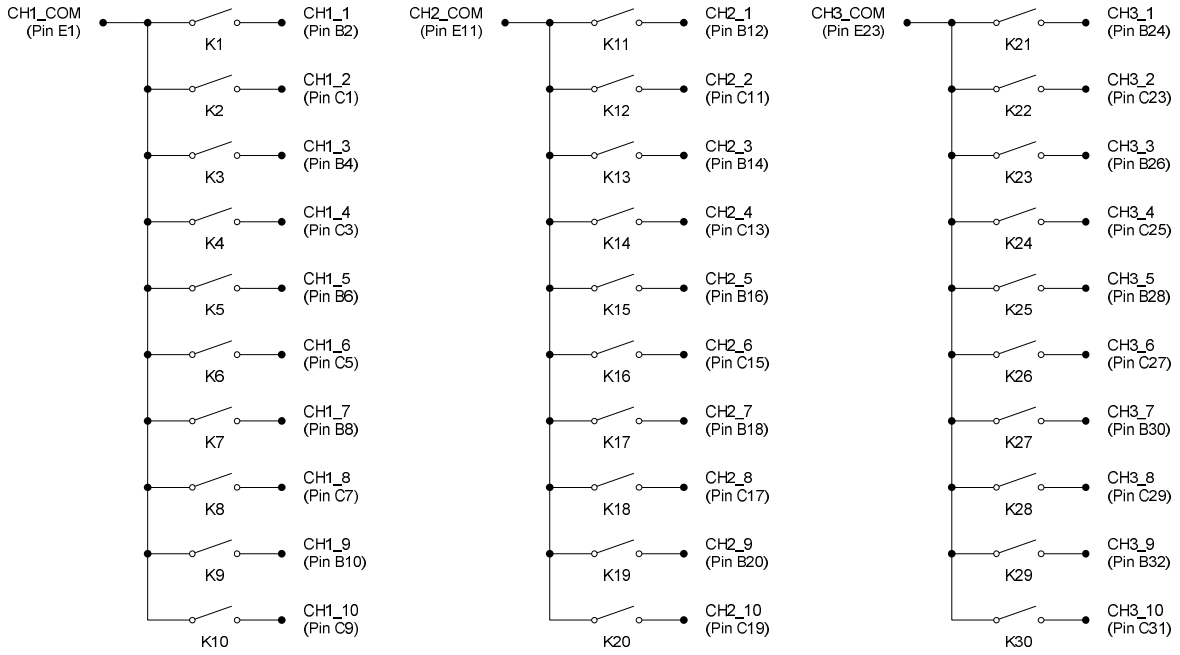



**FIGURE 4-9: EX1200-2008H LOGICAL DIAGRAM**

# EX1200-2008H SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Three (1 x 10) single-wire channels |
| **RELAY TYPE** | |
| | High-voltage reed relays |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 1000 V dc |
| **MAXIMUM SWITCHING CURRENT** | |
| | 1 A |
| **MAXIMUM CARRY CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 25 W dc (resistive load) |
| **MINIMUM CONTACT RATING*** | |
| | 5 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** | $100 \times 10^6$ |
| **Electrical** | $1 \times 10^6$ (full load) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 0.5 Ω |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^7$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 55 MHz (typical) |

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

# EX1200-3001 PLUG-IN MODULE

## 1 X 64 2-WIRE MULTIPLEXER

The EX1200-3001 high-density multiplexer module is designed for scanning of multiple points to a common bus, in either 1-, 2-, or 4-wire configurations, either synchronously with the EX1200 system DMM scan function, or asynchronously as a system switch to other devices through LXI LAN messages or the hardware trigger bus. Up to 384 two-wire (or 192 four-wire) channels can be accommodated in a 1U EX1200 mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Applications include cable harness testing, semiconductor and PCB testing, and applications where multiple points need to be switched to a common resource. All relays also have individual relay control, and each path allows for 2 A switching.

The EX1200-3001 consists of eight individual (1 x 8) 2-wire multiplexers, or eight (1 x 16) 1-wire multiplexers that can be interconnected under program control (via the bussing relays) to configure larger multiplexers as required. This eliminates external wiring and helps reduce unterminated stubs. The card has internal relays that can be closed to connect directly to the EX1200 analog bus. This feature allows the card and the internal EX1200 DMM to be tightly coupled, dramatically reducing test execution times. Access to the DMM also allows 4-wire measurements to be made, providing more accurate resistance measurements that compensate for lead-length.

The EX1200-3001 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 4-11 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. An optional terminal block provides screw termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

## CONNECTOR PINS AND SIGNALS

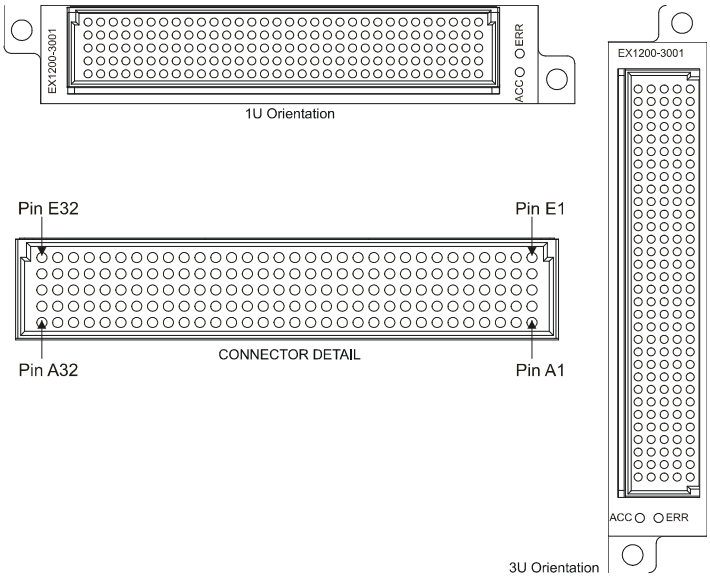



**FIGURE 4-10: EX1200-3001 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH1_1W | **1** | CH1_COMH | **1** | CH1_1H | **1** | CH1_2H | **1** | CH1_3H |
| **2** | SHIELD | **2** | CH1_COML | **2** | CH1_1L | **2** | CH1_2L | **2** | CH1_3L |
| **3** | CH1_4H | **3** | CH1_5H | **3** | CH1_6H | **3** | CH1_7H | **3** | CH1_8H |
| **4** | CH1_4L | **4** | CH1_5L | **4** | CH1_6L | **4** | CH1_7L | **4** | CH1_8L |
| **5** | CH2_1W | **5** | CH2_COMH | **5** | CH2_1H | **5** | CH2_2H | **5** | CH2_3H |
| **6** | SHIELD | **6** | CH2_COML | **6** | CH2_1L | **6** | CH2_2L | **6** | CH2_3L |
| **7** | CH2_4H | **7** | CH2_5H | **7** | CH2_6H | **7** | CH2_7H | **7** | CH2_8H |
| **8** | CH2_4L | **8** | CH2_5L | **8** | CH2_6L | **8** | CH2_7L | **8** | CH2_8L |
| **9** | CH3_1W | **9** | CH3_COMH | **9** | CH3_1H | **9** | CH3_2H | **9** | CH3_3H |
| **10** | SHIELD | **10** | CH3_COML | **10** | CH3_1L | **10** | CH3_2L | **10** | CH3_3L |
| **11** | CH3_4H | **11** | CH3_5H | **11** | CH3_6H | **11** | CH3_7H | **11** | CH3_8H |
| **12** | CH3_4L | **12** | CH3_5L | **12** | CH3_6L | **12** | CH3_7L | **12** | CH3_8L |
| **13** | CH4_1W | **13** | CH4_COMH | **13** | CH4_1H | **13** | CH4_2H | **13** | CH4_3H |
| **14** | SHIELD | **14** | CH4_COML | **14** | CH4_1L | **14** | CH4_2L | **14** | CH4_3L |
| **15** | CH4_4H | **15** | CH4_5H | **15** | CH4_6H | **15** | CH4_7H | **15** | CH4_8H |
| **16** | CH4_4L | **16** | CH4_5L | **16** | CH4_6L | **16** | CH4_7L | **16** | CH4_8L |
| **17** | CH5_1W | **17** | CH5_COMH | **17** | CH5_1H | **17** | CH5_2H | **17** | CH5_3H |
| **18** | SHIELD | **18** | CH5_COML | **18** | CH5_1L | **18** | CH5_2L | **18** | CH5_3L |
| **19** | CH5_4H | **19** | CH5_5H | **19** | CH5_6H | **19** | CH5_7H | **19** | CH5_8H |
| **20** | CH5_4L | **20** | CH5_5L | **20** | CH5_6L | **20** | CH5_7L | **20** | CH5_8L |
| **21** | CH6_1W | **21** | CH6_COMH | **21** | CH6_1H | **21** | CH6_2H | **21** | CH6_3H |
| **22** | SHIELD | **22** | CH6_COML | **22** | CH6_1L | **22** | CH6_2L | **22** | CH6_3L |
| **23** | CH6_4H | **23** | CH6_5H | **23** | CH6_6H | **23** | CH6_7H | **23** | CH6_8H |
| **24** | CH6_4L | **24** | CH6_5L | **24** | CH6_6L | **24** | CH6_7L | **24** | CH6_8L |
| **25** | CH7_1W | **25** | CH7_COMH | **25** | CH7_1H | **25** | CH7_2H | **25** | CH7_3H |
| **26** | CH7_4H | **26** | CH7_COML | **26** | CH7_1L | **26** | CH7_2L | **26** | CH7_3L |
| **27** | CH7_4L | **27** | CH7_5H | **27** | CH7_6H | **27** | CH7_7H | **27** | CH7_8H |
| **28** | CH8_1W | **28** | CH7_5L | **28** | CH7_6L | **28** | CH7_7L | **28** | CH7_8L |
| **29** | CH8_COMH | **29** | CH8_1H | **29** | CH8_2H | **29** | CH8_3H | **29** | CH8_4H |
| **30** | CH8_COML | **30** | CH8_1L | **30** | CH8_2L | **30** | CH8_3L | **30** | CH8_4L |
| **31** | CH8_5H | **31** | CH8_6H | **31** | CH8_7H | **31** | CH8_8H | **31** | SHIELD |
| **32** | CH8_5L | **32** | CH8_6L | **32** | CH8_7L | **32** | CH8_8L | **32** | UNUSED |

**TABLE 4-5: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-3001 incorporates 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. These pins are identified as "SHIELD" in Table 4-5.

## LOGICAL DIAGRAM

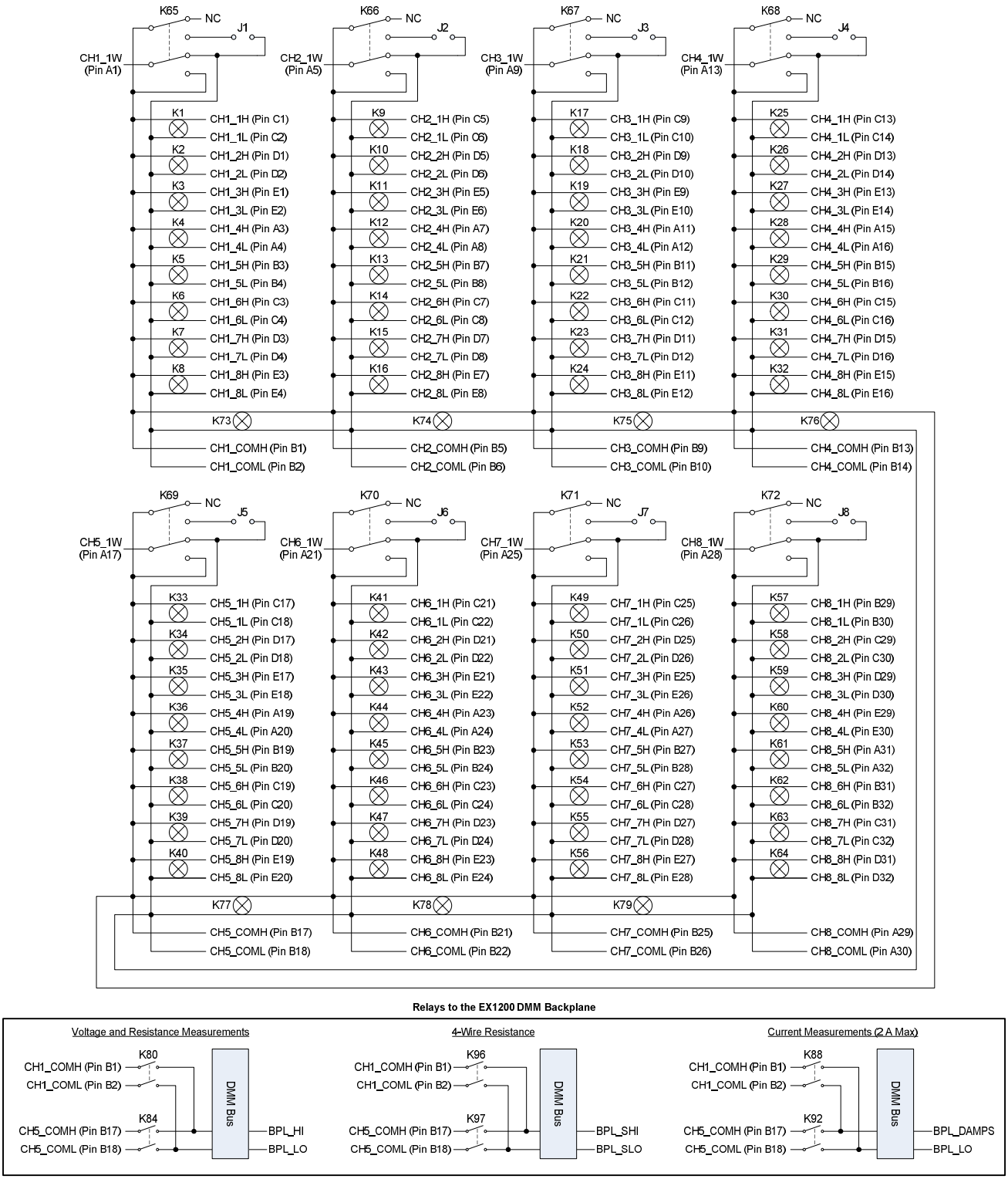



**FIGURE 4-11: EX1200-3001 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH1_7L | D4 | T41 | CH7_7L | D28 | T81 | CH7_5L | B28 | T121 | CH6_1W | A21 |
| T2 | CH1_7H | D3 | T42 | CH7_7H | D27 | T82 | CH7_5H | B27 | T122 | SHIELD | A22 |
| T3 | CH2_2L | D6 | T43 | CH7_2L | D26 | T83 | CH8_1L | B30 | T123 | CH5_4H | A19 |
| T4 | CH2_2H | D5 | T44 | CH7_2H | D25 | T84 | CH8_1H | B29 | T124 | CH5_4L | A20 |
| T5 | CH2_7L | D8 | T45 | CH6_7L | D24 | T85 | CH8_6L | B32 | T125 | CH5_1W | A17 |
| T6 | CH2_7H | D7 | T46 | CH6_7H | D23 | T86 | CH8_6H | B31 | T126 | SHIELD | A18 |
| T7 | CH3_2L | D10 | T47 | CH6_2L | D22 | T87 | CH1_1L | C2 | T127 | CH4_4H | A15 |
| T8 | CH3_2H | D9 | T48 | CH6_2H | D21 | T88 | CH1_1H | C1 | T128 | CH4_4L | A16 |
| T9 | CH3_7L | D12 | T49 | CH5_5L | B20 | T89 | CH1_6L | C4 | T129 | CH7_8L | E28 |
| T10 | CH3_7H | D11 | T50 | CH5_5H | B19 | T90 | CH1_6H | C3 | T130 | CH7_8H | E27 |
| T11 | CH4_2L | D14 | T51 | CH1_1W | A1 | T91 | CH2_1L | C6 | T131 | CH7_3L | E26 |
| T12 | CH4_2H | D13 | T52 | SHIELD | A2 | T92 | CH2_1H | C5 | T132 | CH7_3H | E25 |
| T13 | CH4_7L | D16 | T53 | CH1_4H | A3 | T93 | CH2_6L | C8 | T133 | CH8_4L | E30 |
| T14 | CH4_7H | D15 | T54 | CH1_4L | A4 | T94 | CH2_6H | C7 | T134 | CH8_4H | E29 |
| T15 | CH5_2L | D18 | T55 | CH2_1W | A5 | T95 | CH3_1L | C10 | T135 | CH7_6L | C28 |
| T16 | CH5_2H | D17 | T56 | SHIELD | A6 | T96 | CH3_1H | C9 | T136 | CH7_6H | C27 |
| T17 | CH2_COML | B6 | T57 | CH2_4H | A7 | T97 | CH5_8L | E20 | T137 | CH8_2L | C30 |
| T18 | CH2_COMH | B5 | T58 | CH2_4L | A8 | T98 | CH5_8H | E19 | T138 | CH8_2H | C29 |
| T19 | CH1_5L | B4 | T59 | CH7_COML | B26 | T99 | CH4_8L | E16 | T139 | CH7_1H | C25 |
| T20 | CH1_5H | B3 | T60 | CH7_COMH | B25 | T100 | CH4_8H | E15 | T140 | CH7_1L | C26 |
| T21 | CH2_5L | B8 | T61 | CH6_5L | B24 | T101 | CH6_3L | E22 | T141 | CH6_6H | C23 |
| T22 | CH2_5H | B7 | T62 | CH6_5H | B23 | T102 | CH6_3H | E21 | T142 | CH6_6L | C24 |
| T23 | CH3_COML | B10 | T63 | CH6_COML | B22 | T103 | CH6_8L | E24 | T143 | CH5_1L | C18 |
| T24 | CH3_COMH | B9 | T64 | CH6_COMH | B21 | T104 | CH6_8H | E23 | T144 | CH5_1H | C17 |
| T25 | CH3_5L | B12 | T65 | CH8_3L | D30 | T105 | CH4_3L | E14 | T145 | CH6_1H | C21 |
| T26 | CH3_5H | B11 | T66 | CH8_3H | D29 | T106 | CH4_3H | E13 | T146 | CH6_1L | C22 |
| T27 | CH4_COML | B14 | T67 | CH8_8L | D32 | T107 | CH3_8L | E12 | T147 | CH5_6H | C19 |
| T28 | CH4_COMH | B13 | T68 | CH8_8H | D31 | T108 | CH3_8H | E11 | T148 | CH5_6L | C20 |
| T29 | CH4_5L | B16 | T69 | CH1_3L | E2 | T109 | CH3_3L | E10 | T149 | CH7_1W | A25 |
| T30 | CH4_5H | B15 | T70 | CH1_3H | E1 | T110 | CH3_3H | E9 | T150 | CH8_1W | A28 |
| T31 | CH5_COML | B18 | T71 | CH1_8L | E4 | T111 | CH2_8L | E8 | T151 | CH7_4H | A26 |
| T32 | CH5_COMH | B17 | T72 | CH1_8H | E3 | T112 | CH2_8H | E7 | T152 | CH7_4L | A27 |
| T33 | CH5_7L | D20 | T73 | CH2_3L | E6 | T113 | CH3_6L | C12 | T153 | CH8_COMH | A29 |
| T34 | CH5_7H | D19 | T74 | CH2_3H | E5 | T114 | CH3_6H | C11 | T154 | CH8_COML | A30 |
| T35 | CH3_1W | A9 | T75 | CH5_3H | E17 | T115 | CH4_1L | C14 | T155 | SHIELD | E31 |
| T36 | SHIELD | A10 | T76 | CH5_3L | E18 | T116 | CH4_1H | C13 | T156 | GND_C | E32 |
| T37 | CH3_4H | A11 | T77 | CH1_2L | D2 | T117 | CH4_6L | C16 | T157 | CH8_7H | C31 |
| T38 | CH3_4L | A12 | T78 | CH1_2H | D1 | T118 | CH4_6H | C15 | T158 | CH8_7L | C32 |
| T39 | CH4_1W | A13 | T79 | CH1_COML | B2 | T119 | CH6_4H | A23 | T159 | CH8_5H | A31 |
| T40 | SHIELD | A14 | T80 | CH1_COMH | B1 | T120 | CH6_4L | A24 | T160 | CH8_5L | A32 |

**TABLE 4-6: EX1200-TB160-3 TERMINAL BLOCK TO EX1200-3001 PIN MAPPING**

RT1 can be measured by the EX1200 DMM or may be measured using an external instrument. To use an external instrument, connect it to T164 (L_VS) and T163 (H_VS). To use a sensor other than the onboard thermistor, connect it using T162 (RL_I) and T161 (RH_I). Note that CH1_7L (T1) and CH1_7H (T2) must be dedicated to making temperature measurements once P2 is configured.

# EX1200-3001 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Eight individual (1 x 8) 2-wire or eight (1 x 16) 1-wire |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 300 V ac rms, 300 V dc |
| **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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 0.5 Ω |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ 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)** | |
| | 50 MHz (typical) |
| **INSERTION LOSS** | |
| **100 kHz** | < 0.1 dB |
| **1 MHz** | < 0.2 dB |
| **10 MHz** | < 0.5 dB |
| **CROSSTALK** | |
| **100 kHz** | < -90 dB |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -50 dB |
| **ISOLATION** | |
| **100 kHz** | < -90 dB |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -60 dB |

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

# EX1200-3001DS PLUG-IN MODULE

## 1 X 64 2-WIRE MULTIPLEXER WITH DISCHARGE CIRCUIT

The EX1200-3001DS high-density multiplexer module is designed for scanning of multiple points to a common bus, in either 1-, 2-, or 4-wire configurations, either synchronously with the EX1200 system DMM scan function, or asynchronously as a system switch to other devices through LXI LAN messages or the hardware trigger bus. Up to 384 two-wire (or 192 four-wire) channels can be accommodated in a 1U EX1200 mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Applications include cable harness testing, semiconductor and PCB testing, and applications where multiple points need to be switched to a common resource. All relays also have individual relay control, and each path allows for 2 A switching.

Along with all having all the features of the EX1200-3001, the EX1200-3001DS has 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. These relays protect 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 EX1200-3001DS 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 4-13 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. An optional terminal block provides screw termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

## CONNECTOR PINS AND SIGNALS

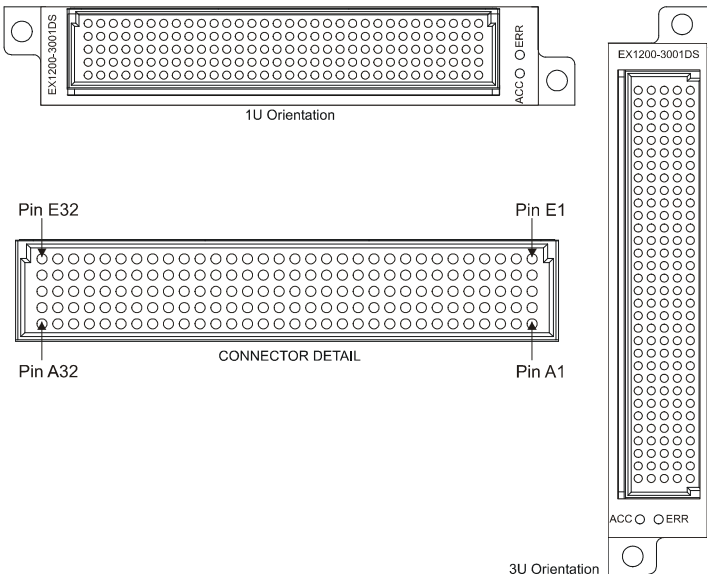



**FIGURE 4-12: EX1200-3001DS FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH1_1W | **1** | CH1_COMH | **1** | CH1_1H | **1** | CH1_2H | **1** | CH1_3H |
| **2** | SHIELD | **2** | CH1_COML | **2** | CH1_1L | **2** | CH1_2L | **2** | CH1_3L |
| **3** | CH1_4H | **3** | CH1_5H | **3** | CH1_6H | **3** | CH1_7H | **3** | CH1_8H |
| **4** | CH1_4L | **4** | CH1_5L | **4** | CH1_6L | **4** | CH1_7L | **4** | CH1_8L |
| **5** | CH2_1W | **5** | CH2_COMH | **5** | CH2_1H | **5** | CH2_2H | **5** | CH2_3H |
| **6** | SHIELD | **6** | CH2_COML | **6** | CH2_1L | **6** | CH2_2L | **6** | CH2_3L |
| **7** | CH2_4H | **7** | CH2_5H | **7** | CH2_6H | **7** | CH2_7H | **7** | CH2_8H |
| **8** | CH2_4L | **8** | CH2_5L | **8** | CH2_6L | **8** | CH2_7L | **8** | CH2_8L |
| **9** | CH3_1W | **9** | CH3_COMH | **9** | CH3_1H | **9** | CH3_2H | **9** | CH3_3H |
| **10** | SHIELD | **10** | CH3_COML | **10** | CH3_1L | **10** | CH3_2L | **10** | CH3_3L |
| **11** | CH3_4H | **11** | CH3_5H | **11** | CH3_6H | **11** | CH3_7H | **11** | CH3_8H |
| **12** | CH3_4L | **12** | CH3_5L | **12** | CH3_6L | **12** | CH3_7L | **12** | CH3_8L |
| **13** | CH4_1W | **13** | CH4_COMH | **13** | CH4_1H | **13** | CH4_2H | **13** | CH4_3H |
| **14** | SHIELD | **14** | CH4_COML | **14** | CH4_1L | **14** | CH4_2L | **14** | CH4_3L |
| **15** | CH4_4H | **15** | CH4_5H | **15** | CH4_6H | **15** | CH4_7H | **15** | CH4_8H |
| **16** | CH4_4L | **16** | CH4_5L | **16** | CH4_6L | **16** | CH4_7L | **16** | CH4_8L |
| **17** | CH5_1W | **17** | CH5_COMH | **17** | CH5_1H | **17** | CH5_2H | **17** | CH5_3H |
| **18** | SHIELD | **18** | CH5_COML | **18** | CH5_1L | **18** | CH5_2L | **18** | CH5_3L |
| **19** | CH5_4H | **19** | CH5_5H | **19** | CH5_6H | **19** | CH5_7H | **19** | CH5_8H |
| **20** | CH5_4L | **20** | CH5_5L | **20** | CH5_6L | **20** | CH5_7L | **20** | CH5_8L |
| **21** | CH6_1W | **21** | CH6_COMH | **21** | CH6_1H | **21** | CH6_2H | **21** | CH6_3H |
| **22** | SHIELD | **22** | CH6_COML | **22** | CH6_1L | **22** | CH6_2L | **22** | CH6_3L |
| **23** | CH6_4H | **23** | CH6_5H | **23** | CH6_6H | **23** | CH6_7H | **23** | CH6_8H |
| **24** | CH6_4L | **24** | CH6_5L | **24** | CH6_6L | **24** | CH6_7L | **24** | CH6_8L |
| **25** | CH7_1W | **25** | CH7_COMH | **25** | CH7_1H | **25** | CH7_2H | **25** | CH7_3H |
| **26** | CH7_4H | **26** | CH7_COML | **26** | CH7_1L | **26** | CH7_2L | **26** | CH7_3L |
| **27** | CH7_4L | **27** | CH7_5H | **27** | CH7_6H | **27** | CH7_7H | **27** | CH7_8H |
| **28** | CH8_1W | **28** | CH7_5L | **28** | CH7_6L | **28** | CH7_7L | **28** | CH7_8L |
| **29** | CH8_COMH | **29** | CH8_1H | **29** | CH8_2H | **29** | CH8_3H | **29** | CH8_4H |
| **30** | CH8_COML | **30** | CH8_1L | **30** | CH8_2L | **30** | CH8_3L | **30** | CH8_4L |
| **31** | CH8_5H | **31** | CH8_6H | **31** | CH8_7H | **31** | CH8_8H | **31** | SHIELD |
| **32** | CH8_5L | **32** | CH8_6L | **32** | CH8_7L | **32** | CH8_8L | **32** | UNUSED |

**TABLE 4-7: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-3001DS incorporates 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. These pins are identified as "SHIELD" in Table 4-7.

## LOGICAL DIAGRAM

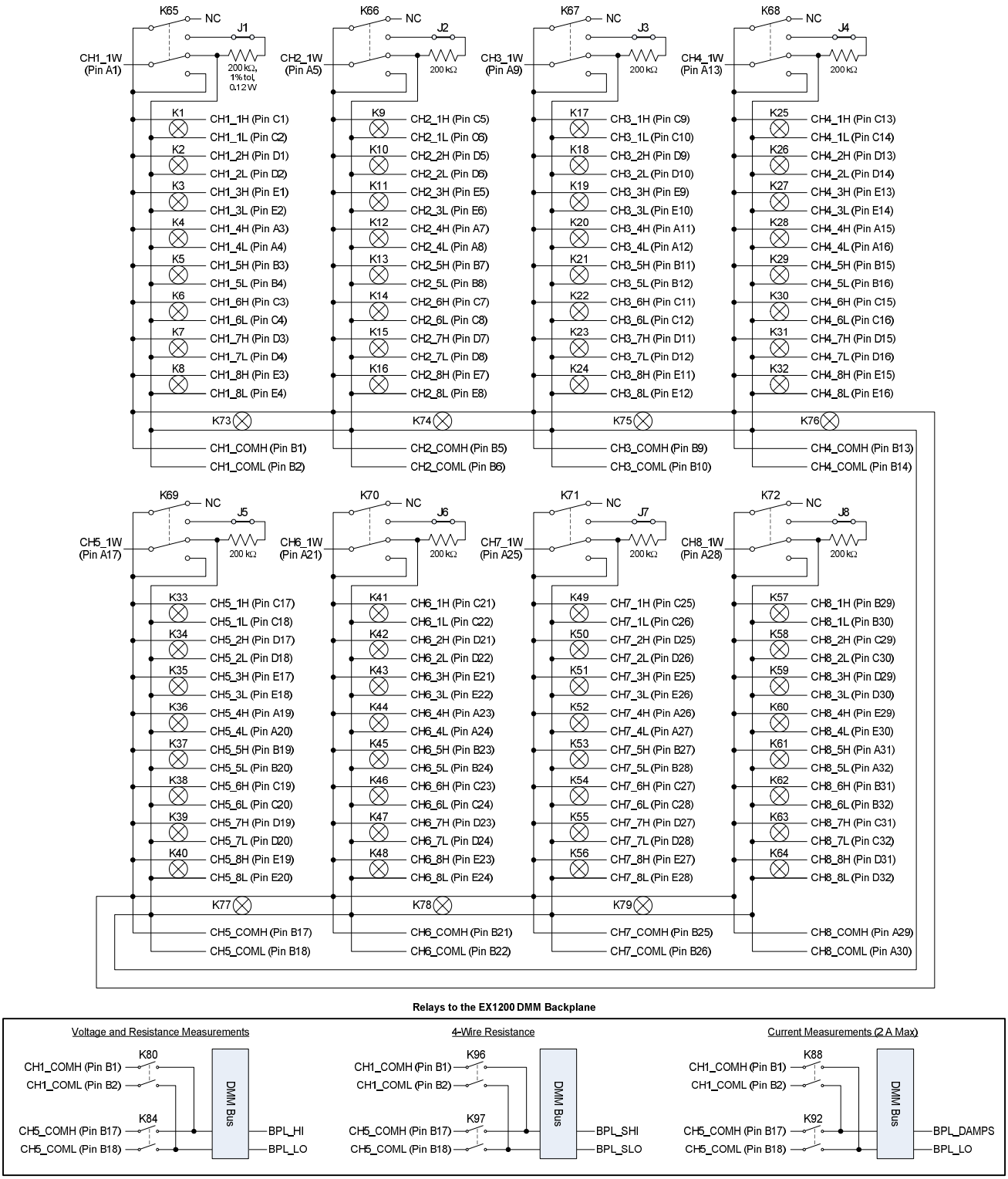



**FIGURE 4-13: EX1200-3001DS LOGICAL DIAGRAM**

# EX1200-3001DS SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Eight individual (1 x 8) 2-wire or eight (1 x 16) 1-wire |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 300 V ac rms, 300V dc |
| **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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 0.5 Ω |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ 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)** | |
| | 50 MHz (typical) |
| **INSERTION LOSS** | |
| **100 kHz** | < 0.1 dB |
| **1 MHz** | < 0.2 dB |
| **10 MHz** | < 0.5 dB |
| **CROSSTALK** | |
| **100 kHz** | < -90 dB |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -50 dB |
| **ISOLATION** | |
| **100 kHz** | < -90 dB |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -60 dB |

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

# EX1200-3048 PLUG-IN MODULE

## 48-CHANNEL 300 V/ 2 A MULTIPLEXER

EX1200-3048 high-density multiplexer modules are designed for scanning multiple points to a common bus in either 2- or 4-wire configurations, either synchronously, with the EX1200 system DMM scan function, or asynchronously, as a system switch to other devices through LXI LAN messages or the hardware trigger bus. Up to 288 two-wire (or 144 four-wire) channels can be accommodated in a 1U EX1200 mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Applications include cable harness testing, semiconductor and PCB testing, and in applications where multiple points need to be switched to a common resource. All relays have individual control and each path allows for hot switching of up to 300 V and 2 A (60 W dc max). The EX1200-3048 also has the capability to directly measure up to 2 A.

The EX1200-3048 consists of dual (1 x 24) 2-wire multiplexer banks. Each bank can be interconnected within a module under program control (via bussing relays) and across modules via the EX1200 analog bus to configure larger multiplexers as required. This eliminates external wiring and helps reduce unterminated stubs. The EX1200-3048 has 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. These relays protect 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 EX1200-3048 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 4-15 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. An optional terminal block provides screw termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

## CONNECTOR PINS AND SIGNALS

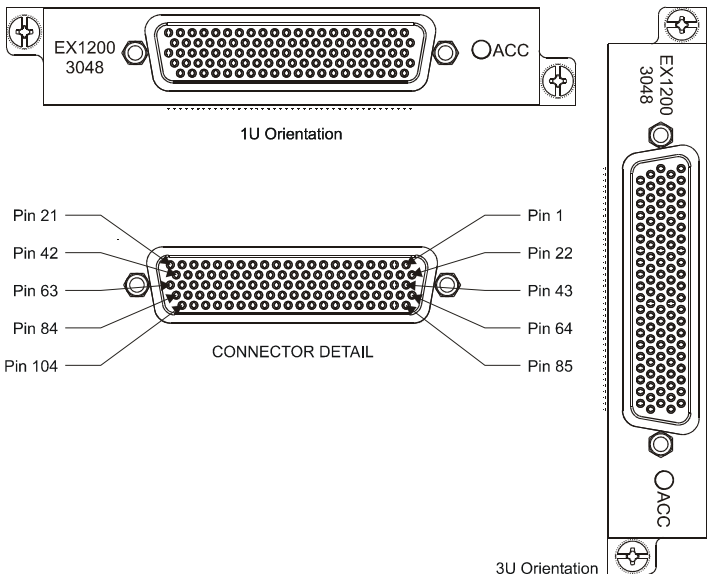



**FIGURE 4-14: EX1200-3048 FRONT PANEL (FRONT VIEW)**

| Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CH1_1L | 22 | CH1_5L | 43 | CH1_10L | 64 | CH1_15L | 85 | CH1_20L |
| 2 | CH1_1H | 23 | CH1_5H | 44 | CH1_10H | 65 | CH1_15H | 86 | CH1_20H |
| 3 | CH1_2L | 24 | CH1_6L | 45 | CH1_11L | 66 | CH1_16L | 87 | CH1_21L |
| 4 | CH1_2H | 25 | CH1_6H | 46 | CH1_11H | 67 | CH1_16H | 88 | CH1_21H |
| 5 | CH1_COML | 26 | CH1_7L | 47 | CH1_12L | 68 | CH1_17L | 89 | CH1_22L |
| 6 | CH1_COMH | 27 | CH1_7H | 48 | CH1_12H | 69 | CH1_17H | 90 | CH1_22H |
| 7 | CH1_3L | 28 | CH1_8L | 49 | CH1_13L | 70 | CH1_18L | 91 | CH1_23L |
| 8 | CH1_3H | 29 | CH1_8H | 50 | CH1_13H | 71 | CH1_18H | 92 | CH1_23H |
| 9 | CH1_4L | 30 | CH1_9L | 51 | CH1_14L | 72 | CH1_19L | 93 | CH1_24L |
| 10 | CH1_4H | 31 | CH1_9H | 52 | CH1_14H | 73 | CH1_19H | 94 | CH1_24H |
| 11 | CH2_1L | 32 | CH2_5L | 53 | CH2_10L | 74 | CH2_15L | 95 | CH2_20L |
| 12 | CH2_1H | 33 | CH2_5H | 54 | CH2_10H | 75 | CH2_15H | 96 | CH2_20H |
| 13 | CH2_2L | 34 | CH2_6L | 55 | CH2_11L | 76 | CH2_16L | 97 | CH2_21L |
| 14 | CH2_2H | 35 | CH2_6H | 56 | CH2_11H | 77 | CH2_16H | 98 | CH2_21H |
| 15 | CH2_COML | 36 | CH2_7L | 57 | CH2_12L | 78 | CH2_17L | 99 | CH2_22L |
| 16 | CH2_COMH | 37 | CH2_7H | 58 | CH2_12H | 79 | CH2_17H | 100 | CH2_22H |
| 17 | CH2_3L | 38 | CH2_8L | 59 | CH2_13L | 80 | CH2_18L | 101 | CH2_23L |
| 18 | CH2_3H | 39 | CH2_8H | 60 | CH2_13H | 81 | CH2_18H | 102 | CH2_23H |
| 19 | CH2_4L | 40 | CH2_9L | 61 | CH2_14L | 82 | CH2_19L | 103 | CH2_24L |
| 20 | CH2_4H | 41 | CH2_9H | 62 | CH2_14H | 83 | CH2_19H | 104 | CH2_24H |
| 21 | CH3_1I | 42 | CH3_1L | 63 | CH3_2I | 84 | CH3_2L | | |

**TABLE 4-8: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

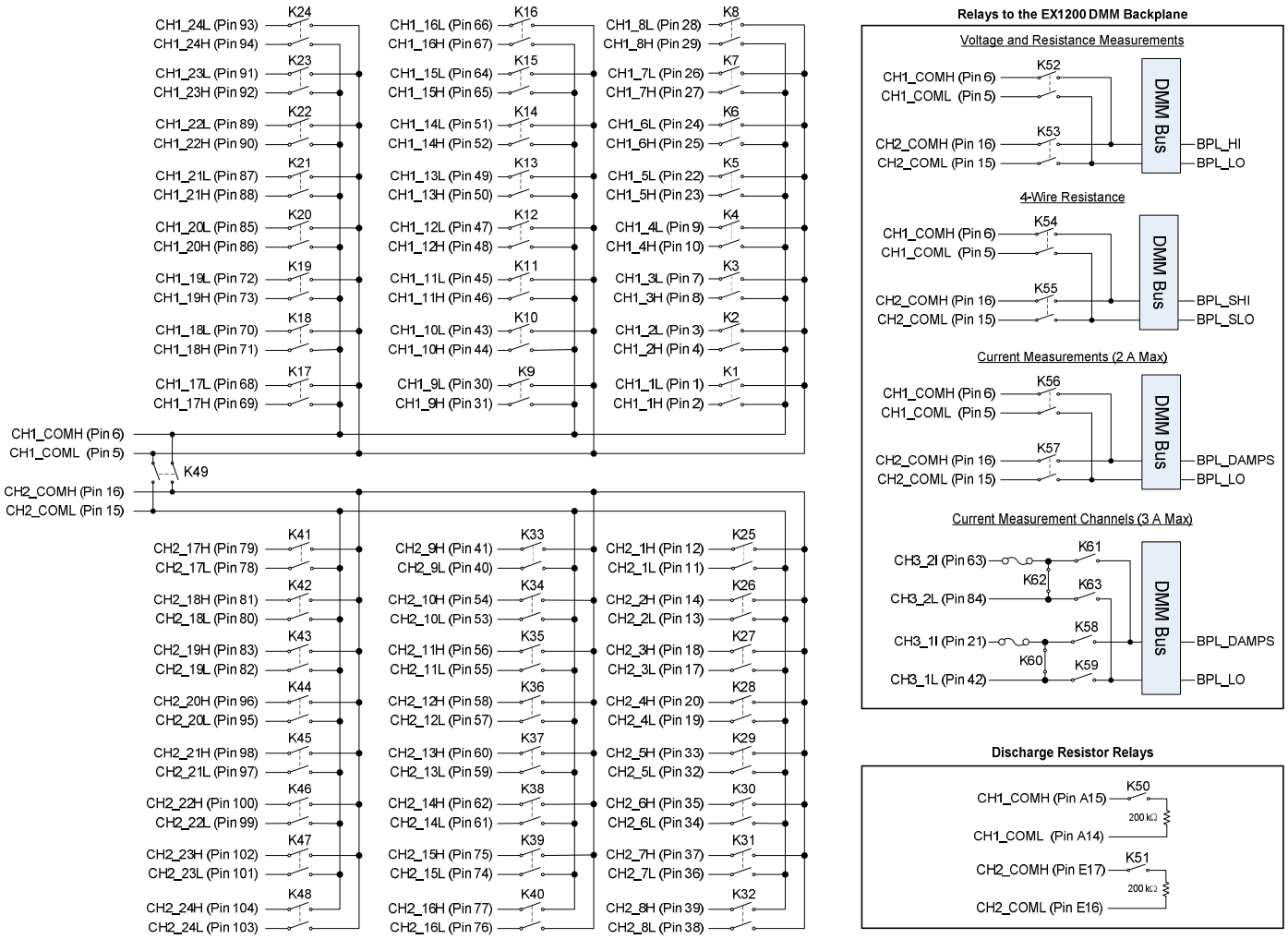



**FIGURE 4-15: EX1200-3048 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH1_1L | 1 | T31 | CH1_9L | 30 | T61 | CH2_13L | 59 | T91 | CH2_19L | 82 |
| T2 | CH1_1H | 2 | T32 | CH1_9H | 31 | T62 | CH2_13H | 60 | T92 | CH2_19H | 83 |
| T3 | CH1_2L | 3 | T33 | CH2_5L | 32 | T63 | CH2_14L | 61 | T93 | UNUSED | N/A |
| T4 | CH1_2H | 4 | T34 | CH2_5H | 33 | T64 | CH2_14H | 62 | T94 | CH3_2L | 84 |
| T5 | CH1_COML | 5 | T35 | CH2_6L | 34 | T65 | UNUSED | N/A | T95 | CH1_20L | 85 |
| T6 | CH1_COMH | 6 | T36 | CH2_6H | 35 | T66 | CH3_2I | 63 | T96 | CH1_20H | 86 |
| T7 | CH1_3L | 7 | T37 | CH2_7L | 36 | T67 | CH1_15L | 64 | T97 | CH1_21L | 87 |
| T8 | CH1_3H | 8 | T38 | CH2_7H | 37 | T68 | CH1_15H | 65 | T98 | CH1_21H | 88 |
| T9 | CH1_4L | 9 | T39 | CH2_8L | 38 | T69 | CH1_16L | 66 | T99 | CH1_22L | 89 |
| T10 | CH1_4H | 10 | T40 | CH2_8H | 39 | T70 | CH1_16H | 67 | T100 | CH1_22H | 90 |
| T11 | CH2_1L | 11 | T41 | CH2_9L | 40 | T71 | CH1_17L | 68 | T101 | CH1_23L | 91 |
| T12 | CH2_1H | 12 | T42 | CH2_9H | 41 | T72 | CH1_17H | 69 | T102 | CH1_23H | 92 |
| T13 | CH2_2L | 13 | T43 | UNUSED | N/A | T73 | CH1_18L | 70 | T103 | CH1_24L | 93 |
| T14 | CH2_2H | 14 | T44 | CH3_1L | 42 | T74 | CH1_18H | 71 | T104 | CH1_24H | 94 |
| T15 | CH2_COML | 15 | T45 | CH1_10L | 43 | T75 | UNUSED | N/A | T105 | CH2_20L | 95 |
| T16 | CH2_COMH | 16 | T46 | CH1_10H | 44 | T76 | UNUSED | N/A | T106 | CH2_20H | 96 |
| T17 | CH2_3L | 17 | T47 | CH1_11L | 45 | T77 | UNUSED | N/A | T107 | CH2_21L | 97 |
| T18 | CH2_3H | 18 | T48 | CH1_11H | 46 | T78 | UNUSED | N/A | T108 | CH2_21H | 98 |
| T19 | CH2_4L | 19 | T49 | CH1_12L | 47 | T79 | UNUSED | N/A | T109 | CH2_22L | 99 |
| T20 | CH2_4H | 20 | T50 | CH1_12H | 48 | T80 | UNUSED | N/A | T110 | CH2_22H | 100 |
| T21 | UNUSED | N/A | T51 | CH1_13L | 49 | T81 | CH1_19L | 72 | T111 | CH2_23L | 101 |
| T22 | CH3_1I | 21 | T52 | CH1_13H | 50 | T82 | CH1_19H | 73 | T112 | CH2_23H | 102 |
| T23 | CH1_5L | 22 | T53 | CH1_14L | 51 | T83 | CH2_15L | 74 | T113 | CH2_24L | 103 |
| T24 | CH1_5H | 23 | T54 | CH1_14H | 52 | T84 | CH2_15H | 75 | T114 | CH2_24H | 104 |
| T25 | CH1_6L | 24 | T55 | CH2_10L | 53 | T85 | CH2_16L | 76 | T115 | UNUSED | N/A |
| T26 | CH1_6H | 25 | T56 | CH2_10H | 54 | T86 | CH2_16H | 77 | T116 | UNUSED | N/A |
| T27 | CH1_7L | 26 | T57 | CH2_11L | 55 | T87 | CH2_17L | 78 | T117 | UNUSED | N/A |
| T28 | CH1_7H | 27 | T58 | CH2_11H | 56 | T88 | CH2_17H | 79 | T118 | UNUSED | N/A |
| T29 | CH1_8L | 28 | T59 | CH2_12L | 57 | T89 | CH2_18L | 80 | T119 | UNUSED | N/A |
| T30 | CH1_8H | 29 | T60 | CH2_12H | 58 | T90 | CH2_18H | 81 | T120 | UNUSED | N/A |

**TABLE 4-10: EX1200-TB104 TERMINAL BLOCK TO EX1200-3048 PIN MAPPING**

RT1 can be measured by the EX1200 DMM or may be measured using an external instrument. If an external sensor is used, it must be connected to T163 (L_VS) and T164 (H_VS). The user may also choose to use a sensor other than the on-board thermistor. To do so, connect the sensor using T161 (RL_I) and T162 (RH_I). Note that CH1_1L (T1) and CH1_1H (T2) must be dedicated to making temperature measurements once P2 is configured.

# EX1200-3048 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 48 two-wire or 24 four-wire |
| **RELAY TYPE** | |
| | Electromechanical, 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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 0.5 Ω |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ 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)** | |
| | 35 MHz (typical) |
| **CROSSTALK** | |
| **100 kHz** | < -55 dB |
| **1 MHz** | < -45 dB |
| **10 MHz** | < -30 dB |

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

# EX1200-3048S PLUG-IN MODULE

## 48-CHANNEL TWO-WIRE FET MULTIPLEXER

The EX1200-3048S is a high-density FET multiplexer module designed for scanning of multiple points to a common bus, in either 2- or 4-wire configurations, either synchronously with the EX1200 system DMM scan function, or asynchronously as a system switch to other devices through LXI LAN messages or the hardware trigger bus. The solid-state design delivers maximum switching speed and near infinite life. Up to 288 two-wire (or 144 four-wire) channels can be accommodated in a 1U EX1200 full rack mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Typical applications include temperature and voltage data acquisition and data logging at up to 1000 scans per second.

The EX1200-3048S consists of dual (1x24) 2-wire multiplexer banks. Each bank can be interconnected within a module under program control (via bussing relays) and across modules via the EX1200 analog bus to configure larger multiplexers as required. This eliminates external wiring and helps reduce unterminated stubs. Internal residual voltage discharge relays 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. These relays protect 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 EX1200-3048S 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 4-17 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. An optional terminal block provides screw termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

## CONNECTOR PINS AND SIGNALS

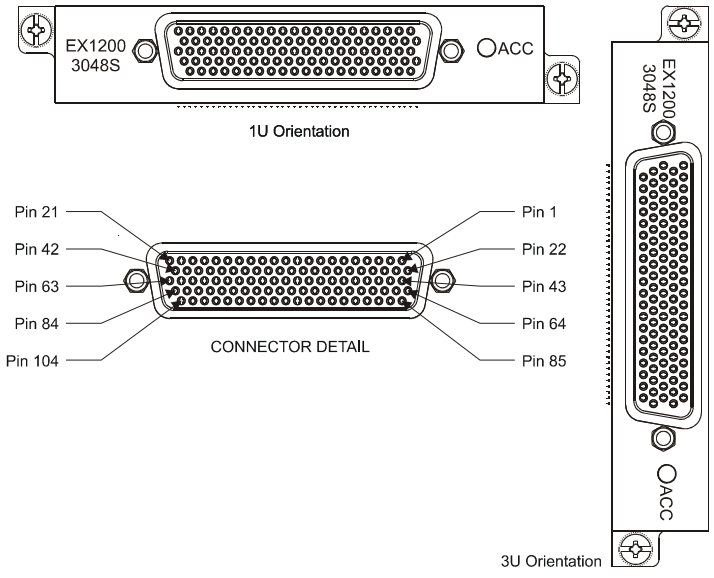



**FIGURE 4-16: EX1200-3048S FRONT PANEL (FRONT VIEW)**

| Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CH1_1L | 22 | CH1_5L | 43 | CH1_10L | 64 | CH1_15L | 85 | CH1_20L |
| 2 | CH1_1H | 23 | CH1_5H | 44 | CH1_10H | 65 | CH1_15H | 86 | CH1_20H |
| 3 | CH1_2L | 24 | CH1_6L | 45 | CH1_11L | 66 | CH1_16L | 87 | CH1_21L |
| 4 | CH1_2H | 25 | CH1_6H | 46 | CH1_11H | 67 | CH1_16H | 88 | CH1_21H |
| 5 | CH1_COML | 26 | CH1_7L | 47 | CH1_12L | 68 | CH1_17L | 89 | CH1_22L |
| 6 | CH1_COMH | 27 | CH1_7H | 48 | CH1_12H | 69 | CH1_17H | 90 | CH1_22H |
| 7 | CH1_3L | 28 | CH1_8L | 49 | CH1_13L | 70 | CH1_18L | 91 | CH1_23L |
| 8 | CH1_3H | 29 | CH1_8H | 50 | CH1_13H | 71 | CH1_18H | 92 | CH1_23H |
| 9 | CH1_4L | 30 | CH1_9L | 51 | CH1_14L | 72 | CH1_19L | 93 | CH1_24L |
| 10 | CH1_4H | 31 | CH1_9H | 52 | CH1_14H | 73 | CH1_19H | 94 | CH1_24H |
| 11 | CH2_1L | 32 | CH2_5L | 53 | CH2_10L | 74 | CH2_15L | 95 | CH2_20L |
| 12 | CH2_1H | 33 | CH2_5H | 54 | CH2_10H | 75 | CH2_15H | 96 | CH2_20H |
| 13 | CH2_2L | 34 | CH2_6L | 55 | CH2_11L | 76 | CH2_16L | 97 | CH2_21L |
| 14 | CH2_2H | 35 | CH2_6H | 56 | CH2_11H | 77 | CH2_16H | 98 | CH2_21H |
| 15 | CH2_COML | 36 | CH2_7L | 57 | CH2_12L | 78 | CH2_17L | 99 | CH2_22L |
| 16 | CH2_COMH | 37 | CH2_7H | 58 | CH2_12H | 79 | CH2_17H | 100 | CH2_22H |
| 17 | CH2_3L | 38 | CH2_8L | 59 | CH2_13L | 80 | CH2_18L | 101 | CH2_23L |
| 18 | CH2_3H | 39 | CH2_8H | 60 | CH2_13H | 81 | CH2_18H | 102 | CH2_23H |
| 19 | CH2_4L | 40 | CH2_9L | 61 | CH2_14L | 82 | CH2_19L | 103 | CH2_24L |
| 20 | CH2_4H | 41 | CH2_9H | 62 | CH2_14H | 83 | CH2_19H | 104 | CH2_24H |
| 21 | SHIELD | 42 | SHIELD | 63 | GND_C | 84 | GND_C | | |

**TABLE 4-11: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-3048S incorporates 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. These pins are identified as "SHIELD" in Table 4-11.

The module also incorporates ground pins, labeled "GND_C" above. These pins tie the module to chassis ground. Note that the SHIELD pins are not tied to ground and have no electrical connections.

## LOGICAL DIAGRAM

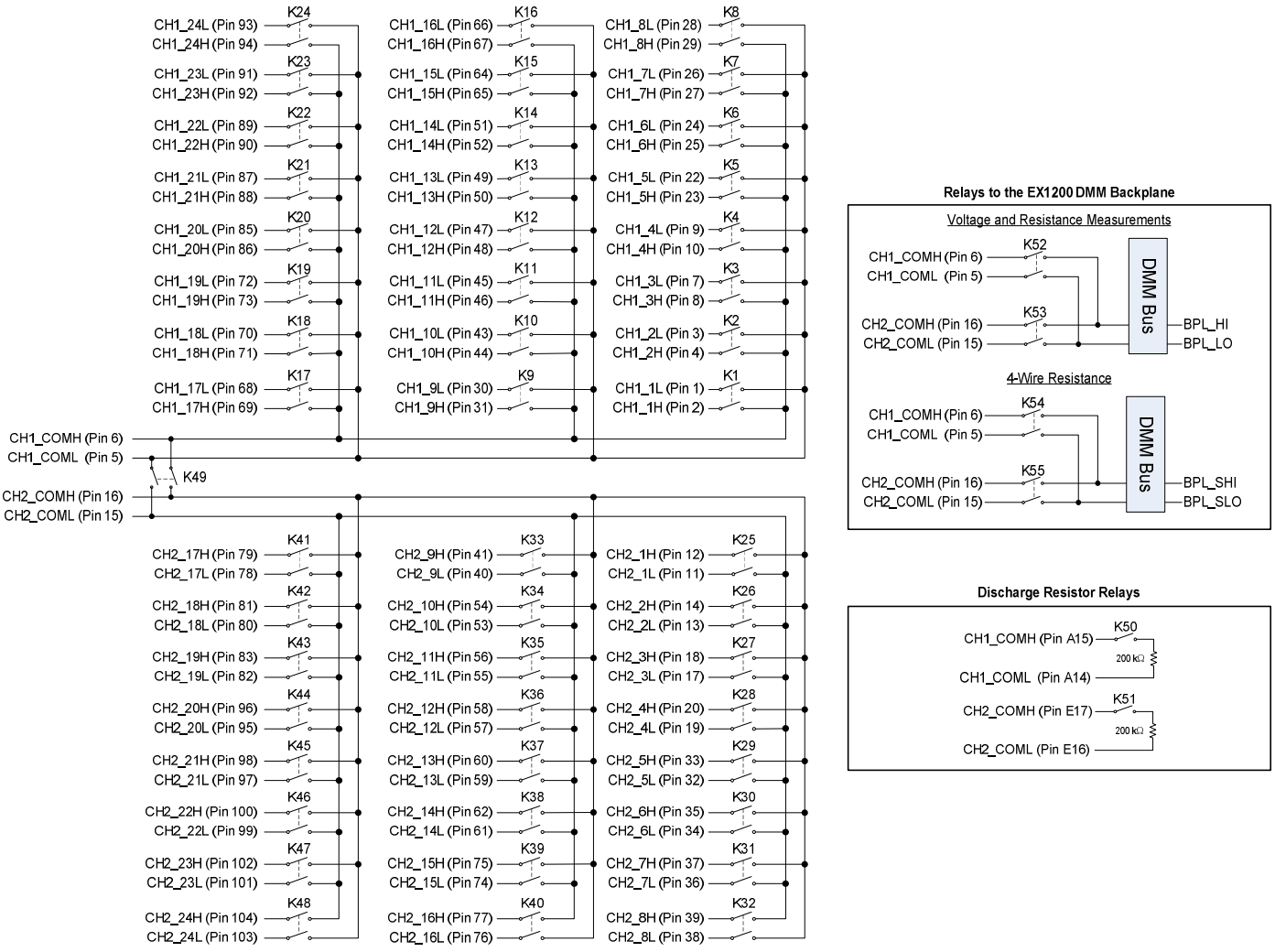



**FIGURE 4-17: EX1200-3048S LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH1_1L | 1 | T31 | CH1_9L | 30 | T61 | CH2_13L | 59 | T91 | CH2_19L | 82 |
| T2 | CH1_1H | 2 | T32 | CH1_9H | 31 | T62 | CH2_13H | 60 | T92 | CH2_19H | 83 |
| T3 | CH1_2L | 3 | T33 | CH2_5L | 32 | T63 | CH2_14L | 61 | T93 | UNUSED | N/A |
| T4 | CH1_2H | 4 | T34 | CH2_5H | 33 | T64 | CH2_14H | 62 | T94 | SHIELD | 84 |
| T5 | CH1_COML | 5 | T35 | CH2_6L | 34 | T65 | UNUSED | N/A | T95 | CH1_20L | 85 |
| T6 | CH1_COMH | 6 | T36 | CH2_6H | 35 | T66 | SHIELD | 63 | T96 | CH1_20H | 86 |
| T7 | CH1_3L | 7 | T37 | CH2_7L | 36 | T67 | CH1_15L | 64 | T97 | CH1_21L | 87 |
| T8 | CH1_3H | 8 | T38 | CH2_7H | 37 | T68 | CH1_15H | 65 | T98 | CH1_21H | 88 |
| T9 | CH1_4L | 9 | T39 | CH2_8L | 38 | T69 | CH1_16L | 66 | T99 | CH1_22L | 89 |
| T10 | CH1_4H | 10 | T40 | CH2_8H | 39 | T70 | CH1_16H | 67 | T100 | CH1_22H | 90 |
| T11 | CH2_1L | 11 | T41 | CH2_9L | 40 | T71 | CH1_17L | 68 | T101 | CH1_23L | 91 |
| T12 | CH2_1H | 12 | T42 | CH2_9H | 41 | T72 | CH1_17H | 69 | T102 | CH1_23H | 92 |
| T13 | CH2_2L | 13 | T43 | UNUSED | N/A | T73 | CH1_18L | 70 | T103 | CH1_24L | 93 |
| T14 | CH2_2H | 14 | T44 | SHIELD | 42 | T74 | CH1_18H | 71 | T104 | CH1_24H | 94 |
| T15 | CH2_COML | 15 | T45 | CH1_10L | 43 | T75 | UNUSED | N/A | T105 | CH2_20L | 95 |
| T16 | CH2_COMH | 16 | T46 | CH1_10H | 44 | T76 | UNUSED | N/A | T106 | CH2_20H | 96 |
| T17 | CH2_3L | 17 | T47 | CH1_11L | 45 | T77 | UNUSED | N/A | T107 | CH2_21L | 97 |
| T18 | CH2_3H | 18 | T48 | CH1_11H | 46 | T78 | UNUSED | N/A | T108 | CH2_21H | 98 |
| T19 | CH2_4L | 19 | T49 | CH1_12L | 47 | T79 | UNUSED | N/A | T109 | CH2_22L | 99 |
| T20 | CH2_4H | 20 | T50 | CH1_12H | 48 | T80 | UNUSED | N/A | T110 | CH2_22H | 100 |
| T21 | UNUSED | N/A | T51 | CH1_13L | 49 | T81 | CH1_19L | 72 | T111 | CH2_23L | 101 |
| T22 | SHIELD | 21 | T52 | CH1_13H | 50 | T82 | CH1_19H | 73 | T112 | CH2_23H | 102 |
| T23 | CH1_5L | 22 | T53 | CH1_14L | 51 | T83 | CH2_15L | 74 | T113 | CH2_24L | 103 |
| T24 | CH1_5H | 23 | T54 | CH1_14H | 52 | T84 | CH2_15H | 75 | T114 | CH2_24H | 104 |
| T25 | CH1_6L | 24 | T55 | CH2_10L | 53 | T85 | CH2_16L | 76 | T115 | UNUSED | N/A |
| T26 | CH1_6H | 25 | T56 | CH2_10H | 54 | T86 | CH2_16H | 77 | T116 | UNUSED | N/A |
| T27 | CH1_7L | 26 | T57 | CH2_11L | 55 | T87 | CH2_17L | 78 | T117 | UNUSED | N/A |
| T28 | CH1_7H | 27 | T58 | CH2_11H | 56 | T88 | CH2_17H | 79 | T118 | UNUSED | N/A |
| T29 | CH1_8L | 28 | T59 | CH2_12L | 57 | T89 | CH2_18L | 80 | T119 | UNUSED | N/A |
| T30 | CH1_8H | 29 | T60 | CH2_12H | 58 | T90 | CH2_18H | 81 | T120 | UNUSED | N/A |

**TABLE 4-13: EX1200-TB104 TERMINAL BLOCK TO EX1200-3048S PIN MAPPING**

RT1 can be measured by the EX1200 DMM or may be measured using an external instrument. If an external sensor is used, it must be connected to T163 (L_VS) and T164 (H_VS). The user may also choose to use a sensor other than the on-board thermistor. To do so, connect the sensor using T161 (RL_I) and T162 (RH_I). Note that CH1_1L (T1) and CH1_1H (T2) must be dedicated to making temperature measurements once P2 is configured.

# EX1200-3048S SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 48 two-wire or 24 four-wire |
| **RELAY TYPE** | |
| | Opto-isolated solid-state |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 250 V |
| **MAXIMUM SWITCHING CURRENT** | |
| | 0.2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 6 W/4.2 VA |
| **RATED SWITCH OPERATIONS** | |
| | Unlimited (solid state relays) |
| **SWITCHING TIME** | |
| | < 500 µs |
| **PATH RESISTANCE** | |
| | < 8 Ω |
| **INSULATION RESISTANCE** | |
| | > 1 x $10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 7 µV |
| **CAPACITANCE** | |
| **Open channel** | < 50 pF |
| **Channel-mainframe** | < 20 pF |
| **High-low** | < 50 pF |
| **BANDWIDTH (-3 dB)** | |
| | 10 MHz (typical) |
| **CROSSTALK (TYPICAL)** | |
| **100 kHz** | < -55 dB |
| **1 MHz** | < -45 dB |
| **10 MHz** | < -30 dB |
| **ISOLATION (TYPICAL)** | |
| **100 kHz** | < -55 dB |
| **1 MHz** | < -40 dB |
| **10 MHz** | < -25 dB |

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

**Application Note**

Solid-state relays are not ideally suited for low-level resistance measurements (< 1 Ω). The relays have an internal resistance of approximately 13 mV which is significant under these circumstances. A leakage current is also present in solid-state relays which varies dramatically with temperature, affecting low-level resistance measurements.

# EX1200-3072 PLUG-IN MODULE

## 72-CHANNEL 300 V/ 2 A MULTIPLEXER

The EX1200-3072 high-density multiplexer modules are designed for scanning of multiple points to a common bus, in either 2- or 4-wire configurations, either synchronously with the EX1200 system DMM scan function, or asynchronously as a system switch to other devices through LXI LAN messages or the hardware trigger bus. Up to 432 two-wire (or 216 four-wire) channels can be accommodated in a 1U EX1200 full rack mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Applications include cable harness testing, semiconductor and PCB testing, and those in which multiple points need to be switched to a common resource. All relays also have individual control, and each path allows for hot switching of up to 300 V and 2 A (60 W dc max).

The EX1200-3072 consists of dual (1 x 36) multiplexer banks. Each bank can be interconnected within a module under program control (via bussing relays) and across modules via the EX1200 analog bus to configure larger multiplexers as required. This eliminates external wiring and helps reduce unterminated stubs. It also has 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. These relays protect 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 EX1200-3072 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 4-19 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. Both single-wire and two-wire programming modes are available. An optional terminal block provides locking-slide termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

## CONNECTOR PINS AND SIGNALS

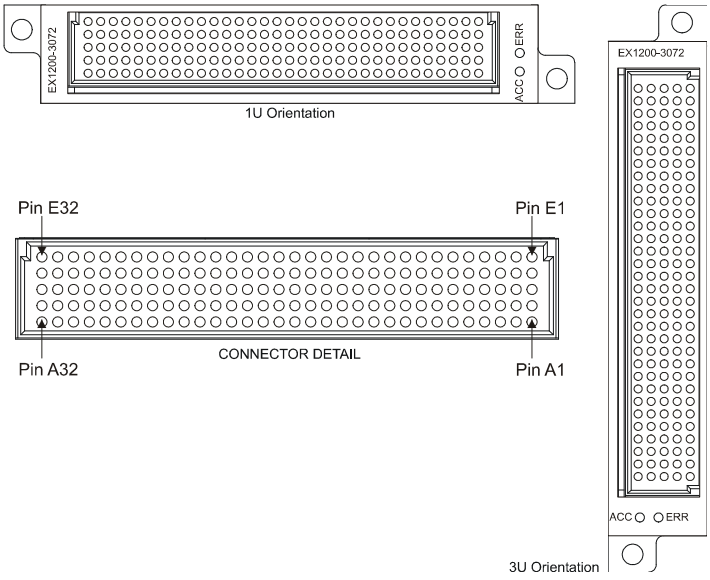



**FIGURE 4-18: EX1200-3072 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | UNUSED | **1** | SHIELD | **1** | SHIELD | **1** | SHIELD | **1** | SHIELD |
| **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** | SHIELD |
| **21** | CH2_7H | **21** | CH2_14H | **21** | CH2_13H | **21** | CH2_6H | **21** | SHIELD |
| **22** | CH2_11L | **22** | CH2_12L | **22** | CH2_17L | **22** | CH2_10L | **22** | CH2_18L |
| **23** | CH2_11H | **23** | CH2_12H | **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** | UNUSED | **32** | SHIELD | **32** | SHIELD | **32** | SHIELD | **32** | SHIELD |

**TABLE 4-14: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-3072 incorporates 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. These pins are identified as "SHIELD" in Table 4-14.

## LOGICAL DIAGRAM

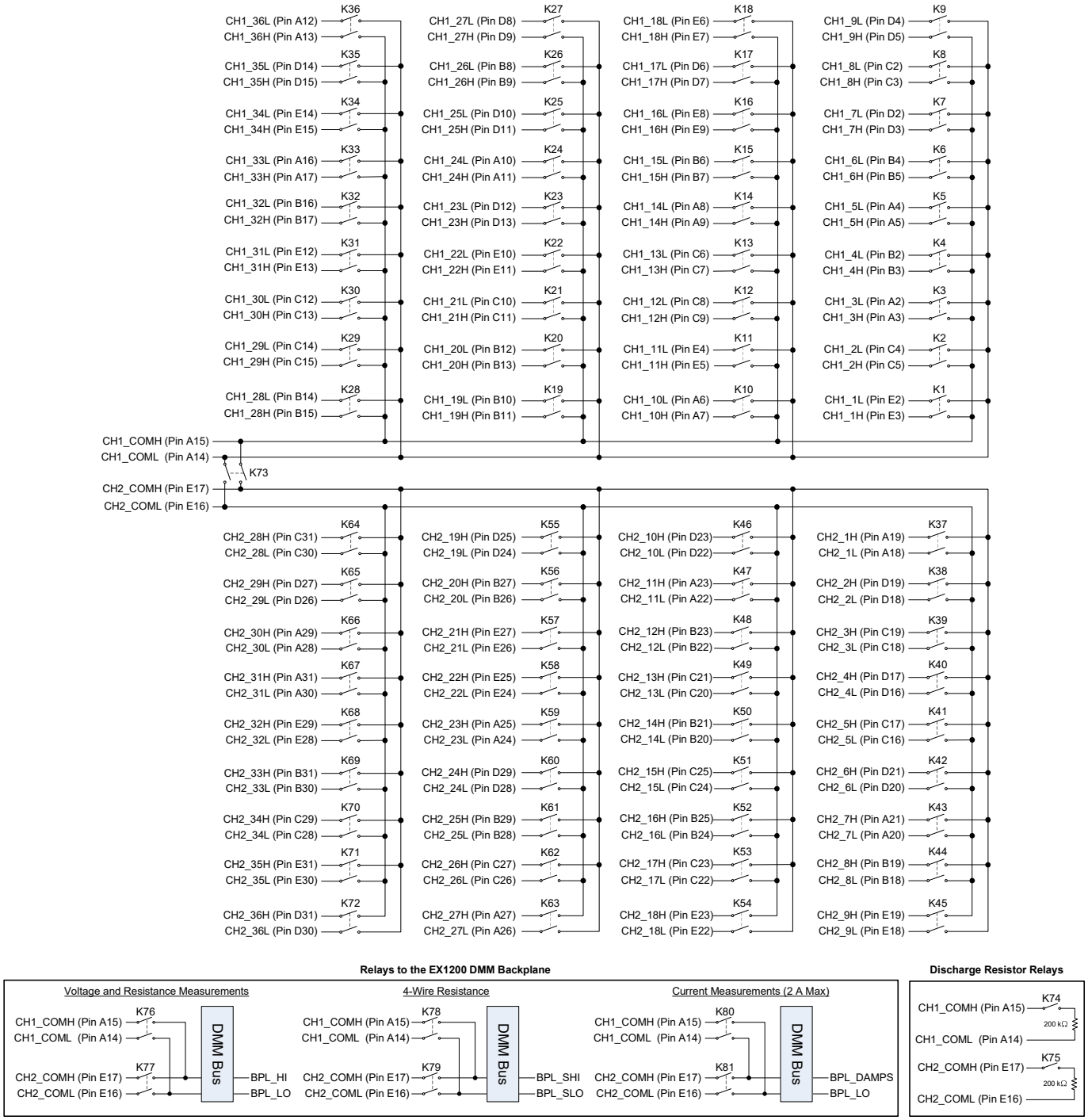



**FIGURE 4-19: EX1200-3072 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH1_1L | E2 | T41 | CH1_21L | C10 | T81 | CH2_1L | A18 | T121 | CH2_21L | E26 |
| T2 | CH1_1H | E3 | T42 | CH1_21H | C11 | T82 | CH2_1H | A19 | T122 | CH2_21H | E27 |
| T3 | CH1_2L | C4 | T43 | CH1_22L | E10 | T83 | CH2_2L | D18 | T123 | CH2_22L | E24 |
| T4 | CH1_2H | C5 | T44 | CH1_22H | E11 | T84 | CH2_2H | D19 | T124 | CH2_22H | E25 |
| T5 | CH1_3L | A2 | T45 | CH1_23L | D12 | T85 | CH2_3L | C18 | T125 | CH2_23L | A24 |
| T6 | CH1_3H | A3 | T46 | CH1_23H | D13 | T86 | CH2_3H | C19 | T126 | CH2_23H | A25 |
| T7 | CH1_4L | B2 | T47 | CH1_24L | A10 | T87 | CH2_4L | D16 | T127 | CH2_24L | D28 |
| T8 | CH1_4H | B3 | T48 | CH1_24H | A11 | T88 | CH2_4H | D17 | T128 | CH2_24H | D29 |
| T9 | CH1_5L | A4 | T49 | CH1_25L | D10 | T89 | CH2_5L | C16 | T129 | CH2_25L | B28 |
| T10 | CH1_5H | A5 | T50 | CH1_25H | D11 | T90 | CH2_5H | C17 | T130 | CH2_25H | B29 |
| T11 | CH1_6L | B4 | T51 | CH1_26L | B8 | T91 | CH2_6L | D20 | T131 | CH2_26L | C26 |
| T12 | CH1_6H | B5 | T52 | CH1_26H | B9 | T92 | CH2_6H | D21 | T132 | CH2_26H | C27 |
| T13 | CH1_7L | D2 | T53 | CH1_27L | D8 | T93 | CH2_7L | A20 | T133 | CH2_27L | A26 |
| T14 | CH1_7H | D3 | T54 | CH1_27H | D9 | T94 | CH2_7H | A21 | T134 | CH2_27H | A27 |
| T15 | CH1_8L | C2 | T55 | CH1_28L | B14 | T95 | CH2_8L | B18 | T135 | CH2_28L | C30 |
| T16 | CH1_8H | C3 | T56 | CH1_28H | B15 | T96 | CH2_8H | B19 | T136 | CH2_28H | C31 |
| T17 | CH1_9L | D4 | T57 | CH1_29L | C14 | T97 | CH2_9L | E18 | T137 | CH2_29L | D26 |
| T18 | CH1_9H | D5 | T58 | CH1_29H | C15 | T98 | CH2_9H | E19 | T138 | CH2_29H | D27 |
| T19 | CH1_10L | A6 | T59 | CH1_30L | C12 | T99 | CH2_10L | D22 | T139 | CH2_30L | A28 |
| T20 | CH1_10H | A7 | T60 | CH1_30H | C13 | T100 | CH2_10H | D23 | T140 | CH2_30H | A29 |
| T21 | CH1_11L | E4 | T61 | CH1_31L | E12 | T101 | CH2_11L | A22 | T141 | CH2_31L | A30 |
| T22 | CH1_11H | E5 | T62 | CH1_31H | E13 | T102 | CH2_11H | A23 | T142 | CH2_31H | A31 |
| T23 | CH1_12L | C8 | T63 | CH1_32L | B16 | T103 | CH2_12L | B22 | T143 | CH2_32L | E28 |
| T24 | CH1_12H | C9 | T64 | CH1_32H | B17 | T104 | CH2_12H | B23 | T144 | CH2_32H | E29 |
| T25 | CH1_13L | C6 | T65 | CH1_33L | A16 | T105 | CH2_13L | C20 | T145 | CH2_33L | B30 |
| T26 | CH1_13H | C7 | T66 | CH1_33H | A17 | T106 | CH2_13H | C21 | T146 | CH2_33H | B31 |
| T27 | CH1_14L | A8 | T67 | CH1_34L | E14 | T107 | CH2_14L | B20 | T147 | CH2_34L | C28 |
| T28 | CH1_14H | A9 | T68 | CH1_34H | E15 | T108 | CH2_14H | B21 | T148 | CH2_34H | C29 |
| T29 | CH1_15L | B6 | T69 | CH1_35L | D14 | T109 | CH2_15L | C24 | T149 | CH2_35L | E30 |
| T30 | CH1_15H | B7 | T70 | CH1_35H | D15 | T110 | CH2_15H | C25 | T150 | CH2_35H | E31 |
| T31 | CH1_16L | E8 | T71 | CH1_36L | A12 | T111 | CH2_16L | B24 | T151 | CH2_36L | D30 |
| T32 | CH1_16H | E9 | T72 | CH1_36H | A13 | T112 | CH2_16H | B25 | T152 | CH2_36H | D31 |
| T33 | CH1_17L | D6 | T73 | CH1_COML | A14 | T113 | CH2_17L | C22 | T153 | CH2_COML | E16 |
| T34 | CH1_17H | D7 | T74 | CH1_COMH | A15 | T114 | CH2_17H | C23 | T154 | CH2_COMH | E17 |
| T35 | CH1_18L | E6 | T75 | SHIELD | E20 | T115 | CH2_18L | E22 | T155 | SHIELD | D32 |
| T36 | CH1_18H | E7 | T76 | SHIELD | E21 | T116 | CH2_18H | E23 | T156 | SHIELD | E32 |
| T37 | CH1_19L | B10 | T77 | SHIELD | E1 | T117 | CH2_19L | D24 | T157 | SHIELD | B32 |
| T38 | CH1_19H | B11 | T78 | SHIELD | D1 | T118 | CH2_19H | D25 | T158 | SHIELD | C32 |
| T39 | CH1_20L | B12 | T79 | SHIELD | C1 | T119 | CH2_20L | B26 | T159 | GND_C | A1 |
| T40 | CH1_20H | B13 | T80 | SHIELD | B1 | T120 | CH2_20H | B27 | T160 | GND_C | A32 |

**TABLE 4-16: EX1200-TB160-1 TERMINAL BLOCK TO EX1200-3072 PIN MAPPING**

RT1 can be measured by the EX1200 DMM or may be measured using an external instrument. If an external sensor is used, it must be connected to T164 (L_VS) and T163 (H_VS). The user may also choose to use a sensor other than the on-board thermistor. To do so, connect the sensor using T162 (RL_I) and T161 (RH_I). Note that CH1_1L (T1) and CH1_1H (T2) must be dedicated to making temperature measurements once P2 is configured.

# EX1200-3072 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | (1 x 72) 2-wire, dual (1 x 36) 2-wire, or (1 x 36) 4-wire |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 300 V ac rms, 300 V dc |
| **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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 500 mΩ |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 3 µV |
| **CAPACITANCE** | |
| **Open channel** | < 50 pF |
| **Channel-mainframe** | < 20 pF |
| **High-low** | < 50 pF |
| **BANDWIDTH (-3 dB)** | |
| | 40 MHz (typical) |
| **CROSSTALK (TYPICAL)** | |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -50 dB |
| **ISOLATION (TYPICAL)** | |
| **1 MHz** | < -55 dB |
| **10 MHz** | < -35 dB |

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

# EX1200-3096 PLUG-IN MODULE

## 96-CHANNEL 100 V / 0.5 A TWO-WIRE MULTIPLEXER

The EX1200-3096 high-density multiplexer modules are designed for scanning of multiple points to a common bus, in either 2- or 4-wire configurations, either synchronously with the EX1200 system DMM scan function, or asynchronously as a system switch to other devices through LXI LAN messages or the hardware trigger bus. Up to 576 two-wire (or 288 four-wire) channels can be accommodated in a 1U EX1200full-rack mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Applications include cable harness testing, semiconductor, and PCB testing, and those in which multiple points need to be switched to a common resource. All relays also have individual control, and each path allows for hot switching of up to 100 V and 0.5 A (30 W dc max).

The EX1200-3096 consists of dual (1x48) 2-wire multiplexer banks. Each bank can be interconnected within a module under program control (via bussing relays) and across modules via the EX1200 analog bus to configure larger multiplexers as required, eliminating external wiring and helping reduce unterminated stubs. Internal residual voltage discharge relays 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. These relays protect 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 EX1200-3096 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 (discussed in the *VTEX Switch Driver Programmer's Manual*, P/N: 82-0117-000). Figure 4-21 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. Both single-wire and two-wire programming modes are available. An optional terminal block provides locking-slide termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

## CONNECTOR PINS AND SIGNALS

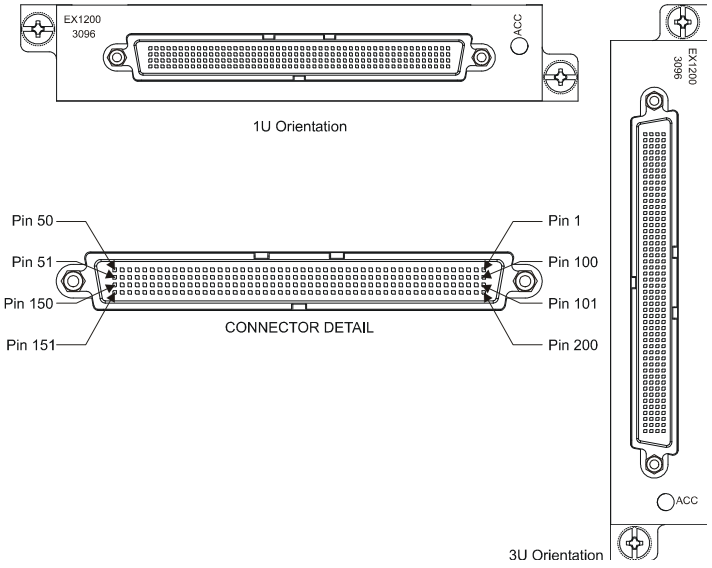



**FIGURE 4-20: EX1200-3096 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH1_1L | **51** | CH2_COML | **101** | CH1_25L | **151** | SHIELD |
| **2** | CH1_1H | **52** | CH2_24H | **102** | CH1_25H | **152** | CH2_48H |
| **3** | CH1_2L | **53** | CH2_24L | **103** | CH1_26L | **153** | CH2_48L |
| **4** | CH1_2H | **54** | CH2_23H | **104** | CH1_26H | **154** | CH2_47H |
| **5** | CH1_3L | **55** | CH2_23L | **105** | CH1_27L | **155** | CH2_47L |
| **6** | CH1_3H | **56** | CH2_22H | **106** | CH1_27H | **156** | CH2_46H |
| **7** | CH1_4L | **57** | CH2_22L | **107** | CH1_28L | **157** | CH2_46L |
| **8** | CH1_4H | **58** | CH2_21H | **108** | CH1_28H | **158** | CH2_45H |
| **9** | CH1_5L | **59** | CH2_21L | **109** | CH1_29L | **159** | CH2_45L |
| **10** | CH1_5H | **60** | CH2_20H | **110** | CH1_29H | **160** | CH2_44H |
| **11** | CH1_6L | **61** | CH2_20L | **111** | CH1_30L | **161** | CH2_44L |
| **12** | CH1_6H | **62** | CH2_19H | **112** | CH1_30H | **162** | CH2_43H |
| **13** | CH1_7L | **63** | CH2_19L | **113** | CH1_31L | **163** | CH2_43L |
| **14** | CH1_7H | **64** | CH2_18H | **114** | CH1_31H | **164** | CH2_42H |
| **15** | CH1_8L | **65** | CH2_18L | **115** | CH1_32L | **165** | CH2_42L |
| **16** | CH1_8H | **66** | CH2_17H | **116** | CH1_32H | **166** | CH2_41H |
| **17** | CH1_9L | **67** | CH2_17L | **117** | CH1_33L | **167** | CH2_41L |
| **18** | CH1_9H | **68** | CH2_16H | **118** | CH1_33H | **168** | CH2_40H |
| **19** | CH1_10L | **69** | CH2_16L | **119** | CH1_34L | **169** | CH2_40L |
| **20** | CH1_10H | **70** | CH2_15H | **120** | CH1_34H | **170** | CH2_39H |
| **21** | CH1_11L | **71** | CH2_15L | **121** | CH1_35L | **171** | CH2_39L |
| **22** | CH1_11H | **72** | CH2_14H | **122** | CH1_35H | **172** | CH2_38H |
| **23** | CH1_12L | **73** | CH2_14L | **123** | CH1_36L | **173** | CH2_38L |
| **24** | CH1_12H | **74** | CH2_13H | **124** | CH1_36H | **174** | CH2_37H |
| **25** | CH1_COML | **75** | CH2_13L | **125** | GND_C | **175** | CH2_37L |
| **26** | CH2_1L | **76** | CH1_COMH | **126** | CH2_25L | **176** | GND_C |
| **27** | CH2_1H | **77** | CH1_24H | **127** | CH2_25H | **177** | CH1_48H |
| **28** | CH2_2L | **78** | CH1_24L | **128** | CH2_26L | **178** | CH1_48L |
| **29** | CH2_2H | **79** | CH1_23H | **129** | CH2_26H | **179** | CH1_47H |
| **30** | CH2_3L | **80** | CH1_23L | **130** | CH2_27L | **180** | CH1_47L |
| **31** | CH2_3H | **81** | CH1_22H | **131** | CH2_27H | **181** | CH1_46H |
| **32** | CH2_4L | **82** | CH1_22L | **132** | CH2_28L | **182** | CH1_46L |
| **33** | CH2_4H | **83** | CH1_21H | **133** | CH2_28H | **183** | CH1_45H |
| **34** | CH2_5L | **84** | CH1_21L | **134** | CH2_29L | **184** | CH1_45L |
| **35** | CH2_5H | **85** | CH1_20H | **135** | CH2_29H | **185** | CH1_44H |
| **36** | CH2_6L | **86** | CH1_20L | **136** | CH2_30L | **186** | CH1_44L |
| **37** | CH2_6H | **87** | CH1_19H | **137** | CH2_30H | **187** | CH1_43H |
| **38** | CH2_7L | **88** | CH1_19L | **138** | CH2_31L | **188** | CH1_43L |
| **39** | CH2_7H | **89** | CH1_18H | **139** | CH2_31H | **189** | CH1_42H |
| **40** | CH2_8L | **90** | CH1_18L | **140** | CH2_32L | **190** | CH1_42L |
| **41** | CH2_8H | **91** | CH1_17H | **141** | CH2_32H | **191** | CH1_41H |
| **42** | CH2_9L | **92** | CH1_17L | **142** | CH2_33L | **192** | CH1_41L |
| **43** | CH2_9H | **93** | CH1_16H | **143** | CH2_33H | **193** | CH1_40H |
| **44** | CH2_10L | **94** | CH1_16L | **144** | CH2_34L | **194** | CH1_40L |
| **45** | CH2_10H | **95** | CH1_15H | **145** | CH2_34H | **195** | CH1_39H |
| **46** | CH2_11L | **96** | CH1_15L | **146** | CH2_35L | **196** | CH1_39L |
| **47** | CH2_11H | **97** | CH1_14H | **147** | CH2_35H | **197** | CH1_38H |
| **48** | CH2_12L | **98** | CH1_14L | **148** | CH2_36L | **198** | CH1_38L |
| **49** | CH2_12H | **99** | CH1_13H | **149** | CH2_36H | **199** | CH1_37H |
| **50** | CH2_COMH | **100** | CH1_13L | **150** | SHIELD | **200** | CH1_37L |

**TABLE 4-17: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-3096 incorporates 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. These pins are identified as "SHIELD" in Table 4-17.

The module also incorporates ground pins, labeled “GND_C” above. These pins tie the module to chassis ground. Note that the SHIELD pins are not tied to ground and have no electrical connections.

## LOGICAL DIAGRAM

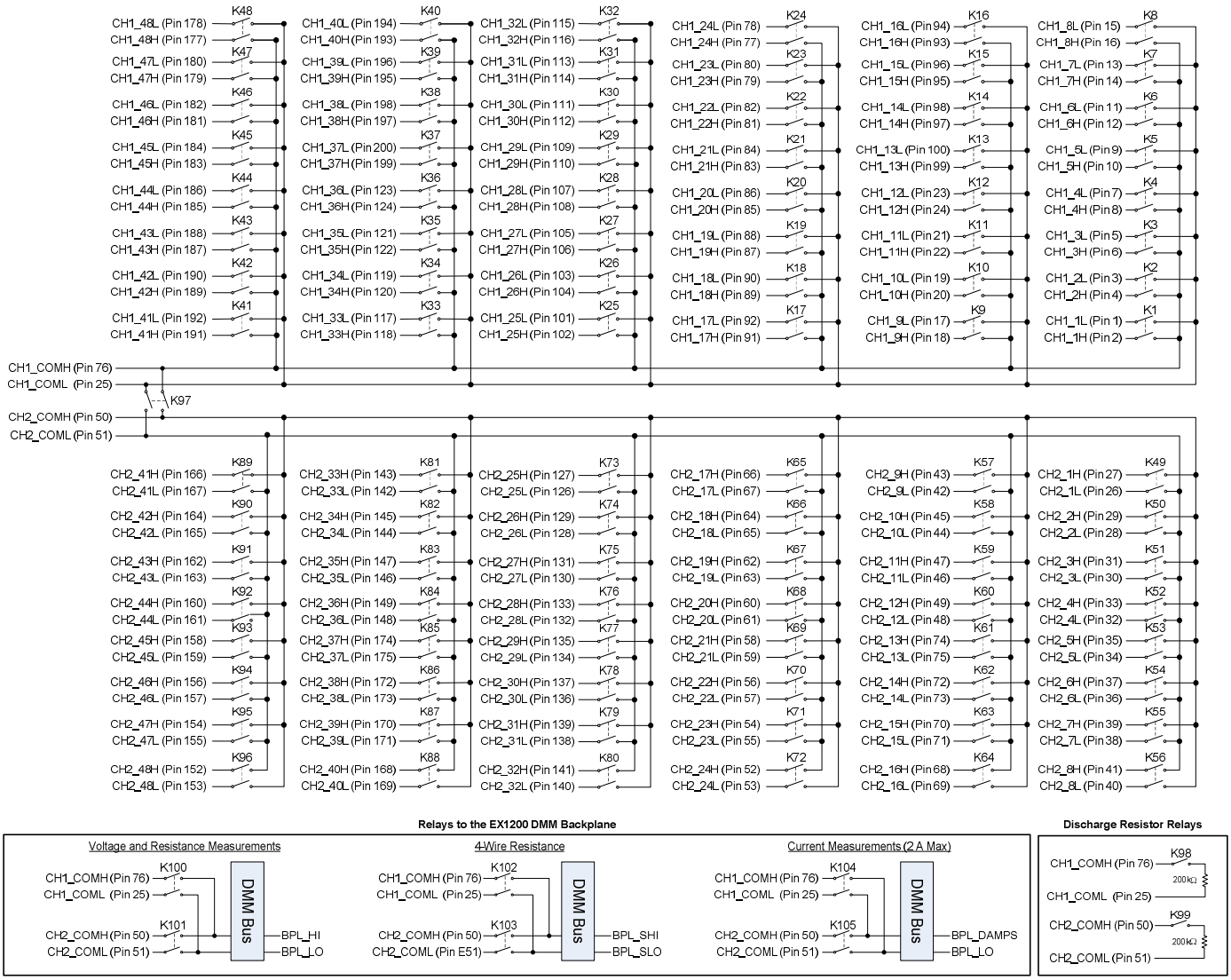



**FIGURE 4-21: EX1200-3096 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH1_1L | 1 | T52 | CH1_8H | 16 | T103 | CH2_27L | 130 | T154 | CH2_41H | 166 |
| T2 | CH1_1H | 2 | T53 | CH1_19L | 88 | T104 | CH2_27H | 131 | T155 | CH2_29L | 134 |
| T3 | CH1_13L | 100 | T54 | CH1_19H | 87 | T105 | CH2_39L | 171 | T156 | CH2_29H | 135 |
| T4 | CH1_13H | 99 | T55 | CH1_7L | 13 | T106 | CH2_39H | 170 | T157 | CH2_40L | 169 |
| T5 | CH1_2L | 3 | T56 | CH1_7H | 14 | T107 | CH2_26L | 128 | T158 | CH2_40H | 168 |
| T6 | CH1_2H | 4 | T57 | CH1_18L | 90 | T108 | CH2_26H | 129 | T159 | CH2_28L | 132 |
| T7 | CH1_14L | 98 | T58 | CH1_18H | 89 | T109 | CH2_37L | 175 | T160 | CH2_28H | 133 |
| T8 | CH1_14H | 97 | T59 | CH1_6L | 11 | T110 | CH2_37H | 174 | T161 | CH2_12H | 49 |
| T9 | CH1_3L | 5 | T60 | CH1_6H | 12 | T111 | CH2_25L | 126 | T162 | CH2_12L | 48 |
| T10 | CH1_3H | 6 | T61 | CH1_46L | 182 | T112 | CH2_25H | 127 | T163 | CH2_24L | 53 |
| T11 | CH1_15L | 96 | T62 | CH1_46H | 181 | T113 | CH1_48L | 178 | T164 | CH2_24H | 52 |
| T12 | CH1_15H | 95 | T63 | CH1_34L | 119 | T114 | CH1_48H | 177 | T165 | CH2_COMH | 50 |
| T13 | CH1_4L | 7 | T64 | CH1_34H | 120 | T115 | CH1_36L | 123 | T166 | CH2_COML | 51 |
| T14 | CH1_4H | 8 | T65 | CH1_45L | 184 | T116 | CH1_36H | 124 | T167 | CH2_23L | 55 |
| T15 | CH1_16L | 94 | T66 | CH1_45H | 183 | T117 | CH1_47L | 180 | T168 | CH2_23H | 54 |
| T16 | CH1_16H | 93 | T67 | CH1_33L | 117 | T118 | CH1_47H | 179 | T169 | CH2_11L | 46 |
| T17 | CH1_5L | 9 | T68 | CH1_33H | 118 | T119 | CH1_35L | 121 | T170 | CH2_11H | 47 |
| T18 | CH1_5H | 10 | T69 | CH1_44L | 186 | T120 | CH1_35H | 122 | T171 | CH2_22L | 57 |
| T19 | CH1_17L | 92 | T70 | CH1_44H | 185 | T121 | CH2_8L | 40 | T172 | CH2_22H | 56 |
| T20 | CH1_17H | 91 | T71 | CH1_32L | 115 | T122 | CH2_8H | 41 | T173 | CH2_10L | 44 |
| T21 | CH1_25L | 101 | T72 | CH1_32H | 116 | T123 | CH2_19L | 63 | T174 | CH2_10H | 45 |
| T22 | CH1_25H | 102 | T73 | CH1_43L | 188 | T124 | CH2_19H | 62 | T175 | CH2_21L | 59 |
| T23 | CH1_37L | 200 | T74 | CH1_43H | 187 | T125 | CH2_7L | 38 | T176 | CH2_21H | 58 |
| T24 | CH1_37H | 199 | T75 | CH1_31L | 113 | T126 | CH2_7H | 39 | T177 | CH2_9L | 42 |
| T25 | CH1_26L | 103 | T76 | CH1_31H | 114 | T127 | CH2_18L | 65 | T178 | CH2_9H | 43 |
| T26 | CH1_26H | 104 | T77 | CH1_42L | 190 | T128 | CH2_18H | 64 | T179 | CH2_20L | 61 |
| T27 | CH1_38L | 198 | T78 | CH1_42H | 189 | T129 | CH2_6L | 36 | T180 | CH2_20H | 60 |
| T28 | CH1_38H | 197 | T79 | CH1_30L | 111 | T130 | CH2_6H | 37 | T181 | UNUSED | N/A |
| T29 | CH1_27L | 105 | T80 | CH1_30H | 112 | T131 | CH2_17L | 67 | T182 | UNUSED | N/A |
| T30 | CH1_27H | 106 | T81 | CH2_2L | 28 | T132 | CH2_17H | 66 | T183 | UNUSED | N/A |
| T31 | CH1_39L | 196 | T82 | CH2_2H | 29 | T133 | CH2_5L | 34 | T184 | UNUSED | N/A |
| T32 | CH1_39H | 195 | T83 | CH2_14L | 73 | T134 | CH2_5H | 35 | T185 | CH2_48L | 153 |
| T33 | CH1_28L | 107 | T84 | CH2_14H | 72 | T135 | CH2_16L | 69 | T186 | CH2_48H | 152 |
| T34 | CH1_28H | 108 | T85 | CH2_3L | 30 | T136 | CH2_16H | 68 | T187 | CH2_36L | 148 |
| T35 | CH1_40L | 194 | T86 | CH2_3H | 31 | T137 | CH2_4L | 32 | T188 | CH2_36H | 149 |
| T36 | CH1_40H | 193 | T87 | CH2_13L | 75 | T138 | CH2_4H | 33 | T189 | CH2_47L | 155 |
| T37 | CH1_29L | 109 | T88 | CH2_13H | 74 | T139 | CH2_15L | 71 | T190 | CH2_47H | 154 |
| T38 | CH1_29H | 110 | T89 | CH2_1L | 26 | T140 | CH2_15H | 70 | T191 | CH2_35L | 146 |
| T39 | CH1_41L | 192 | T90 | CH2_1H | 27 | T141 | CH2_44L | 161 | T192 | CH2_35H | 147 |
| T40 | CH1_41H | 191 | T91 | CH1_COML | 25 | T142 | CH2_44H | 160 | T193 | CH2_46L | 157 |
| T41 | CH1_22L | 82 | T92 | CH1_COMH | 76 | T143 | CH2_32L | 140 | T194 | CH2_46H | 156 |
| T42 | CH1_22H | 81 | T93 | CH1_24L | 78 | T144 | CH2_32H | 141 | T195 | CH2_34L | 144 |
| T43 | CH1_10L | 19 | T94 | CH1_24H | 77 | T145 | CH2_43L | 163 | T196 | CH2_34H | 145 |
| T44 | CH1_10H | 20 | T95 | CH1_12L | 23 | T146 | CH2_43H | 162 | T197 | CH2_45L | 159 |
| T45 | CH1_21L | 84 | T96 | CH1_12H | 24 | T147 | CH2_31L | 138 | T198 | CH2_45H | 158 |
| T46 | CH1_21H | 83 | T97 | CH1_23L | 80 | T148 | CH2_31H | 139 | T199 | CH2_33L | 142 |
| T47 | CH1_9L | 17 | T98 | CH1_23H | 79 | T149 | CH2_42L | 165 | T200 | CH2_33H | 143 |
| T48 | CH1_9H | 18 | T99 | CH1_11L | 21 | T150 | CH2_42H | 164 | T201 | SHIELD | 150 |
| T49 | CH1_20L | 86 | T100 | CH1_11H | 22 | T151 | CH2_30L | 136 | T202 | SHIELD | 151 |
| T50 | CH1_20H | 85 | T101 | CH2_38L | 173 | T152 | CH2_30H | 137 | T203 | GND_C | 125 |
| T51 | CH1_8L | 15 | T102 | CH2_38H | 172 | T153 | CH2_41L | 167 | T204 | GND_C | 176 |

**TABLE 4-19: EX1200-TB200 TERMINAL BLOCK TO EX1200-3096 PIN MAPPING**

RT1 can be measured by the EX1200 DMM or may be measured using an external instrument. To use an external instrument, connect it to T183 (L_VS) and T184 (H_VS). To use a sensor other than the onboard thermistor, connect it using T181 (RL_I) and T182 (RH_I). Note that CH1_1L (T1) and CH1_1H (T2) must be dedicated to making temperature measurements once P2 is configured.

# EX1200-3096 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | (1 x 96) 2-wire, dual (1 x 48) 2-wire, or (1 x 48) 4-wire |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 100 V |
| **MAXIMUM SWITCHING CURRENT** | |
| | 0.5 A |
| **MAXIMUM SWITCHING POWER** | |
| | 30 W dc (resistive), 37.5 VA (resistive) |
| **MINIMUM CONTACT RATING*** | |
| | 10 mV dc, 10 µA |
| **This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions* | |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^7$ |
| **Electrical** | $1 \times 10^5$ @ 30 V dc 1 A (resistive) or 125 V ac 0.3 A (resistive), |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 500 mΩ |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 7 µV |
| **CAPACITANCE** | |
| **Open channel** | < 50 pF |
| **Channel-mainframe** | < 20 pF |
| **High-low** | < 50 pF |
| **BANDWIDTH (-3 dB)** | |
| | 30 MHz (typical) |
| **CROSSTALK (TYPICAL)** | |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -50 dB |
| **ISOLATION (TYPICAL)** | |
| **1 MHz** | < -50 dB |
| **10 MHz** | < -35 dB |

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

# EX1200-3164 PLUG-IN MODULE

## 16 (1X4) 2-WIRE 300 V/ 2 AMP MULTIPLEXER

The EX1200-3164 high-density multiplexer module is designed to provide a flexible switching multiplexing architecture with 16 individual 1 x 4 2-wire multiplexers. Up to 96 1 x 4 two-wire channels can be accommodated in a 1U EX1200 full rack mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. Applications include cable harness testing, semiconductor and PCB testing, and those in which multiple points need to be switched to a common resource. All relays also have individual control, and each path allows for hot switching of up to 300 V and 2 A (60 W dc max).

Each bank can be interconnected within a module under program control (via bussing relays) to form larger 2-wire muxes, up to a maximum of 1 x 64. The EX1200 analog bus can be used to configure larger multiplexers across modules as required to eliminate external wiring and helps reduce unterminated stubs effects. The analog bus can also be routed directly to the optional EX1200 series 6.5 digit DMM for direct measurements across the backplane further reduce external wiring. Stub-breaking relays remove the module from the analog bus to minimize a module's effect on measurements being made through other modules.

An optional terminal block provides screw termination points for external field wiring. This terminal block also includes cold junction compensation reference for more precise temperature measurements.

The EX1200-3164 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 4-23 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

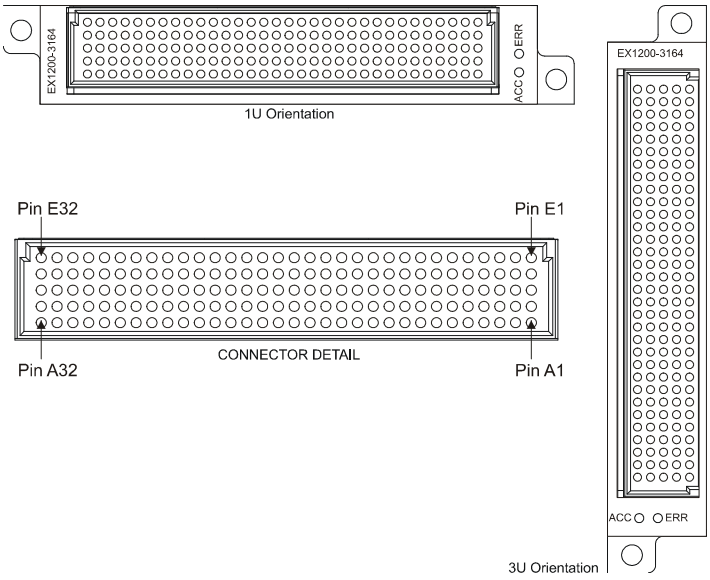



**FIGURE 4-22: EX1200-3164 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH5_COMH | **1** | CH4_2H | **1** | CH4_COMH | **1** | CH5_2H | **1** | CH5_4H |
| **2** | CH5_COML | **2** | CH4_2L | **2** | CH4_COML | **2** | CH5_2L | **2** | CH5_4L |
| **3** | CH5_3H | **3** | CH4_4H | **3** | CH6_4H | **3** | CH4_1H | **3** | CH5_1H |
| **4** | CH5_3L | **4** | CH4_4L | **4** | CH6_4L | **4** | CH4_1L | **4** | CH5_1L |
| **5** | CH4_3H | **5** | CH3_2H | **5** | CH3_COMH | **5** | CH6_2H | **5** | CH6_COMH |
| **6** | CH4_3L | **6** | CH3_2L | **6** | CH3_COML | **6** | CH6_2L | **6** | CH6_COML |
| **7** | CH6_3H | **7** | CH3_4H | **7** | CH7_4H | **7** | CH3_1H | **7** | CH6_1H |
| **8** | CH6_3L | **8** | CH3_4L | **8** | CH7_4L | **8** | CH3_1L | **8** | CH6_1L |
| **9** | CH3_3H | **9** | CH2_2H | **9** | CH2_COMH | **9** | CH7_2H | **9** | CH7_COMH |
| **10** | CH3_3L | **10** | CH2_2L | **10** | CH2_COML | **10** | CH7_2L | **10** | CH7_COML |
| **11** | CH7_3H | **11** | CH2_4H | **11** | CH8_4H | **11** | CH2_1H | **11** | CH7_1H |
| **12** | CH7_3L | **12** | CH2_4L | **12** | CH8_4L | **12** | CH2_1L | **12** | CH7_1L |
| **13** | CH2_3H | **13** | CH1_2H | **13** | CH1_COMH | **13** | CH8_2H | **13** | CH8_COMH |
| **14** | CH2_3L | **14** | CH1_2L | **14** | CH1_COML | **14** | CH8_2L | **14** | CH8_COML |
| **15** | CH8_3H | **15** | CH1_4H | **15** | CH16_4H | **15** | CH1_1H | **15** | CH8_1H |
| **16** | CH8_3L | **16** | CH1_4L | **16** | CH16_4L | **16** | CH1_1L | **16** | CH8_1L |
| **17** | CH1_3H | **17** | CH9_2H | **17** | CH9_COMH | **17** | CH16_1H | **17** | CH16_2H |
| **18** | CH1_3L | **18** | CH9_2L | **18** | CH9_COML | **18** | CH16_1L | **18** | CH16_2L |
| **19** | CH16_COMH | **19** | CH16_3H | **19** | CH15_4H | **19** | CH9_1H | **19** | CH15_1H |
| **20** | CH16_COML | **20** | CH16_3L | **20** | CH15_4L | **20** | CH9_1L | **20** | CH15_1L |
| **21** | CH9_4H | **21** | CH10_2H | **21** | CH10_COMH | **21** | CH14_1H | **21** | CH15_2H |
| **22** | CH9_4L | **22** | CH10_2L | **22** | CH10_COML | **22** | CH14_1L | **22** | CH15_2L |
| **23** | CH9_3H | **23** | CH15_COMH | **23** | CH14_2H | **23** | CH10_1H | **23** | CH14_4H |
| **24** | CH9_3L | **24** | CH15_COML | **24** | CH14_2L | **24** | CH10_1L | **24** | CH14_4L |
| **25** | CH15_3H | **25** | CH11_COMH | **25** | CH11_1H | **25** | CH13_1H | **25** | CH10_4H |
| **26** | CH15_3L | **26** | CH11_COML | **26** | CH11_1L | **26** | CH13_1L | **26** | CH10_4L |
| **27** | CH10_3H | **27** | CH11_4H | **27** | CH13_3H | **27** | CH11_2H | **27** | CH13_4H |
| **28** | CH10_3L | **28** | CH11_4L | **28** | CH13_3L | **28** | CH11_2L | **28** | CH13_4L |
| **29** | CH14_COMH | **29** | CH12_2H | **29** | CH12_1H | **29** | CH11_3H | **29** | CH14_3H |
| **30** | CH14_COML | **30** | CH12_2L | **30** | CH12_1L | **30** | CH11_3L | **30** | CH14_3L |
| **31** | CH12_4H | **31** | CH13_COMH | **31** | CH12_3H | **31** | CH12_COMH | **31** | CH13_2H |
| **32** | CH12_4L | **32** | CH13_COML | **32** | CH12_3L | **32** | CH12_COML | **32** | CH13_2L |

**TABLE 4-20: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

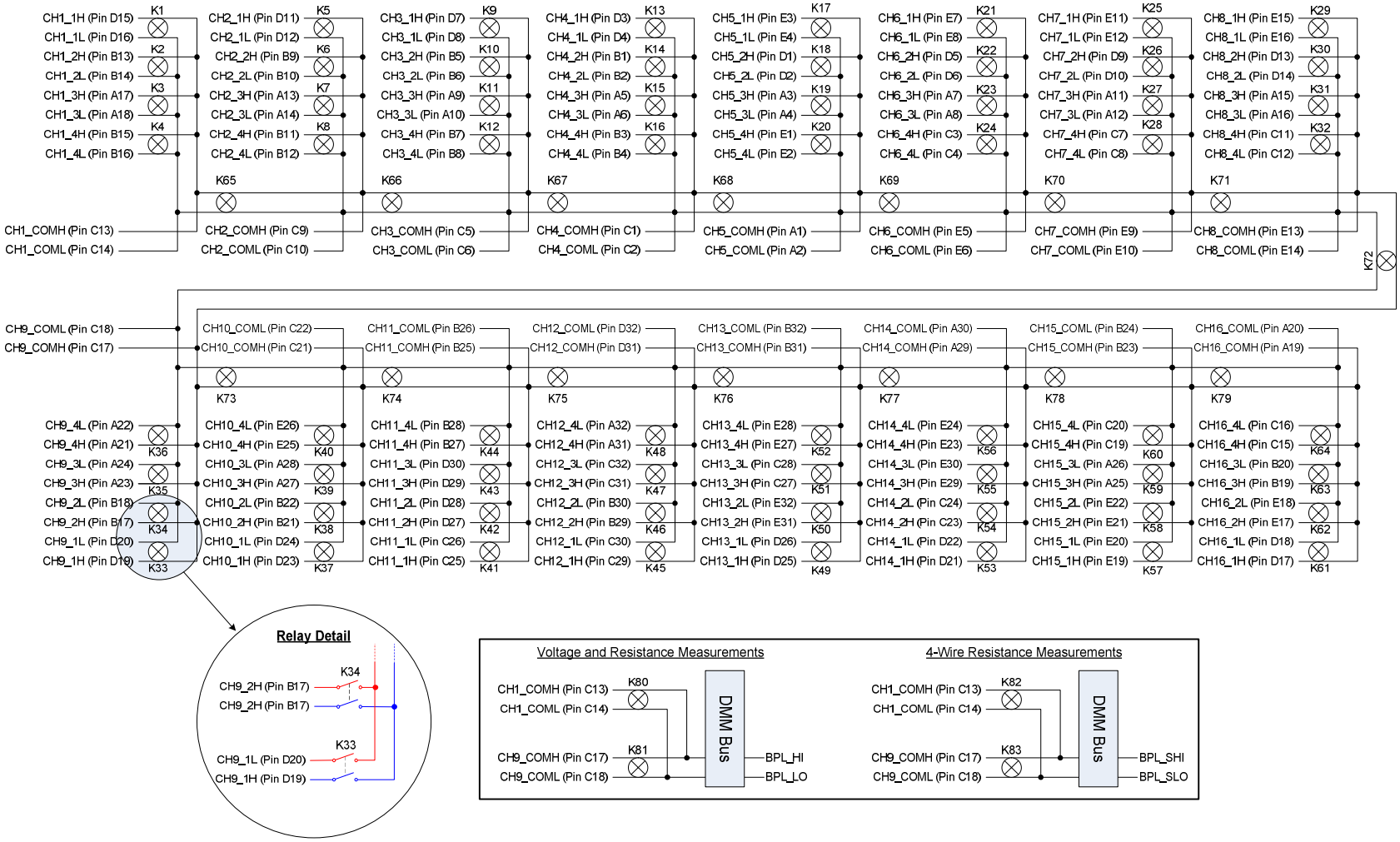



**FIGURE 4-23: EX1200-3164 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH4_1L | D4 | T41 | CH11_2L | D28 | T81 | CH11_4L | B28 | T121 | CH9_4H | A21 |
| T2 | CH4_1H | D3 | T42 | CH11_2H | D27 | T82 | CH11_4H | B27 | T122 | CH9_4L | A22 |
| T3 | CH6_2L | D6 | T43 | CH13_1L | D26 | T83 | CH12_2L | B30 | T123 | CH16_COMH | A19 |
| T4 | CH6_2H | D5 | T44 | CH13_1H | D25 | T84 | CH12_2H | B29 | T124 | CH16_COML | A20 |
| T5 | CH3_1L | D8 | T45 | CH10_1L | D24 | T85 | CH13_COML | B32 | T125 | CH1_3H | A17 |
| T6 | CH3_1H | D7 | T46 | CH10_1H | D23 | T86 | CH13_COMH | B31 | T126 | CH1_3L | A18 |
| T7 | CH7_2L | D10 | T47 | CH14_1L | D22 | T87 | CH4_COML | C2 | T127 | CH8_3H | A15 |
| T8 | CH7_2H | D9 | T48 | CH14_1H | D21 | T88 | CH4_COMH | C1 | T128 | CH8_3L | A16 |
| T9 | CH2_1L | D12 | T49 | CH16_3L | B20 | T89 | CH6_4L | C4 | T129 | CH13_4L | E28 |
| T10 | CH2_1H | D11 | T50 | CH16_3H | B19 | T90 | CH6_4H | C3 | T130 | CH13_4H | E27 |
| T11 | CH8_2L | D14 | T51 | CH5_COMH | A1 | T91 | CH3_COML | C6 | T131 | CH10_4L | E26 |
| T12 | CH8_2H | D13 | T52 | CH5_COML | A2 | T92 | CH3_COMH | C5 | T132 | CH10_4H | E25 |
| T13 | CH1_1L | D16 | T53 | CH5_3H | A3 | T93 | CH7_4L | C8 | T133 | CH14_3L | E30 |
| T14 | CH1_1H | D15 | T54 | CH5_3L | A4 | T94 | CH7_4H | C7 | T134 | CH14_3H | E29 |
| T15 | CH16_1L | D18 | T55 | CH4_3H | A5 | T95 | CH2_COML | C10 | T135 | CH13_3L | C28 |
| T16 | CH16_1H | D17 | T56 | CH4_3L | A6 | T96 | CH2_COMH | C9 | T136 | CH13_3H | C27 |
| T17 | CH3_2L | B6 | T57 | CH6_3H | A7 | T97 | CH15_1L | E20 | T137 | CH12_1L | C30 |
| T18 | CH3_2H | B5 | T58 | CH6_3L | A8 | T98 | CH15_1H | E19 | T138 | CH12_1H | C29 |
| T19 | CH4_4L | B4 | T59 | CH11_COML | B26 | T99 | CH8_1L | E16 | T139 | CH11_1H | C25 |
| T20 | CH4_4H | B3 | T60 | CH11_COMH | B25 | T100 | CH8_1H | E15 | T140 | CH11_1L | C26 |
| T21 | CH3_4L | B8 | T61 | CH15_COML | B24 | T101 | CH15_2L | E22 | T141 | CH14_2H | C23 |
| T22 | CH3_4H | B7 | T62 | CH15_COMH | B23 | T102 | CH15_2H | E21 | T142 | CH14_2L | C24 |
| T23 | CH2_2L | B10 | T63 | CH10_2L | B22 | T103 | CH14_4L | E24 | T143 | CH9_COML | C18 |
| T24 | CH2_2H | B9 | T64 | CH10_2H | B21 | T104 | CH14_4H | E23 | T144 | CH9_COMH | C17 |
| T25 | CH2_4L | B12 | T65 | CH11_3L | D30 | T105 | CH8_COML | E14 | T145 | CH10_COMH | C21 |
| T26 | CH2_4H | B11 | T66 | CH11_3H | D29 | T106 | CH8_COMH | E13 | T146 | CH10_COML | C22 |
| T27 | CH1_2L | B14 | T67 | CH12_COML | D32 | T107 | CH7_1L | E12 | T147 | CH15_4H | C19 |
| T28 | CH1_2H | B13 | T68 | CH12_COMH | D31 | T108 | CH7_1H | E11 | T148 | CH15_4L | C20 |
| T29 | CH1_4L | B16 | T69 | CH5_4L | E2 | T109 | CH7_COML | E10 | T149 | CH15_3H | A25 |
| T30 | CH1_4H | B15 | T70 | CH5_4H | E1 | T110 | CH7_COMH | E9 | T150 | CH15_3L | A26 |
| T31 | CH9_2L | B18 | T71 | CH5_1L | E4 | T111 | CH6_1L | E8 | T151 | CH10_3H | A27 |
| T32 | CH9_2H | B17 | T72 | CH5_1H | E3 | T112 | CH6_1H | E7 | T152 | CH10_3L | A28 |
| T33 | CH9_1L | D20 | T73 | CH6_COML | E6 | T113 | CH8_4L | C12 | T153 | CH14_COMH | A29 |
| T34 | CH9_1H | D19 | T74 | CH6_COMH | E5 | T114 | CH8_4H | C11 | T154 | CH14_COML | A30 |
| T35 | CH3_3H | A9 | T75 | CH16_2H | E17 | T115 | CH1_COML | C14 | T155 | CH13_2H | E31 |
| T36 | CH3_3L | A10 | T76 | CH16_2L | E18 | T116 | CH1_COMH | C13 | T156 | CH13_2L | E32 |
| T37 | CH7_3H | A11 | T77 | CH5_2L | D2 | T117 | CH16_4L | C16 | T157 | CH12_3H | C31 |
| T38 | CH7_3L | A12 | T78 | CH5_2H | D1 | T118 | CH16_4H | C15 | T158 | CH12_3L | C32 |
| T39 | CH2_3H | A13 | T79 | CH4_2L | B2 | T119 | CH9_3H | A23 | T159 | CH12_4H | A31 |
| T40 | CH2_3L | A14 | T80 | CH4_2H | B1 | T120 | CH9_3L | A24 | T160 | CH12_4L | A32 |

**TABLE 4-21: EX1200-TB160-2 TERMINAL BLOCK TO EX1200-3164 PIN MAPPING**

RT1 can be measured by the EX1200 DMM or may be measured using an external instrument. If an external sensor is used, it must be connected to T164 (L_VS) and T163 (H_VS). The user may also choose to use a sensor other than the on-board thermistor. To do so, connect the sensor using T162 (RL_I) and T161 (RH_I). Note that CH4_1L (T1) and CH4_1H (T2) must be dedicated to making temperature measurements once P2 is configured.

# EX1200-3164 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Configured as either 16 (1x4), 8 (1x8), 4 (1x16), 2 (1x32) or 1 (1x64) 2-wire multiplexers |
| **RELAY TYPE** | |
| | Electromechanical, 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.* | |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **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* | |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 500 mΩ |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ 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)** | |
| | 40 MHz (typical) |
| **CROSSTALK (TYPICAL)** | |
| **1 MHz** | < -70 dB |
| **10 MHz** | < -50 dB |
| **ISOLATION (TYPICAL)** | |
| **1 MHz** | < -55 dB |
| **10 MHz** | < -35 dB |

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

# EX1200-3824 PLUG-IN MODULE

## 8 (1 X 24) SOLID STATE, 100V/100MA MULTIPLEXER

The EX1200-3824 is a high speed multiplexer designed to provide flexible switching multiplexing architecture with 8 banks of 1 x 24 one-wire multiplexers. Upto 48 1 x 24 one-wire channels can be accommodated in a 1U EX1200 full rack mainframe for maximum density, or mixed and matched with other EX1200 plug-ins for flexibility. The solid-state design delivers maximum switching speed and near infinite life.

The EX1200-3824 may be used in applications in which its inputs are connected to DUT capable of producing signals that approach 100 V, with its commons being connected to high-speed measurement devices. In this type of applications, the input signal will need to be attenuated. For this very reason EX1200-3824 also has attenuator option, this will consist of user configurable 10KHz Low Pass Filter or 400KHz Low Pass Filter, refer to Figure 4-28 for configuring the LPF.

The EX1200-3824 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 4-29 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.

EX1200-38TB the break out box (BOB) can be used along with the EX1200-3824. This EX1200-38TB can be mounted on the EX1200-3824 front panel, mates with 200 Pin connector directly.

## EX1200-3824 STANDARD BOARD

Figure 4-24 explains the EX1200-3824 without Attenuator option. For the standard configuration a 0 Ohm resistor bypasses the attenuator circuit bringing out the 8 commons to the 200 pin front panel. This functions as a multiplexer module of 8 banks (1 x 24).

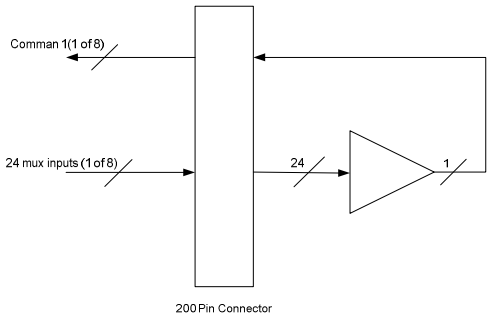



**FIGURE 4-24: I/O IMPLEMENTATION, STANDARD EX1200-3824 BOARD**

## EX1200-3824 WITH ATTENUATOR OPTION

Figure 4-25 exlains the EX1200-3824 with Attenuator option, the zero Ohm resistor is removed and the Mux outputs are fed through the attenuator circuit. The 8 common pins in the standard board will be treated as Ground Pins for connecting the DUT. Ground pins are dedicated to each bank contributing a total of 8 ground pins at the Front Panel Connector.

Attenuator Section comprises of two different user selectable low pass frequency options – 10 Khz and 400Khz. Jumpers are provided to select the frequencies. 10Khz LPF is selected if jumper is connected. 400 Khz LPF is selected if jumper is not connected. Refer Figure 4-28

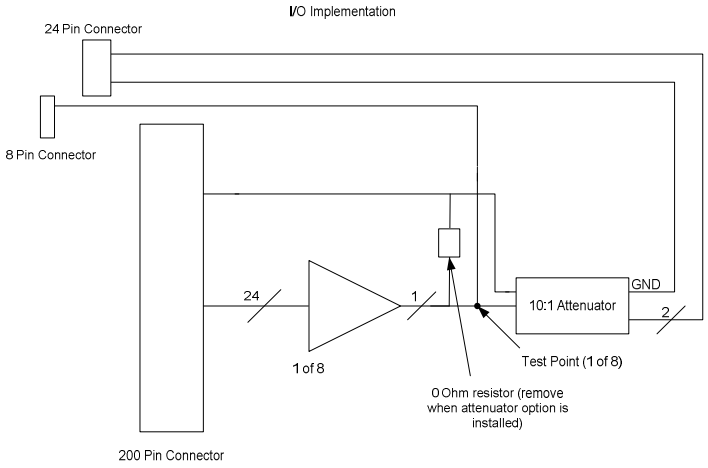



**FIGURE 4-25: I/O IMPLEMENTATION, EX1200-3824 BOARD WITH ATTENUATOR OPTION**

## CONNECTOR PINS AND SIGNALS

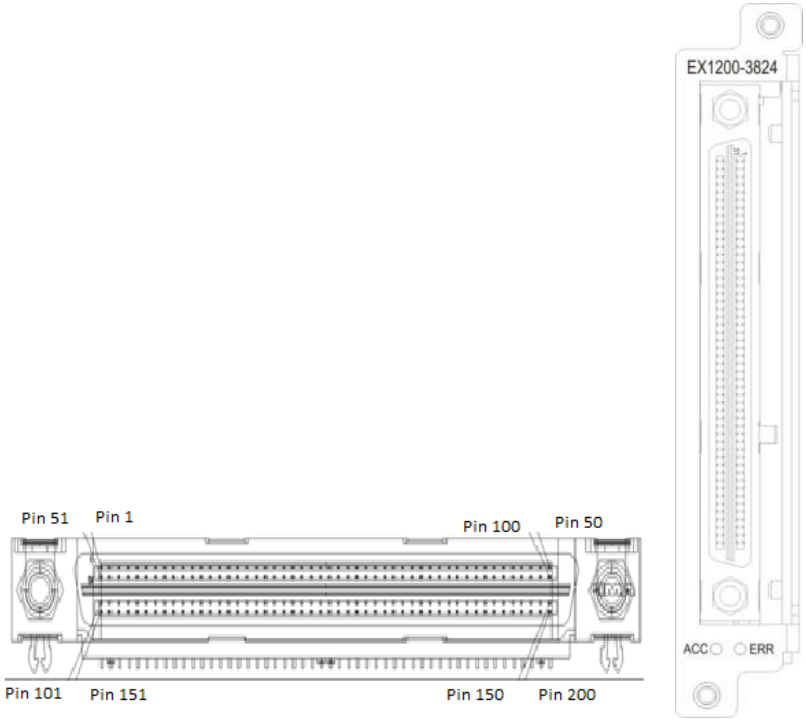



**FIGURE 4-26: EX1200-3824 FRONT PANEL (FRONT VIEW)**

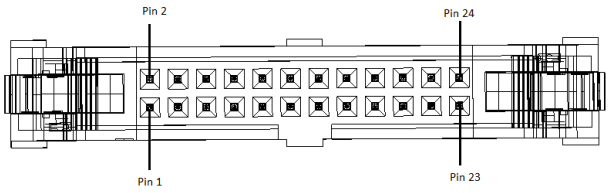
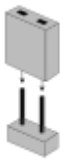



**FIGURE 4-27: EX1200-3824, ATTENUATOR CONNECTOR 24-PIN**



Jumper Close : 10 KHz LPF

Jumper Open : 400 KHz LPF

**FIGURE 4-28: EX1200-3824, LOW PASS FILTER CONFIGURATION CONNECTOR 2-PIN**

| EX1200-3824 MUX CARD 200PIN CONNECTOR PINOUTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **P1 PIN** | **Desc** | P1 PIN | **Desc** | P1 PIN | **Desc** | P1 PIN | **Desc** |
| 1 | MUX1_CH_1 | 51 | MUX3_CH_1 | 101 | MUX5_CH_1 | 151 | MUX7_CH_1 |
| 2 | MUX1_CH_2 | 52 | MUX3_CH_2 | 102 | MUX5_CH_2 | 152 | MUX7_CH_2 |
| 3 | MUX1_CH_3 | 53 | MUX3_CH_3 | 103 | MUX5_CH_3 | 153 | MUX7_CH_3 |
| 4 | MUX1_CH_4 | 54 | MUX3_CH_4 | 104 | MUX5_CH_4 | 154 | MUX7_CH_4 |
| 5 | MUX1_CH_5 | 55 | MUX3_CH_5 | 105 | MUX5_CH_5 | 155 | MUX7_CH_5 |
| 6 | MUX1_CH_6 | 56 | MUX3_CH_6 | 106 | MUX5_CH_6 | 156 | MUX7_CH_6 |
| 7 | MUX1_CH_7 | 57 | MUX3_CH_7 | 107 | MUX5_CH_7 | 157 | MUX7_CH_7 |
| 8 | MUX1_CH_8 | 58 | MUX3_CH_8 | 108 | MUX5_CH_8 | 158 | MUX7_CH_8 |
| 9 | MUX1_CH_9 | 59 | MUX3_CH_9 | 109 | MUX5_CH_9 | 159 | MUX7_CH_9 |
| 10 | MUX1_CH_10 | 60 | MUX3_CH_10 | 110 | MUX5_CH_10 | 160 | MUX7_CH_10 |
| 11 | MUX1_CH_11 | 61 | MUX3_CH_11 | 111 | MUX5_CH_11 | 161 | MUX7_CH_11 |
| 12 | MUX1_CH_12 | 62 | MUX3_CH_12 | 112 | MUX5_CH_12 | 162 | MUX7_CH_12 |
| 13 | MUX1_(COM/GND) | 63 | MUX3_(COM/GND) | 113 | MUX5_(COM/GND) | 163 | MUX7_(COM/GND) |
| 14 | MUX1_CH_13 | 64 | MUX3_CH_13 | 114 | MUX5_CH_13 | 164 | MUX7_CH_13 |
| 15 | MUX1_CH_14 | 65 | MUX3_CH_14 | 115 | MUX5_CH_14 | 165 | MUX7_CH_14 |
| 16 | MUX1_CH_15 | 66 | MUX3_CH_15 | 116 | MUX5_CH_15 | 166 | MUX7_CH_15 |
| 17 | MUX1_CH_16 | 67 | MUX3_CH_16 | 117 | MUX5_CH_16 | 167 | MUX7_CH_16 |
| 18 | MUX1_CH_17 | 68 | MUX3_CH_17 | 118 | MUX5_CH_17 | 168 | MUX7_CH_17 |
| 19 | MUX1_CH_18 | 69 | MUX3_CH_18 | 119 | MUX5_CH_18 | 169 | MUX7_CH_18 |
| 20 | MUX1_CH_19 | 70 | MUX3_CH_19 | 120 | MUX5_CH_19 | 170 | MUX7_CH_19 |
| 21 | MUX1_CH_20 | 71 | MUX3_CH_20 | 121 | MUX5_CH_20 | 171 | MUX7_CH_20 |
| 22 | MUX1_CH_21 | 72 | MUX3_CH_21 | 122 | MUX5_CH_21 | 172 | MUX7_CH_21 |
| 23 | MUX1_CH_22 | 73 | MUX3_CH_22 | 123 | MUX5_CH_22 | 173 | MUX7_CH_22 |
| 24 | MUX1_CH_23 | 74 | MUX3_CH_23 | 124 | MUX5_CH_23 | 174 | MUX7_CH_23 |
| 25 | MUX1_CH_24 | 75 | MUX3_CH_24 | 125 | MUX5_CH_24 | 175 | MUX7_CH_24 |
| 26 | MUX2_CH_1 | 76 | MUX4_CH_1 | 126 | MUX6_CH_1 | 176 | MUX8_CH_1 |
| 27 | MUX2_CH_2 | 77 | MUX4_CH_2 | 127 | MUX6_CH_2 | 177 | MUX8_CH_2 |
| 28 | MUX2_CH_3 | 78 | MUX4_CH_3 | 128 | MUX6_CH_3 | 178 | MUX8_CH_3 |
| 29 | MUX2_CH_4 | 79 | MUX4_CH_4 | 129 | MUX6_CH_4 | 179 | MUX8_CH_4 |
| 30 | MUX2_CH_5 | 80 | MUX4_CH_5 | 130 | MUX6_CH_5 | 180 | MUX8_CH_5 |
| 31 | MUX2_CH_6 | 81 | MUX4_CH_6 | 131 | MUX6_CH_6 | 181 | MUX8_CH_6 |
| 32 | MUX2_CH_7 | 82 | MUX4_CH_7 | 132 | MUX6_CH_7 | 182 | MUX8_CH_7 |
| 33 | MUX2_CH_8 | 83 | MUX4_CH_8 | 133 | MUX6_CH_8 | 183 | MUX8_CH_8 |
| 34 | MUX2_CH_9 | 84 | MUX4_CH_9 | 134 | MUX6_CH_9 | 184 | MUX8_CH_9 |
| 35 | MUX2_CH_10 | 85 | MUX4_CH_10 | 135 | MUX6_CH_10 | 185 | MUX8_CH_10 |
| 36 | MUX2_CH_11 | 86 | MUX4_CH_11 | 136 | MUX6_CH_11 | 186 | MUX8_CH_11 |
| 37 | MUX2_CH_12 | 87 | MUX4_CH_12 | 137 | MUX6_CH_12 | 187 | MUX8_CH_12 |
| 38 | MUX2_(COM/GND) | 88 | MUX4_(COM/GND) | 138 | MUX6_(COM/GND) | 188 | MUX8_(COM/GND) |
| 39 | MUX2_CH_13 | 89 | MUX4_CH_13 | 139 | MUX6_CH_13 | 189 | MUX8_CH_13 |
| 40 | MUX2_CH_14 | 90 | MUX4_CH_14 | 140 | MUX6_CH_14 | 190 | MUX8_CH_14 |
| 41 | MUX2_CH_15 | 91 | MUX4_CH_15 | 141 | MUX6_CH_15 | 191 | MUX8_CH_15 |
| 42 | MUX2_CH_16 | 92 | MUX4_CH_16 | 142 | MUX6_CH_16 | 192 | MUX8_CH_16 |
| 43 | MUX2_CH_17 | 93 | MUX4_CH_17 | 143 | MUX6_CH_17 | 193 | MUX8_CH_17 |
| 44 | MUX2_CH_18 | 94 | MUX4_CH_18 | 144 | MUX6_CH_18 | 194 | MUX8_CH_18 |
| 45 | MUX2_CH_19 | 95 | MUX4_CH_19 | 145 | MUX6_CH_19 | 195 | MUX8_CH_19 |
| 46 | MUX2_CH_20 | 96 | MUX4_CH_20 | 146 | MUX6_CH_20 | 196 | MUX8_CH_20 |
| 47 | MUX2_CH_21 | 97 | MUX4_CH_21 | 147 | MUX6_CH_21 | 197 | MUX8_CH_21 |
| 48 | MUX2_CH_22 | 98 | MUX4_CH_22 | 148 | MUX6_CH_22 | 198 | MUX8_CH_22 |
| 49 | MUX2_CH_23 | 99 | MUX4_CH_23 | 149 | MUX6_CH_23 | 199 | MUX8_CH_23 |
| 50 | MUX2_CH_24 | 100 | MUX4_CH_24 | 150 | MUX6_CH_24 | 200 | MUX8_CH_24 |

**TABLE 4-22: EX1200-3824 MUX CARD 200PIN CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

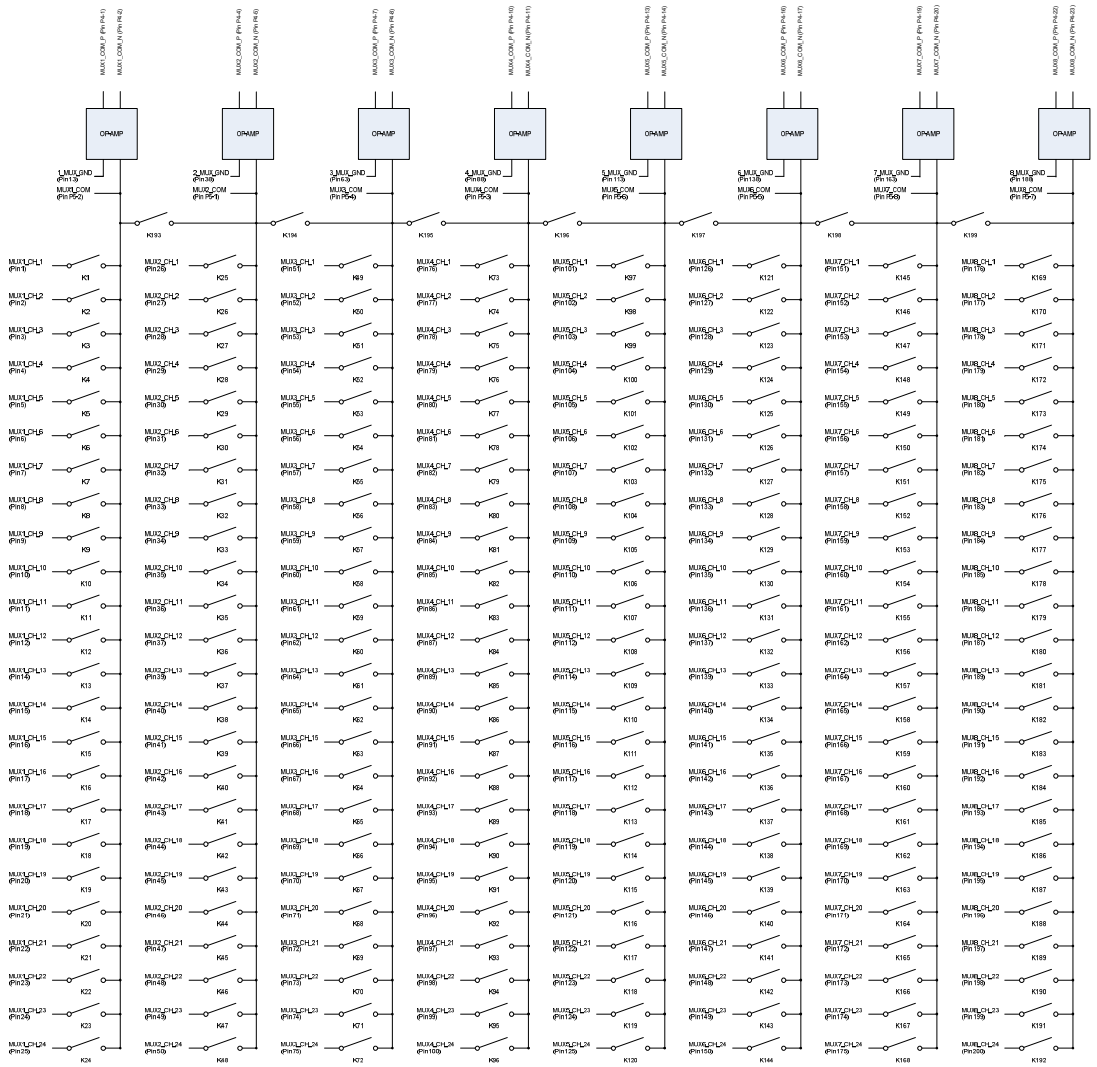


FIGURE 4-29: EX1200-3824 LOGICAL DIAGRAM

| 24 Pin Connector Pinout | |
|---|---|
| 1 | **MUX1_COM_P** |
| 2 | **MUX1_COM_N** |
| 3 | GND_A |
| 4 | **MUX2_COM_P** |
| 5 | **MUX2_COM_N** |
| 6 | GND_A |
| 7 | **MUX3_COM_P** |
| 8 | **MUX3_COM_N** |
| 9 | GND_A |
| 10 | **MUX4_COM_P** |
| 11 | **MUX4_COM_N** |
| 12 | GND_A |
| 13 | **MUX5_COM_P** |
| 14 | **MUX5_COM_N** |
| 15 | GND_A |
| 16 | **MUX6_COM_P** |
| 17 | **MUX6_COM_N** |
| 18 | GND_A |
| 19 | **MUX7_COM_P** |
| 20 | **MUX7_COM_N** |
| 21 | GND_A |
| 22 | **MUX8_COM_P** |
| 23 | **MUX8_COM_N** |
| 24 | GND_A |

**TABLE 4-23: EX1200-3824 ATTENUATOR OUTPUT 24 PIN MAPPING AND EX1200-38TB P10&P11 PIN MAPPING**

## EX1200-38TB

EX1200-38TB is the terminal box that can be used with EX1200-3824, it gets mounted on the front panel connecting to the 200 pin connector on the EX1200-3824 Board. The 8 Banks of 1x24 can be accessed on the 8 Nos of 50 Pin connectors on the EX1200-38TB. The 24 Pin connector on the EX1200-3824 for the Attenuator Output can also be brought out 1:1 using a 24 pin Female-Female IDC Cable. For Pinouts of P2-P9 please refer to Table 4-26, for P10&P11 Pinouts refer to Table 4-23.

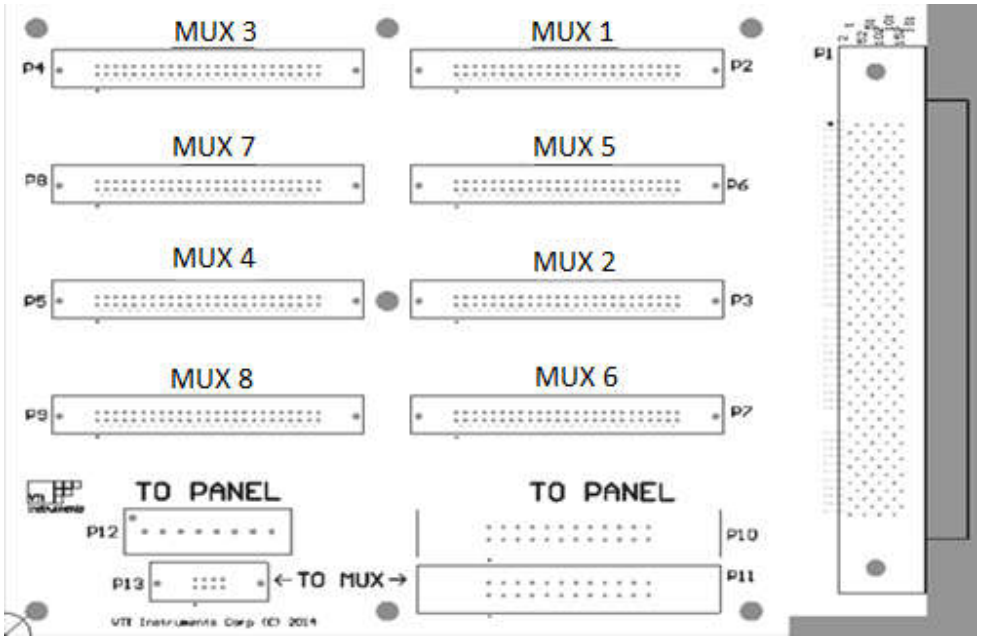



**FIGURE 4-30: EX1200-38TB TERMINAL BOARD FOR EX1200-3824**

| P12 - 8 Pin Connector Pinouts | |
|---|---|
| 1 | MUX1_COM |
| 2 | MUX 2_COM |
| 3 | MUX 3_COM |
| 4 | MUX 4_COM |
| 5 | MUX 5_COM |
| 6 | MUX 6_COM |
| 7 | MUX 7_COM |
| 8 | MUX 8_COM |

**TABLE 4-24: EX1200-38TB P12 PINOUTS**

| P13 - 8 Pin Connector Pinouts | |
|---|---|
| 1 | MUX2_COM |
| 2 | MUX1_COM |
| 3 | MUX4_COM |
| 4 | MUX3_COM |
| 5 | MUX6_COM |
| 6 | MUX5_COM |
| 7 | MUX8_COM |
| 8 | MUX7_COM |

**TABLE 4-25: EX1200-38TB P13 PINOUTS**

| P2-P9 50 PIN CONNECTOR PINOUTS on EX1200-38TB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PIN** | **P2** | P3 | **P4** | P5 | **P6** | P7 | **P8** | **P9** |
| 1 | MUX1_CH_24 | MUX2_CH_24 | MUX3_CH_24 | MUX4_CH_24 | MUX5_CH_24 | MUX6_CH_24 | MUX7_CH_24 | MUX8_CH_24 |
| 2 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 3 | MUX1_CH_23 | MUX2_CH_23 | MUX3_CH_23 | MUX4_CH_23 | MUX5_CH_23 | MUX6_CH_23 | MUX7_CH_23 | MUX8_CH_23 |
| 4 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 5 | MUX1_CH_22 | MUX2_CH_22 | MUX3_CH_22 | MUX4_CH_22 | MUX5_CH_22 | MUX6_CH_22 | MUX7_CH_22 | MUX8_CH_22 |
| 6 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 7 | MUX1_CH_21 | MUX2_CH_21 | MUX3_CH_21 | MUX4_CH_21 | MUX5_CH_21 | MUX6_CH_21 | MUX7_CH_21 | MUX8_CH_21 |
| 8 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 9 | MUX1_CH_20 | MUX2_CH_20 | MUX3_CH_20 | MUX4_CH_20 | MUX5_CH_20 | MUX6_CH_20 | MUX7_CH_20 | MUX8_CH_20 |
| 10 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 11 | MUX1_CH_19 | MUX2_CH_19 | MUX3_CH_19 | MUX4_CH_19 | MUX5_CH_19 | MUX6_CH_19 | MUX7_CH_19 | MUX8_CH_19 |
| 12 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 13 | MUX1_CH_18 | MUX2_CH_18 | MUX3_CH_18 | MUX4_CH_18 | MUX5_CH_18 | MUX6_CH_18 | MUX7_CH_18 | MUX8_CH_18 |
| 14 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 15 | MUX1_CH_17 | MUX2_CH_17 | MUX3_CH_17 | MUX4_CH_17 | MUX5_CH_17 | MUX6_CH_17 | MUX7_CH_17 | MUX8_CH_17 |
| 16 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |

| P2-P9 50 PIN CONNECTOR PINOUTS on EX1200-38TB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PIN** | **P2** | P3 | **P4** | P5 | **P6** | P7 | **P8** | **P9** |
| 17 | MUX1_CH_16 | MUX2_CH_16 | MUX3_CH_16 | MUX4_CH_16 | MUX5_CH_16 | MUX6_CH_16 | MUX7_CH_16 | MUX8_CH_16 |
| 18 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 19 | MUX1_CH_15 | MUX2_CH_15 | MUX3_CH_15 | MUX4_CH_15 | MUX5_CH_15 | MUX6_CH_15 | MUX7_CH_15 | MUX8_CH_15 |
| 20 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 21 | MUX1_CH_14 | MUX2_CH_14 | MUX3_CH_14 | MUX4_CH_14 | MUX5_CH_14 | MUX6_CH_14 | MUX7_CH_14 | MUX8_CH_14 |
| 22 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 23 | MUX1_CH_13 | MUX2_CH_13 | MUX3_CH_13 | MUX4_CH_13 | MUX5_CH_13 | MUX6_CH_13 | MUX7_CH_13 | MUX8_CH_13 |
| 24 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 25 | MUX1_CH_12 | MUX2_CH_12 | MUX3_CH_12 | MUX4_CH_12 | MUX5_CH_12 | MUX6_CH_12 | MUX7_CH_12 | MUX8_CH_12 |
| 26 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 27 | MUX1_CH_11 | MUX2_CH_11 | MUX3_CH_11 | MUX4_CH_11 | MUX5_CH_11 | MUX6_CH_11 | MUX7_CH_11 | MUX8_CH_11 |
| 28 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 29 | MUX1_CH_10 | MUX2_CH_10 | MUX3_CH_10 | MUX4_CH_10 | MUX5_CH_10 | MUX6_CH_10 | MUX7_CH_10 | MUX8_CH_10 |
| 30 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 31 | MUX1_CH_9 | MUX2_CH_9 | MUX3_CH_9 | MUX4_CH_9 | MUX5_CH_9 | MUX6_CH_9 | MUX7_CH_9 | MUX8_CH_9 |
| 32 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 33 | MUX1_CH_8 | MUX2_CH_8 | MUX3_CH_8 | MUX4_CH_8 | MUX5_CH_8 | MUX6_CH_8 | MUX7_CH_8 | MUX8_CH_8 |
| 34 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 35 | MUX1_CH_7 | MUX2_CH_7 | MUX3_CH_7 | MUX4_CH_7 | MUX5_CH_7 | MUX6_CH_7 | MUX7_CH_7 | MUX8_CH_7 |
| 36 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 37 | MUX1_CH_6 | MUX2_CH_6 | MUX3_CH_6 | MUX4_CH_6 | MUX5_CH_6 | MUX6_CH_6 | MUX7_CH_6 | MUX8_CH_6 |
| 38 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 39 | MUX1_CH_5 | MUX2_CH_5 | MUX3_CH_5 | MUX4_CH_5 | MUX5_CH_5 | MUX6_CH_5 | MUX7_CH_5 | MUX8_CH_5 |
| 40 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 41 | MUX1_CH_4 | MUX2_CH_4 | MUX3_CH_4 | MUX4_CH_4 | MUX5_CH_4 | MUX6_CH_4 | MUX7_CH_4 | MUX8_CH_4 |
| 42 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 43 | MUX1_CH_3 | MUX2_CH_3 | MUX3_CH_3 | MUX4_CH_3 | MUX5_CH_3 | MUX6_CH_3 | MUX7_CH_3 | MUX8_CH_3 |
| 44 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 45 | MUX1_CH_2 | MUX2_CH_2 | MUX3_CH_2 | MUX4_CH_2 | MUX5_CH_2 | MUX6_CH_2 | MUX7_CH_2 | MUX8_CH_2 |
| 46 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 47 | MUX1_CH_1 | MUX2_CH_1 | MUX3_CH_1 | MUX4_CH_1 | MUX5_CH_1 | MUX6_CH_1 | MUX7_CH_1 | MUX8_CH_1 |
| 48 | MUX1_GND | MUX2_GND | MUX3_GND | MUX4_GND | MUX5_GND | MUX6_GND | MUX7_GND | MUX8_GND |
| 49 | NC | NC | NC | NC | NC | NC | NC | NC |
| 50 | NC | NC | NC | NC | NC | NC | NC | NC |

**TABLE 4-26: EX1200-38TB P2-P9 PINOUTS**

## EX1200-3824 SPECIFICATIONS

| SPECIFICATIONS FOR EX1200-3824 STANDARD BOARD | |
|---|---|
| **CHANNEL COUNT** | |
| | 8 (1x24) one-wire multiplexers |
| **RELAY TYPE** | |
| | Solid State |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 70V DC 100V AC |
| **MAXIMUM SWITCHING CURRENT** | |
| | 100mA |
| **SWITCHING TIME** | |
| | < 500µs |
| **PATH RESISTANCE** | |
| | <10 Ohms |
| **CROSSTALK (TYPICAL)** | |
| **100 KHz** | <-70 dB |
| **1 MHz** | < -55 dB |
| **10 MHz** | < -30 dB |
| **INSERTION LOSS (-3 DB)** | |
| | >25 MHz |

| SPECIFICATIONS FOR EX1200-3824 WITH ATTENUATOR OPTION | |
|---|---|
| **CHANNEL COUNT** | |
| | 8 (1x24) one-wire multiplexers |
| **RELAY TYPE** | |
| | Solid State |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 70V DC 100V AC |
| **MAXIMUM SWITCHING CURRENT** | |
| | 100mA |
| **SWITCHING TIME** | |
| | < 500µs |
| **PATH RESISTANCE** | |
| | <10 Ohms |
| **FREQUENCY RESPONSE -CUTOFF** | |
| 10kHz | -3dB |
| 400kHz | -3dB |
| **FREQUENCY RESPONSE -FLATNESS** | |
| 10kHz | 0.1dB |
| 400kHz | 0.1dB |
| **CROSSTALK (TYPICAL)** | |
| 10kHz | <-40dB |
| 400kHz | < -30dB |
| **CMRR – 400kHz** | |
| | -30dB |
| **DC OFFSET** | |
| | 1mV |

# EX1200-4003 PLUG-IN MODULE

## DUAL 4 X 16 TWO-WIRE MATRIX, 300 V / 2 A

The EX1200-4003 high-density matrix module allow 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. For example, a digital multimeter, counter/timer and digitizers can be connected to the input rows, and each of these devices can be connected to any of the output columns depending on the measurement function that is desired during the test. The connections between rows and columns occur internal to the module which greatly reduces external cabling.

The smallest building block is a (4 x 16) 2-wire matrix, and rows and columns can easily be expanded to form larger matrices. A (4 x 192) 2-wire matrix can be accommodated in an EX1200 series full rack mainframe. The two banks of matrices can be connected under program control to further simplify field wiring.

Fail-safe relays capable of switching up to 300 V and up to 2 A are used to maximize the range of application spaces that can be addressed with this module. All relays are fail-safe which ensures that no undesired signals are present at the user interface in the case of power interruption.

The EX1200-4003 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 4-32 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. Both single-wire and two-wire programming modes are available.

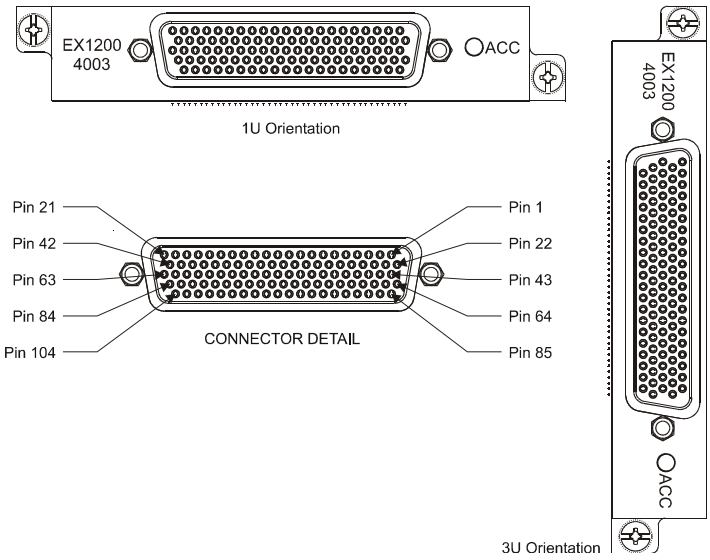



**FIGURE 4-31: EX1200-4003 FRONT PANEL (FRONT VIEW)**

| Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal | Pin | Signal |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CH1_C6H | 22 | CH1_C13L | 43 | CH1_C14L | 64 | CH1_C7H | 85 | CH1_C15H |
| 2 | CH1_C6L | 23 | CH1_C13H | 44 | CH1_C14H | 65 | CH1_C7L | 86 | CH1_C15L |
| 3 | CH1_C12H | 24 | CH1_C16L | 45 | CH1_C5L | 66 | CH1_R2H | 87 | CH1_R1L |
| 4 | CH1_C12L | 25 | CH1_C16H | 46 | CH1_C5H | 67 | CH1_R2L | 88 | CH1_R1H |
| 5 | CH1_C4H | 26 | CH1_C11L | 47 | SHIELD | 68 | SHIELD | 89 | CH1_R3H |
| 6 | CH1_C4L | 27 | CH1_C11H | 48 | SHIELD | 69 | SHIELD | 90 | CH1_R3L |
| 7 | CH1_C9H | 28 | CH1_R4H | 49 | SHIELD | 70 | CH1_C3L | 91 | SHIELD |
| 8 | CH1_C9L | 29 | CH1_R4L | 50 | SHIELD | 71 | CH1_C3H | 92 | SHIELD |
| 9 | CH1_C1L | 30 | CH1_C10H | 51 | CH2_C19L | 72 | CH1_C2L | 93 | SHIELD |
| 10 | CH1_C1H | 31 | CH1_C10L | 52 | CH2_C19H | 73 | CH1_C2H | 94 | SHIELD |
| 11 | CH1_C8L | 32 | CH2_C20H | 53 | SHIELD | 74 | CH2_C17L | 95 | SHIELD |
| 12 | CH1_C8H | 33 | CH2_C20L | 54 | SHIELD | 75 | CH2_C17H | 96 | SHIELD |
| 13 | CH2_C21L | 34 | CH2_C32H | 55 | SHIELD | 76 | CH2_R5H | 97 | SHIELD |
| 14 | CH2_C21H | 35 | CH2_C32L | 56 | SHIELD | 77 | CH2_R5L | 98 | SHIELD |
| 15 | CH2_C31H | 36 | SHIELD | 57 | CH2_C22H | 78 | CH2_R6H | 99 | CH2_R8L |
| 16 | CH2_C31L | 37 | SHIELD | 58 | CH2_C22L | 79 | CH2_R6L | 100 | CH2_R8H |
| 17 | CH2_C23L | 38 | CH2_C30L | 59 | CH2_C18L | 80 | CH2_R7L | 101 | CH2_C25H |
| 18 | CH2_C23H | 39 | CH2_C30H | 60 | CH2_C18H | 81 | CH2_R7H | 102 | CH2_C25L |
| 19 | CH2_C29H | 40 | CH2_C24H | 61 | CH2_C28L | 82 | CH2_C27L | 103 | CH2_C26H |
| 20 | CH2_C29L | 41 | CH2_C24L | 62 | CH2_C28H | 83 | CH2_C27H | 104 | CH2_C26L |
| 21 | SHIELD | 42 | SHIELD | 63 | UNUSED | 84 | UNUSED | | |

**TABLE 4-27: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-4003 incorporates 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. These pins are identified as "SHIELD" in Table 4-27. Note that SHIELD pins are not tied to ground and have no electrical connections.

**TABLE 4-28**

## LOGICAL DIAGRAM

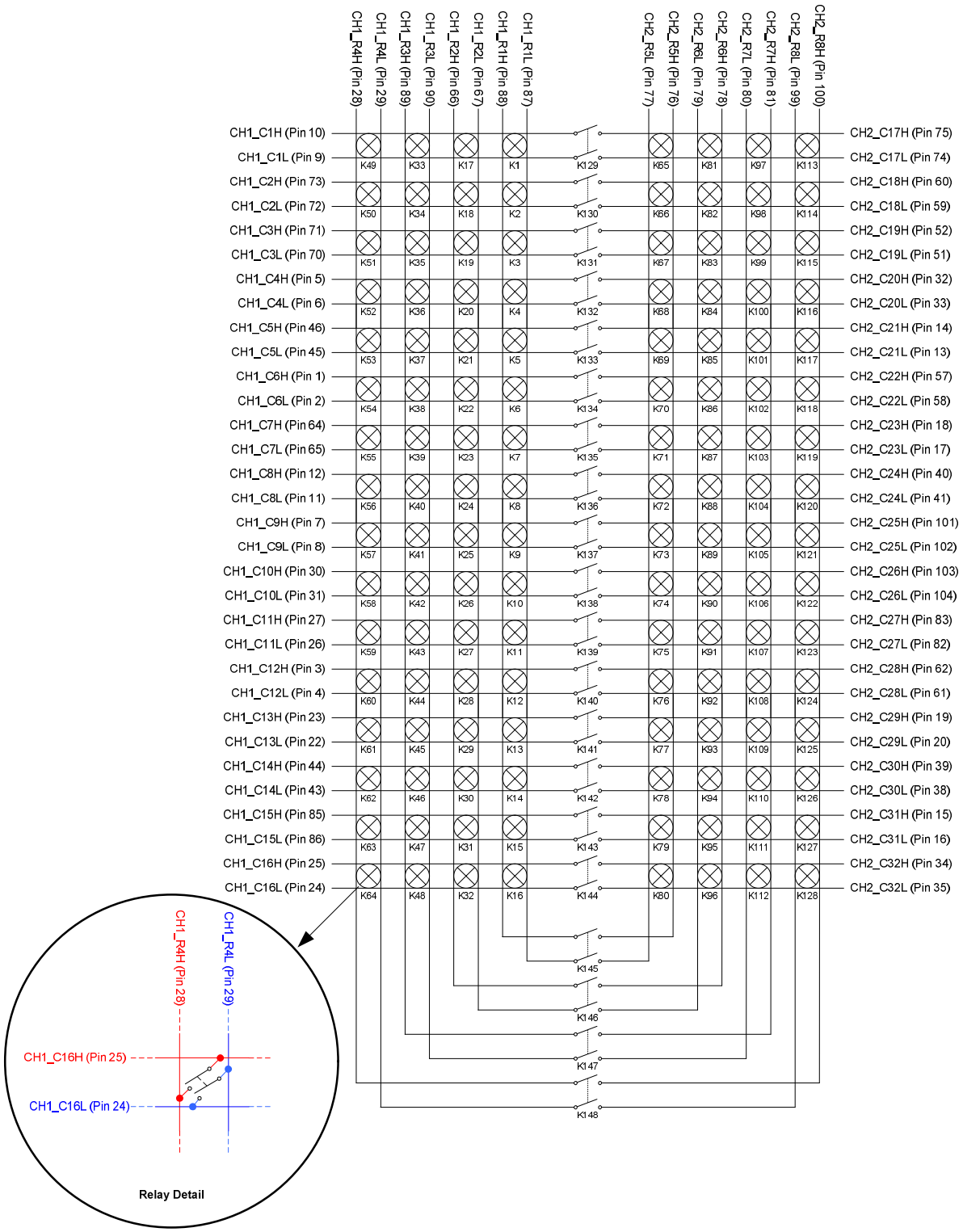



**FIGURE 4-32: EX1200-4003 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH1_C6H | 1 | T31 | CH1_C10H | 30 | T61 | CH2_C18L | 59 | T91 | CH2_C27L | 82 |
| T2 | CH1_C6L | 2 | T32 | CH1_C10L | 31 | T62 | CH2_C18H | 60 | T92 | CH2_C27H | 83 |
| T3 | CH1_C12H | 3 | T33 | CH2_C20H | 32 | T63 | CH2_C28L | 61 | T93 | UNUSED | N/A |
| T4 | CH1_C12L | 4 | T34 | CH2_C20L | 33 | T64 | CH2_C28H | 62 | T94 | GND_C | 84 |
| T5 | CH1_C4H | 5 | T35 | CH2_C32H | 34 | T65 | UNUSED | N/A | T95 | CH1_C15H | 85 |
| T6 | CH1_C4L | 6 | T36 | CH2_C32L | 35 | T66 | GND_C | 63 | T96 | CH1_C15L | 86 |
| T7 | CH1_C9L | 7 | T37 | SHIELD | 36 | T67 | CH1_C7H | 64 | T97 | CH1_R1L | 87 |
| T8 | CH1_C9H | 8 | T38 | SHIELD | 37 | T68 | CH1_C7L | 65 | T98 | CH1_R1H | 88 |
| T9 | CH1_C1L | 9 | T39 | CH2_C30L | 38 | T69 | CH1_R2H | 66 | T99 | CH1_R3H | 89 |
| T10 | CH1_C1H | 10 | T40 | CH2_C30H | 39 | T70 | CH1_R2L | 67 | T100 | CH1_R3L | 90 |
| T11 | CH1_C8L | 11 | T41 | CH2_C24H | 40 | T71 | SHIELD | 68 | T101 | SHIELD | 91 |
| T12 | CH1_C8H | 12 | T42 | CH2_C24L | 41 | T72 | SHIELD | 69 | T102 | SHIELD | 92 |
| T13 | CH2_C21L | 13 | T43 | UNUSED | N/A | T73 | CH1_C3L | 70 | T103 | SHIELD | 93 |
| T14 | CH2_C21H | 14 | T44 | SHIELD | 42 | T74 | CH1_C3H | 71 | T104 | SHIELD | 94 |
| T15 | CH2_C31H | 15 | T45 | CH1_C14L | 43 | T75 | UNUSED | N/A | T105 | SHIELD | 95 |
| T16 | CH2_C31L | 16 | T46 | CH1_C14H | 44 | T76 | UNUSED | N/A | T106 | SHIELD | 96 |
| T17 | CH2_C23L | 17 | T47 | CH1_C5L | 45 | T77 | UNUSED | N/A | T107 | SHIELD | 97 |
| T18 | CH2_C23H | 18 | T48 | CH1_C5H | 46 | T78 | UNUSED | N/A | T108 | SHIELD | 98 |
| T19 | CH2_C29H | 19 | T49 | SHIELD | 47 | T79 | UNUSED | N/A | T109 | CH2_R8L | 99 |
| T20 | CH2_C29L | 20 | T50 | SHIELD | 48 | T80 | UNUSED | N/A | T110 | CH2_R8H | 100 |
| T21 | UNUSED | N/A | T51 | SHIELD | 49 | T81 | CH1_C2L | 72 | T111 | CH2_C25H | 101 |
| T22 | SHIELD | 21 | T52 | SHIELD | 50 | T82 | CH1_C2H | 73 | T112 | CH2_C25L | 102 |
| T23 | CH1_C13L | 22 | T53 | CH2_C19H | 51 | T83 | CH2_C17L | 74 | T113 | CH2_C26H | 103 |
| T24 | CH1_C13H | 23 | T54 | CH2_C19L | 52 | T84 | CH2_C17H | 75 | T114 | CH2_C26L | 104 |
| T25 | CH1_C16L | 24 | T55 | SHIELD | 53 | T85 | CH2_R5H | 76 | T155 | UNUSED | N/A |
| T26 | CH1_C16H | 25 | T56 | SHIELD | 54 | T86 | CH2_R5L | 77 | T156 | UNUSED | N/A |
| T27 | CH1_C11L | 26 | T57 | SHIELD | 55 | T87 | CH2_R6H | 78 | T157 | UNUSED | N/A |
| T28 | CH1_C11H | 27 | T58 | SHIELD | 56 | T88 | CH2_R6L | 79 | T158 | UNUSED | N/A |
| T29 | CH1_R4H | 28 | T59 | CH2_C22H | 57 | T89 | CH2_R7L | 80 | T159 | UNUSED | N/A |
| T30 | CH1_R4L | 29 | T60 | CH2_C22L | 58 | T90 | CH2_R7H | 81 | T160 | UNUSED | N/A |

**TABLE 4-29: EX1200-TB104 TERMINAL BLOCK TO EX1200-4003 PIN MAPPING**

The EX1200-4003 terminal block is a special case switch where, although the terminal block has a thermistor, it does not have access to the DMM backplane and cannot use the internal EX1200 DMM. RT1 can still be measured, though, with an external instrument. Connect the instrument to T163 (L_VS) and T164 (H_VS) and then remove the jumper on pins 3 and 4 of P2.

# EX1200-4003 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Configurable as dual (4 x 16), or single (8 x 16) two-wire matrices |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 220 V dc, 250 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 60 W dc, 62.5 VA |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 500 mΩ |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 10 µV |
| **BANDWIDTH (-3 dB)** | |
| | 45 MHz (typical, 4 x 16 configuration) |
| **CAPACITANCE** | |
| **Open channel** | < 90 pF |
| **Channel-mainframe** | < 390 pF |
| **High-low** | < 170 pF |
| **CROSSTALK (TYPICAL)** | |
| **1 MHz** | < -55 dB |
| **10 MHz** | < -45 dB |
| **ISOLATION (TYPICAL)** | |
| **1 MHz** | < -60 dB |
| **10 MHz** | < -50 dB |

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

# EX1200-4128 PLUG-IN MODULE

## 4 X 128 ONE-WIRE MATRIX, 150 V/0.5 A

The EX1200-4128 is an ultra high-density matrix module that allows the user to connect any input row to any output column, with an SPST 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 one-wire architecture allows for any of the 128 row inputs to be connected to any of the four column outputs.

The four output columns can be routed to the EX1200 series internal analog backplane to build large matrices, or to connect to the optional 6.5 digit DMM, which also limits the amount of external cabling required. A (4 x 512) 1-wire matrix can be accommodated in only four slots of an EX1200 series mainframe, as an example.

Stub-breaking relays can remove a matrix module from the backplane to increase signal integrity of measurements being made on other modules. All relays are fail-safe which ensures that no undesired signals are present at the user interface in the case of power interruption.

The EX1200-4128 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 4-3434 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

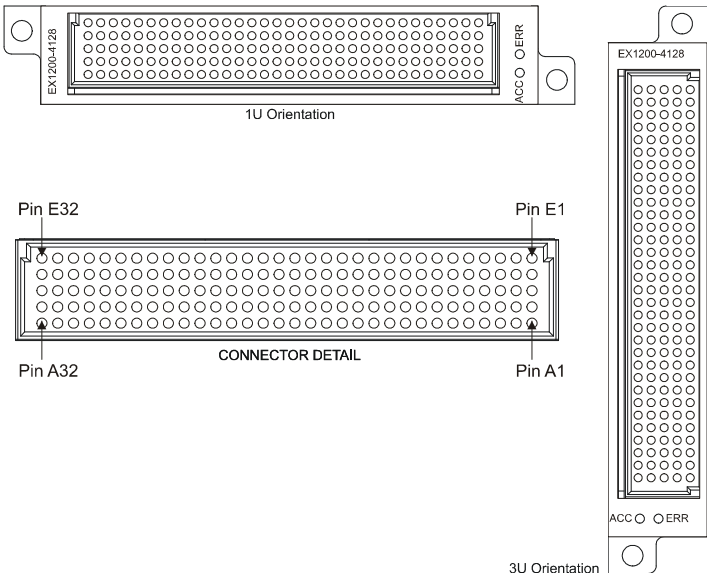



**FIGURE 4-33: EX1200-4128 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH_C1 | **1** | CH_C3 | **1** | CH_R1 | **1** | CH_R2 | **1** | CH_R3 |
| **2** | CH_C2 | **2** | CH_C4 | **2** | UNUSED | **2** | CH_R4 | **2** | CH_R5 |
| **3** | UNUSED | **3** | CH_R61 | **3** | CH_R62 | **3** | CH_R6 | **3** | CH_R7 |
| **4** | CH_R63 | **4** | CH_R64 | **4** | CH_R65 | **4** | CH_R8 | **4** | CH_R9 |
| **5** | CH_R66 | **5** | CH_R67 | **5** | CH_R68 | **5** | CH_R10 | **5** | CH_R11 |
| **6** | CH_R69 | **6** | CH_R70 | **6** | CH_R71 | **6** | CH_R12 | **6** | CH_R13 |
| **7** | CH_R72 | **7** | CH_R73 | **7** | CH_R74 | **7** | CH_R14 | **7** | CH_R15 |
| **8** | CH_R75 | **8** | CH_R76 | **8** | CH_R77 | **8** | CH_R16 | **8** | CH_R17 |
| **9** | CH_R78 | **9** | CH_R79 | **9** | CH_R80 | **9** | CH_R18 | **9** | CH_R19 |
| **10** | CH_R81 | **10** | CH_R82 | **10** | CH_R83 | **10** | CH_R20 | **10** | CH_R21 |
| **11** | CH_R84 | **11** | CH_R85 | **11** | CH_R86 | **11** | CH_R22 | **11** | CH_R23 |
| **12** | CH_R87 | **12** | CH_R88 | **12** | CH_R89 | **12** | CH_R24 | **12** | CH_R25 |
| **13** | CH_R90 | **13** | CH_R91 | **13** | CH_R92 | **13** | CH_R26 | **13** | CH_R27 |
| **14** | CH_R93 | **14** | CH_R94 | **14** | CH_R95 | **14** | CH_R28 | **14** | CH_R29 |
| **15** | CH_R96 | **15** | CH_R97 | **15** | CH_R98 | **15** | CH_R30 | **15** | CH_R31 |
| **16** | SHIELD | **16** | SHIELD | **16** | SHIELD | **16** | CH_R32 | **16** | CH_R33 |
| **17** | SHIELD | **17** | SHIELD | **17** | SHIELD | **17** | CH_R34 | **17** | UNUSED |
| **18** | CH_R99 | **18** | CH_R100 | **18** | SHIELD | **18** | UNUSED | **18** | UNUSED |
| **19** | CH_R102 | **19** | CH_R103 | **19** | CH_R101 | **19** | CH_R35 | **19** | CH_R36 |
| **20** | CH_R105 | **20** | CH_R106 | **20** | CH_R104 | **20** | CH_R37 | **20** | CH_R38 |
| **21** | CH_R108 | **21** | CH_R109 | **21** | CH_R107 | **21** | CH_R39 | **21** | CH_R40 |
| **22** | CH_R111 | **22** | CH_R112 | **22** | CH_R110 | **22** | CH_R41 | **22** | CH_R42 |
| **23** | CH_R114 | **23** | CH_R115 | **23** | CH_R113 | **23** | CH_R43 | **23** | CH_R44 |
| **24** | CH_R117 | **24** | CH_R118 | **24** | CH_R116 | **24** | CH_R45 | **24** | CH_R46 |
| **25** | UNUSED | **25** | UNUSED | **25** | CH_R119 | **25** | CH_R47 | **25** | CH_R48 |
| **26** | CH_R120 | **26** | CH_R121 | **26** | CH_R122 | **26** | CH_R49 | **26** | CH_R50 |
| **27** | CH_R123 | **27** | CH_R124 | **27** | CH_R125 | **27** | CH_R51 | **27** | UNUSED |
| **28** | CH_R126 | **28** | CH_R127 | **28** | CH_R128 | **28** | UNUSED | **28** | UNUSED |
| **29** | UNUSED | **29** | UNUSED | **29** | CH_R52 | **29** | CH_R59 | **29** | CH_R60 |
| **30** | GND_C | **30** | SHIELD | **30** | UNUSED | **30** | CH_R57 | **30** | CH_R58 |
| **31** | GND_C | **31** | SHIELD | **31** | GND_C | **31** | CH_R55 | **31** | CH_R56 |
| **32** | GND_C | **32** | SHIELD | **32** | GND_C | **32** | CH_R53 | **32** | CH_R54 |

**TABLE 4-30: 1-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-4128 incorporates 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. These pins are identified as "SHIELD" in Table 4-30.

The module also incorporates ground pins, labeled "GND_C" above. These pins tie the module to chassis ground. Note that the SHIELD pins are not tied to ground and have no electrical connections.

| Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D5 | H | CH1_2W | E16 | H | CH17_2W | C4 | H | CH33_2W | B15 | H | CH49_2W |
| D1 | L | | D17 | L | | A5 | L | | C15 | L | |
| E1 | H | CH2_2W | D19 | H | CH18_2W | B5 | H | CH34_2W | A18 | H | CH50_2W |
| D2 | L | | E19 | L | | C5 | L | | B18 | L | |
| E2 | H | CH3_2W | D20 | H | CH19_2W | A6 | H | CH35_2W | C19 | H | CH51_2W |
| D3 | L | | E20 | L | | B6 | L | | A19 | L | |
| A8 | H | CH4_2W | D21 | H | CH20_2W | C6 | H | CH36_2W | B19 | H | CH52_2W |
| C9 | L | | E21 | L | | A7 | L | | C20 | L | |
| E4 | H | CH5_2W | D22 | H | CH21_2W | B7 | H | CH37_2W | A20 | H | CH53_2W |
| D5 | L | | E22 | L | | C7 | L | | B20 | L | |
| E5 | H | CH6_2W | D23 | H | CH22_2W | A8 | H | CH38_2W | C21 | H | CH54_2W |
| D6 | L | | E23 | L | | B8 | L | | A21 | L | |
| E6 | H | CH7_2W | D24 | H | CH23_2W | C8 | H | CH39_2W | B21 | H | CH55_2W |
| D7 | L | | E24 | L | | A9 | L | | C22 | L | |
| E7 | H | CH8_2W | D25 | H | CH24_2W | B9 | H | CH40_2W | A22 | H | CH56_2W |
| D8 | L | | E25 | L | | C9 | L | | B22 | L | |
| E8 | H | CH9_2W | D26 | H | CH25_2W | A10 | H | CH41_2W | C23 | H | CH57_2W |
| D9 | L | | E26 | L | | B10 | L | | A23 | L | |
| E9 | H | CH10_2W | D27 | H | CH26_2W | C10 | H | CH42_2W | B23 | H | CH58_2W |
| D10 | L | | C29 | L | | A11 | L | | C24 | L | |
| E10 | H | CH11_2W | D32 | H | CH27_2W | B11 | H | CH43_2W | A24 | H | CH59_2W |
| D11 | L | | E32 | L | | C11 | L | | B24 | L | |
| E11 | H | CH12_2W | D31 | H | CH28_2W | A12 | H | CH44_2W | C25 | H | CH60_2W |
| D12 | L | | E31 | L | | B12 | L | | A26 | L | |
| E12 | H | CH13_2W | D30 | H | CH29_2W | C12 | H | CH45_2W | B26 | H | CH61_2W |
| D13 | L | | E30 | L | | A13 | L | | C26 | L | |
| E13 | H | CH14_2W | D29 | H | CH30_2W | B13 | H | CH46_2W | A27 | H | CH62_2W |
| D14 | L | | E29 | L | | C13 | L | | B27 | L | |
| E14 | H | CH15_2W | B3 | H | CH31_2W | A14 | H | CH47_2W | C27 | H | CH63_2W |
| D15 | L | | C3 | L | | B14 | L | | A28 | L | |
| E15 | H | CH16_2W | A4 | H | CH32_2W | C14 | H | CH48_2W | B28 | H | CH64_2W |
| D16 | L | | B4 | L | | A15 | L | | C28 | L | |

**2-Wire Common and Backplane Signal Names**

| Pin/DMM Bus Line | H/L | Signal | Pin/DMM Bus Line | H/L | Signal |
|---|---|---|---|---|---|
| A2 | H | CH1_2WCOM | B2 | H | CH2_2WCOM |
| A1 | L | | B1 | L | |
| BPL_HI | H | ACV | BPL_HI | H | DCV |
| BPL_LO | L | | BPL_LO | L | |
| BPL_HI | H | 2WOHM | | | |
| BPL_LO | L | | | | |

**TABLE 4-31: 2-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

**NOTES** The H/L column represents the “HI” and “LO” pins for the 2-wire signal.
The “BPL” references are lines available on the EX1200 mainframe backplane that connect the plug-in module to the on-board DMM (if installed). For more information on these lines, refer to the *EX1200 Series User’s Manual*.

| Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D5 | H1 | CH1_4W | E16 | H1 | CH9_4W | C4 | H1 | CH17_4W | B15 | H1 | CH25_4W |
| D1 | L1 | | D17 | L1 | | A5 | L1 | | C15 | L1 | |
| E1 | H2 | | D19 | H2 | | B5 | H2 | | A18 | H2 | |
| D2 | L2 | | E19 | L2 | | C5 | L2 | | B18 | L2 | |
| E2 | H1 | CH2_4W | D20 | H1 | CH10_4W | A6 | H1 | CH18_4W | C19 | H1 | CH26_4W |
| D3 | L1 | | E20 | L1 | | B6 | L1 | | A19 | L1 | |
| A8 | H2 | | D21 | H2 | | C6 | H2 | | B19 | H2 | |
| C9 | L2 | | E21 | L2 | | A7 | L2 | | C20 | L2 | |
| E4 | H1 | CH3_4W | D22 | H1 | CH11_4W | B7 | H1 | CH19_4W | A20 | H1 | CH27_4W |
| D5 | L1 | | E22 | L1 | | C7 | L1 | | B20 | L1 | |
| E5 | H2 | | D23 | H2 | | A8 | H2 | | C21 | H2 | |
| D6 | L2 | | E23 | L2 | | B8 | L2 | | A21 | L2 | |
| E6 | H1 | CH4_4W | D24 | H1 | CH12_4W | C8 | H1 | CH20_4W | B21 | H1 | CH28_4W |
| D7 | L1 | | E24 | L1 | | A9 | L1 | | C22 | L1 | |
| E7 | H2 | | D25 | H2 | | B9 | H2 | | A22 | H2 | |
| D8 | L2 | | E25 | L2 | | C9 | L2 | | B22 | L2 | |
| E8 | H1 | CH5_4W | D26 | H1 | CH13_4W | A10 | H1 | CH21_4W | C23 | H1 | CH29_4W |
| D9 | L1 | | E26 | L1 | | B10 | L1 | | A23 | L1 | |
| E9 | H2 | | D27 | H2 | | C10 | H2 | | B23 | H2 | |
| D10 | L2 | | C29 | L2 | | A11 | L2 | | C24 | L2 | |
| E10 | H1 | CH6_4W | D32 | H1 | CH14_4W | B11 | H1 | CH22_4W | A24 | H1 | CH30_4W |
| D11 | L1 | | E32 | L1 | | C11 | L1 | | B24 | L1 | |
| E11 | H2 | | D31 | H2 | | A12 | H2 | | C25 | H2 | |
| D12 | L2 | | E31 | L2 | | B12 | L2 | | A26 | L2 | |
| E12 | H1 | CH7_4W | D30 | H1 | CH15_4W | C12 | H1 | CH23_4W | B26 | H1 | CH31_4W |
| D13 | L1 | | E30 | L1 | | A13 | L1 | | C26 | L1 | |
| E13 | H2 | | D29 | H2 | | B13 | H2 | | A27 | H2 | |
| D14 | L2 | | E29 | L2 | | C13 | L2 | | B27 | L2 | |
| E14 | H1 | CH8_4W | B3 | H1 | CH16_4W | A14 | H1 | CH24_4W | C27 | H1 | CH32_4W |
| D15 | L1 | | C3 | L1 | | B14 | L1 | | A28 | L1 | |
| E15 | H2 | | A4 | H2 | | C14 | H2 | | B28 | H2 | |
| D16 | L2 | | B4 | L2 | | A15 | L2 | | C28 | L2 | |

**4-Wire Common and Backplane Signal Names**

| Pin/DMM Bus Line | H/L | Signal | Pin/DMM Bus Line | H/L | Signal |
|---|---|---|---|---|---|
| A2 | H1 | CH_C | BPL_HI | H1 | 4WOHM |
| A1 | L1 | | BPL_LO | L1 | |
| B2 | H2 | | BPL_SHI | H2 | |
| B1 | L2 | | BPL_SLO | L2 | |

**TABLE 4-32: 4-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

**NOTES** The H/L column represents the "HI" and "LO" pins for the 4-wire signal.
The "BPL" references are lines available on the EX1200 mainframe backplane that connect the plug-in module to the on-board DMM (if installed). For more information on these lines, refer to the *EX1200 Series User's Manual*.

## LOGICAL DIAGRAM

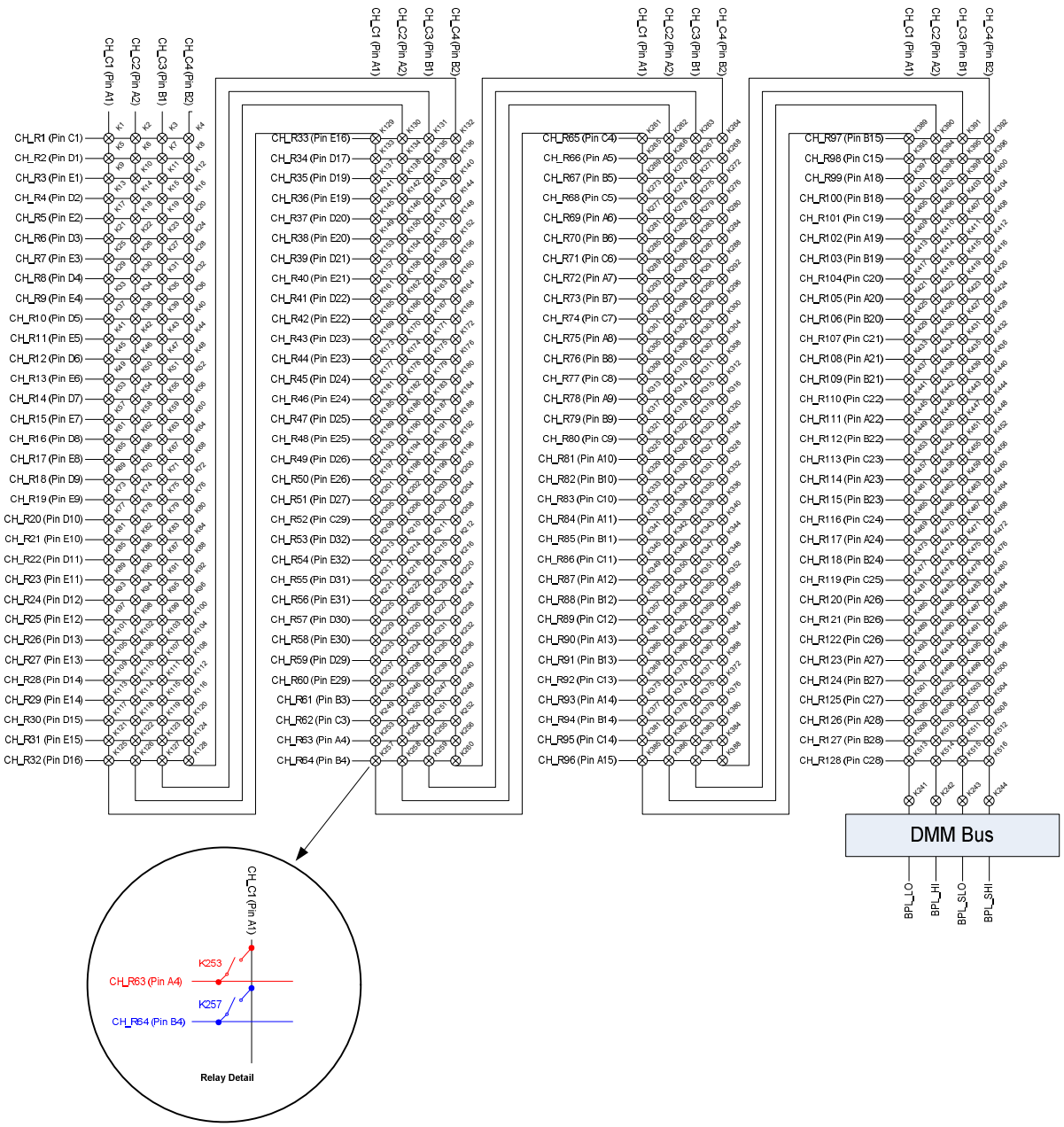



**FIGURE 4-34: EX1200-4128 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH_R5 | E2 | T41 | CH_R96 | A15 | T81 | CH_R95 | C14 | T121 | CH_R111 | A22 |
| T2 | CH_R4 | D2 | T42 | CH_R93 | A14 | T82 | CH_R94 | B14 | T122 | CH_R114 | A23 |
| T3 | CH_R7 | E3 | T43 | CH_R90 | A13 | T83 | CH_R98 | C15 | T123 | CH_R105 | A20 |
| T4 | CH_R6 | D3 | T44 | CH_R87 | A12 | T84 | CH_R97 | B15 | T124 | CH_R99 | A18 |
| T5 | CH_R9 | E4 | T45 | CH_R81 | A10 | T85 | SHIELD | C16 | T125 | CH_R102 | A19 |
| T6 | CH_R8 | D4 | T46 | CH_R20 | D10 | T86 | SHIELD | B16 | T126 | SHIELD | A16 |
| T7 | CH_R11 | E5 | T47 | CH_R21 | E10 | T87 | SHIELD | C17 | T127 | SHIELD | A17 |
| T8 | CH_R10 | D5 | T48 | CH_R86 | C11 | T88 | SHIELD | B17 | T128 | CH_R53 | D32 |
| T9 | CH_R13 | E6 | T49 | CH_R85 | B11 | T89 | SHIELD | C18 | T129 | CH_R58 | E30 |
| T10 | CH_R12 | D6 | T50 | CH_R84 | A11 | T90 | CH_R100 | B18 | T130 | CH_R57 | D30 |
| T11 | CH_R15 | E7 | T51 | CH_R88 | B12 | T91 | CH_R101 | C19 | T131 | CH_R60 | E29 |
| T12 | CH_R14 | D7 | T52 | CH_R89 | C12 | T92 | CH_R103 | B19 | T132 | CH_R59 | D29 |
| T13 | CH_R17 | E8 | T53 | CH_R91 | B13 | T93 | CH_R104 | C20 | T133 | CH_R56 | E31 |
| T14 | CH_R16 | D8 | T54 | CH_R92 | C13 | T94 | CH_R106 | B20 | T134 | CH_R55 | D31 |
| T15 | CH_R19 | E9 | T55 | CH_R78 | A9 | T95 | GND_C | C32 | T135 | UNUSED | C30 |
| T16 | CH_R18 | D9 | T56 | CH_R75 | A8 | T96 | CH_R3 | E1 | T136 | SHIELD | B30 |
| T17 | CH_R62 | C3 | T57 | CH_R72 | A7 | T97 | CH_R50 | E26 | T137 | GND_C | C31 |
| T18 | CH_R61 | B3 | T58 | CH_R69 | A6 | T98 | CH_R49 | D26 | T138 | SHIELD | B31 |
| T19 | UNUSED | C2 | T59 | CH_R66 | A5 | T99 | CH_R46 | E24 | T139 | UNUSED | B29 |
| T20 | CH_C4 | B2 | T60 | CH_R63 | A4 | T100 | CH_R45 | D24 | T140 | CH_R52 | C29 |
| T21 | CH_R65 | C4 | T61 | UNUSED | A3 | T101 | UNUSED | E27 | T141 | CH_R127 | B28 |
| T22 | CH_R64 | B4 | T62 | CH_C2 | A2 | T102 | CH_R51 | D27 | T142 | CH_R128 | C28 |
| T23 | CH_R68 | C5 | T63 | CH_R82 | B10 | T103 | UNUSED | E28 | T143 | CH_R119 | C25 |
| T24 | CH_R67 | B5 | T64 | CH_R83 | C10 | T104 | UNUSED | D28 | T144 | UNUSED | B25 |
| T25 | CH_R71 | C6 | T65 | CH_R31 | E15 | T105 | CH_R44 | E23 | T145 | CH_R124 | B27 |
| T26 | CH_R70 | B6 | T66 | CH_R30 | D15 | T106 | CH_R43 | D23 | T146 | CH_R125 | C27 |
| T27 | CH_R74 | C7 | T67 | CH_R33 | E16 | T107 | CH_R42 | E22 | T147 | CH_R121 | B26 |
| T28 | CH_R73 | B7 | T68 | CH_R32 | D16 | T108 | CH_R41 | D22 | T148 | CH_R122 | C26 |
| T29 | CH_R77 | C8 | T69 | UNUSED | E17 | T109 | CH_R47 | D25 | T149 | CH_R120 | A26 |
| T30 | CH_R76 | B8 | T70 | CH_R34 | D17 | T110 | CH_R48 | E25 | T150 | CH_R123 | A27 |
| T31 | CH_R80 | C9 | T71 | UNUSED | E18 | T111 | CH_R38 | E20 | T151 | CH_R126 | A28 |
| T32 | CH_R79 | B9 | T72 | UNUSED | D18 | T112 | CH_R37 | D20 | T152 | UNUSED | A29 |
| T33 | CH_R23 | E11 | T73 | CH_R36 | E19 | T113 | CH_R110 | C22 | T153 | GND_C | A30 |
| T34 | CH_R22 | D11 | T74 | CH_R35 | D19 | T114 | CH_R112 | B22 | T154 | GND_C | A31 |
| T35 | CH_R24 | D12 | T75 | CH_R107 | C21 | T115 | CH_R113 | C23 | T155 | CH_R54 | E32 |
| T36 | CH_R25 | E12 | T76 | CH_R109 | B21 | T116 | CH_R115 | B23 | T156 | CH_C3 | B1 |
| T37 | CH_R26 | D13 | T77 | CH_R2 | D1 | T117 | CH_R116 | C24 | T157 | GND_C | A32 |
| T38 | CH_R27 | E13 | T78 | CH_R108 | A21 | T118 | CH_R118 | B24 | T158 | CH_C1 | A1 |
| T39 | CH_R28 | D14 | T79 | CH_R39 | D21 | T119 | CH_R117 | A24 | T159 | SHIELD | B32 |
| T40 | CH_R29 | E14 | T80 | CH_R40 | E21 | T120 | UNUSED | A25 | T160 | CH_R1 | C1 |

**TABLE 4-33: EX1200-TB160SE TERMINAL BLOCK TO EX1200-4128 PIN MAPPING**

## EX1200-4128 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 4 x 128 one-wire cross-point matrix |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 250 V AC, 220 V DC |
| **MAXIMUM SWITCHING CURRENT** | |
| | 1 A |
| **MAXIMUM SWITCHING POWER** | |
| | 60 W dc, 62.5 VA |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | 5 ms typical |
| **PATH RESISTANCE** | |
| | < 1 Ω |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 10 µV |
| **BANDWIDTH (-3 dB)** | |
| | 3 MHz (typical) |
| **CROSSTALK** | |
| **1 MHz** | < -55 dB< -30 dB |
| **10 MHz** | |
| **ISOLATION** | |
| **1 MHz** | < -60 dB |
| **10 MHz** | < -30 dB |

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

# EX1200-4260 PLUG-IN MODULE

## 2 X 60 2-WIRE MATRIX

The EX1200-4260 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 4-356 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

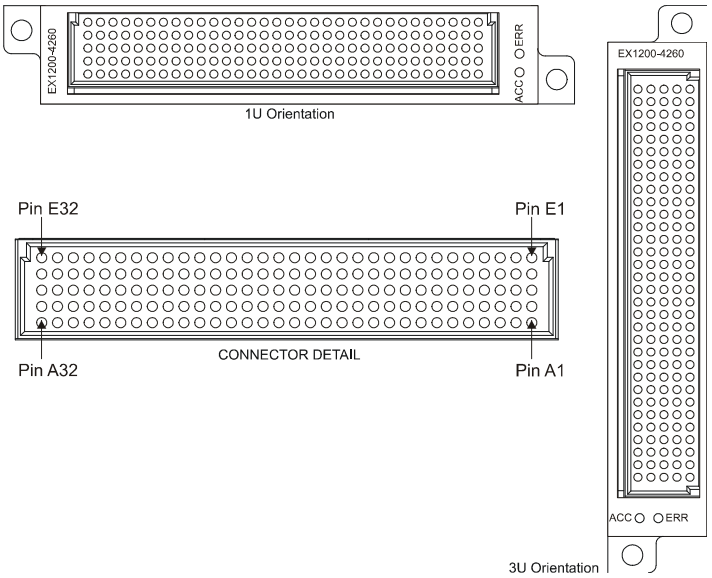



**FIGURE 4-35: EX1200-4260 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | UNUSED | **1** | CH1_R1 | **1** | CH1_R2 | **1** | CH1_R3 | **1** | CH1_R4 |
| **2** | CH1_C1 | **2** | CH1_R5 | **2** | CH1_R6 | **2** | CH1_R7 | **2** | CH1_R8 |
| **3** | CH1_C2 | **3** | CH1_R9 | **3** | CH1_R10 | **3** | CH1_R11 | **3** | CH1_R12 |
| **4** | CH1_C3 | **4** | CH1_R13 | **4** | CH1_R14 | **4** | CH1_R15 | **4** | CH1_R16 |
| **5** | CH1_C4 | **5** | CH1_R17 | **5** | CH1_R18 | **5** | CH1_R19 | **5** | CH1_R20 |
| **6** | UNUSED | **6** | CH1_R21 | **6** | CH1_R22 | **6** | CH1_R23 | **6** | CH1_R24 |
| **7** | UNUSED | **7** | CH1_R25 | **7** | CH1_R26 | **7** | CH1_R27 | **7** | CH1_R28 |
| **8** | UNUSED | **8** | CH1_R29 | **8** | CH1_R30 | **8** | CH1_R31 | **8** | CH1_R32 |
| **9** | SHIELD | **9** | CH1_R33 | **9** | CH1_R34 | **9** | CH1_R35 | **9** | CH1_R36 |
| **10** | SHIELD | **10** | CH1_R37 | **10** | CH1_R38 | **10** | CH1_R39 | **10** | CH1_R40 |
| **11** | SHIELD | **11** | CH1_R41 | **11** | CH1_R42 | **11** | CH1_R43 | **11** | CH1_R44 |
| **12** | SHIELD | **12** | CH1_R45 | **12** | CH1_R46 | **12** | CH1_R47 | **12** | CH1_R48 |
| **13** | SHIELD | **13** | CH1_R49 | **13** | CH1_R50 | **13** | CH1_R51 | **13** | CH1_R52 |
| **14** | SHIELD | **14** | CH1_R53 | **14** | CH1_R54 | **14** | CH1_R55 | **14** | CH1_R56 |
| **15** | SHIELD | **15** | CH1_R57 | **15** | CH1_R58 | **15** | CH1_R59 | **15** | CH1_R60 |
| **16** | SHIELD | **16** | UNUSED | **16** | UNUSED | **16** | UNUSED | **16** | UNUSED |
| **17** | SHIELD | **17** | CH2_R1 | **17** | CH2_R2 | **17** | UNUSED | **17** | UNUSED |
| **18** | SHIELD | **18** | CH2_R5 | **18** | CH2_R6 | **18** | UNUSED | **18** | UNUSED |
| **19** | SHIELD | **19** | CH2_R9 | **19** | CH2_R10 | **19** | CH2_R59 | **19** | CH2_R60 |
| **20** | SHIELD | **20** | CH2_R13 | **20** | CH2_R14 | **20** | CH2_R57 | **20** | CH2_R58 |
| **21** | SHIELD | **21** | CH2_R17 | **21** | CH2_R18 | **21** | CH2_R55 | **21** | CH2_R56 |
| **22** | SHIELD | **22** | CH2_R21 | **22** | CH2_R22 | **22** | CH2_R53 | **22** | CH2_R54 |
| **23** | SHIELD | **23** | CH2_R25 | **23** | CH2_R26 | **23** | CH2_R51 | **23** | CH2_R52 |
| **24** | SHIELD | **24** | CH2_R31 | **24** | CH2_R32 | **24** | CH2_R49 | **24** | CH2_R50 |
| **25** | UNUSED | **25** | CH2_R3 | **25** | CH2_R4 | **25** | CH2_R47 | **25** | CH2_R48 |
| **26** | UNUSED | **26** | CH2_R7 | **26** | CH2_R8 | **26** | CH2_R45 | **26** | CH2_R46 |
| **27** | UNUSED | **27** | CH2_R11 | **27** | CH2_R12 | **27** | CH2_R43 | **27** | CH2_R44 |
| **28** | CH2_C1 | **28** | CH2_R15 | **28** | CH2_R16 | **28** | CH2_R41 | **28** | CH2_R42 |
| **29** | CH2_C2 | **29** | CH2_R19 | **29** | CH2_R20 | **29** | CH2_R39 | **29** | CH2_R40 |
| **30** | CH2_C3 | **30** | CH2_R23 | **30** | CH2_R24 | **30** | CH2_R37 | **30** | CH2_R38 |
| **31** | CH2_C4 | **31** | CH2_R27 | **31** | CH2_R28 | **31** | CH2_R35 | **31** | CH2_R36 |
| **32** | UNUSED | **32** | CH2_R29 | **32** | CH2_R30 | **32** | CH2_R33 | **32** | CH2_R34 |

**TABLE 4-34: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

| Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | H | CH1_MC1 | B9 | H | CH1_MC17 | B18 | H | CH2_MC3 | D30 | H | CH2_MC19 |
| D1 | L | | D9 | L | | B26 | L | | D29 | L | |
| C1 | H | CH1_MC2 | C9 | H | CH1_MC18 | C18 | H | CH2_MC4 | E30 | H | CH2_MC20 |
| E1 | L | | E9 | L | | C26 | L | | E29 | L | |
| B2 | H | CH1_MC3 | B10 | H | CH1_MC19 | B19 | H | CH2_MC5 | D28 | H | CH2_MC21 |
| D2 | L | | D10 | L | | B27 | L | | D27 | L | |
| C2 | H | CH1_MC4 | C10 | H | CH1_MC20 | C19 | H | CH2_MC6 | E28 | H | CH2_MC22 |
| E2 | L | | E10 | L | | C27 | L | | E27 | L | |
| B3 | H | CH1_MC5 | B11 | H | CH1_MC21 | B20 | H | CH2_MC7 | D26 | H | CH2_MC23 |
| D3 | L | | D11 | L | | B28 | L | | D25 | L | |
| C3 | H | CH1_MC6 | C11 | H | CH1_MC22 | C20 | H | CH2_MC8 | E26 | H | CH2_MC24 |
| E3 | L | | E11 | L | | C28 | L | | E25 | L | |
| B4 | H | CH1_MC7 | B12 | H | CH1_MC23 | B21 | H | CH2_MC9 | D24 | H | CH2_MC25 |
| D4 | L | | D12 | L | | B29 | L | | D23 | L | |
| C4 | H | CH1_MC8 | C12 | H | CH1_MC24 | C21 | H | CH2_MC10 | E24 | H | CH2_MC26 |
| E4 | L | | E12 | L | | C29 | L | | E23 | L | |
| B5 | H | CH1_MC9 | B13 | H | CH1_MC25 | B22 | H | CH2_MC11 | D22 | H | CH2_MC27 |
| D5 | L | | D13 | L | | B30 | L | | D21 | L | |
| C5 | H | CH1_MC10 | C13 | H | CH1_MC26 | C22 | H | CH2_MC12 | E22 | H | CH2_MC28 |
| E5 | L | | E13 | L | | C30 | L | | E21 | L | |
| B6 | H | CH1_MC11 | B14 | H | CH1_MC27 | B23 | H | CH2_MC13 | D20 | H | CH2_MC29 |
| D6 | L | | D14 | L | | B31 | L | | D19 | L | |
| C6 | H | CH1_MC12 | C14 | H | CH1_MC28 | C23 | H | CH2_MC14 | E20 | H | CH2_MC30 |
| E6 | L | | E14 | L | | C31 | L | | E19 | L | |
| B7 | H | CH1_MC13 | B15 | H | CH1_MC29 | B32 | H | CH2_MC15 | | | |
| D7 | L | | D15 | L | | B24 | L | | | | |
| C7 | H | CH1_MC14 | C15 | H | CH1_MC30 | C32 | H | CH2_MC16 | | | |
| E7 | L | | E15 | L | | C24 | L | | | | |
| B8 | H | CH1_MC15 | B17 | H | CH2_MC1 | D32 | H | CH2_MC17 | | | |
| D8 | L | | B24 | L | | D31 | L | | | | |
| C8 | H | CH1_MC16 | C17 | H | CH2_MC2 | E32 | H | CH2_MC18 | | | |
| E8 | L | | D24 | L | | E31 | L | | | | |

**2-Wire Common and Backplane Signal Names**

| Pin/DMM Bus Line | H/L | Signal | Pin/DMM Bus Line | H/L | Signal |
|---|---|---|---|---|---|
| A2 | H | CH1_MC1_COM | A28 | H | CH2_MC1_COM |
| A4 | L | | A30 | L | |
| A3 | H | CH1_MC2_COM | A29 | H | CH2_MC2_COM |
| A5 | L | | A31 | L | |
| BPL_HI | H | ACV | BPL_HI | H | DCV |
| BPL_LO | L | | BPL_LO | L | |
| BPL_HI | H | 2WOHM | | | |
| BPL_LO | L | | | | |

**TABLE 4-35: 2-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

**NOTES** The H/L column represents the "HI" and "LO" pins for the 2-wire signal.
The "BPL" references are lines available on the EX1200 mainframe backplane that connect the plug-in module to the on-board DMM (if installed). For more information on these lines, refer to the *EX1200 Series User's Manual*.

| Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | H1 | CH1_MC1_4W | B9 | H1 | CH1_MC9_4W | B18 | H1 | CH2_MC2_4W | D30 | H1 | CH2_MC10_4W |
| C1 | H2 | | C9 | H2 | | C18 | H2 | | E30 | H2 | |
| D1 | L1 | | D9 | L1 | | B26 | L1 | | D29 | L1 | |
| E1 | L2 | | E9 | L2 | | C26 | L2 | | E29 | L2 | |
| C1 | H1 | CH1_MC2_4W | B10 | H1 | CH1_MC10_4W | B19 | H1 | CH2_MC3_4W | D28 | H1 | CH2_MC11_4W |
| B2 | H2 | | C10 | H2 | | C19 | H2 | | E28 | H2 | |
| E1 | L1 | | D10 | L1 | | B27 | L1 | | D27 | L1 | |
| D2 | L2 | | E10 | L2 | | C27 | L2 | | E27 | L2 | |
| B3 | H1 | CH1_MC3_4W | B11 | H1 | CH1_MC11_4W | B20 | H1 | CH2_MC4_4W | D26 | H1 | CH2_MC12_4W |
| C3 | H2 | | C11 | H2 | | C20 | H2 | | E26 | H2 | |
| D3 | L1 | | D11 | L1 | | B28 | L1 | | D25 | L1 | |
| E3 | L2 | | E11 | L2 | | C28 | L2 | | E25 | L2 | |
| B4 | H1 | CH1_MC4_4W | B12 | H1 | CH1_MC12_4W | B21 | H1 | CH2_MC5_4W | D24 | H1 | CH2_MC13_4W |
| C4 | H2 | | C12 | H2 | | C21 | H2 | | E24 | H2 | |
| D4 | L1 | | D12 | L1 | | B29 | L1 | | D23 | L1 | |
| E4 | L2 | | E12 | L2 | | C29 | L2 | | E23 | L2 | |
| B5 | H1 | CH1_MC5_4W | B13 | H1 | CH1_MC13_4W | B22 | H1 | CH2_MC6_4W | D22 | H1 | CH2_MC14_4W |
| C5 | H2 | | C13 | H2 | | C22 | H2 | | E22 | H2 | |
| D5 | L1 | | D13 | L1 | | B30 | L1 | | D21 | L1 | |
| E5 | L2 | | E13 | L2 | | C30 | L2 | | E21 | L2 | |
| B6 | H1 | CH1_MC6_4W | B14 | H1 | CH1_MC14_4W | B23 | H1 | CH2_MC7_4W | D20 | H1 | CH2_MC15_4W |
| C6 | H2 | | C14 | H2 | | C23 | H2 | | E20 | H2 | |
| D6 | L1 | | D14 | L1 | | B31 | L1 | | D19 | L1 | |
| E6 | L2 | | E14 | L2 | | C31 | L2 | | E19 | L2 | |
| B7 | H1 | CH1_MC7_4W | B15 | H1 | CH1_MC15_4W | B32 | H1 | CH2_MC8_4W | | | |
| C7 | H2 | | C15 | H2 | | C32 | H2 | | | | |
| D7 | L1 | | D15 | L1 | | B24 | L1 | | | | |
| E7 | L2 | | E15 | L2 | | C24 | L2 | | | | |
| B8 | H1 | CH1_MC8_4W | B17 | H1 | CH2_MC1_4W | D32 | H1 | CH2_MC9_4W | | | |
| C8 | H2 | | C17 | H2 | | E32 | H2 | | | | |
| D8 | L1 | | B24 | L1 | | D31 | L1 | | | | |
| E8 | L2 | | D24 | L2 | | E31 | L2 | | | | |

**4-Wire Common and Backplane Signal Names**

| Pin/DMM Bus Line | H/L | Signal | Pin/DMM Bus Line | H/L | Signal |
|---|---|---|---|---|---|
| A2 | H1 | CH1_MC_COM_4W | A28 | H1 | CH2_MC_COM_4W |
| A4 | H2 | | A30 | H2 | |
| A3 | L1 | | A29 | L1 | |
| A5 | L2 | | A31 | L2 | |
| BPL_HI | H1 | 4WOHM | | | |
| BPL_SHI | H2 | | | | |
| BPL_LO | L1 | | | | |
| BPL_SLO | L2 | | | | |

**TABLE 4-36: 4-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

**NOTES** The H/L column represents the "HI" and "LO" pins for the 4-wire signal.
The "BPL" references are lines available on the EX1200 mainframe backplane that connect the plug-in module to the on-board DMM (if installed). For more information on these lines, refer to the *EX1200 Series User's Manual*.

## LOGICAL DIAGRAM

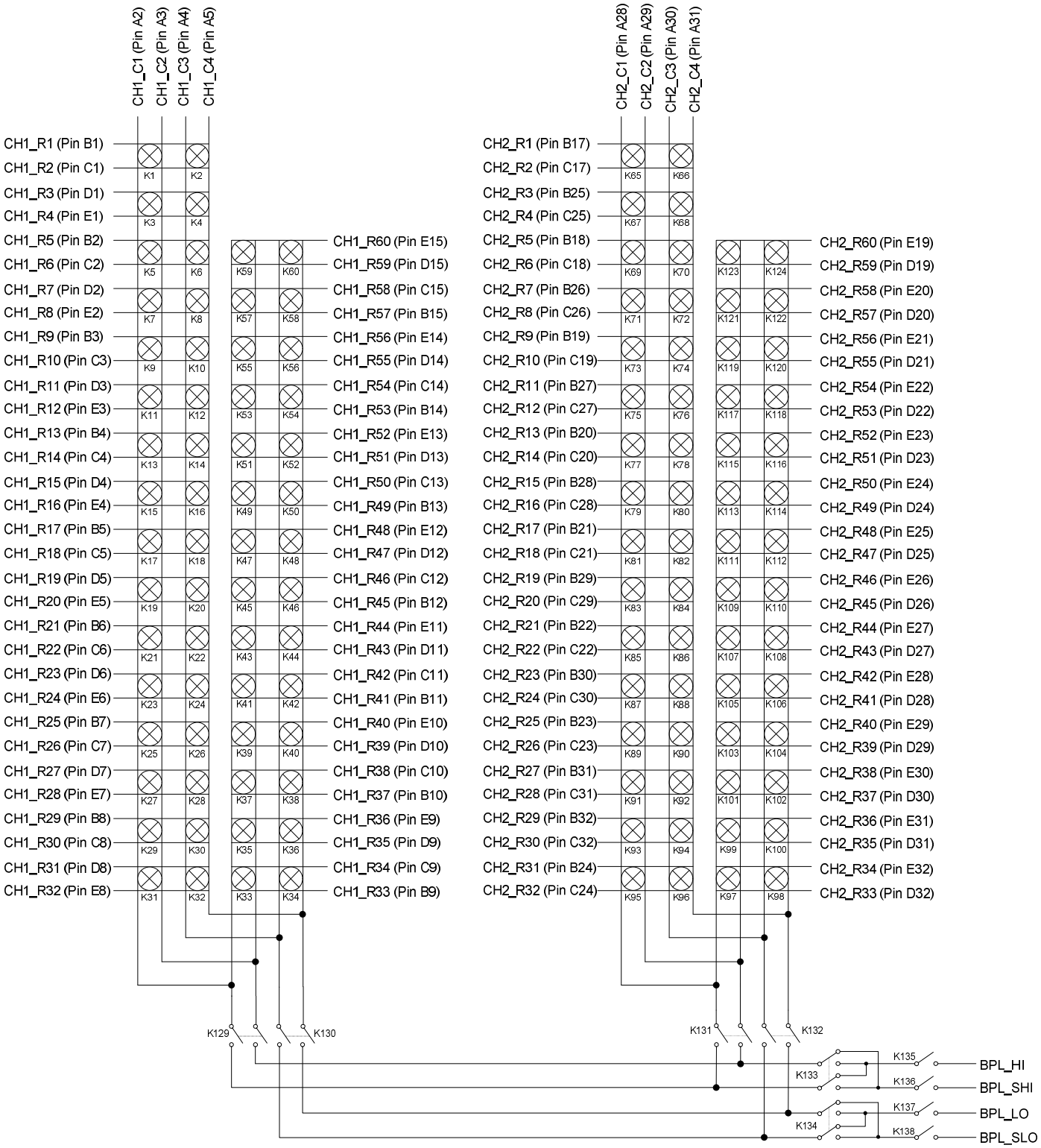



**FIGURE 4-36: EX1200-4260 LOGICAL DIAGRAM**

## EX1200-4260 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Two 60 x 2 2-wire channels |
| **RELAY TYPE** | |
| | Electromechanically, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 220 V dc/ 250 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 60 W, 62.5 VA (see the _Figure 4-37 for more information) |
| **MINIMUM CONTACT RATING*** | |
| | 100 µV |
| **This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions* | |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME (TYPICAL)** | |
| | < 10 ms |
| **PATH RESISTANCE** | |
| | < 0.5 Ω |
| **INSULATION RESISTANCE** | |
| | $>10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 10 µV |
| **BANDWIDTH (-3 dB)** | |
| | > 40 MHz |
| **CROSSTALK (TYPICAL)** | |
| **1 MHz** | < -45 dB |
| **10 MHz** | < -30 dB |
| **ISOLATION (TYPICAL)** | |
| **1 MHz** | < -60 dB |
| **10 MHz** | < -50 dB |

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

## RELAY BREAKING CAPACITY

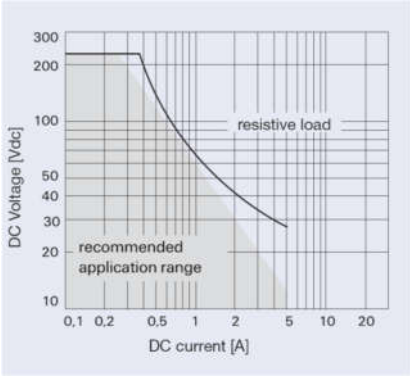



**FIGURE 4-37: RELAY BREAKING CAPACITY**

# EX1200-4264 PLUG-IN MODULE

## 2 X 64 2-WIRE MATRIX

The EX1200-4264 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 4-389 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

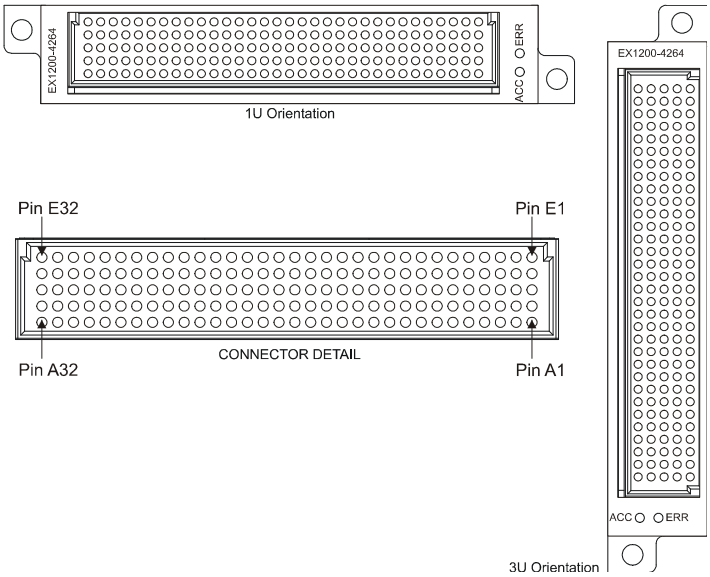



**FIGURE 4-38: EX1200-4264 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | UNUSED | **1** | CH1_R1 | **1** | CH1_R2 | **1** | CH1_R3 | **1** | CH1_R4 |
| **2** | CH1_C1 | **2** | CH1_R5 | **2** | CH1_R6 | **2** | CH1_R7 | **2** | CH1_R8 |
| **3** | CH1_C2 | **3** | CH1_R9 | **3** | CH1_R10 | **3** | CH1_R11 | **3** | CH1_R12 |
| **4** | CH1_C3 | **4** | CH1_R13 | **4** | CH1_R14 | **4** | CH1_R15 | **4** | CH1_R16 |
| **5** | CH1_C4 | **5** | CH1_R17 | **5** | CH1_R18 | **5** | CH1_R19 | **5** | CH1_R20 |
| **6** | UNUSED | **6** | CH1_R21 | **6** | CH1_R22 | **6** | CH1_R23 | **6** | CH1_R24 |
| **7** | UNUSED | **7** | CH1_R25 | **7** | CH1_R26 | **7** | CH1_R27 | **7** | CH1_R28 |
| **8** | UNUSED | **8** | CH1_R29 | **8** | CH1_R30 | **8** | CH1_R31 | **8** | CH1_R32 |
| **9** | SHIELD | **9** | CH1_R33 | **9** | CH1_R34 | **9** | CH1_R35 | **9** | CH1_R36 |
| **10** | SHIELD | **10** | CH1_R37 | **10** | CH1_R38 | **10** | CH1_R39 | **10** | CH1_R40 |
| **11** | SHIELD | **11** | CH1_R41 | **11** | CH1_R42 | **11** | CH1_R43 | **11** | CH1_R44 |
| **12** | SHIELD | **12** | CH1_R45 | **12** | CH1_R46 | **12** | CH1_R47 | **12** | CH1_R48 |
| **13** | SHIELD | **13** | CH1_R49 | **13** | CH1_R50 | **13** | CH1_R51 | **13** | CH1_R52 |
| **14** | SHIELD | **14** | CH1_R53 | **14** | CH1_R54 | **14** | CH1_R55 | **14** | CH1_R56 |
| **15** | SHIELD | **15** | CH1_R57 | **15** | CH1_R58 | **15** | CH1_R59 | **15** | CH1_R60 |
| **16** | SHIELD | **16** | CH1_R61 | **16** | CH1_R62 | **16** | CH1_R63 | **16** | CH1_R64 |
| **17** | SHIELD | **17** | CH2_R1 | **17** | CH2_R2 | **17** | CH2_R63 | **17** | CH2_R64 |
| **18** | SHIELD | **18** | CH2_R5 | **18** | CH2_R6 | **18** | CH2_R61 | **18** | CH2_R62 |
| **19** | SHIELD | **19** | CH2_R9 | **19** | CH2_R10 | **19** | CH2_R59 | **19** | CH2_R60 |
| **20** | SHIELD | **20** | CH2_R13 | **20** | CH2_R14 | **20** | CH2_R57 | **20** | CH2_R58 |
| **21** | SHIELD | **21** | CH2_R17 | **21** | CH2_R18 | **21** | CH2_R55 | **21** | CH2_R56 |
| **22** | SHIELD | **22** | CH2_R21 | **22** | CH2_R22 | **22** | CH2_R53 | **22** | CH2_R54 |
| **23** | SHIELD | **23** | CH2_R25 | **23** | CH2_R26 | **23** | CH2_R51 | **23** | CH2_R52 |
| **24** | SHIELD | **24** | CH2_R31 | **24** | CH2_R32 | **24** | CH2_R49 | **24** | CH2_R50 |
| **25** | UNUSED | **25** | CH2_R3 | **25** | CH2_R4 | **25** | CH2_R47 | **25** | CH2_R48 |
| **26** | UNUSED | **26** | CH2_R7 | **26** | CH2_R8 | **26** | CH2_R45 | **26** | CH2_R46 |
| **27** | UNUSED | **27** | CH2_R11 | **27** | CH2_R12 | **27** | CH2_R43 | **27** | CH2_R44 |
| **28** | CH2_C1 | **28** | CH2_R15 | **28** | CH2_R16 | **28** | CH2_R41 | **28** | CH2_R42 |
| **29** | CH2_C2 | **29** | CH2_R19 | **29** | CH2_R20 | **29** | CH2_R39 | **29** | CH2_R40 |
| **30** | CH2_C3 | **30** | CH2_R23 | **30** | CH2_R24 | **30** | CH2_R37 | **30** | CH2_R38 |
| **31** | CH2_C4 | **31** | CH2_R27 | **31** | CH2_R28 | **31** | CH2_R35 | **31** | CH2_R36 |
| **32** | UNUSED | **32** | CH2_R29 | **32** | CH2_R30 | **32** | CH2_R33 | **32** | CH2_R34 |

**TABLE 4-37: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

| Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | H | CH1_MC1 | B9 | H | CH1_MC17 | B17 | H | CH2_MC1 | D32 | H | CH2_MC17 |
| D1 | L | | D9 | L | | B25 | L | | D31 | L | |
| C1 | H | CH1_MC2 | C9 | H | CH1_MC18 | C17 | H | CH2_MC2 | E32 | H | CH2_MC18 |
| E1 | L | | E9 | L | | C25 | L | | E31 | L | |
| B2 | H | CH1_MC3 | B10 | H | CH1_MC19 | B18 | H | CH2_MC3 | D30 | H | CH2_MC19 |
| D2 | L | | D10 | L | | B26 | L | | D29 | L | |
| C2 | H | CH1_MC4 | C10 | H | CH1_MC20 | C18 | H | CH2_MC4 | E30 | H | CH2_MC20 |
| E2 | L | | E10 | L | | C26 | L | | E29 | L | |
| B3 | H | CH1_MC5 | B11 | H | CH1_MC21 | B19 | H | CH2_MC5 | D28 | H | CH2_MC21 |
| D3 | L | | D11 | L | | B27 | L | | D27 | L | |
| C3 | H | CH1_MC6 | C11 | H | CH1_MC22 | C19 | H | CH2_MC6 | E28 | H | CH2_MC22 |
| E3 | L | | E11 | L | | C27 | L | | E27 | L | |
| B4 | H | CH1_MC7 | B12 | H | CH1_MC23 | B20 | H | CH2_MC7 | D26 | H | CH2_MC23 |
| D4 | L | | D12 | L | | B28 | L | | D25 | L | |
| C4 | H | CH1_MC8 | C12 | H | CH1_MC24 | C20 | H | CH2_MC8 | E26 | H | CH2_MC24 |
| E4 | L | | E12 | L | | C28 | L | | E25 | L | |
| B5 | H | CH1_MC9 | B13 | H | CH1_MC25 | B21 | H | CH2_MC9 | D24 | H | CH2_MC25 |
| D5 | L | | D13 | L | | B29 | L | | D23 | L | |
| C5 | H | CH1_MC10 | C13 | H | CH1_MC26 | C21 | H | CH2_MC10 | E24 | H | CH2_MC26 |
| E5 | L | | E13 | L | | C29 | L | | E23 | L | |
| B6 | H | CH1_MC11 | B14 | H | CH1_MC27 | B22 | H | CH2_MC11 | D22 | H | CH2_MC27 |
| D6 | L | | D14 | L | | B30 | L | | D21 | L | |
| C6 | H | CH1_MC12 | C14 | H | CH1_MC28 | C22 | H | CH2_MC12 | E22 | H | CH2_MC28 |
| E6 | L | | E14 | L | | C30 | L | | E21 | L | |
| B7 | H | CH1_MC13 | B15 | H | CH1_MC29 | B23 | H | CH2_MC13 | D20 | H | CH2_MC29 |
| D7 | L | | D15 | L | | B31 | L | | D19 | L | |
| C7 | H | CH1_MC14 | C15 | H | CH1_MC30 | C23 | H | CH2_MC14 | E20 | H | CH2_MC30 |
| E7 | L | | E15 | L | | C31 | L | | E19 | L | |
| B8 | H | CH1_MC15 | B16 | H | CH1_MC31 | B32 | H | CH2_MC15 | D18 | H | CH2_MC31 |
| D8 | L | | D16 | L | | B24 | L | | D17 | L | |
| C8 | H | CH1_MC16 | C16 | H | CH1_MC32 | C32 | H | CH2_MC16 | E18 | H | CH2_MC32 |
| E8 | L | | E16 | L | | C24 | L | | E17 | L | |

**2-Wire Common and Backplane Signal Names**

| Pin/DMM Bus Line | H/L | Signal | Pin/DMM Bus Line | H/L | Signal |
|---|---|---|---|---|---|
| A2 | H | CH1_MC1_COM | A28 | H | CH2_MC1_COM |
| A4 | L | | A30 | L | |
| A3 | H | CH1_MC2_COM | A29 | H | CH2_MC2_COM |
| A5 | L | | A31 | L | |
| BPL_HI | H | ACV | BPL_HI | H | DCV |
| BPL_LO | L | | BPL_LO | L | |
| BPL_HI | H | 2WOHM | | | |
| BPL_LO | L | | | | |

**TABLE 4-38: 2-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

**NOTES** The H/L column represents the "HI" and "LO" pins for the 2-wire signal.
The "BPL" references are lines available on the EX1200 mainframe backplane that connect the plug-in module to the on-board DMM (if installed). For more information on these lines, refer to the *EX1200 Series User's Manual*.

| Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal | Pin | H/L | Signal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B1 | H1 | CH1_MC1_4W | B9 | H1 | CH1_MC9_4W | B17 | H1 | CH2_MC1_4W | D32 | H1 | CH2_MC9_4W |
| C1 | H2 | | C9 | H2 | | C17 | H2 | | E32 | H2 | |
| D1 | L1 | | D9 | L1 | | B25 | L1 | | D31 | L1 | |
| E1 | L2 | | E9 | L2 | | C25 | L2 | | E31 | L2 | |
| B2 | H1 | CH1_MC2_4W | B10 | H1 | CH1_MC10_4W | B18 | H1 | CH2_MC2_4W | D30 | H1 | CH2_MC10_4W |
| C2 | H2 | | C10 | H2 | | C18 | H2 | | E30 | H2 | |
| D2 | L1 | | D10 | L1 | | B26 | L1 | | D29 | L1 | |
| E2 | L2 | | E10 | L2 | | C26 | L2 | | E29 | L2 | |
| B3 | H1 | CH1_MC3_4W | B11 | H1 | CH1_MC11_4W | B19 | H1 | CH2_MC3_4W | D28 | H1 | CH2_MC11_4W |
| C3 | H2 | | C11 | H2 | | C19 | H2 | | E28 | H2 | |
| D3 | L1 | | D11 | L1 | | B27 | L1 | | D27 | L1 | |
| E3 | L2 | | E11 | L2 | | C27 | L2 | | E27 | L2 | |
| B4 | H1 | CH1_MC4_4W | B12 | H1 | CH1_MC12_4W | B20 | H1 | CH2_MC4_4W | D26 | H1 | CH2_MC12_4W |
| C4 | H2 | | C12 | H2 | | C20 | H2 | | E26 | H2 | |
| D4 | L1 | | D12 | L1 | | B28 | L1 | | D25 | L1 | |
| E4 | L2 | | E12 | L2 | | C28 | L2 | | E25 | L2 | |
| B5 | H1 | CH1_MC5_4W | B13 | H1 | CH1_MC13_4W | B21 | H1 | CH2_MC5_4W | D24 | H1 | CH2_MC13_4W |
| C5 | H2 | | C13 | H2 | | C21 | H2 | | E24 | H2 | |
| D5 | L1 | | D13 | L1 | | B29 | L1 | | D23 | L1 | |
| E5 | L2 | | E13 | L2 | | C29 | L2 | | E23 | L2 | |
| B6 | H1 | CH1_MC6_4W | B14 | H1 | CH1_MC14_4W | B22 | H1 | CH2_MC6_4W | D22 | H1 | CH2_MC14_4W |
| C6 | H2 | | C14 | H2 | | C22 | H2 | | E22 | H2 | |
| D6 | L1 | | D14 | L1 | | B30 | L1 | | D21 | L1 | |
| E6 | L2 | | E14 | L2 | | C30 | L2 | | E21 | L2 | |
| B7 | H1 | CH1_MC7_4W | B15 | H1 | CH1_MC15_4W | B23 | H1 | CH2_MC7_4W | D20 | H1 | CH2_MC15_4W |
| C7 | H2 | | C15 | H2 | | C23 | H2 | | E20 | H2 | |
| D7 | L1 | | D15 | L1 | | B31 | L1 | | D19 | L1 | |
| E7 | L2 | | E15 | L2 | | C31 | L2 | | E19 | L2 | |
| B8 | H1 | CH1_MC8_4W | B16 | H1 | CH1_MC16_4W | B32 | H1 | CH2_MC8_4W | D18 | H1 | CH2_MC16_4W |
| C8 | H2 | | C16 | H2 | | C32 | H2 | | E18 | H2 | |
| D8 | L1 | | D16 | L1 | | B24 | L1 | | D17 | L1 | |
| E8 | L2 | | E16 | L2 | | C24 | L2 | | E17 | L2 | |

**4-Wire Common and Backplane Signal Names**

| Pin/DMM Bus Line | H/L | Signal | Pin/DMM Bus Line | H/L | Signal |
|---|---|---|---|---|---|
| A2 | H1 | CH1_MC_COM_4W | A28 | H1 | CH2_MC_COM_4W |
| A3 | H2 | | A29 | H2 | |
| A4 | L1 | | A30 | L1 | |
| A5 | L2 | | A31 | L2 | |
| BPL_HI | H1 | 4WOHM | | | |
| BPL_SHI | H2 | | | | |
| BPL_LO | L1 | | | | |
| BPL_SLO | L2 | | | | |

**TABLE 4-39: 4-WIRE CONNECTOR PINS & SIGNAL ASSIGNMENTS**

**NOTES** The H/L column represents the "HI" and "LO" pins for the 4-wire signal.
The "BPL" references are lines available on the EX1200 mainframe backplane that connect the plug-in module to the on-board DMM (if installed). For more information on these lines, refer to the *EX1200 Series User's Manual*.

## LOGICAL DIAGRAM

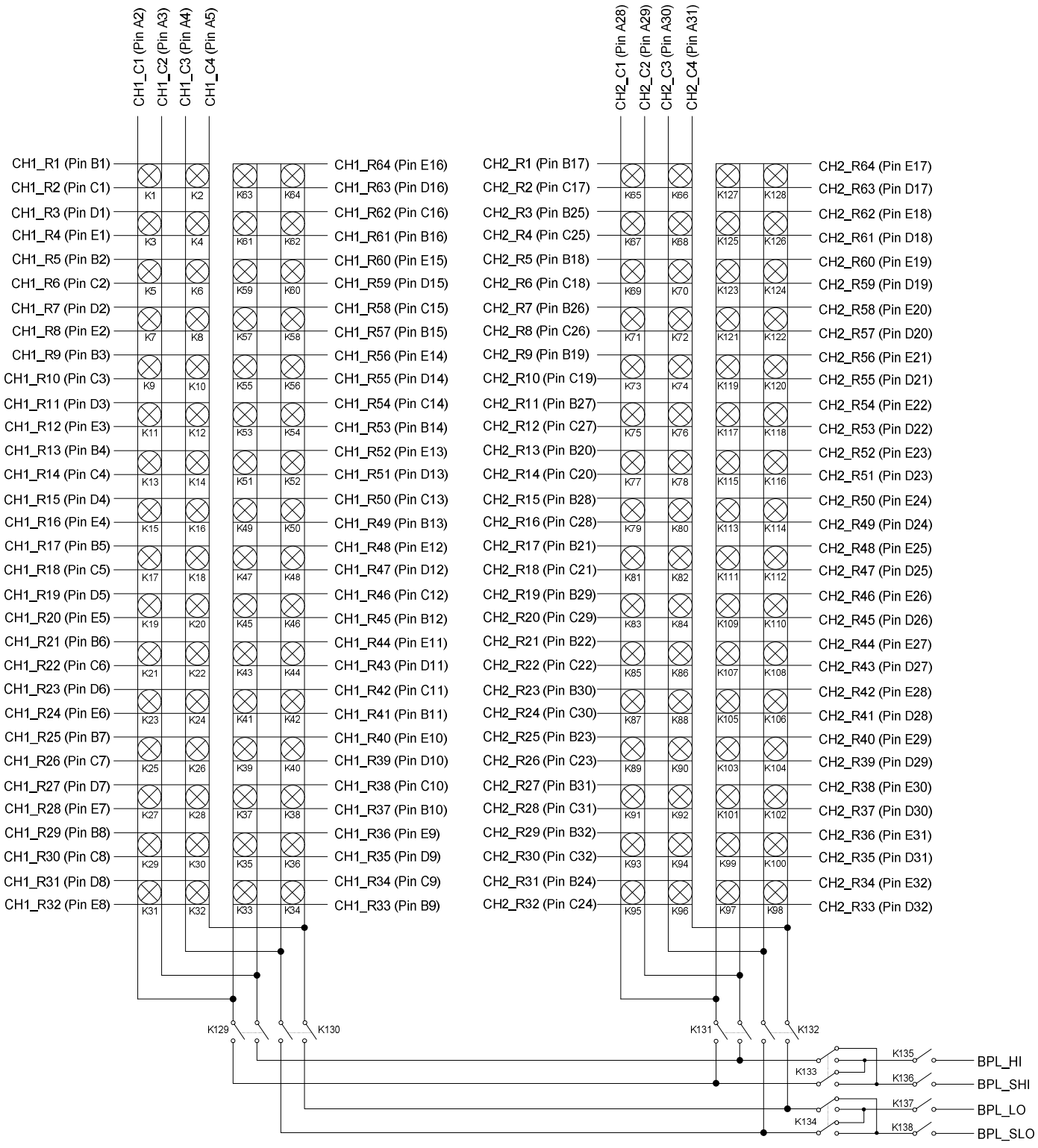



**FIGURE 4-39: EX1200-4264 LOGICAL DIAGRAM**

## EX1200-4264 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Two 64x2 2-wire channels |
| **RELAY TYPE** | |
| | Electromechanically, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 220 V dc/ 250 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 60 W, 62.5 VA (see the _Figure 4-40 for more information) |
| **MINIMUM CONTACT RATING*** | |
| | 100 µV |
| **This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions* | |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME (TYPICAL)** | |
| | < 10 ms |
| **PATH RESISTANCE** | |
| | < 0.5 Ω |
| **INSULATION RESISTANCE** | |
| | $>10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 10 µV |
| **BANDWIDTH (-3 dB)** | |
| | > 40 MHz |
| **CROSSTALK (TYPICAL)** | |
| **1 MHz** | < -45 dB |
| **10 MHz** | < -30 dB |
| **ISOLATION (TYPICAL)** | |
| **1 MHz** | < -60 dB |
| **10 MHz** | < -50 dB |

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

## RELAY BREAKING CAPACITY

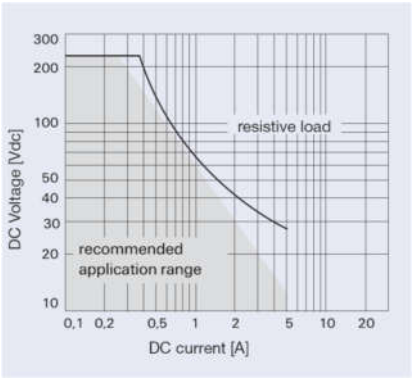



**FIGURE 4-40: RELAY BREAKING CAPACITY**

# EX1200-5001 PLUG-IN MODULE

## 80-CHANNEL 2 AMP FORM A (SPST) SWITCH

The EX1200-5001 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. Up to 480 SPST relays can be accommodated in a 1U full-rack mainframe for maximum density. The modules can also be configured with other EX1200 series switch modules as part of a flexible system switch design.

Since these modules may be used to switch power to the UUT or interface, the digital input lines on the EX1200 series mainframes support the ability to force all relays automatically to their normally open state if a fault condition occurs. This approach instantly removes all power to the UUT or interface. These modules can be automatically configured in the setup phase at the beginning of each scan step to facilitate test sequencing and control.

The EX1200-5001 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 4-422 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

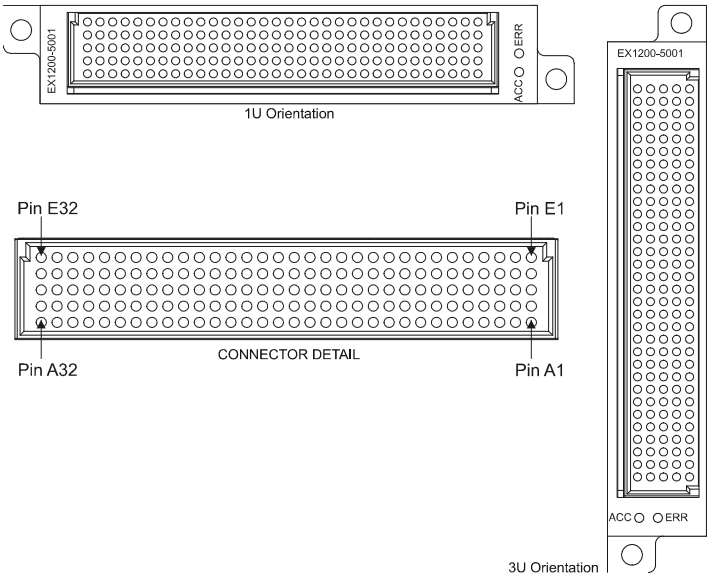



**FIGURE 4-41: EX1200-5001 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH_1NO | **1** | CH_2NO | **1** | CH_3NO | **1** | CH_4NO | **1** | CH_5NO |
| **2** | CH_1COM | **2** | CH_2COM | **2** | CH_3COM | **2** | CH_4COM | **2** | CH_5COM |
| **3** | CH_6NO | **3** | CH_7NO | **3** | CH_8NO | **3** | CH_9NO | **3** | CH_10NO |
| **4** | CH_6COM | **4** | CH_7COM | **4** | CH_8COM | **4** | CH_9COM | **4** | CH_10COM |
| **5** | CH_11NO | **5** | CH_12NO | **5** | CH_13NO | **5** | CH_14NO | **5** | CH_15NO |
| **6** | CH_11COM | **6** | CH_12COM | **6** | CH_13COM | **6** | CH_14COM | **6** | CH_15COM |
| **7** | CH_16NO | **7** | CH_17NO | **7** | CH_18NO | **7** | CH_19NO | **7** | CH_20NO |
| **8** | CH_16COM | **8** | CH_17COM | **8** | CH_18COM | **8** | CH_19COM | **8** | CH_20COM |
| **9** | CH_21NO | **9** | CH_22NO | **9** | CH_23NO | **9** | CH_24NO | **9** | CH_25NO |
| **10** | CH_21COM | **10** | CH_22COM | **10** | CH_23COM | **10** | CH_24COM | **10** | CH_25COM |
| **11** | CH_26NO | **11** | CH_27NO | **11** | CH_28NO | **11** | CH_29NO | **11** | CH_30NO |
| **12** | CH_26COM | **12** | CH_27COM | **12** | CH_28COM | **12** | CH_29COM | **12** | CH_30COM |
| **13** | CH_31NO | **13** | CH_32NO | **13** | CH_33NO | **13** | CH_34NO | **13** | CH_35NO |
| **14** | CH_31COM | **14** | CH_32COM | **14** | CH_33COM | **14** | CH_34COM | **14** | CH_35COM |
| **15** | CH_36NO | **15** | CH_37NO | **15** | CH_38NO | **15** | CH_39NO | **15** | CH_40NO |
| **16** | CH_36COM | **16** | CH_37COM | **16** | CH_38COM | **16** | CH_39COM | **16** | CH_40COM |
| **17** | CH_41NO | **17** | CH_42NO | **17** | CH_43NO | **17** | CH_44NO | **17** | CH_45NO |
| **18** | CH_41COM | **18** | CH_42COM | **18** | CH_43COM | **18** | CH_44COM | **18** | CH_45COM |
| **19** | CH_46NO | **19** | CH_47NO | **19** | CH_48NO | **19** | CH_49NO | **19** | CH_50NO |
| **20** | CH_46COM | **20** | CH_47COM | **20** | CH_48COM | **20** | CH_49COM | **20** | CH_50COM |
| **21** | CH_51NO | **21** | CH_52NO | **21** | CH_53NO | **21** | CH_54NO | **21** | CH_55NO |
| **22** | CH_51COM | **22** | CH_52COM | **22** | CH_53COM | **22** | CH_54COM | **22** | CH_55COM |
| **23** | CH_56NO | **23** | CH_57NO | **23** | CH_58NO | **23** | CH_59NO | **23** | CH_60NO |
| **24** | CH_56COM | **24** | CH_57COM | **24** | CH_58COM | **24** | CH_59COM | **24** | CH_60COM |
| **25** | CH_61NO | **25** | CH_62NO | **25** | CH_63NO | **25** | CH_64NO | **25** | CH_65NO |
| **26** | CH_61COM | **26** | CH_62COM | **26** | CH_63COM | **26** | CH_64COM | **26** | CH_65COM |
| **27** | CH_66NO | **27** | CH_67NO | **27** | CH_68NO | **27** | CH_69NO | **27** | CH_70NO |
| **28** | CH_66COM | **28** | CH_67COM | **28** | CH_68COM | **28** | CH_69COM | **28** | CH_70COM |
| **29** | CH_71NO | **29** | CH_72NO | **29** | CH_73NO | **29** | CH_74NO | **29** | CH_75NO |
| **30** | CH_71COM | **30** | CH_72COM | **30** | CH_73COM | **30** | CH_74COM | **30** | CH_75COM |
| **31** | CH_76NO | **31** | CH_77NO | **31** | CH_78NO | **31** | CH_79NO | **31** | CH_80NO |
| **32** | CH_76COM | **32** | CH_77COM | **32** | CH_78COM | **32** | CH_79COM | **32** | CH_80COM |

**TABLE 4-40: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

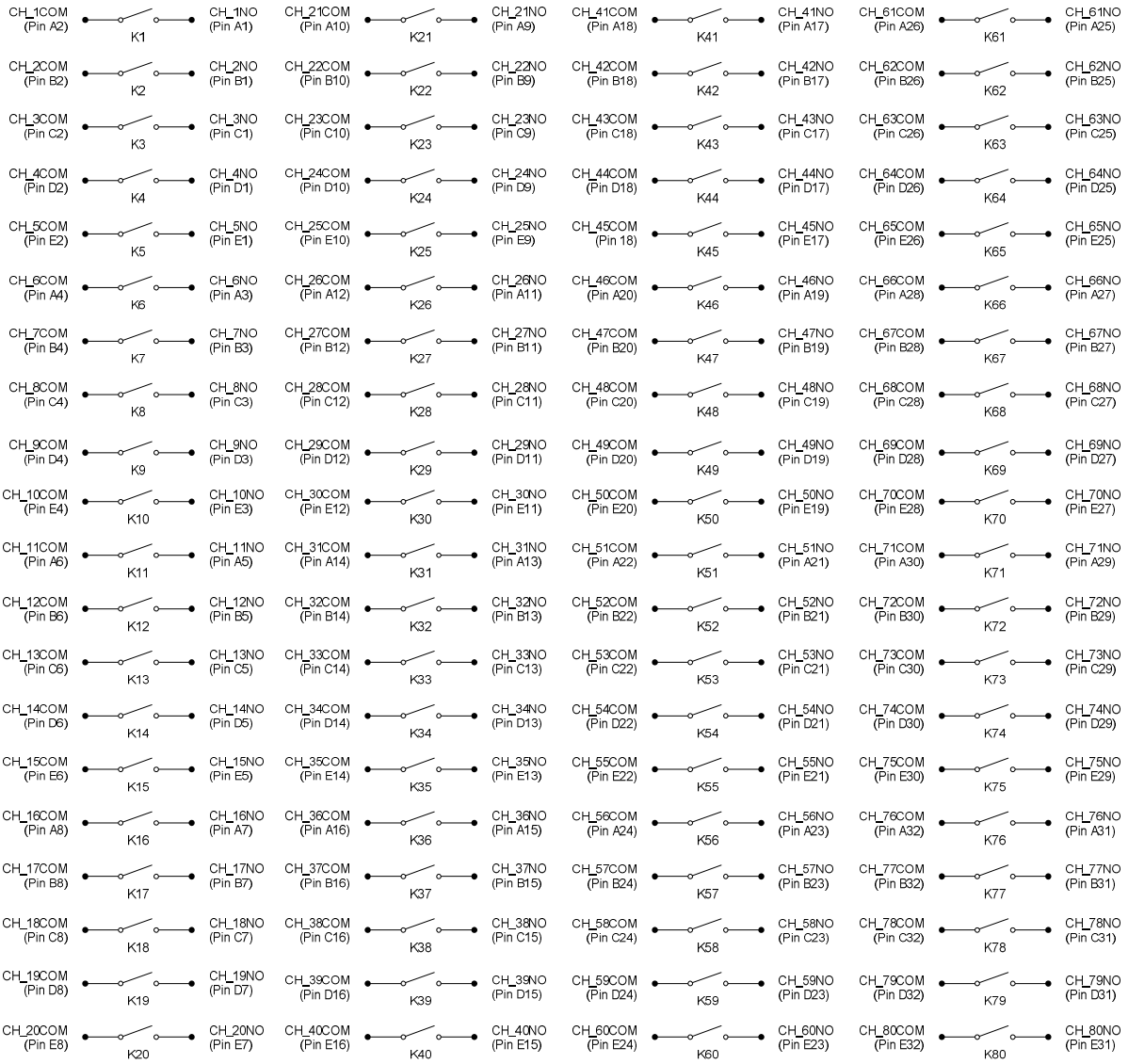



**FIGURE 4-42: EX1200-5001 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH_5COM | E2 | T41 | CH_36NO | A15 | T81 | CH_33COM | C14 | T121 | CH_51COM | A22 |
| T2 | CH_4COM | D2 | T42 | CH_31COM | A14 | T82 | CH_32COM | B14 | T122 | CH_56NO | A23 |
| T3 | CH_10NO | E3 | T43 | CH_31NO | A13 | T83 | CH_38NO | C15 | T123 | CH_46COM | A20 |
| T4 | CH_9NO | D3 | T44 | CH_26COM | A12 | T84 | CH_37NO | B15 | T124 | CH_41COM | A18 |
| T5 | CH_10COM | E4 | T45 | CH_21COM | A10 | T85 | CH_38COM | C16 | T125 | CH_46NO | A19 |
| T6 | CH_9COM | D4 | T46 | CH_24COM | D10 | T86 | CH_37COM | B16 | T126 | CH_36COM | A16 |
| T7 | CH_15NO | E5 | T47 | CH_25COM | E10 | T87 | CH_43NO | C17 | T127 | CH_41NO | A17 |
| T8 | CH_14NO | D5 | T48 | CH_28NO | C11 | T88 | CH_42NO | B17 | T128 | CH_79COM | D32 |
| T9 | CH_15COM | E6 | T49 | CH_27NO | B11 | T89 | CH_43COM | C18 | T129 | CH_75COM | E30 |
| T10 | CH_14COM | D6 | T50 | CH_26NO | A11 | T90 | CH_42COM | B18 | T130 | CH_74COM | D30 |
| T11 | CH_20NO | E7 | T51 | CH_27COM | B12 | T91 | CH_48NO | C19 | T131 | CH_75NO | E29 |
| T12 | CH_19NO | D7 | T52 | CH_28COM | C12 | T92 | CH_47NO | B19 | T132 | CH_74NO | D29 |
| T13 | CH_20COM | E8 | T53 | CH_32NO | B13 | T93 | CH_48COM | C20 | T133 | CH_80NO | E31 |
| T14 | CH_19COM | D8 | T54 | CH_33NO | C13 | T94 | CH_47COM | B20 | T134 | CH_79NO | D31 |
| T15 | CH_25NO | E9 | T55 | CH_21NO | A9 | T95 | CH_78COM | C32 | T135 | CH_73COM | C30 |
| T16 | CH_24NO | D9 | T56 | CH_16COM | A8 | T96 | CH_5NO | E1 | T136 | CH_72COM | B30 |
| T17 | CH_8NO | C3 | T57 | CH_16NO | A7 | T97 | CH_65COM | E26 | T137 | CH_78NO | C31 |
| T18 | CH_7NO | B3 | T58 | CH_11COM | A6 | T98 | CH_64COM | D26 | T138 | CH_77NO | B31 |
| T19 | CH_3COM | C2 | T59 | CH_11NO | A5 | T99 | CH_60COM | E24 | T139 | CH_72NO | B29 |
| T20 | CH_2COM | B2 | T60 | CH_6COM | A4 | T100 | CH_59COM | D24 | T140 | CH_73NO | C29 |
| T21 | CH_8COM | C4 | T61 | CH_6NO | A3 | T101 | CH_70NO | E27 | T141 | CH_67COM | B28 |
| T22 | CH_7COM | B4 | T62 | CH_1COM | A2 | T102 | CH_69NO | D27 | T142 | CH_68COM | C28 |
| T23 | CH_13NO | C5 | T63 | CH_22COM | B10 | T103 | CH_70COM | E28 | T143 | CH_63NO | C25 |
| T24 | CH_12NO | B5 | T64 | CH_23COM | C10 | T104 | CH_69COM | D28 | T144 | CH_62NO | B25 |
| T25 | CH_13COM | C6 | T65 | CH_40NO | E15 | T105 | CH_60NO | E23 | T145 | CH_67NO | B27 |
| T26 | CH_12COM | B6 | T66 | CH_39NO | D15 | T106 | CH_59NO | D23 | T146 | CH_68NO | C27 |
| T27 | CH_18NO | C7 | T67 | CH_40COM | E16 | T107 | CH_55COM | E22 | T147 | CH_62COM | B26 |
| T28 | CH_17NO | B7 | T68 | CH_39COM | D16 | T108 | CH_54COM | D22 | T148 | CH_63COM | C26 |
| T29 | CH_18COM | C8 | T69 | CH_45NO | E17 | T109 | CH_64NO | D25 | T149 | CH_61COM | A26 |
| T30 | CH_17COM | B8 | T70 | CH_44NO | D17 | T110 | CH_65NO | E25 | T150 | CH_66NO | A27 |
| T31 | CH_23NO | C9 | T71 | CH_45COM | E18 | T111 | CH_50COM | E20 | T151 | CH_66COM | A28 |
| T32 | CH_22NO | B9 | T72 | CH_44COM | D18 | T112 | CH_49COM | D20 | T152 | CH_71NO | A29 |
| T33 | CH_30NO | E11 | T73 | CH_50NO | E19 | T113 | CH_53COM | C22 | T153 | CH_71COM | A30 |
| T34 | CH_29NO | D11 | T74 | CH_49NO | D19 | T114 | CH_52COM | B22 | T154 | CH_76NO | A31 |
| T35 | CH_29COM | D12 | T75 | CH_53NO | C21 | T115 | CH_58NO | C23 | T155 | CH_80COM | E32 |
| T3 | CH_30COM | E12 | T76 | CH_52NO | B21 | T116 | CH_57NO | B23 | T156 | CH_2NO | B1 |
| T37 | CH_34NO | D13 | T77 | CH_4NO | D1 | T117 | CH_58COM | C24 | T157 | CH_76COM | A32 |
| T38 | CH_35NO | E13 | T78 | CH_51NO | A21 | T118 | CH_57COM | B24 | T158 | CH_1NO | A1 |
| T39 | CH_34COM | D14 | T79 | CH_54NO | D21 | T119 | CH_56COM | A24 | T159 | CH_77COM | B32 |
| T40 | CH_35COM | E14 | T80 | CH_55NO | E21 | T120 | CH_61NO | A25 | T160 | CH_3NO | C1 |

**TABLE 4-41: EX1200-TB160SE TERMINAL BLOCK TO EX1200-5001 PIN MAPPING**

# EX1200-5001 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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 300 mΩ |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ 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*.

# EX1200-5002 PLUG-IN MODULE

## 32-CHANNEL, 2 AMP FORM C (SPDT) SWITCH

The EX1200-5002 is a high-density general purpose 2 A switch module 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. For example, three relays on a -5002 module can be configured as a SP4T tree, and seven relays can be configured as a SP8T tree. Up to 192 individual SPDT or 384 SPST relays can be accommodated in a 1U EX1200 mainframe for maximum density. The modules can also be configured with other EX1200 series switch modules as part of a flexible system switch design.

Since these modules may be used to switch power to the UUT or interface, the digital input lines on the EX1200 series mainframes support the ability to force all relays automatically to their normally open state if a fault condition occurs. This approach instantly removes all power to the UUT or interface. These modules can be automatically configured in the setup phase at the beginning of each scan step to facilitate test sequencing and control.

The EX1200-5002 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 4-444 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

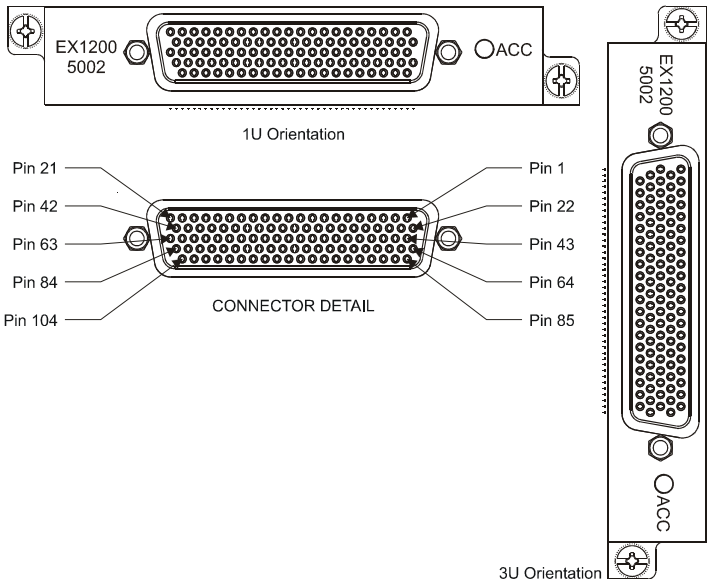



**FIGURE 4-43: EX1200-5002 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH_1NO | **22** | CH_2NO | **43** | CH_3NO | **64** | CH_4NO | **85** | CH_5NO |
| **2** | CH_1COM | **23** | CH_2COM | **44** | CH_3COM | **65** | CH_4COM | **86** | CH_5COM |
| **3** | CH_1NC | **24** | CH_2NC | **45** | CH_3NC | **66** | CH_4NC | **87** | CH_5NC |
| **4** | CH_6NO | **25** | CH_7NO | **46** | CH_8NO | **67** | CH_9NO | **88** | CH_10NO |
| **5** | CH_6COM | **26** | CH_7COM | **47** | CH_8COM | **68** | CH_9COM | **89** | CH_10COM |
| **6** | CH_6NC | **27** | CH_7NC | **48** | CH_8NC | **69** | CH_9NC | **90** | CH_10NC |
| **7** | CH_11NO | **28** | CH_12NO | **49** | CH_13NO | **70** | CH_14NO | **91** | CH_15NO |
| **8** | CH_11COM | **29** | CH_12COM | **50** | CH_13COM | **71** | CH_14COM | **92** | CH_15COM |
| **9** | CH_11NC | **30** | CH_12NC | **51** | CH_13NC | **72** | CH_14NC | **93** | CH_15NC |
| **10** | CH_16NO | **31** | CH_17NO | **52** | CH_18NO | **73** | CH_19NO | **94** | CH_20NO |
| **11** | CH_16COM | **32** | CH_17COM | **53** | CH_18COM | **74** | CH_19COM | **95** | CH_20COM |
| **12** | CH_16NC | **33** | CH_17NC | **54** | CH_18NC | **75** | CH_19NC | **96** | CH_20NC |
| **13** | CH_21NO | **34** | CH_22NO | **55** | CH_23NO | **76** | CH_24NO | **97** | CH_25NO |
| **14** | CH_21COM | **35** | CH_22COM | **56** | CH_23COM | **77** | CH_24COM | **98** | CH_25COM |
| **15** | CH_NC_21 | **36** | CH_22NC | **57** | CH_23NC | **78** | CH_24NC | **99** | CH_25NC |
| **16** | CH_26NO | **37** | CH_27NO | **58** | CH_28NO | **79** | CH_29NO | **100** | CH_30NO |
| **17** | CH_26COM | **38** | CH_27COM | **59** | CH_28COM | **80** | CH_29COM | **101** | CH_30COM |
| **18** | CH_26NC | **39** | CH_27NC | **60** | CH_28NC | **81** | CH_29NC | **102** | CH_30NC |
| **19** | CH_31NO | **40** | CH_32NO | **61** | SHIELD | **82** | SHIELD | **103** | GND_C |
| **20** | CH_31COM | **41** | CH_32COM | **62** | SHIELD | **83** | SHIELD | **104** | GND_C |
| **21** | CH_31NC | **42** | CH_32NC | **63** | SHIELD | **84** | SHIELD | | |

**TABLE 4-42: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

The EX1200-5002 incorporates 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. These pins are identified as "SHIELD" in Table 4-14.

The module also incorporates ground pins, labeled "GND_C" above. These pins tie the module to chassis ground. Note that the SHIELD pins are not tied to ground and have no electrical connections.

## LOGICAL DIAGRAM

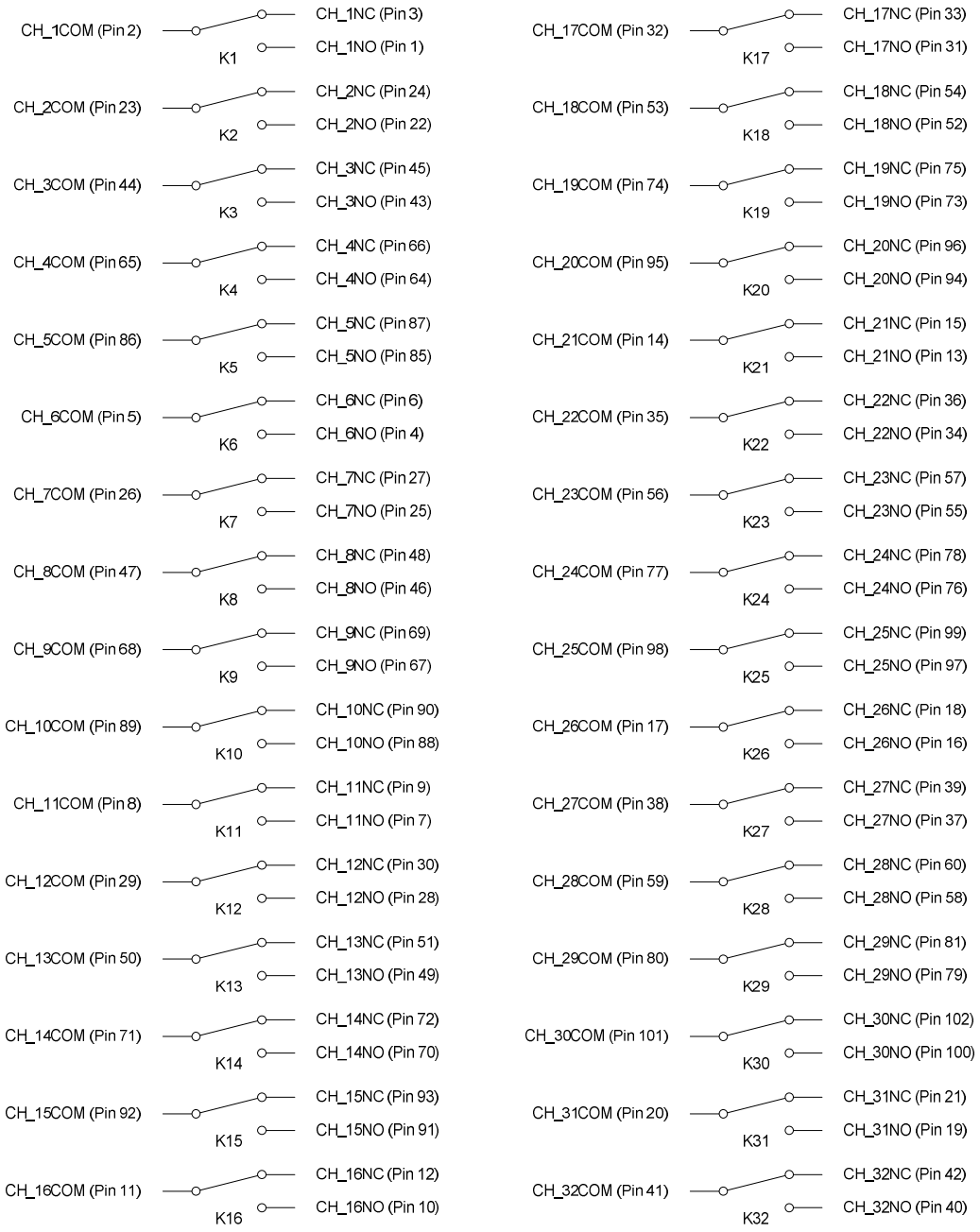



**FIGURE 4-44: EX1200-5002 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH_1NO | 1 | T41 | CH_27NO | 37 | T81 | CH_18NO | 52 | T121 | CH_NC | 87 |
| T2 | CH_1COM | 2 | T42 | CH_27COM | 38 | T82 | CH_18COM | 53 | T122 | CH_10NO | 88 |
| T3 | CH_1NC | 3 | T43 | CH_27NC | 39 | T83 | CH_18NC | 54 | T123 | CH_10COM | 89 |
| T4 | CH_6NO | 4 | T44 | CH_32NO | 40 | T84 | CH_23NO | 55 | T124 | CH_10NC | 90 |
| T5 | CH_6COM | 5 | T45 | CH_32COM | 41 | T85 | CH_23COM | 56 | T125 | CH_15NO | 91 |
| T6 | CH_6NC | 6 | T46 | CH_32NC | 42 | T86 | CH_23NC | 57 | T126 | CH_15COM | 92 |
| T7 | CH_11NO | 7 | T47 | UNUSED | N/A | T87 | CH_28NO | 58 | T127 | CH_15NC | 93 |
| T8 | CH_11COM | 8 | T48 | UNUSED | N/A | T88 | CH_28COM | 59 | T128 | SHIELD | 83 |
| T9 | CH_11NC | 9 | T49 | UNUSED | N/A | T89 | CH_28NC | 60 | T129 | CH_20NO | 94 |
| T10 | CH_16NO | 10 | T50 | UNUSED | N/A | T90 | UNUSED | N/A | T130 | CH_20COM | 95 |
| T11 | CH_16COM | 11 | T51 | UNUSED | N/A | T91 | UNUSED | N/A | T131 | CH_20NC | 96 |
| T12 | CH_16NC | 12 | T52 | UNUSED | N/A | T92 | UNUSED | N/A | T132 | CH_25NO | 97 |
| T13 | CH_21NO | 13 | T53 | UNUSED | N/A | T93 | UNUSED | N/A | T133 | CH_25COM | 98 |
| T14 | CH_21COM | 14 | T54 | UNUSED | N/A | T94 | UNUSED | N/A | T134 | CH_25NC | 99 |
| T15 | CH_21NC | 15 | T55 | UNUSED | N/A | T95 | SHIELD | 82 | T135 | CH_30NO | 100 |
| T16 | UNUSED | N/A | T56 | UNUSED | N/A | T96 | UNUSED | N/A | T136 | CH_30COM | 101 |
| T17 | CH_26NO | 16 | T57 | UNUSED | N/A | T97 | CH_4NO | 64 | T137 | CH_30NC | 102 |
| T18 | CH_26COM | 17 | T58 | UNUSED | N/A | T98 | CH_4COM | 65 | T138 | UNUSED | N/A |
| T19 | CH_26NC | 18 | T59 | UNUSED | N/A | T99 | CH_4NC | 66 | T139 | UNUSED | N/A |
| T20 | CH_31NO | 19 | T60 | UNUSED | N/A | T100 | CH_9NO | 67 | T140 | UNUSED | N/A |
| T21 | CH_31COM | 20 | T61 | UNUSED | N/A | T101 | CH_9COM | 68 | T141 | UNUSED | N/A |
| T22 | CH31NC | 21 | T62 | UNUSED | N/A | T102 | CH_9NC | 69 | T142 | UNUSED | N/A |
| T23 | CH_2NO | 22 | T63 | UNUSED | N/A | T103 | CH_14NO | 70 | T143 | UNUSED | N/A |
| T24 | CH_2COM | 23 | T64 | UNUSED | N/A | T104 | CH_14COM | 71 | T144 | UNUSED | N/A |
| T25 | CH_2NC | 24 | T65 | CH_3NO | 43 | T105 | CH_14NC | 72 | T145 | UNUSED | N/A |
| T26 | CH_7NO | 25 | T66 | CH_3COM | 44 | T106 | CH_19NO | 73 | T146 | UNUSED | N/A |
| T27 | CH_7COM | 26 | T67 | CH_3NC | 45 | T107 | CH_19COM | 74 | T147 | UNUSED | N/A |
| T28 | CH_7NC | 27 | T68 | CH_8NO | 46 | T108 | CH_19NC | 75 | T148 | UNUSED | N/A |
| T29 | CH_12NO | 28 | T69 | CH_8COM | 47 | T109 | CH_24NO | 76 | T149 | UNUSED | N/A |
| T30 | CH_12COM | 29 | T70 | CH_8NC | 48 | T110 | CH_24COM | 77 | T150 | UNUSED | N/A |
| T31 | CH_12NC | 30 | T71 | CH_13NO | 49 | T111 | CH_24NC | 78 | T151 | UNUSED | N/A |
| T32 | UNUSED | N/A | T72 | CH_13COM | 50 | T112 | UNUSED | N/A | T152 | UNUSED | N/A |
| T33 | SHIELD | 61 | T73 | CH_13NC | 51 | T113 | CH_29NO | 79 | T153 | UNUSED | N/A |
| T34 | UNUSED | N/A | T74 | UNUSED | N/A | T114 | CH_29COM | 80 | T154 | UNUSED | N/A |
| T35 | CH_17NO | 31 | T75 | UNUSED | N/A | T115 | CH_29NC | 81 | T155 | SHIELD | 63, 84 |
| T36 | CH_17COM | 32 | T76 | UNUSED | N/A | T116 | UNUSED | N/A | T156 | UNUSED | N/A |
| T37 | CH_17NC | 33 | T77 | UNUSED | N/A | T117 | UNUSED | N/A | T157 | GND_C | 103 |
| T38 | CH_22NO | 34 | T78 | UNUSED | N/A | T118 | UNUSED | N/A | T158 | UNUSED | N/A |
| T39 | CH_22COM | 35 | T79 | UNUSED | N/A | T119 | CH_5NO | 85 | T159 | GND_C | 104 |
| T40 | CH_22NC | 36 | T80 | SHIELD | 62 | T120 | CH_5COM | 86 | T160 | UNUSED | N/A |

**TABLE 4-43: EX1200-TB160SE TERMINAL BLOCK TO EX1200-5002 PIN MAPPING**

# EX1200-5002 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 32 SPDT |
| **RELAY TYPE** | |
| | Electromechanical, 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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 300 mΩ |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | <1 µV |
| **CAPACITANCE** | |
| **Open channel** | < 50 pF |
| **Channel-mainframe** | <250 pF |
| **High-low** | <120 pF |
| **BANDWIDTH (-3 dB)** | |
| | 30 MHz (typical) |
| **CROSSTALK (TYPICAL)** | |
| **100 kHz** | < -80 dB |
| **1 MHz** | < -60 dB |
| **ISOLATION (TYPICAL)** | |
| **100 kHz** | < -50 dB |
| **1 MHz** | < -45 dB |

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

# EX1200-5004 PLUG-IN MODULE

## 32-CHANNEL, 5 A SPDT SWITCH

The EX1200-5004 is a high-density 5 A switch module designed for switching applications such as process control, appliance pass/fail testing, and on/off control. Up to 192 individual SPDT relays can be accommodated in a 1U full-rack mainframe for maximum density. The modules can also be configured with other EX1200 series switch modules as part of a flexible system switch design.

## CONNECTOR PINS AND SIGNALS

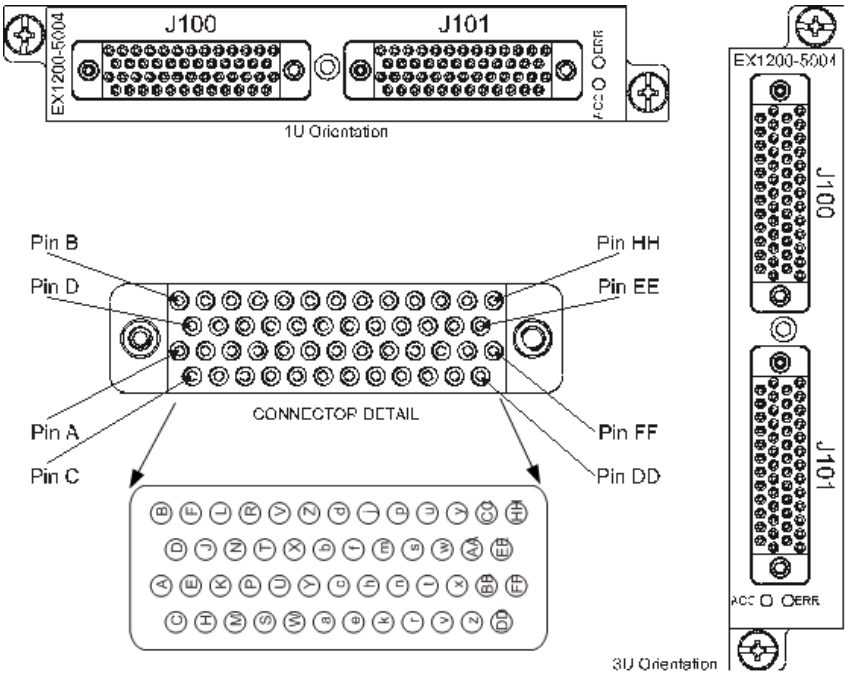



FIGURE 4-45: EX1200-5004 FRONT PANEL (FRONT VIEW)

| J100 | | | | | J101 | | | |
|---|---|---|---|---|---|---|---|---|
| Pin | Signal | Pin | Signal | | Pin | Signal | Pin | Signal |
| A | UNUSED | d | CH_31NC | | A | UNUSED | d | CH_30NC |
| B | CH_3NO | e | CH_14NO | | B | CH_18NC | e | CH_27NC |
| C | CH_10NO | f | CH_4NC | | C | CH_15NO | f | CH_11NC |
| D | CH_31COM | h | CH_12NC | | D | CH_29NC | h | CH_26NO |
| E | CH_6COM | j | CH_18NO | | E | CH_17COM | j | CH_29COM |
| F | CH_1COM | k | CH_13NC | | F | CH_11NO | k | CH_25NC |
| H | CH_8NO | m | CH_17NC | | H | CH_21NC | m | CH_30COM |
| J | CH_2NC | n | CH_10COM | | J | CH_17NO | n | CH_22NC |
| K | CH_6NO | p | CH_5NO | | K | CH_16COM | p | CH_19COM |
| L | CH_2COM | r | CH_15NC | | L | CH_15COM | r | CH_28NO |
| M | CH_8COM | s | CH_13NO | | M | CH_23COM | s | CH_24COM |
| N | CH_7NC | t | CH_13COM | | N | CH_24NA | t | CH_22COM |
| P | CH_5NC | u | CH_1NO | | P | CH_16NO | u | CH_32NO |
| R | CH_14COM | v | CH_5COM | | R | CH_28COM | v | CH_19NC |
| S | CH_4NO | w | CH_12COM | | S | CH_21COM | w | CH_22NO |
| T | CH_4COM | x | CH_26NC | | T | CH_20COM | x | CH_20NO |
| U | CH_3NC | y | CH_8NC | | U | CH_25COM | y | CH_23NO |
| V | CH_31NO | z | CH_9NO | | V | CH_30NO | z | CH_20NC |
| W | CH_7COM | AA | CH_12NO | | W | CH_23NC | AA | CH_27COM |
| X | CH_3COM | BB | CH_9COM | | X | CH_11COM | BB | CH_19NO |
| Y | CH_9NC | CC | CH_14NC | | Y | CH_27NO | CC | CH_29NO |
| Z | CH_18COM | DD | CH_16NC | | Z | CH_28NC | DD | CH_21NO |
| a | CH_7NO | EE | CH_2NO | | a | CH_26COM | EE | CH_32COM |
| b | CH_10NC | FF | UNUSED | | b | CH_24NC | FF | UNUSED |
| c | CH_6NC | HH | CH_1NC | | c | CH_25NO | HH | CH_32NC |

**TABLE 4-44: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

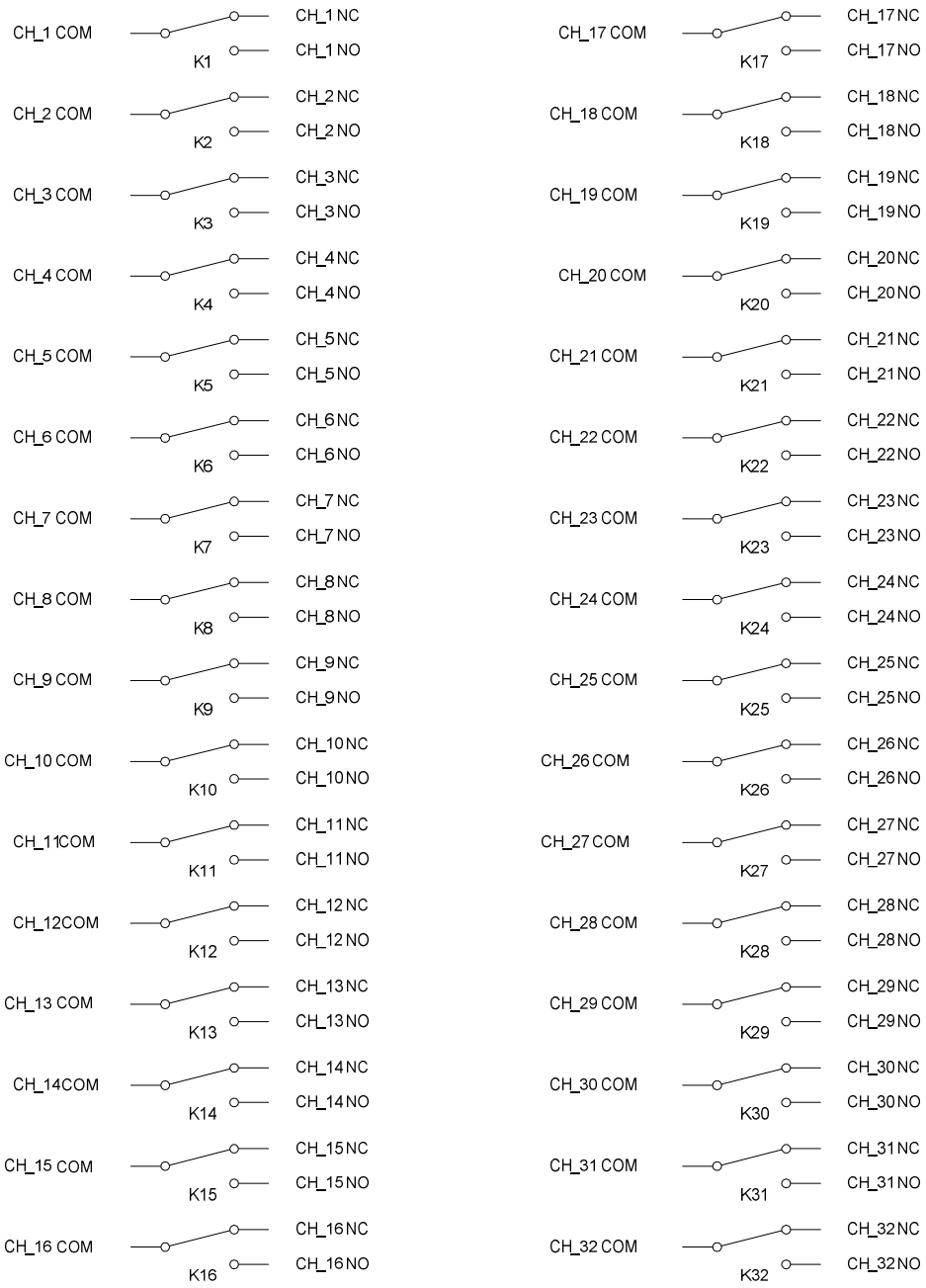



**FIGURE 4-46: EX1200-5004 LOGICAL DIAGRAM**

# EX1200-5004 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 32 SPDT |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 250 V ac rms, 110 V dc |
| **MAXIMUM SWITCHING CURRENT** | |
| | 5 A |
| **MAXIMUM SWITCHING POWER** | |
| | 150 W dc, 1250 VA per channel<br>18 kW per switch module |
| **MINIMUM CONTACT RATING*** | |
| | 10 mA, 5 V dc |
| **This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions* | |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^7$ |
| **Electrical** | $5 \times 10^5$ |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 0.15 Ω |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | < 7 µV |
| **CAPACITANCE** | |
| **Open channel** | < 50 pF |
| **Channel-mainframe** | < 80 pF |
| **BANDWIDTH (-3 DB)** | |
| | 50 MHz (typical) |
| **CROSSTALK (TYPICAL)** | |
| **100 kHz** | < -80 dB |
| **1 MHz** | < -60 dB |
| **10 MHz** | < -40 dB |
| **ISOLATION (TYPICAL)** | |
| **100 kHz** | < -50 dB |
| **1 MHz** | < -45 dB |
| **10 MHz** | < -40 dB |
| **INSERTION LOSS (TYPICAL)** | |
| **100 kHz** | < 0.1 dB |
| **1 MHz** | < 0.2 dB |
| **10 MHz** | < 1.0 dB |

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

# EX1200-5006 PLUG-IN MODULE

## 40-CHANNEL 2 AMP FORM A (SPST) SWITCH

The EX1200-5006 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. Up to 240 SPST relays can be accommodated in a 1U full-rack mainframe for maximum density. The modules can also be configured with other EX1200 series switch modules as part of a flexible system switch design.

Since these modules may be used to switch power to the UUT or interface, the digital input lines on the EX1200 series mainframes support the ability to force all relays automatically to their normally open state if a fault condition occurs. This approach instantly removes all power to the UUT or interface. These modules can be automatically configured in the setup phase at the beginning of each scan step to facilitate test sequencing and control.

The EX1200-5006 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 4-428 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

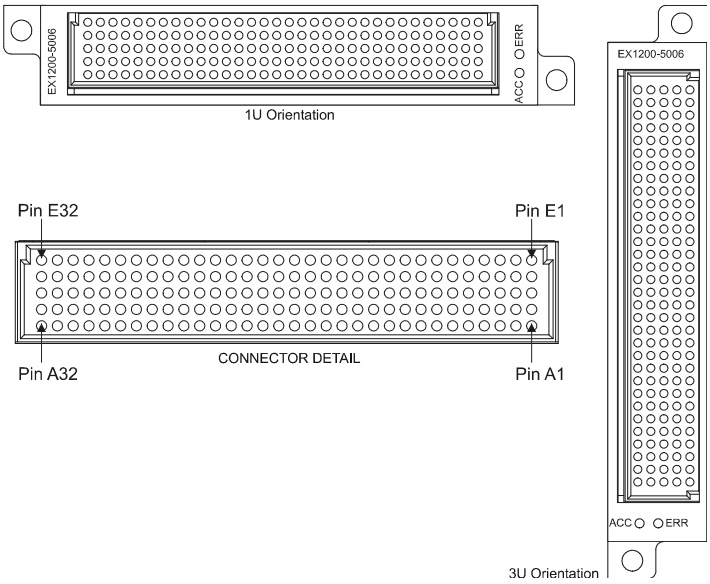



**FIGURE 4-47: EX1200-5006 FRONT PANEL (FRONT VIEW)**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH_1NO | **1** | CH_2NO | **1** | CH_3NO | **1** | CH_4NO | **1** | CH_5NO |
| **2** | CH_1COM | **2** | CH_2COM | **2** | CH_3COM | **2** | CH_4COM | **2** | CH_5COM |
| **3** | CH_6NO | **3** | CH_7NO | **3** | CH_8NO | **3** | CH_9NO | **3** | CH_10NO |
| **4** | CH_6COM | **4** | CH_7COM | **4** | CH_8COM | **4** | CH_9COM | **4** | CH_10COM |
| **5** | CH_11NO | **5** | CH_12NO | **5** | CH_13NO | **5** | CH_14NO | **5** | CH_15NO |
| **6** | CH_11COM | **6** | CH_12COM | **6** | CH_13COM | **6** | CH_14COM | **6** | CH_15COM |
| **7** | CH_16NO | **7** | CH_17NO | **7** | CH_18NO | **7** | CH_19NO | **7** | CH_20NO |
| **8** | CH_16COM | **8** | CH_17COM | **8** | CH_18COM | **8** | CH_19COM | **8** | CH_20COM |
| **9** | CH_21NO | **9** | CH_22NO | **9** | CH_23NO | **9** | CH_24NO | **9** | CH_25NO |
| **10** | CH_21COM | **10** | CH_22COM | **10** | CH_23COM | **10** | CH_24COM | **10** | CH_25COM |
| **11** | CH_26NO | **11** | CH_27NO | **11** | CH_28NO | **11** | CH_29NO | **11** | CH_30NO |
| **12** | CH_26COM | **12** | CH_27COM | **12** | CH_28COM | **12** | CH_29COM | **12** | CH_30COM |
| **13** | CH_31NO | **13** | CH_32NO | **13** | CH_33NO | **13** | CH_34NO | **13** | CH_35NO |
| **14** | CH_31COM | **14** | CH_32COM | **14** | CH_33COM | **14** | CH_34COM | **14** | CH_35COM |
| **15** | CH_36NO | **15** | CH_37NO | **15** | CH_38NO | **15** | CH_39NO | **15** | CH_40NO |
| **16** | CH_36COM | **16** | CH_37COM | **16** | CH_38COM | **16** | CH_39COM | **16** | CH_40COM |
| **17** | UNUSED | **17** | UNUSED | **17** | UNUSED | **17** | UNUSED | **17** | UNUSED |
| **18** | UNUSED | **18** | UNUSED | **18** | UNUSED | **18** | UNUSED | **18** | UNUSED |
| **19** | UNUSED | **19** | UNUSED | **19** | UNUSED | **19** | UNUSED | **19** | UNUSED |
| **20** | UNUSED | **20** | UNUSED | **20** | UNUSED | **20** | UNUSED | **20** | UNUSED |
| **21** | UNUSED | **21** | UNUSED | **21** | UNUSED | **21** | UNUSED | **21** | UNUSED |
| **22** | UNUSED | **22** | UNUSED | **22** | UNUSED | **22** | UNUSED | **22** | UNUSED |
| **23** | UNUSED | **23** | UNUSED | **23** | UNUSED | **23** | UNUSED | **23** | UNUSED |
| **24** | UNUSED | **24** | UNUSED | **24** | UNUSED | **24** | UNUSED | **24** | UNUSED |
| **25** | UNUSED | **25** | UNUSED | **25** | UNUSED | **25** | UNUSED | **25** | UNUSED |
| **26** | UNUSED | **26** | UNUSED | **26** | UNUSED | **26** | UNUSED | **26** | UNUSED |
| **27** | UNUSED | **27** | UNUSED | **27** | UNUSED | **27** | UNUSED | **27** | UNUSED |
| **28** | UNUSED | **28** | UNUSED | **28** | UNUSED | **28** | UNUSED | **28** | UNUSED |
| **29** | UNUSED | **29** | UNUSED | **29** | UNUSED | **29** | UNUSED | **29** | UNUSED |
| **30** | UNUSED | **30** | UNUSED | **30** | UNUSED | **30** | UNUSED | **30** | UNUSED |
| **31** | UNUSED | **31** | UNUSED | **31** | UNUSED | **31** | UNUSED | **31** | UNUSED |
| **32** | UNUSED | **32** | UNUSED | **32** | UNUSED | **32** | UNUSED | **32** | UNUSED |

**TABLE 4-45: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

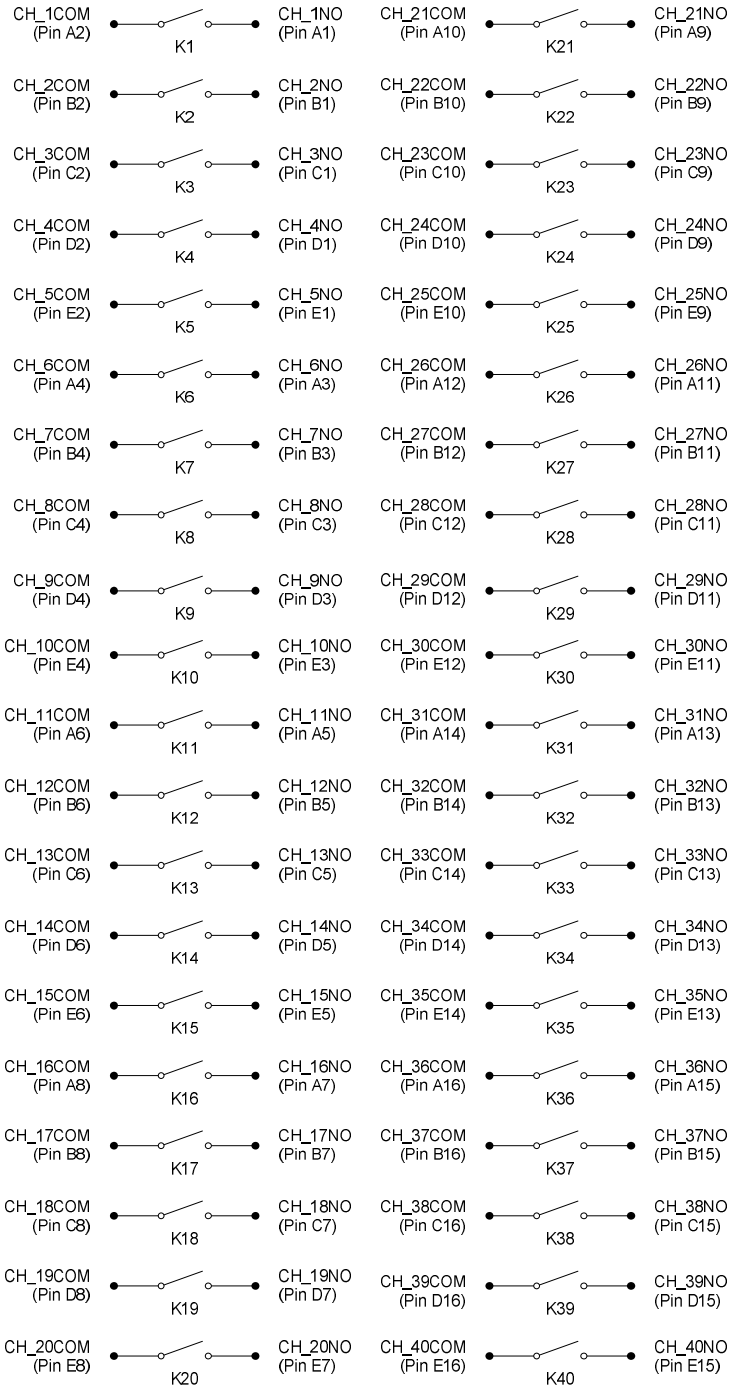



**FIGURE 4-48: EX1200-5006 LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | CH_5COM | E2 | T41 | CH_36NO | A15 | T81 | CH_33COM | C14 | T121 | UNUSED | N/A |
| T2 | CH_4COM | D2 | T42 | CH_31COM | A14 | T82 | CH_32COM | B14 | T122 | UNUSED | N/A |
| T3 | CH_10NO | E3 | T43 | CH_31NO | A13 | T83 | CH_38NO | C15 | T123 | UNUSED | N/A |
| T4 | CH_9NO | D3 | T44 | CH_26COM | A12 | T84 | CH_37NO | B15 | T124 | UNUSED | N/A |
| T5 | CH_10COM | E4 | T45 | CH_21COM | A10 | T85 | CH_38COM | C16 | T125 | UNUSED | N/A |
| T6 | CH_9COM | D4 | T46 | CH_24COM | D10 | T86 | CH_37COM | B16 | T126 | UNUSED | N/A |
| T7 | CH_15NO | E5 | T47 | CH_25COM | E10 | T87 | UNUSED | N/A | T127 | UNUSED | N/A |
| T8 | CH_14NO | D5 | T48 | CH_28NO | C11 | T88 | UNUSED | N/A | T128 | UNUSED | N/A |
| T9 | CH_15COM | E6 | T49 | CH_27NO | B11 | T89 | UNUSED | N/A | T129 | UNUSED | N/A |
| T10 | CH_14COM | D6 | T50 | CH_26NO | A11 | T90 | UNUSED | N/A | T130 | UNUSED | N/A |
| T11 | CH_20NO | E7 | T51 | CH_27COM | B12 | T91 | UNUSED | N/A | T131 | UNUSED | N/A |
| T12 | CH_19NO | D7 | T52 | CH_28COM | C12 | T92 | UNUSED | N/A | T132 | UNUSED | N/A |
| T13 | CH_20COM | E8 | T53 | CH_32NO | B13 | T93 | UNUSED | N/A | T133 | UNUSED | N/A |
| T14 | CH_19COM | D8 | T54 | CH_33NO | C13 | T94 | UNUSED | N/A | T134 | UNUSED | N/A |
| T15 | CH_25NO | E9 | T55 | CH_21NO | A9 | T95 | UNUSED | N/A | T135 | UNUSED | N/A |
| T16 | CH_24NO | D9 | T56 | CH_16COM | A8 | T96 | CH_5NO | E1 | T136 | UNUSED | N/A |
| T17 | CH_8NO | C3 | T57 | CH_16NO | A7 | T97 | UNUSED | N/A | T137 | UNUSED | N/A |
| T18 | CH_7NO | B3 | T58 | CH_11COM | A6 | T98 | UNUSED | N/A | T138 | UNUSED | N/A |
| T19 | CH_3COM | C2 | T59 | CH_11NO | A5 | T99 | UNUSED | N/A | T139 | UNUSED | N/A |
| T20 | CH_2COM | B2 | T60 | CH_6COM | A4 | T100 | UNUSED | N/A | T140 | UNUSED | N/A |
| T21 | CH_8COM | C4 | T61 | CH_6NO | A3 | T101 | UNUSED | N/A | T141 | UNUSED | N/A |
| T22 | CH_7COM | B4 | T62 | CH_1COM | A2 | T102 | UNUSED | N/A | T142 | UNUSED | N/A |
| T23 | CH_13NO | C5 | T63 | CH_22COM | B10 | T103 | UNUSED | N/A | T143 | UNUSED | N/A |
| T24 | CH_12NO | B5 | T64 | CH_23COM | C10 | T104 | UNUSED | N/A | T144 | UNUSED | N/A |
| T25 | CH_13COM | C6 | T65 | CH_40NO | E15 | T105 | UNUSED | N/A | T145 | UNUSED | N/A |
| T26 | CH_12COM | B6 | T66 | CH_39NO | D15 | T106 | UNUSED | N/A | T146 | UNUSED | N/A |
| T27 | CH_18NO | C7 | T67 | CH_40COM | E16 | T107 | UNUSED | N/A | T147 | UNUSED | N/A |
| T28 | CH_17NO | B7 | T68 | CH_39COM | D16 | T108 | UNUSED | N/A | T148 | UNUSED | N/A |
| T29 | CH_18COM | C8 | T69 | UNUSED | N/A | T109 | UNUSED | N/A | T149 | UNUSED | N/A |
| T30 | CH_17COM | B8 | T70 | UNUSED | N/A | T110 | UNUSED | N/A | T150 | UNUSED | N/A |
| T31 | CH_23NO | C9 | T71 | UNUSED | N/A | T111 | UNUSED | N/A | T151 | UNUSED | N/A |
| T32 | CH_22NO | B9 | T72 | UNUSED | N/A | T112 | UNUSED | N/A | T152 | UNUSED | N/A |
| T33 | CH_30NO | E11 | T73 | UNUSED | N/A | T113 | UNUSED | N/A | T153 | UNUSED | N/A |
| T34 | CH_29NO | D11 | T74 | UNUSED | N/A | T114 | UNUSED | N/A | T154 | UNUSED | N/A |
| T35 | CH_29COM | D12 | T75 | UNUSED | N/A | T115 | UNUSED | N/A | T155 | UNUSED | N/A |
| T3 | CH_30COM | E12 | T76 | UNUSED | N/A | T116 | UNUSED | N/A | T156 | CH_2NO | B1 |
| T37 | CH_34NO | D13 | T77 | CH_4NO | D1 | T117 | UNUSED | N/A | T157 | UNUSED | N/A |
| T38 | CH_35NO | E13 | T78 | UNUSED | N/A | T118 | UNUSED | N/A | T158 | CH_1NO | A1 |
| T39 | CH_34COM | D14 | T79 | UNUSED | N/A | T119 | UNUSED | N/A | T159 | UNUSED | N/A |
| T40 | CH_35COM | E14 | T80 | UNUSED | N/A | T120 | UNUSED | N/A | T160 | CH_3NO | C1 |

**TABLE 4-46: EX1200-TB160SE TERMINAL BLOCK TO EX1200-5006 PIN MAPPING**

# EX1200-5006 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 40 SPST / 20 DPST |
| **RELAY TYPE** | |
| | Electromechanical, 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** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 300 mΩ |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ 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 |

# EX1200-6101 PLUG-IN MODULE

## 10 SP4T RF MULTIPLEXERS, 1.3 GHZ

The EX1200-6101 is a high-density RF switch module with ten individual SP4T coaxial trees that are isolated from each other and system ground to provide a high-fidelity switch path for switching signals in excess of 1.3 GHz. Excellent crosstalk and isolation is maintained by using very short low-loss coaxial runs from the connector directly to the relays. All modules are also configured to avoid any unterminated stub effects, improving overall signal integrity and allowing for high frequency matrix designs and large multiplexer configurations while preserving bandwidth and maintaining low VSWR. The front panel utilizes two high-density, 26-pin coaxial connectors designed for high reliability and low insertion loss.

Six of the modules can be accommodated in a 1U EX1200 full rack mainframe to provide a very flexible RF switch network. For example, a single module can be configured through external cabling to provide dual 1 x 16 multiplexers into two channels of a scope, or as a single 4 x 4 RF matrix. The modules can also be combined with other EX1200 switch cards to configure a general purpose subsystem to switch dc to > 1.3 GHz.

The EX1200-6101 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 4-500 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. Both single-wire and two-wire programming modes are available.

## CONNECTOR PINS AND SIGNALS

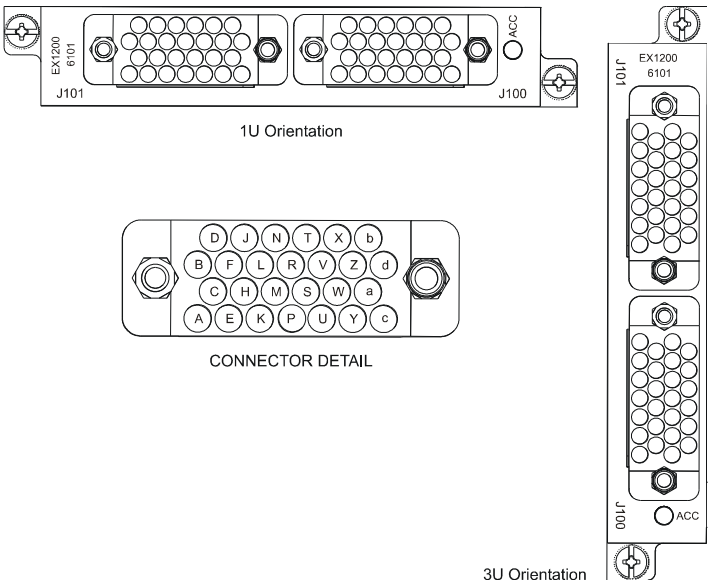



**FIGURE 4-49: EX1200-6101 FRONT PANEL (FRONT VIEW)**

| J101 | | J100 | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| **A** | CH1_NO3 | **A** | CH6_NO3 |
| **B** | CH3_NO3 | **B** | CH8_NO3 |
| **C** | CH2_NO3 | **C** | CH7_NO3 |
| **D** | CH4_NO3 | **D** | CH9_NO3 |
| **E** | CH1_COM | **E** | CH6_COM |
| **F** | CH3_COM | **F** | CH8_COM |
| **H** | CH2_COM | **H** | CH7_COM |
| **J** | CH4_COM | **J** | CH9_COM |
| **K** | CH1_NC | **K** | CH6_NC |
| **L** | CH3_NC | **L** | CH8_NC |
| **M** | CH2_NC | **M** | CH7_NC |
| **N** | CH4_NC | **N** | CH9_NC |
| **P** | CH1_NO1 | **P** | CH6_NO1 |
| **R** | CH3_NO1 | **R** | CH8_NO1 |
| **S** | CH2_NO1 | **S** | CH7_NO1 |
| **T** | CH4_NO1 | **T** | CH9_NO1 |
| **U** | CH1_NO2 | **U** | CH6_NO2 |
| **V** | CH3_NO2 | **V** | CH8_NO2 |
| **W** | CH2_NO2 | **W** | CH7_NO2 |
| **X** | CH4_NO2 | **X** | CH9_NO2 |
| **Y** | CH5_NC | **Y** | CH10_NC |
| **Z** | CH5_NO1 | **Z** | CH10_NO1 |
| **a** | CH5_NO2 | **a** | CH10_NO2 |
| **b** | CH5_NO3 | **b** | CH10_NO3 |
| **c** | CH5_COM | **c** | CH10_COM |
| **d** | UNUSED | **d** | UNUSED |

**TABLE 4-47: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

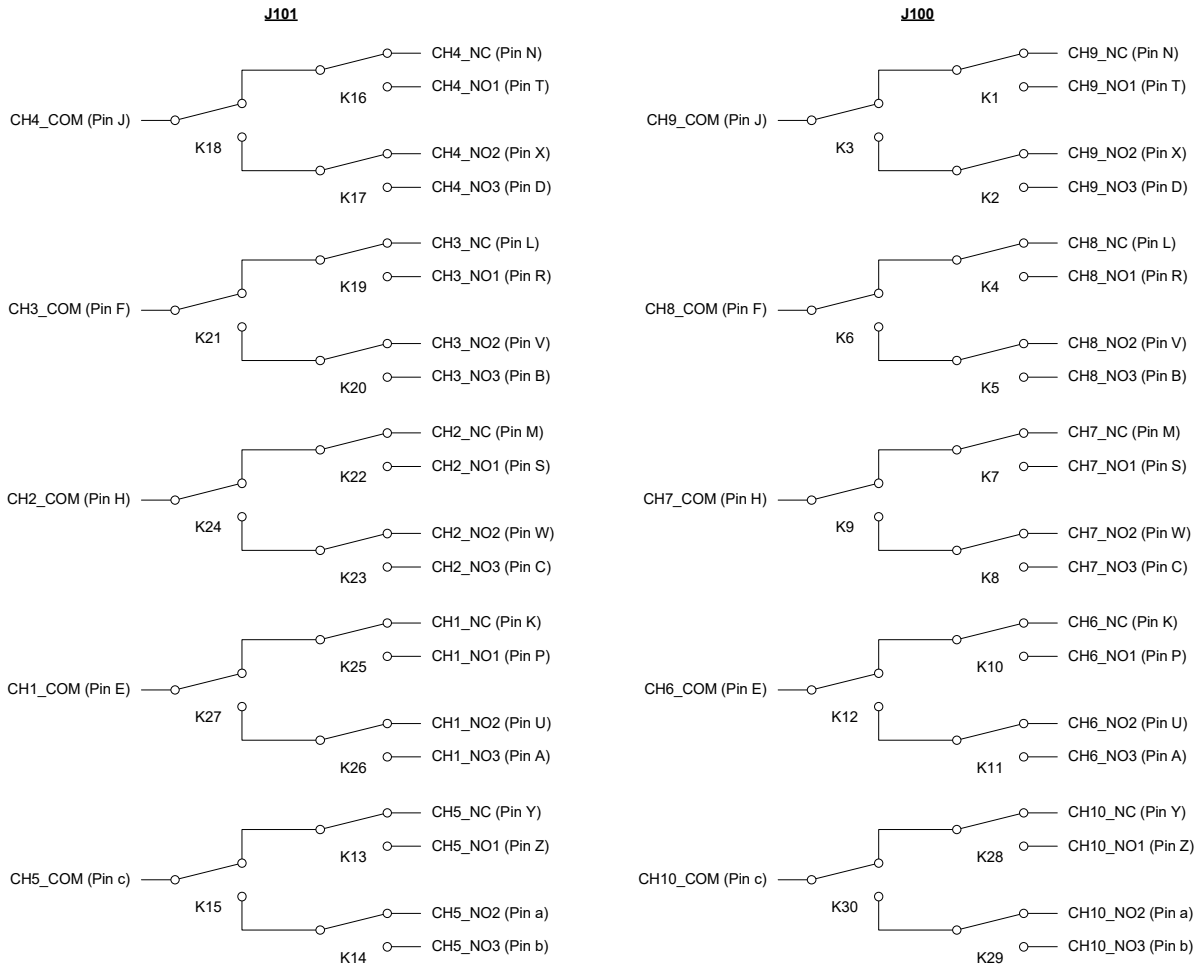



**FIGURE 4-50: EX1200-6101 LOGICAL DIAGRAM**

# EX1200-6101 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 10 SP4T multiplexers |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 220 V dc, 250 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 50 W, 62.5 VA |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $5 \times 10^6$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 0.250 Ω |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^9$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 1.3 GHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **500 MHz** | < 0.9 dB |
| **1.3 GHz** | < 3.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **500 MHz** | < -70 dB |
| **1.3 GHz** | < -60 dB |
| **ISOLATION (TYPICAL)** | |
| **500 MHz** | < -70 dB |
| **1.3 GHz** | < -60 dB |
| **VSWR (TYPICAL)** | |
| **500 MHz** | < 1.11:1 |
| **1.3 GHz** | < 2.92:1 |

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

# EX1200-6102 PLUG-IN MODULE

## 17-CHANNEL (1X2) COAXIAL SWITCHES, 1.3GHZ

The EX1200-6102 is a high-density RF switch module designed for high-fidelity RF switching applications up to 1.3 GHz. Excellent crosstalk and isolation is maintained by using RF relays with bandwidths in excess of 2.0 GHz, along with short, low-loss coaxial runs from connector directly to relays. All modules are also configured to avoid any unterminated stub effects, improving overall signal integrity, and allowing for high frequency matrix designs and larger multiplexer configurations while maintaining bandwidth and VSWR.

The EX1200-6102 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 4-52 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. Both single-wire and two-wire programming modes are available.

## CONNECTOR PINS AND SIGNALS

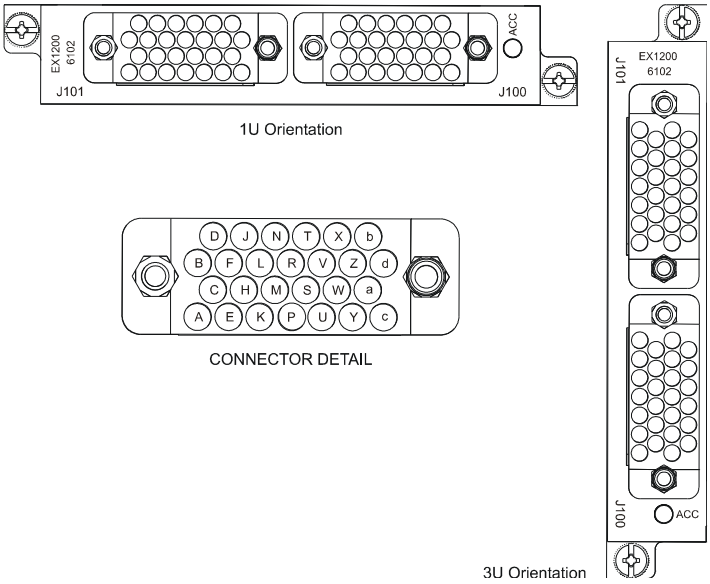



**FIGURE 4-51: EX1200-6102 FRONT PANEL (FRONT VIEW)**

| J101 | | J100 | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| **A** | CH_9NC | **A** | CH_1NC |
| **B** | CH_10NC | **B** | CH_2NC |
| **C** | CH_11NC | **C** | CH_3NC |
| **D** | CH_12NC | **D** | CH_4NC |
| **E** | CH_9COM | **E** | CH_1COM |
| **F** | CH_10COM | **F** | CH_2COM |
| **H** | CH_11COM | **H** | CH_3COM |
| **J** | CH_12COM | **J** | CH_4COM |
| **K** | CH_9NO | **K** | CH_1NO |
| **L** | CH_10NO | **L** | CH_2NO |
| **M** | CH_11NO | **M** | CH_3NO |
| **N** | CH_12NO | **N** | CH_4NO |
| **P** | CH_13NC | **P** | CH_5NC |
| **R** | CH_14NC | **R** | CH_6NC |
| **S** | CH_15NC | **S** | CH_7NC |
| **T** | CH_16NC | **T** | CH_8NC |
| **U** | CH_13COM | **U** | CH_5COM |
| **V** | CH_14COM | **V** | CH_6COM |
| **W** | CH_15COM | **W** | CH_7COM |
| **X** | CH_16COM | **X** | CH_8COM |
| **Y** | CH_13NO | **Y** | CH_5NO |
| **Z** | CH_14NO | **Z** | CH_6NO |
| **a** | CH_15NO | **a** | CH_7NO |
| **b** | CH_16NO | **b** | CH_8NO |
| **c** | CH_17NC | **c** | CH_17NO |
| **d** | UNUSED | **d** | CH_17COM |

**TABLE 4-48: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM


**FIGURE 4-52: EX1200-6102 LOGICAL DIAGRAM**

# EX1200-6102 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 17 SPDT |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 30 V dc |
| **MAXIMUM SWITCHING CURRENT** | |
| | 0.5 A |
| **MAXIMUM CARRY CURRENT** | |
| | 0.5 A |
| **MAXIMUM SWITCHING POWER** | |
| | 10 W |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $5 \times 10^6$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 1 Ω |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^9$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 1.3 GHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **100 MHz** | < 0.2 dB |
| **500 MHz** | < 0.5 dB |
| **1.3 GHz** | < 2.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **10 MHz** | < -70 dB |
| **100 MHz** | < -65 dB |
| **500 MHz** | < -60 dB |
| **1.3 GHz** | < -55 dB |
| **ISOLATION (TYPICAL)** | |
| **10 MHz** | < -80 dB |
| **100 MHz** | < -70 dB |
| **500 MHz** | < -65 dB |
| **1.3 GHz** | < -55 dB |
| **VSWR (TYPICAL)** | |
| **100 MHz** | < 1.2:1 |
| **1.3 GHz** | < 1.5:1 |

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

# EX1200-6111 PLUG-IN MODULE

## 5-CHANNEL SP4T COAXIAL SWITCH

The EX1200-6111 is a high-density RF switch module with ten individual SP4T coaxial trees that are isolated from each other and system ground to provide a high-fidelity switch path for switching signals in excess of 1.3 GHz. Excellent crosstalk and isolation is maintained by using very short low-loss coaxial runs from the connector directly to the relays. All modules are also configured to avoid any unterminated stub effects, improving overall signal integrity and allowing for high frequency matrix designs and large multiplexer configurations while preserving bandwidth and maintaining low VSWR. The front panel utilizes a high-density, 26-pin coaxial connectors designed for high reliability and low insertion loss.

Six of the modules can be accommodated in a 1U EX1200 full rack mainframe to provide a very flexible RF switch network. For example, a single module can be configured through external cabling to provide dual 1 x 16 multiplexers into two channels of a scope, or as a single 4 x 4 RF matrix. The modules can also be combined with other EX1200 switch cards to configure a general purpose subsystem to switch dc to > 1.3 GHz.

The EX1200-6111 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 4-544 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. Both single-wire and two-wire programming modes are available.

## CONNECTOR PINS AND SIGNALS

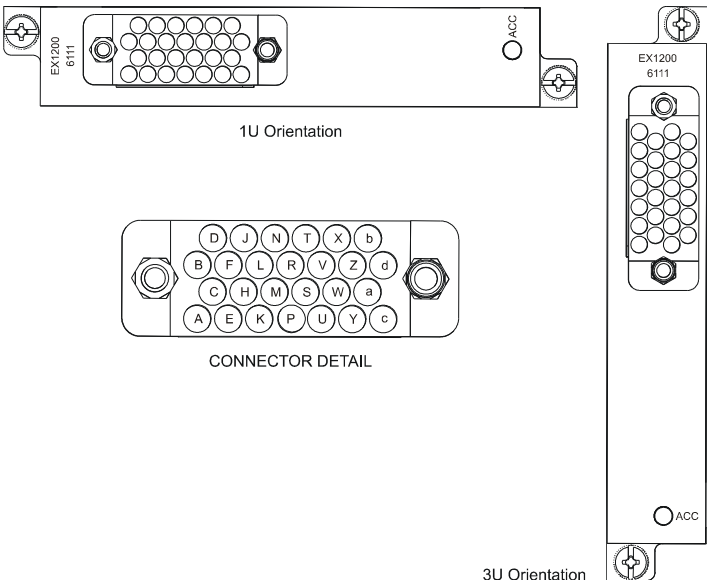



**FIGURE 4-53: EX1200-6111 FRONT PANEL (FRONT VIEW)**

| Pin | Signal |
|---|---|
| **A** | CH1_NO3 |
| **B** | CH3_NO3 |
| **C** | CH2_NO3 |
| **D** | CH4_NO3 |
| **E** | CH1_COM |
| **F** | CH3_COM |
| **H** | CH2_COM |
| **J** | CH4_COM |
| **K** | CH1_NC |
| **L** | CH3_NC |
| **M** | CH2_NC |
| **N** | CH4_NC |
| **P** | CH1_NO1 |
| **R** | CH3_NO1 |
| **S** | CH2_NO1 |
| **T** | CH4_NO1 |
| **U** | CH1_NO2 |
| **V** | CH3_NO2 |
| **W** | CH2_NO2 |
| **X** | CH4_NO2 |
| **Y** | CH5_NC |
| **Z** | CH5_NO1 |
| **a** | CH5_NO2 |
| **b** | CH5_NO3 |
| **c** | CH5_COM |
| **d** | UNUSED |

**TABLE 4-49: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

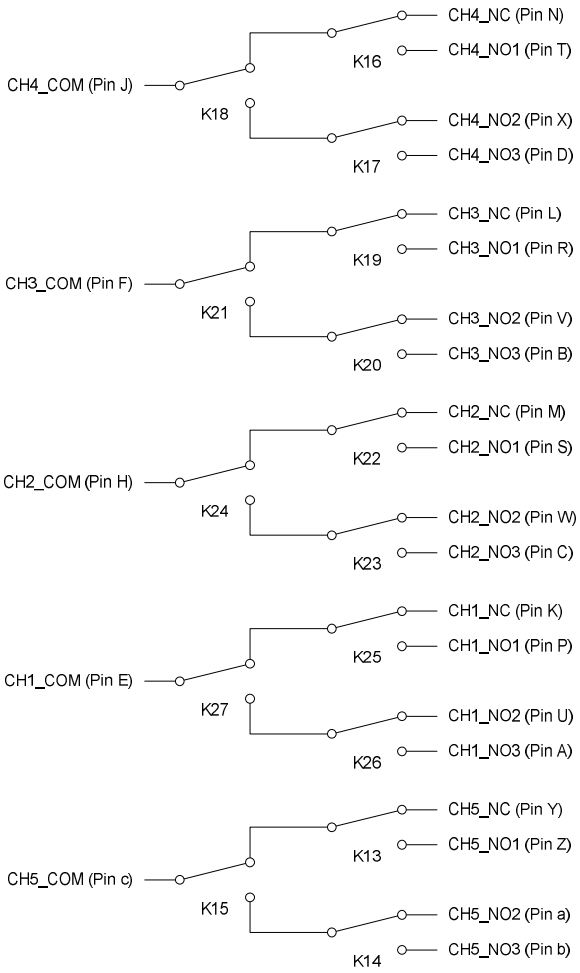



**FIGURE 4-54: EX1200-6111 LOGICAL DIAGRAM**

# EX1200-6111 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 5 SP4T multiplexers |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 220 V dc, 250 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 50 W, 62.5 VA |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $5 \times 10^6$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 0.250 Ω |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^9$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 1.3 GHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **500 MHz** | < 0.9 dB |
| **1.3 GHz** | < 3.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **500 MHz** | < -70 dB |
| **1.3 GHz** | < -60 dB |
| **ISOLATION (TYPICAL)** | |
| **500 MHz** | < -70 dB |
| **1.3 GHz** | < -60 dB |
| **VSWR (TYPICAL)** | |
| **500 MHz** | < 1.11:1 |
| **1.3 GHz** | < 2.92:1 |

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

# EX1200-6216 PLUG-IN MODULE

## DUAL 1 X 16 RF MUX, 1 GHZ SWITCH

The EX1200-6216 is a high-density RF switch module configured as dual 1 x 16 coaxial trees that are isolated from each other and system ground to provide a high-fidelity switch path for switching signals in excess of 1 GHz in a 50 Ω environment. On-board jumpers can be added to connect all shields together or to system ground if desired. Excellent crosstalk and isolation is maintained by using very short low-loss coaxial runs from the connector directly to the relays.

All modules are also configured to avoid any unterminated stub effects. This improves overall signal integrity and allows for high frequency matrix designs or large multiplexer configurations while preserving bandwidth and maintaining low VSWR. The front panel utilizes two high-density, 26-pin coaxial connectors designed for high reliability and low insertion loss.

Six of the modules can be accommodated in a 1U EX1200 full rack mainframe to provide a very flexible RF switch network. The modules can also be combined with other EX1200 switch cards to configure a general purpose subsystem to switch dc to > 1 GHz.

The EX1200-6216 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 4-566 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. Both single-wire and two-wire programming modes are available.

## CONNECTOR PINS AND SIGNALS

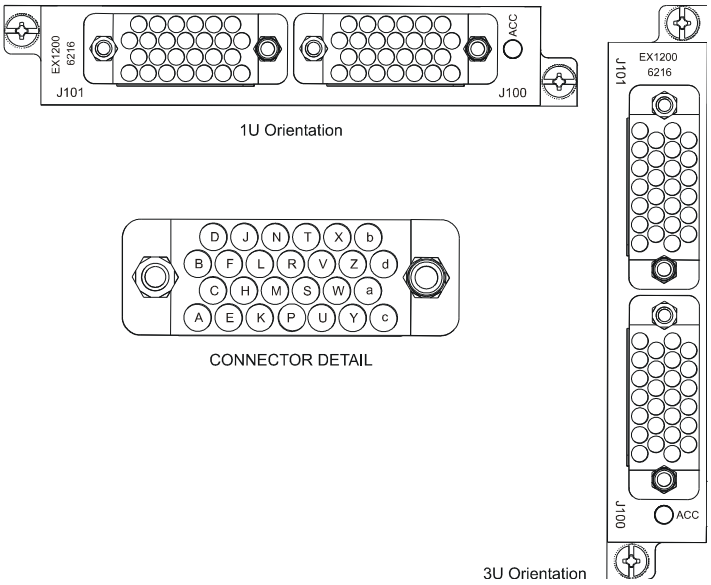



**FIGURE 4-55: EX1200-6216 FRONT PANEL (FRONT VIEW)**

| J101 | | J100 | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| **A** | UNUSED | **A** | UNUSED |
| **B** | CH1_COM | **B** | CH2_COM |
| **C** | UNUSED | **C** | UNUSED |
| **D** | UNUSED | **D** | UNUSED |
| **E** | UNUSED | **E** | UNUSED |
| **F** | UNUSED | **F** | UNUSED |
| **H** | UNUSED | **H** | UNUSED |
| **J** | UNUSED | **J** | UNUSED |
| **K** | UNUSED | **K** | UNUSED |
| **L** | UNUSED | **L** | UNUSED |
| **M** | CH1_NO7 | **M** | CH2_NO7 |
| **N** | CH1_NO11 | **N** | CH2_NO11 |
| **P** | CH1_NO3 | **P** | CH2_NO3 |
| **R** | CH1_NO15 | **R** | CH2_NO15 |
| **S** | CH1_NO6 | **S** | CH2_NO6 |
| **T** | CH1_NO10 | **T** | CH2_NO10 |
| **U** | CH1_NO2 | **U** | CH2_NO2 |
| **V** | CH1_NO14 | **V** | CH2_NO14 |
| **W** | CH1_NO5 | **W** | CH2_NO5 |
| **X** | CH1_NO9 | **X** | CH2_NO9 |
| **Y** | CH1_NO1 | **Y** | CH2_NO1 |
| **Z** | CH1_NO13 | **Z** | CH2_NO13 |
| **a** | CH1_NO4 | **a** | CH2_NO4 |
| **b** | CH1_NO8 | **b** | CH2_NO8 |
| **c** | CH1_NC | **c** | CH2_NC |
| **d** | CH1_NO12 | **d** | CH2_NO12 |

**TABLE 4-50: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

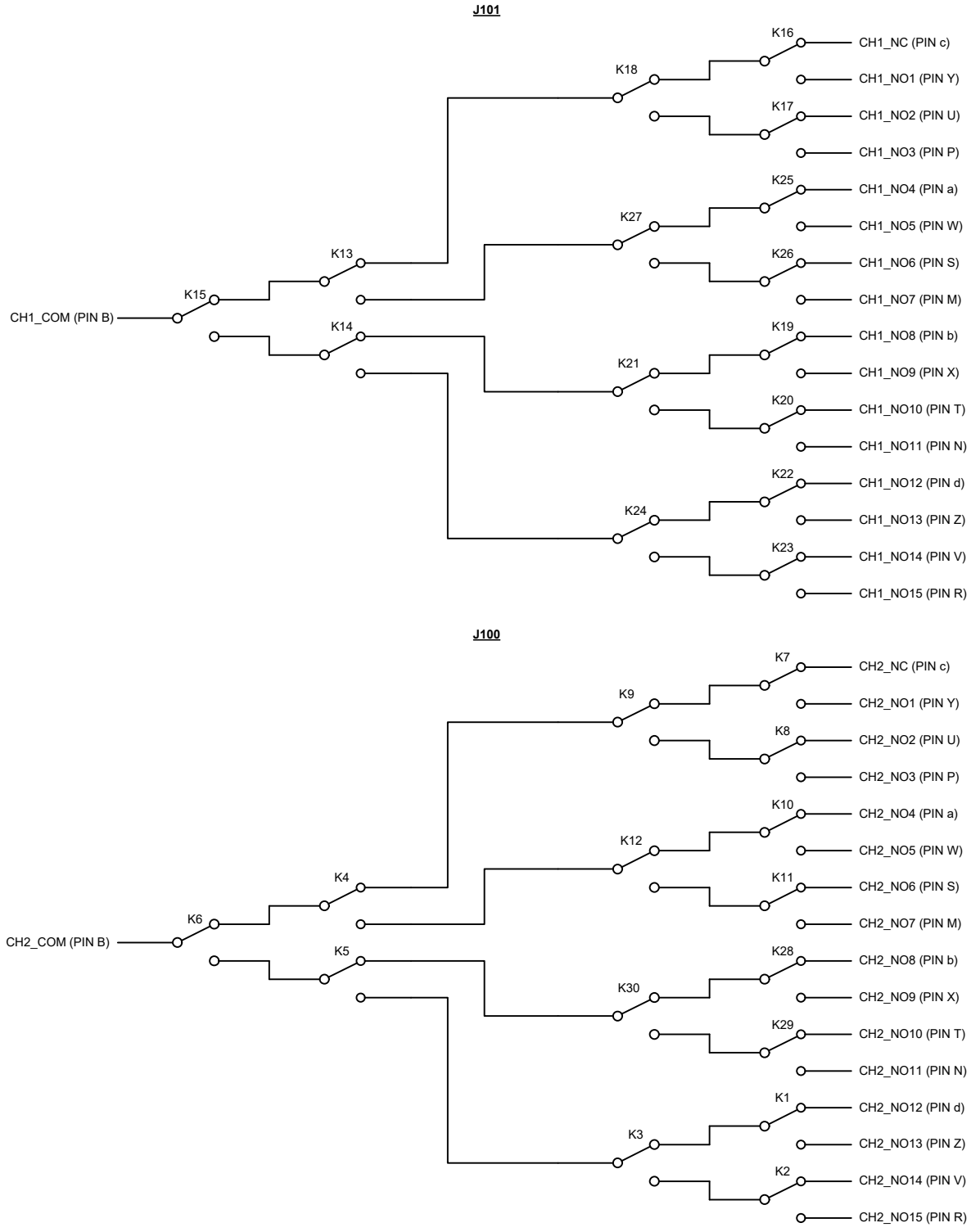



**FIGURE 4-56: EX1200-6216 LOGICAL DIAGRAM**

# EX1200-6216 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Dual (1 x 16) 50 Ω RF multiplexers, 1 GHz |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 220 V dc, 250 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 2 A |
| **MAXIMUM SWITCHING POWER** | |
| | 50 W, 62.5 VA |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $5 \times 10^6$ |
| **Electrical** | $1 \times 10^5$ at full load |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 500 mΩ |
| **INSULATION RESISTANCE** | |
| | > $1 \times 10^9$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 1 GHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **500 MHz** | < 1.0 dB |
| **1 GHz** | < 3.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **500 MHz** | < -75 dB |
| **1 GHz** | < -70 dB |
| **ISOLATION (TYPICAL)** | |
| **500 MHz** | < -75 dB |
| **1 GHz** | < -70 dB |
| **VSWR (TYPICAL)** | |
| **500 MHz** | < 1.4:1 |
| **1 GHz** | < 2.5:1 |

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

# EX1200-6216HV PLUG-IN MODULE

## DUAL (1X16) 500 V 250 MHZ MULTIPLEXERS

The EX1200-6216HV is an RF switch module designed in a star configuration. A star switch allows any channel to be connected to any other channel. This configuration approach also allows for the creation of simple matrices (i.e. 8 x 1 x 8).

Additionally, for applications that require the switching of high voltage probes or transient power supply signals, the EX1200-6216HV provides the capability of switching up to 500 V and up to 250 MHz.

The EX1200-621HV 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 4-578 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. Both single-wire and two-wire programming modes are available.

## CONNECTOR PINS AND SIGNALS

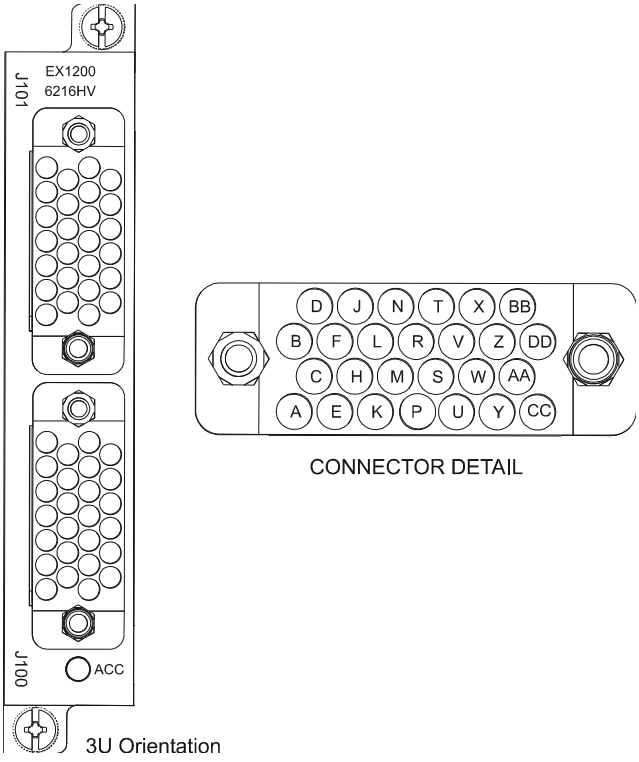



**FIGURE 4-57: EX1200-6216HV FRONT PANEL (FRONT VIEW)**

| | |
|---|---|
| **NOTE** | This module is for use in the 3U EX1200 series mainframes only. This module contains ***position-sensitive, mercury switches***. This module must be installed in an upright position and this position must be maintained in order for these switches to function properly. |

| J101 | | J100 | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| **A** | CH1_1 | **A** | CH1_9 |
| **B** | CH2_1 | **B** | CH2_9 |
| **C** | CH1_5 | **C** | CH1_13 |
| **D** | CH2_5 | **D** | CH2_13 |
| **E** | CH1_2 | **E** | CH1_10 |
| **F** | CH2_2 | **F** | CH2_10 |
| **H** | CH1_6 | **H** | CH1_14 |
| **J** | CH2_6 | **J** | CH2_14 |
| **K** | CH1_3 | **K** | CH1_11 |
| **L** | CH2_3 | **L** | CH2_11 |
| **M** | CH1_7 | **M** | CH1_15 |
| **N** | CH2_7 | **N** | CH2_15 |
| **P** | CH1_4 | **P** | CH1_12 |
| **R** | CH2_4 | **R** | CH2_12 |
| **S** | CH1_8 | **S** | CH1_16 |
| **T** | CH2_8 | **T** | CH2_16 |
| **U** | UNUSED | **U** | UNUSED |
| **V** | UNUSED | **V** | UNUSED |
| **W** | UNUSED | **W** | UNUSED |
| **X** | UNUSED | **X** | UNUSED |
| **Y** | UNUSED | **Y** | UNUSED |
| **Z** | UNUSED | **Z** | UNUSED |
| **AA** | UNUSED | **AA** | CH1_CHASSIS |
| **BB** | UNUSED | **BB** | CH2_CHASSIS |
| **CC** | CH1_COM | **CC** | UNUSED |
| **DD** | CH2_COM | **DD** | UNUSED |

**TABLE 4-51: CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

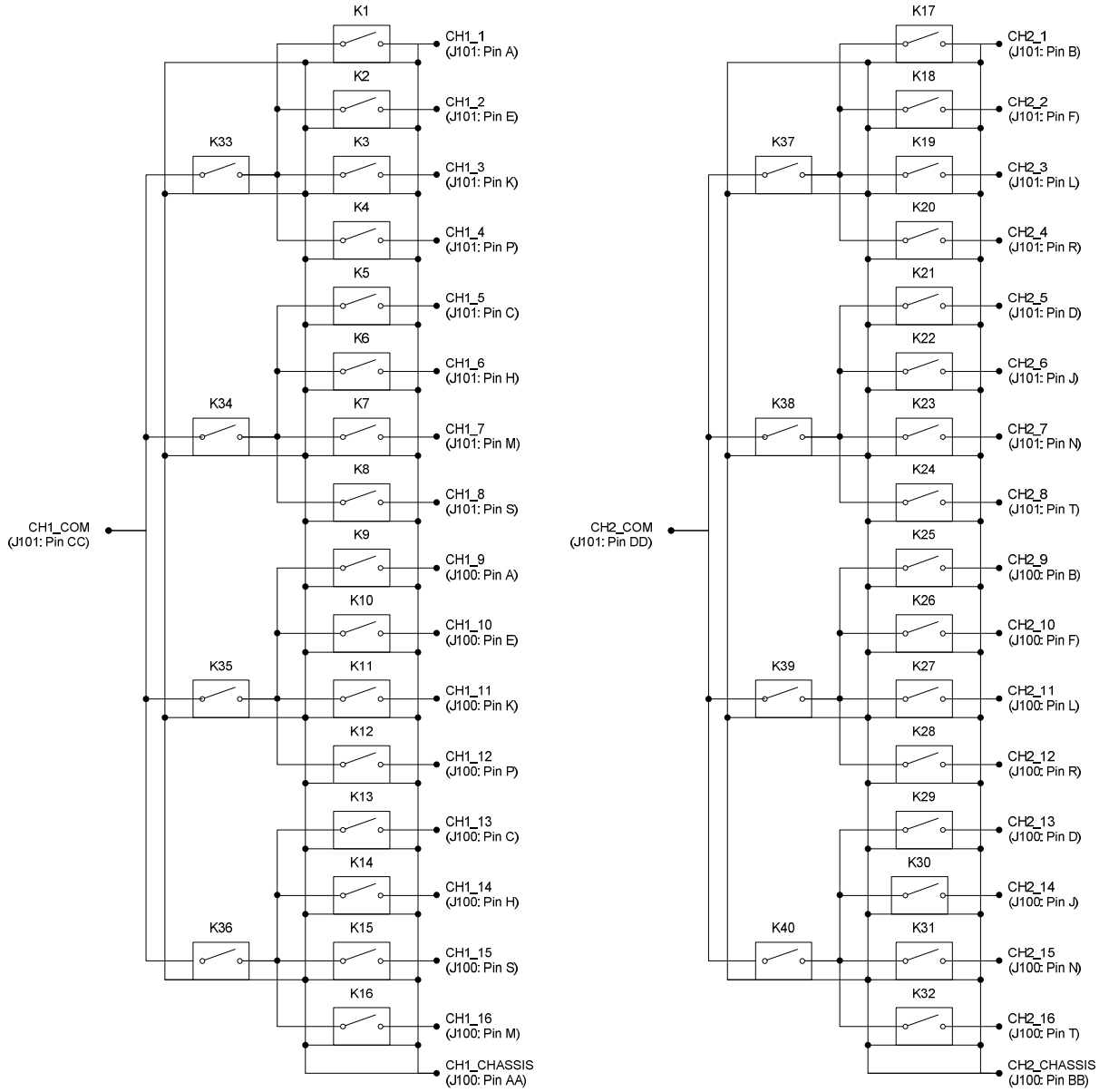



**FIGURE 4-58: EX1200-6216HV LOGICAL DIAGRAM**

# EX1200-6216HV SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Two (1 x 16) multiplexer channels |
| **RELAY TYPE** | |
| | Reed |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 500 V ac rms |
| **MAXIMUM SWITCHING CURRENT** | |
| | 0.5 A |
| **MAXIMUM CARRYING CURRENT** | |
| | 2.0 A |
| **MAXIMUM SWITCHING POWER** | |
| | 10 W |
| **RATED SWITCH OPERATIONS** | |
| **@ 1 V, 10 mA** | $100 \times 10^6$ |
| **SWITCHING TIME** | |
| | < 1 ms |
| **PATH RESISTANCE** | |
| | < 500 mΩ (valid at 50 mV, 10 mA load) |
| **BANDWIDTH (-3 dB)** | |
| | 250 MHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **100 MHz** | < 1.0 dB |
| **250 MHz** | < 3.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **100 MHz** | < -45 dB |
| **250 MHz** | < -35 dB |
| **ISOLATION (TYPICAL)** | |
| **100 MHz** | < -45 dB |
| **250 MHz** | < -35 dB |
| **VSWR (TYPICAL)** | |
| **100 MHz** | < 1.2:1 |
| **250 MHz** | < 1.5:1 |

# EX1200-6301 PLUG-IN MODULE

## 4 CHANNEL SP4T, RF MULTIPLEXER, 50 Ω, 3 GHZ

The EX1200-6301 is designed with SMB male connectors for applications that require RF signal switching upto 3 GHz in a 50 Ω environment. Excellent crosstalk and isolation performance is achieved by using short low-loss coaxial runs from the connector directly to the relays. All modules are designed to avoid any unterminated stub effects improving overall signal integrity and enabling the construction of larger high frequency multiplexer configurations while maintaining bandwidth and VSWR.

Six of the modules can be accommodated in a single EX1200 full rack mainframe or combined with other switch modules to create a flexible switching configuration that can cover a wide range of applications.

## CONNECTOR PINS AND SIGNALS

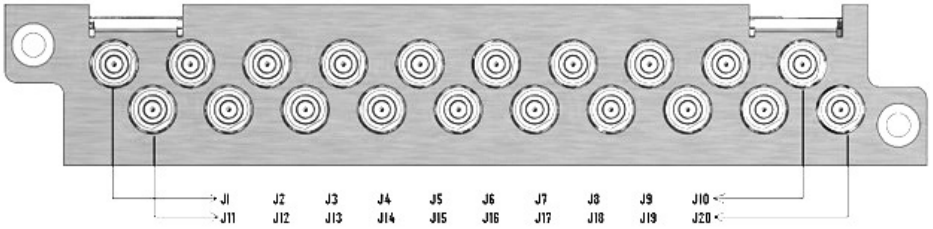



FIGURE 4-59: EX1200-6301 FRONT PANEL (FRONT VIEW)

| EX1200-6301 Front Panel | |
|---|---|
| **Pin** | **Signal** |
| **J1** | CH1_1 |
| **J2** | CH1_2 |
| **J3** | CH1_COM |
| **J4** | CH1_3 |
| **J5** | CH1_4 |
| **J6** | CH2_1 |
| **J7** | CH2_2 |
| **J8** | CH2_COM |
| **J9** | CH2_3 |
| **J10** | CH2_4 |
| **J11** | CH3_1 |
| **J12** | CH3_2 |
| **J13** | CH3_COM |
| **J14** | CH3_3 |
| **J15** | CH3_4 |
| **J16** | CH4_1 |
| **J17** | CH4_2 |
| **J18** | CH4_COM |
| **J19** | CH4_3 |
| **J20** | CH4_4 |

TABLE 4-52: CONNECTOR PINS & SIGNAL ASSIGNMENTS

## LOGICAL DIAGRAM

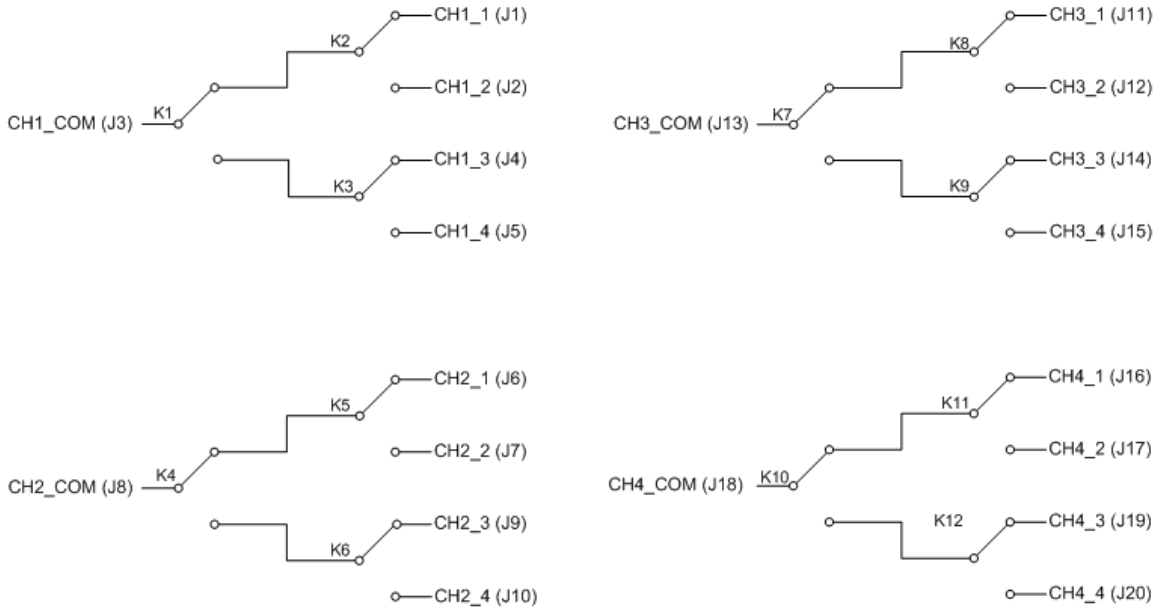



**FIGURE 4-60: EX1200-6301 LOGICAL DIAGRAM**

# EX1200-6301 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Four SP4T 50 Ω RF multiplexers, 3GHz |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 30 VDC |
| **MAXIMUM SWITCHING CURRENT** | |
| | 0.5A |
| **MAXIMUM SWITCHING POWER** | |
| | 10 W |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $5 \times 10^6$ |
| **Electrical** | $1 \times 10^5$ (Full Load) |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 1 Ω |
| **INSULATION RESISTANCE** | |
| | $1 \times 10^9$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 3GHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **1 GHz** | < 0.5 dB |
| **3 GHz** | < 3.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **1 GHz** | < -60 dB |
| **3 GHz** | < -55 dB |
| **ISOLATION (TYPICAL)** | |
| **1 GHz** | < -65 dB |
| **3 GHz** | < -55 dB |
| **VSWR (TYPICAL)** | |
| **1 GHz** | < 1.2:1 |
| **3 GHz** | < 1.5:1 |

# EX1200-6301T PLUG-IN MODULE

## 4 CHANNEL SP4T, SELF-TERMINATED RF MULTIPLEXER, 50 Ω, 3 GHZ

The EX1200-6301T is has on-board self-termination option and is designed with SMB male connectors for applications that require RF signal switching upto 3 GHz in a 50 Ω environment. Excellent crosstalk and isolation performance is achieved by using short low-loss coaxial runs from the connector directly to the relays. All modules are designed to avoid any unterminated stub effects improving overall signal integrity and enabling the construction of larger high frequency multiplexer configurations while maintaining bandwidth and VSWR.

Six of the modules can be accommodated in a single EX1200 full rack mainframe or combined with other switch modules to create a flexible switching configuration that can cover a wide range of applications.

## CONNECTOR PINS AND SIGNALS

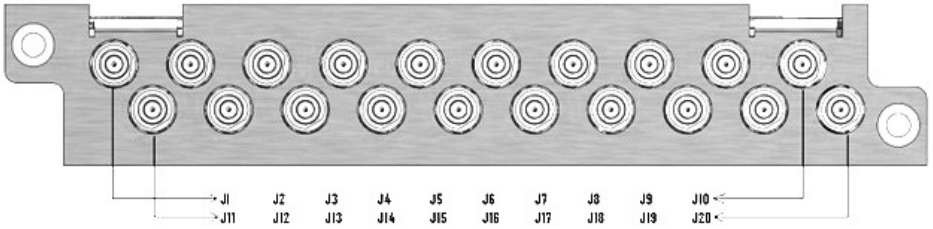
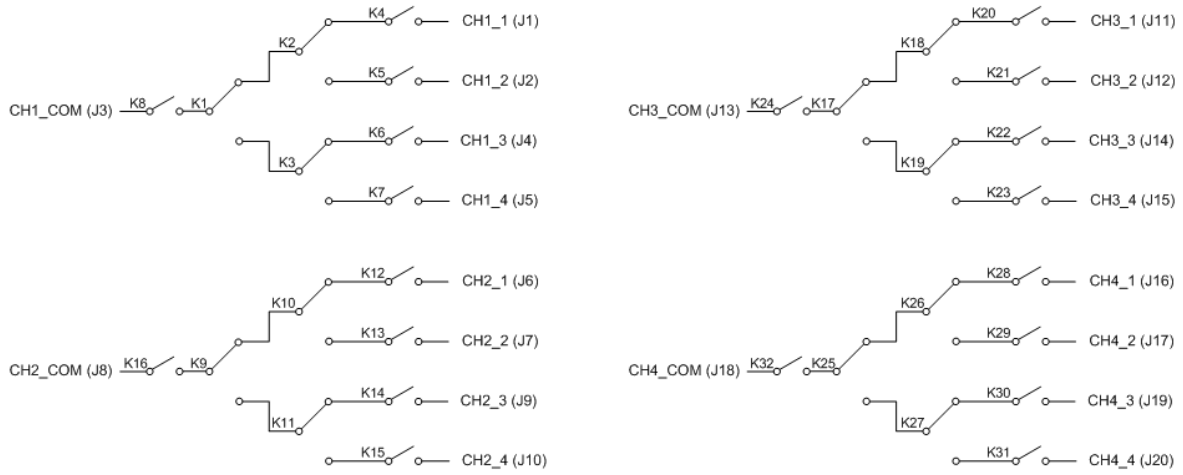



FIGURE 4-61: EX1200-6301T FRONT PANEL (FRONT VIEW)

| EX1200-6301T Front Panel | |
|---|---|
| **Pin** | **Signal** |
| **J1** | CH1_1 |
| **J2** | CH1_2 |
| **J3** | CH1_COM |
| **J4** | CH1_3 |
| **J5** | CH1_4 |
| **J6** | CH2_1 |
| **J7** | CH2_2 |
| **J8** | CH2_COM |
| **J9** | CH2_3 |
| **J10** | CH2_4 |
| **J11** | CH3_1 |
| **J12** | CH3_2 |
| **J13** | CH3_COM |
| **J14** | CH3_3 |
| **J15** | CH3_4 |
| **J16** | CH4_1 |
| **J17** | CH4_2 |
| **J18** | CH4_COM |
| **J19** | CH4_3 |
| **J20** | CH4_4 |

TABLE 4-53: CONNECTOR PINS & SIGNAL ASSIGNMENTS

## LOGICAL DIAGRAM




NOTE: Channels (CHX_COM and CHX_X) are terminated when they are in open condition

**FIGURE 4-62: EX1200-6301T LOGICAL DIAGRAM**

# EX1200-6301T SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | Four SP4T 50 Ω RF multiplexers, 3GHz, with onboard self-termination |
| **RELAY TYPE** | |
| | Electromechanical, fail-safe |
| **MAXIMUM SWITCHING VOLTAGE** | |
| | 30 VDC |
| **MAXIMUM SWITCHING CURRENT** | |
| | 0.5A |
| **MAXIMUM SWITCHING POWER** | |
| | 10 W |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $5 \times 10^6$ |
| **Electrical** | $1 \times 10^5$ (Full Load) |
| **SWITCHING TIME** | |
| | < 5 ms |
| **PATH RESISTANCE** | |
| | < 1 Ω |
| **INSULATION RESISTANCE** | |
| | $1 \times 10^9$ Ω |
| **BANDWIDTH (-3 dB)** | |
| | 3GHz (typical) |
| **INSERTION LOSS (TYPICAL)** | |
| **1 GHz** | < 0.5 dB |
| **3 GHz** | < 3.0 dB |
| **CROSSTALK (TYPICAL)** | |
| **1 GHz** | < -60 dB |
| **3 GHz** | < -55 dB |
| **ISOLATION (TYPICAL)** | |
| **1 GHz** | < -65 dB |
| **3 GHz** | < -55 dB |
| **VSWR (TYPICAL)** | |
| **1 GHz** | < 1.2:1 |
| **3 GHz** | < 1.5:1 |

# EX1200-7000 PLUG-IN MODULE

## 96 CHANNEL BREADBOARD

The EX1200-7000 uses the standard EX1200 form factor and interface. The EX1200-7000 interface provides register based control of 96 I/O lines and their associated control signals. Voltage translating dual octal transceivers buffer converts the 96 I/O lines from the low-voltage programmable logic device to the 5V prototype signals. These signals are routed to the "Proto-Input" connector, which provides user access to the I/O signals. The user can hard-wire the I/O signals to components in the bread board space (prototyping area). Alternatively, the end user can plug in an adapter board with their logic on it. A separate via array is provided which is compatible with a 160-pin DIN connector. Support will be provided to allow the use of three row high density D-sub on the end users adapter board.

The EX1200-7000 provides access to 96 digital I/O lines and three fused power rails for interfacing to user-defined logic. Custom designs can be laid out on the through-hole pattern available on the breadboard space. A connector header is provided to facilitate migration of the custom design to a printed circuit board layout. This enables the use of multiple front panel I/O possibilities, ranging from 15-pin D-sub to 160-pin high-density DIN connectors.

A simplified block diagram of the EX1200-7000 is provided below.

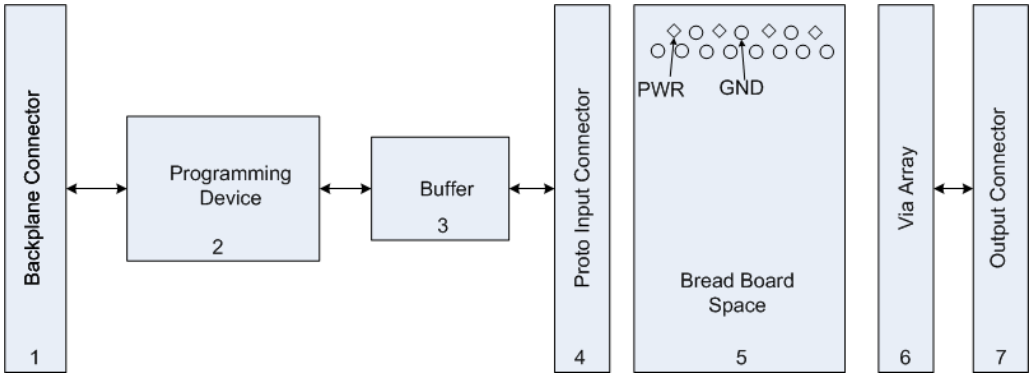



**FIGURE 4-63: EX1200-7000 BLOCK DIAGRAM**

***Component Details***

1. Backplane Connector: 64-pin right angle male
2. Programmable device
3. Three state Bidirectional Buffers
4. Proto connector in: 32-pin (J1,J2,J3,J4)
5. Breadboard space: 6" x 3.7"
6. Via array: 160-pin 5 row 0.1" via array
7. Output connector: option of 160-pin ERNI

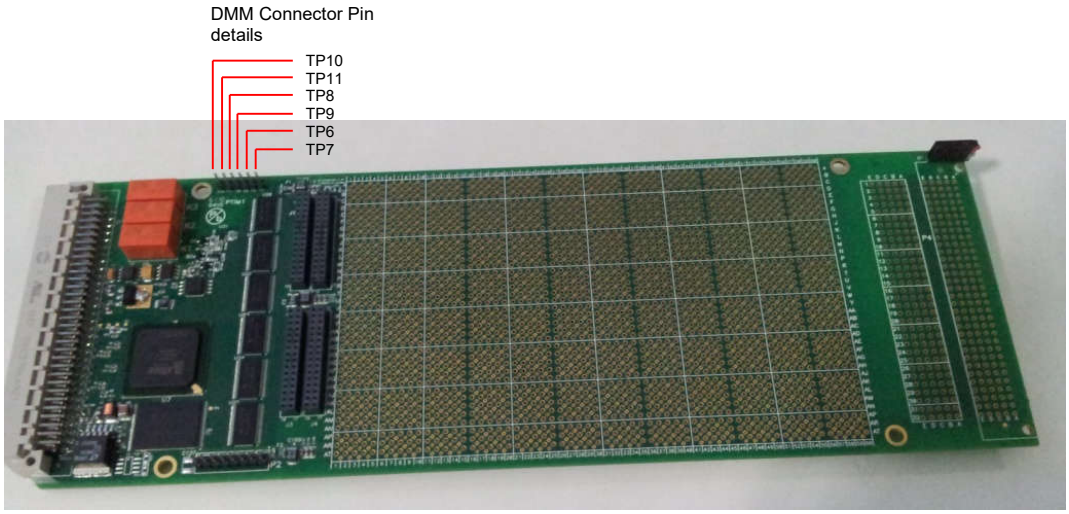



**FIGURE 4-64: EX1200-7000 BREADBOARD AND DMM CONNECTOR PIN DETAILS**

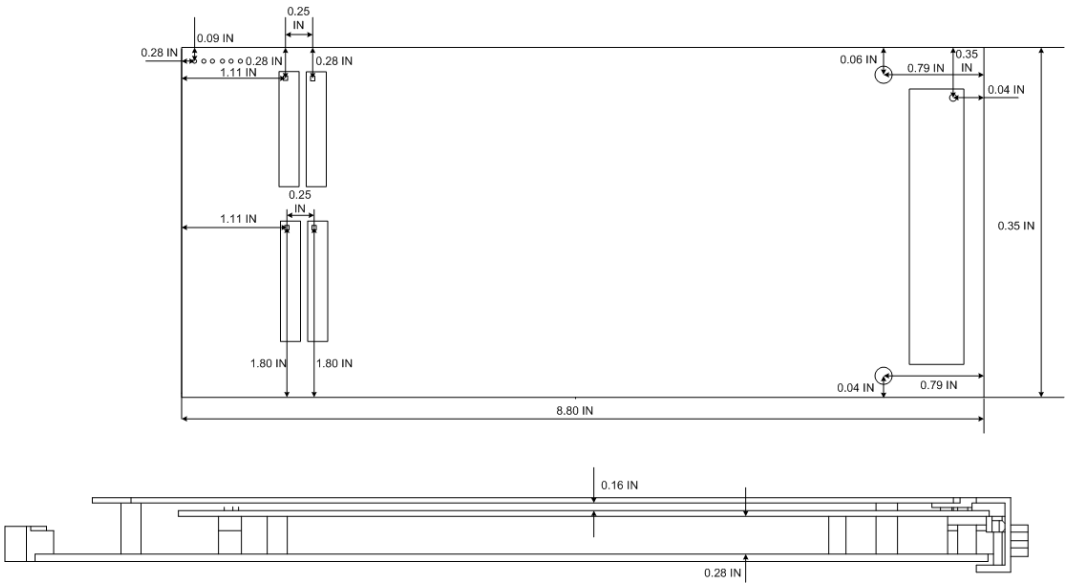



**FIGURE 4-65: EX1200-7000 DAUGHTER BOARD LAYOUT DIMENSIONS**

## PROTO INPUT CONNECTOR PIN OUTS

The logic lines will be made available on the user breadboard through pads on the PCB and are 5 V logic. The I/O lines will be connected to the pads of a “proto-input” connector which can be used to fly-wire to the via array of the prototype board or can connect to an end user’s prototype adapter card. A similar set of connector pads will be available to connect from the via array or adapter board to the front panel connector.

| J1 | | J2 | | J3 | | J4 | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | CH3_B7 | **1** | CH0_B7 | **1** | CH9_B7 | **1** | CH6_B7 |
| **2** | CH3_B6 | **2** | CH0_B6 | **2** | CH9_B6 | **2** | CH6_B6 |
| **3** | CH3_B5 | **3** | CH0_B5 | **3** | CH9_B5 | **3** | CH6_B5 |
| **4** | CH3_B4 | **4** | CH0_B4 | **4** | CH9_B4 | **4** | CH6_B4 |
| **5** | CH3_B3 | **5** | CH0_B3 | **5** | CH9_B3 | **5** | CH6_B3 |

| J1 | | J2 | | J3 | | J4 | |
|---|---|---|---|---|---|---|---|
| **6** | CH3_B2 | **6** | CH0_B2 | **6** | CH9_B2 | **6** | CH6_B2 |
| **7** | CH3_B1 | **7** | CH0_B1 | **7** | CH9_B1 | **7** | CH6_B1 |
| **8** | CH3_B0 | **8** | CH0_B0 | **8** | CH9_B0 | **8** | CH6_B0 |
| **9** | CH2_B7 | **9** | CH4_B7 | **9** | CH8_B7 | **9** | CH10_B7 |
| **10** | CH2_B6 | **10** | CH4_B6 | **10** | CH8_B6 | **10** | CH10_B6 |
| **11** | CH2_B5 | **11** | CH4_B5 | **11** | CH8_B5 | **11** | CH10_B5 |
| **12** | CH2_B4 | **12** | CH4_B4 | **12** | CH8_B4 | **12** | CH10_B4 |
| **13** | CH2_B3 | **13** | CH4_B3 | **13** | CH8_B3 | **13** | CH10_B3 |
| **14** | CH2_B2 | **14** | CH4_B2 | **14** | CH8_B2 | **14** | CH10_B2 |
| **15** | CH2_B1 | **15** | CH4_B1 | **15** | CH8_B1 | **15** | CH10_B1 |
| **16** | CH2_B0 | **16** | CH4_B0 | **16** | CH8_B0 | **16** | CH10_B0 |
| **17** | CH5_B0 | **17** | 3.3V_FUSED | **17** | CH11_B0 | **17** | 24V_FUSED |
| **18** | CH5_B1 | **18** | CLK | **18** | CH11_B1 | **18** | 24V_FUSED |
| **19** | CH5_B2 | **19** | 3.3V_FUSED | **19** | CH11_B2 | **19** | GND_D |
| **20** | CH5_B3 | **20** | GND_D | **20** | CH11_B3 | **20** | GND_D |
| **21** | CH5_B4 | **21** | GND_D | **21** | CH11_B4 | **21** | 24V_FUSED |
| **22** | CH5_B5 | **22** | +5V_FUSED | **22** | CH11_B5 | **22** | 24V_FUSED |
| **23** | CH5_B6 | **23** | +5V_FUSED | **23** | CH11_B6 | **23** | GND_D |
| **24** | CH5_B7 | **24** | GND_D | **24** | CH11_B7 | **24** | Not Used |
| **25** | CH1_B0 | **25** | GND_D | **25** | CH7_B0 | **25** | Not Used |
| **26** | CH1_B1 | **26** | +5V_FUSED | **26** | CH7_B1 | **26** | GND_D |
| **27** | CH1_B2 | **27** | +5V_FUSED | **27** | CH7_B2 | **27** | GND_D |
| **28** | CH1_B3 | **28** | GND_D | **28** | CH7_B3 | **28** | 3.3V_FUSED |
| **29** | CH1_B4 | **29** | GND_D | **29** | CH7_B4 | **29** | 3.3V_FUSED |
| **30** | CH1_B5 | **30** | +5V_FUSED | **30** | CH7_B5 | **30** | GND_D |
| **31** | CH1_B6 | **31** | +5V_FUSED | **31** | CH7_B6 | **31** | GND_D |
| **32** | CH1_B7 | **32** | GND_D | **32** | CH7_B7 | **32** | GND_D |

**TABLE 4-54: PROTO INPUT CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## CONNECTOR PINS AND SIGNALS

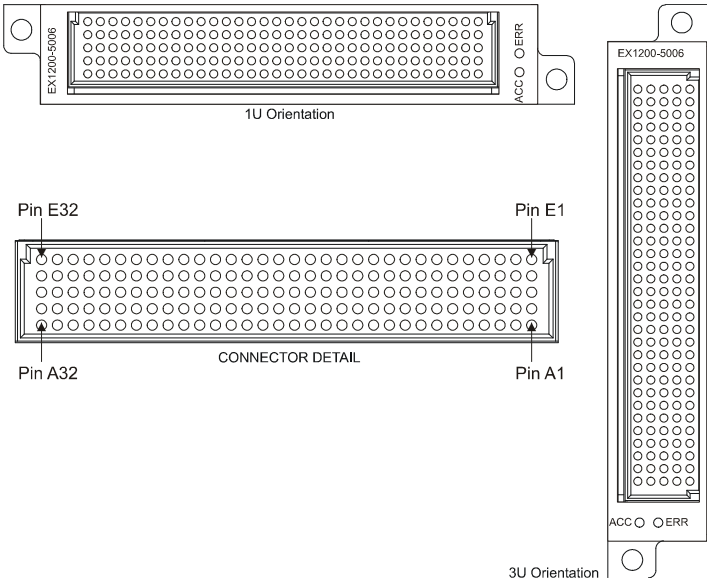



**FIGURE 4-66: EX1200-7000 160 PIN FRONT PANEL (FRONT VIEW)**

# EX1200-7000 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **MODEL TYPE** | |
| | Prototyping module |
| **BREADBOARD SPACE** | |
| | 6" x 3.7" |
| **FRONT PANEL CONNECTORS** | |
| | 15-pin high-density D-Sub<br>26-pin high-density D-Sub<br>44-pin high-density D-Sub<br>62-pin high-density D-Sub (solder cup)<br>160-pin DIN |
| **POWER RAILS** | |

| Proto-Power Voltage | Max Current Limit $I_{hold}$ Limit | Current Limit $I_{trip}$ Limit |
|---|---|---|
| +5V | 2.0A | 3.5A |
| +24V | *0.05A | 0.15A |
| +3.3V | *2.0A | 4.00A |

| | |
|---|---|
| **I/O CHANNELS** | |
| **Mechanical** | 96 bi-directional TTL |
| **MAXIMUM CURRENT PER CONNECTOR PIN** | |
| | 1A |
| **MAXIMUM VOLTAGE PER CONNECTOR PIN** | |
| | 125V |
| **DMM CONNECTIVITY** | |
| | 125V, 2A |

* The maximum current available on any single slot for the 24 V rail is 1 A, with a maximum of 2.6 A available for all slots (EX12x2 and EX12x6 models).The PCB board trace having the capacity to handle 1A current. If the fuse is replaced with higher rating 1A current can be achieved.

# EX1200-7100 PLUG-IN MODULE

## DC - 26 GHZ MICROWAVE SWITCH CARRIER AND RELAY DRIVER

The EX1200-7100 is a high-density microwave switch module carrier, designed for use with EX1200 mainframes, extending the platforms switching capabilities to the 26 GHz range. Each carrier can accommodate three miniature microwave switch modules to provide added system flexibility. Each microwave switch can be removed, replaced, or relocated in the carrier by the user allowing for easy configuration and maintenance.

In addition to using the four specially-designed switch modules, the carrier can also be used as a relay driver to control external microwave relays that are not compatible with the EX1200-7100 carrier. Each carrier provides six control lines compatible with 24 V logic.

The EX1200-7100 module occupies two plug-in-modules slot space and can be mixed and matched with other EX1200 plug-in modules to configure high-density customized switching solutions. Approximately 54 switch points can be switched within a 1U rack space, providing exceptional density without signal integrity degradation.

The EX1200-7100 series has been priced to help reduce the cost of microwave switching by at least 20% over existing solutions. Switches are competitively priced to satisfy the lower frequency cellular switching market needs.

The EX1200-7100 can be controlled programmatically using IviSwtch-compliant calls. Refer to the host driver documentation for additional details. Logical diagrams are provided for each switch module which identify how the front connector and rear connector pins.

## FRONT PANEL ENCLOSURE

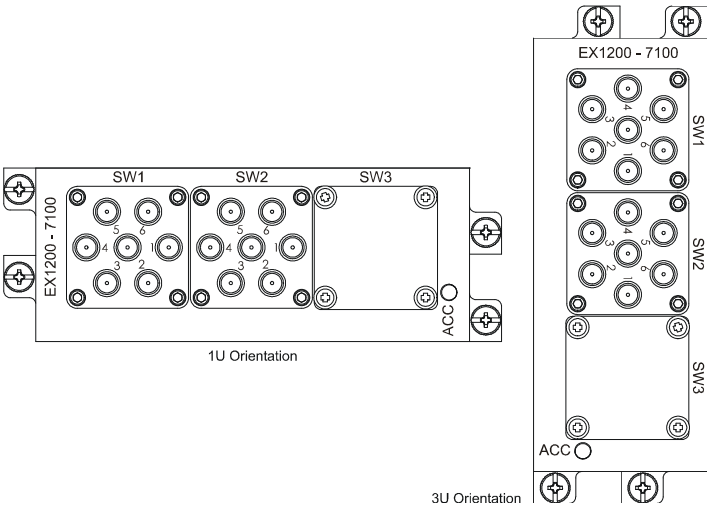



**FIGURE 4-67: EX1200-7100 FRONT PANEL WITH TWO 7106 MODULES (FRONT VIEW)**

## MICROWAVE SWITCH MODULES

VTI provides four microwave switch modules that can be used with the EX1200 carrier. Table 4-55 shows the models and their switching functionality.

| Model | Type |
|---|---|
| **7102** | Dual SPDT |
| **7104** | SP4T |
| **7106** | SP6T |
| **7122** | Transfer |

**TABLE 4-55: EX1200-7100 PLUG-IN MICROWAVE SWITCH MODULES**

These modules utilize a 4-bit ID that allows the user to change the location and type of relay in any given carrier slot as needed. When the modules are inserted, the EX1200-7100 carrier reads this ID and the information is automatically updated and reflected in the Soft Front Panel (for more information on the EX1200 Series soft front panels, please refer to the *EX1200 Series User's Manual*, P/N: 82-0127-000.) The following information provides these module's logical diagrams as well as front and rear panel connector information.

### *7102 Microwave Module*

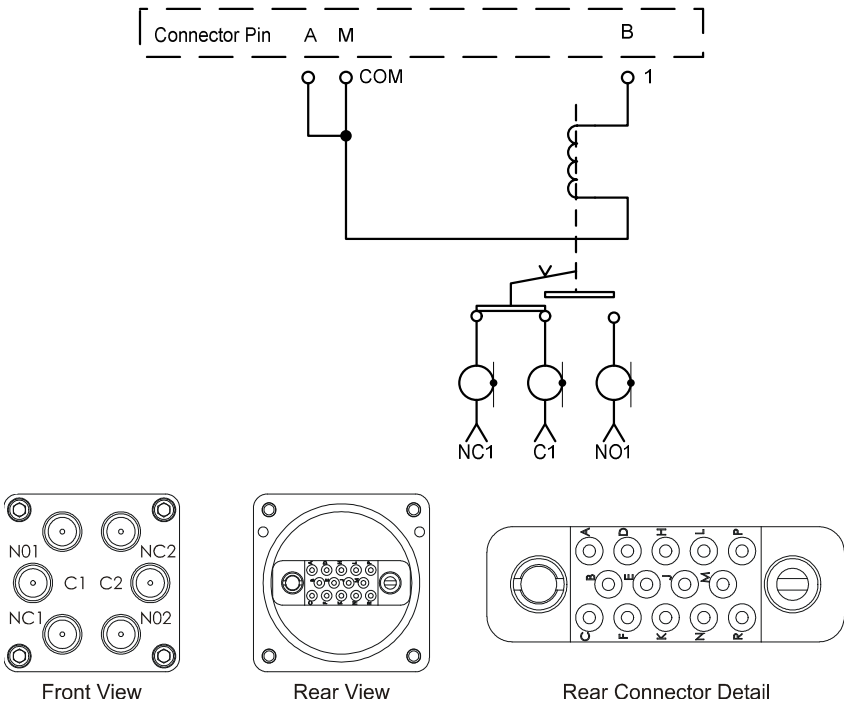



**FIGURE 4-68: 7102 LOGICAL DIAGRAM, SIGNALS, AND SWITCH DETAILS**

### *7104 Microwave Module*

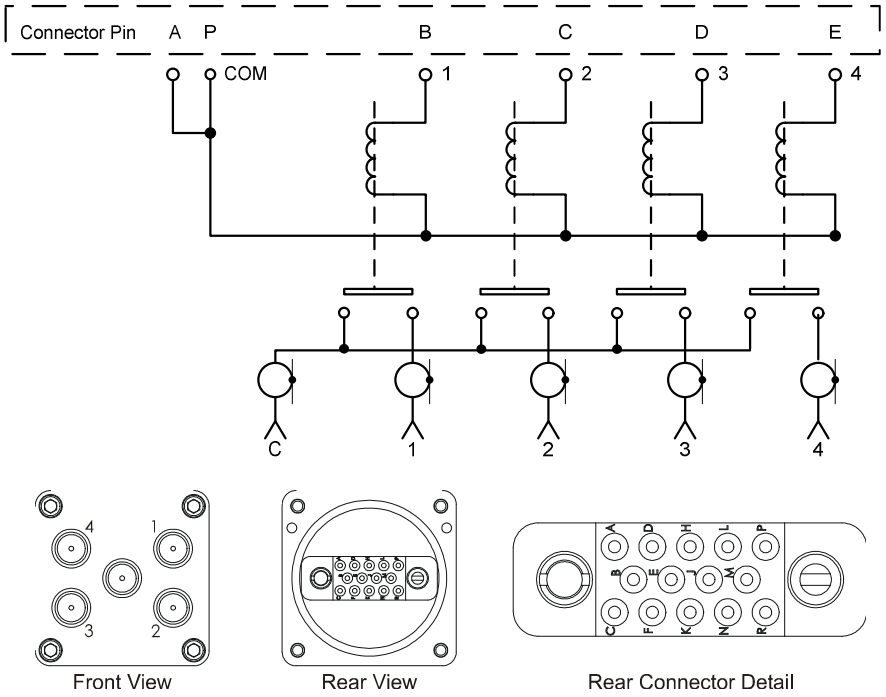



**FIGURE 4-69: 7104 LOGICAL DIAGRAM, SIGNALS, AND SWITCH DETAILS**

### *7106 Microwave Module*

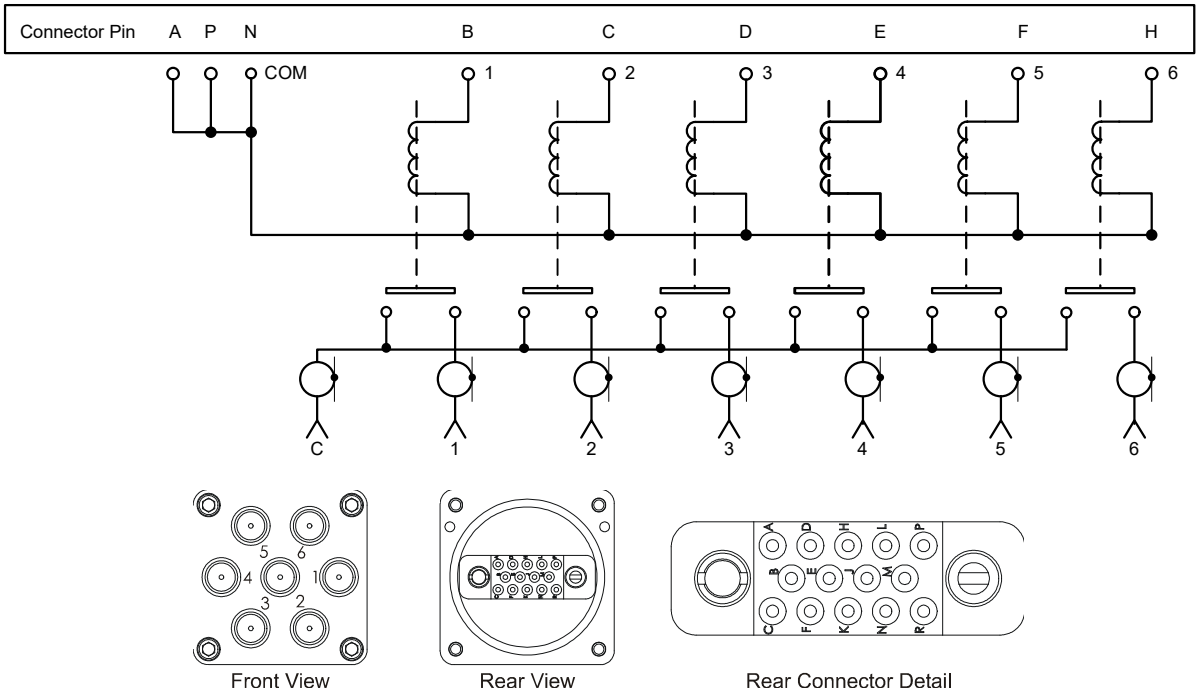



**FIGURE 4-70: 7106 LOGICAL DIAGRAM, SIGNALS, AND SWITCH DETAILS**

### *7122 Microwave Module*

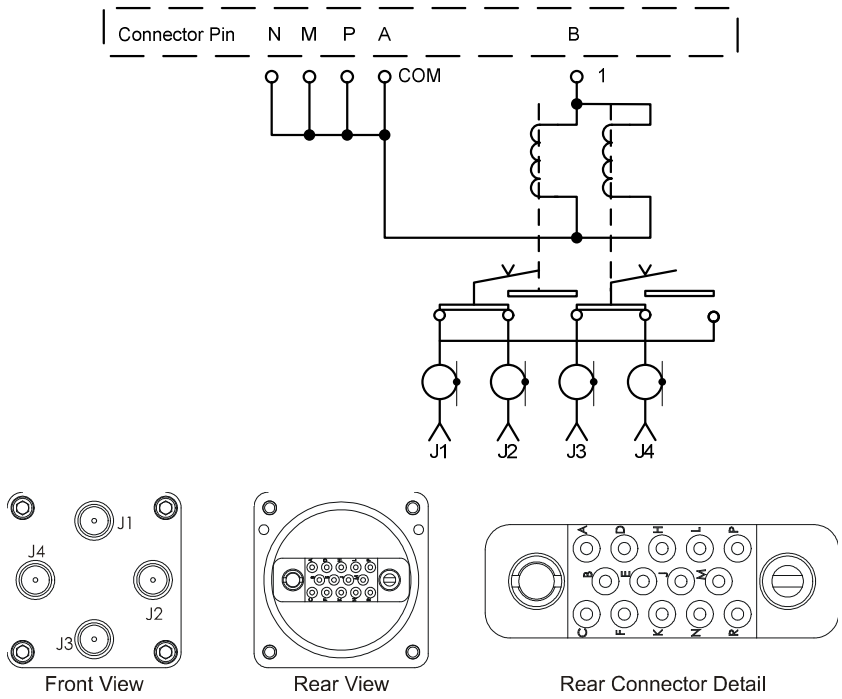



**FIGURE 4-71: 7122 LOGICAL DIAGRAM, SIGNALS, AND SWITCH DETAILS**

### *Installing a Switch Module*

Prior to a switch module into the EX1200-7100 enclosure, ensure that has been removed from the mainframe. If the enclosure is already installed into an EX1200 mainframe, remove it from the mainframe to facilitate installation. Next, slide the module into the enclosure and carefully ensure that the guide pins on the enclosure mate with the pins on the module. Once the guide pins are aligned, firmly push the module into the mating connector until the module is seated flush in the enclosure. Install the four socket head cap screw's to complete the installation.

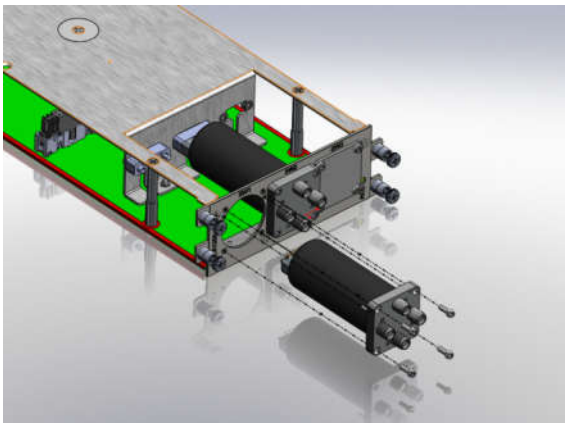


**FIGURE 4-72: INSTALLING A SWITCH MODULE**

## EX1200-7100 Carrier Front Panel Connectors

The EX1200-7100 carrier provides six lines of control for external microwave switches. Using a pass through adapter (VTI P/N: 70-0146-026), external microwave switches can be connected to the three 14-pin connectors located inside the carrier. The signals for the connector pins are shown in Table 4-56.

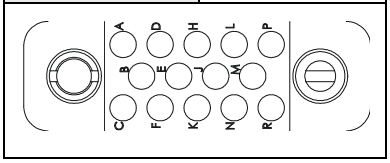
| Connector Pin | Signal |
|---|---|
| **A** | +24V |
| **B** | RELAY 1 |
| **C** | RELAY 2 |
| **D** | RELAY 3 |
| **E** | RELAY 4 |
| **F** | RELAY 5 |
| **H** | RELAY 6 |
| **J** | Not Used |
| **K** | Not Used |
| **L** | Not Used |
| **M** | ID0 |
| **N** | ID1 |
| **P** | ID2 |
| **R** | ID3 |
|  | |



**Table 4-56: EX1200-7100 Connector Pins and Signals**

## EX1200-7100 Soft Front Panel

Although soft front panel (SFP) operation is detailed in the *EX1200 Series User's Manual*, the EX1200-7100 has a unique input/output interface that is available when a pass through adapter is used. When the SFP is initially viewed, a PIO*x_y* (**PIO1_2** in Figure 4-735) the slot is viewed. From here, the user can enter the value that will be input or output by the relay driver. When **PIO1_2** is clicked, the slot expands to show the seven bits that are controlled when the input/output is set.

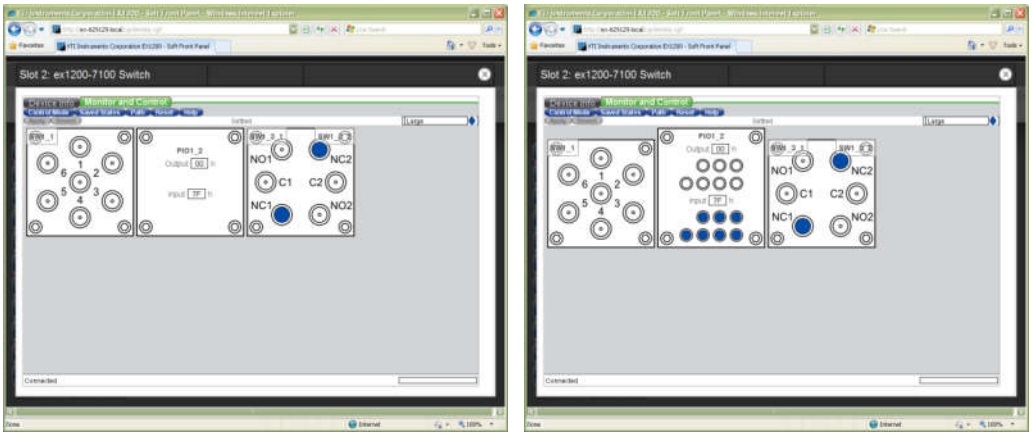



**Figure 4-73: Standard (Left) and Expanded (Right) Image for PIO1_2 Port**

# EX1200-7100 SPECIFICATIONS

| RF PERFORMANCE SPECIFICATIONS | | | | | |
|---|---|---|---|---|---|
| **Frequency (GHz)** | DC – 4 | 4 – 8 | 8 – 12 | 12 – 18 | 18 – 26 |
| **VSWR** | 1.25:1 | 1.35:1 | 1.40:1 | 1.50:1 | 1.8:1 |
| **Insertion loss (dB max)** | 0.20 | 0.30 | 0.40 | 0.50 | 0.80 |
| **Isolation (dB min)** | 70 | 65 | 60 | 60 | 50 |
| **RF power (CW)** | 100 | 70 | 60 | 45 | 30 |

| ADDITIONAL SPECIFICATIONS | |
|---|---|
| **Maximum operating voltage** | 24 V dc |
| **Maximum current rating (carrier)** | 1 A |
| **Maximum current per switch** | |
| **7102/7104/7106** | 140 mA @ nominal voltage and 25 °C |
| **7122** | 280 mA @ nominal voltage and 25 °C |
| **Switching time** | 20 ms (maximum) |
| **Operating mode** | |
| **7102/7104** | Failsafe |
| **7106** | Normally open |
| **7122** | Transfer, failsafe |
| **Switching sequence** | Break-Before-Make |
| **Operating life** | 2,000,000 cycles per position minimum |

# EX1200-SMP

## EX1200-SMP4 Carrier Module

The EX1200-SMP4 is a four slot Carrier Module with an integrated analog backplane that can accept different Matrix Modules. The Carrier Module will plug into a standard EX1208A mainframe and the Matrix modules (IO / Resource cards) will plug into the Carrier Module.

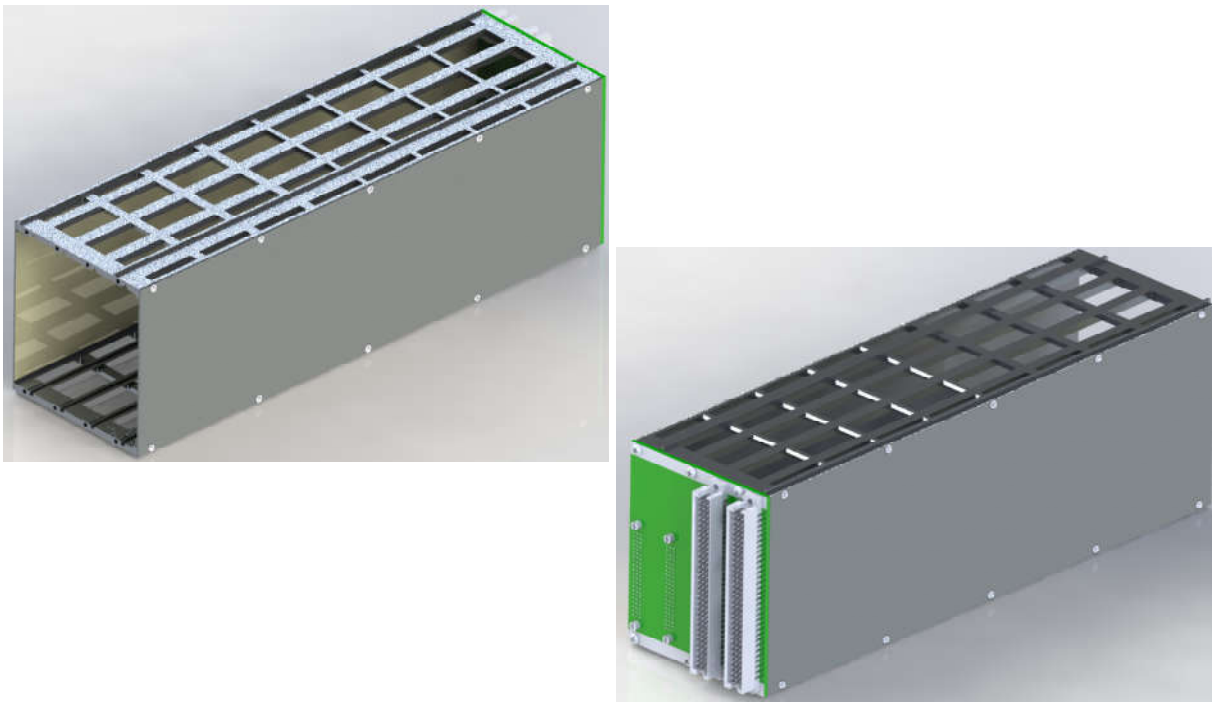


**Figure 4-74: EX1200-SMP-4 Carrier Module (Front & Rear View)**

## EX1200-08442 I/O Matrix Card

The EX1200-08442 is a high density Matrix plug in that will plug-in to an EX1200-SMP4 Carrier with connections to a 16 line backplane on the EX1208A. This will reduce the external wiring required to create larger matrices by bridging rows across the backplane. By fully populating an EX1200-SMP4 Carrier with four of these modules, a 176 x 8 matrix can be easily construced without the need for external wiring.

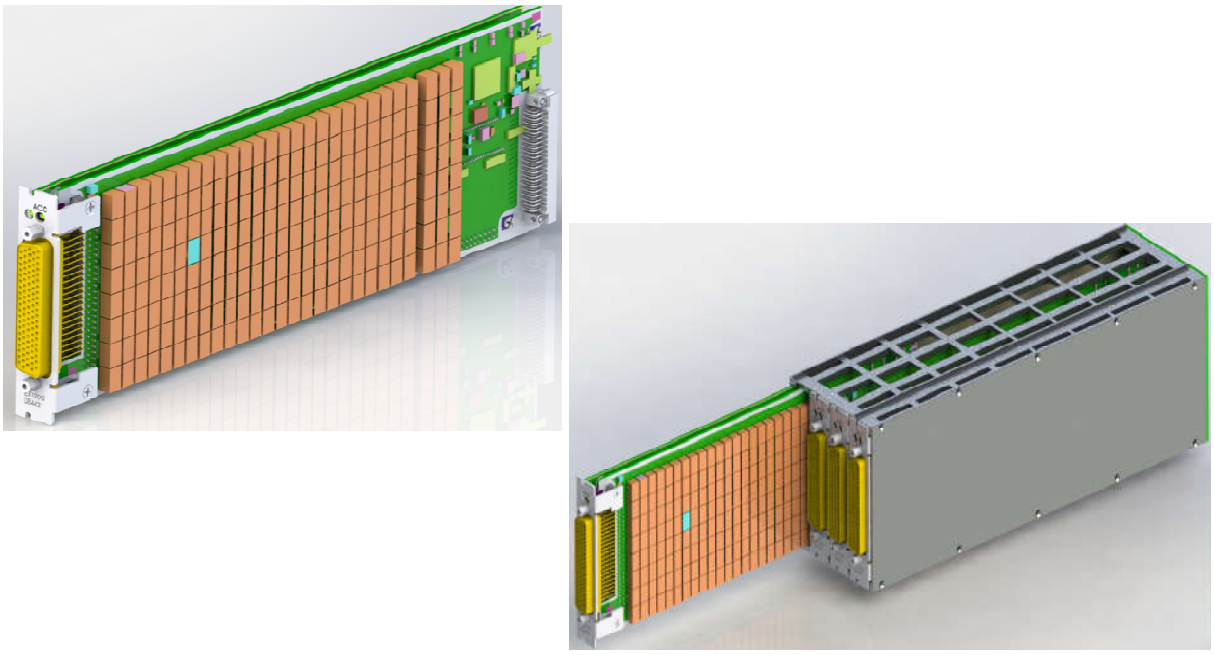


**FIGURE 4-75: EX1200-08442 IO MATRIX CARD**

## SMP ARCHITECTURE

The switching architecture of SMP is as shown below

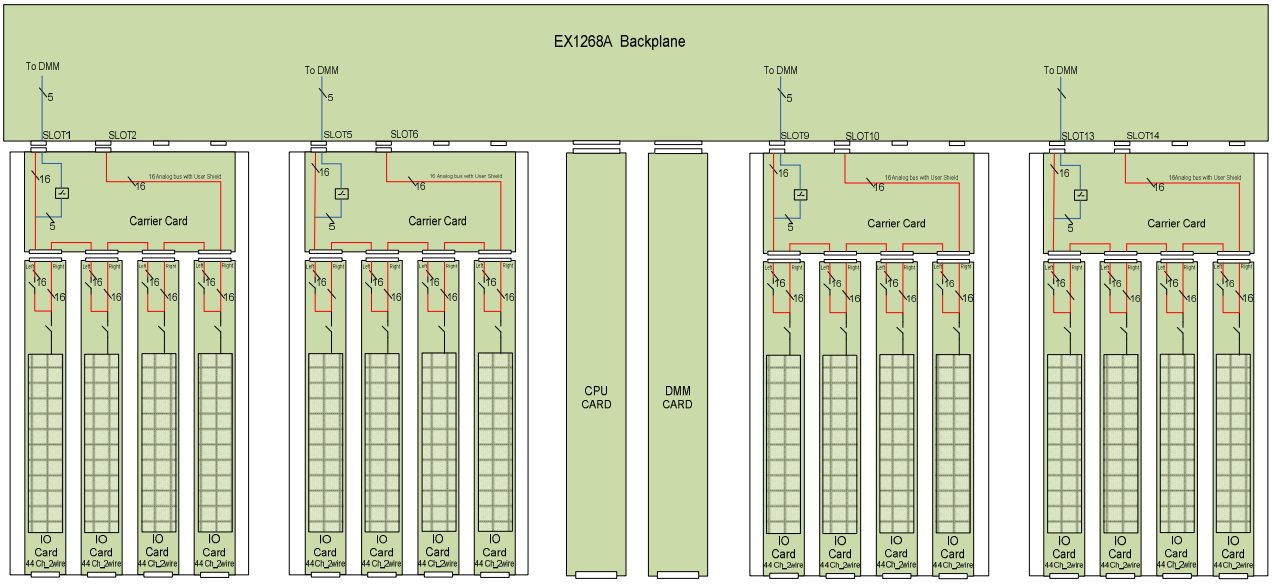



**FIGURE 4-76: EX1200-SMP ARCHITECTURE**

## CONNECTOR PINS AND SIGNALS

Front Panel connector

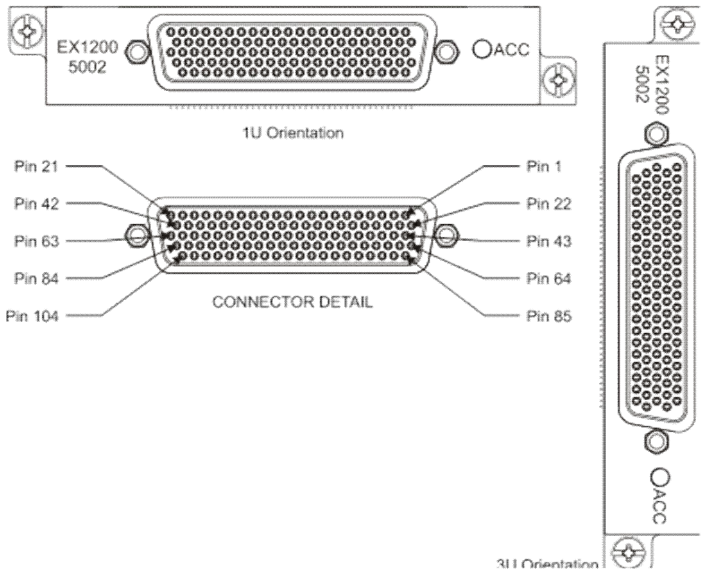



**FIGURE 4-77: EX1200-08442 IO CARD FRONT PANEL CONNECTOR**

| Row A | | Row B | | Row C | | Row D | | Row E | |
|---|---|---|---|---|---|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** | **Pin** | **Signal** |
| **1** | R_21H | **22** | R_22H | **43** | R_16L | **64** | R_38H | **85** | R_44H |
| **2** | R_21L | **23** | R_22L | **44** | R_16H | **65** | R_38L | **86** | R_44L |
| **3** | R_14L | **24** | R_15L | **45** | R_11H | **66** | R_33H | **87** | R_37H |
| **4** | R_14H | **25** | R_15H | **46** | R_11L | **67** | R_33L | **88** | R_37L |
| **5** | R_10H | **26** | R_13L | **47** | R_36H | **68** | R_43H | **89** | R_42H |
| **6** | R_10L | **27** | R_13H | **48** | R_36L | **69** | R_43L | **90** | R_42L |
| **7** | R_34H | **28** | R_12L | **49** | R_20H | **70** | R_32H | **91** | R_35H |
| **8** | R_34L | **29** | R_12H | **50** | R_20L | **71** | R_32L | **92** | R_35L |
| **9** | R_6L | **30** | R_19H | **51** | R_28H | **72** | R_41H | **93** | USER_SHIELD |
| **10** | R_6H | **31** | R_19L | **52** | R_28L | **73** | R_41L | **94** | USER_SHIELD |
| **11** | R_5H | **32** | R_9H | **53** | R_27H | **74** | R_31H | **95** | USER_SHIELD |
| **12** | R_5L | **33** | R_9L | **54** | R_27L | **75** | R_31L | **96** | USER_SHIELD |
| **13** | R_18H | **34** | R_8H | **55** | R_26H | **76** | R_40H | **97** | USER_SHIELD |
| **14** | R_18L | **35** | R_8L | **56** | R_26L | **77** | R_40L | **98** | USER_SHIELD |
| **15** | R_4H | **36** | R_17H | **57** | R_25H | **78** | R_30H | **99** | USER_SHIELD |
| **16** | R_4L | **37** | R_17L | **58** | R_25L | **79** | R_30L | **100** | USER_SHIELD |
| **17** | R_2L | **38** | R_3L | **59** | R_24H | **80** | R_39H | **101** | USER_SHIELD |
| **18** | R_2H | **39** | R_3H | **60** | R_24L | **81** | R_39L | **102** | USER_SHIELD |
| **19** | R_7H | **40** | R_1L | **61** | R_23H | **82** | R_29H | **103** | USER_SHIELD |
| **20** | R_7L | **41** | R_1H | **62** | R_23L | **83** | R_29L | **104** | USER_SHIELD |
| **21** | USER_SHIELD | **42** | USER_SHIELD | **63** | USER_SHIELD | **84** | USER_SHIELD | | |

**TABLE 4-57: EX1200-08442 FRONT PANEL CONNECTOR PINS & SIGNAL ASSIGNMENTS**

## LOGICAL DIAGRAM

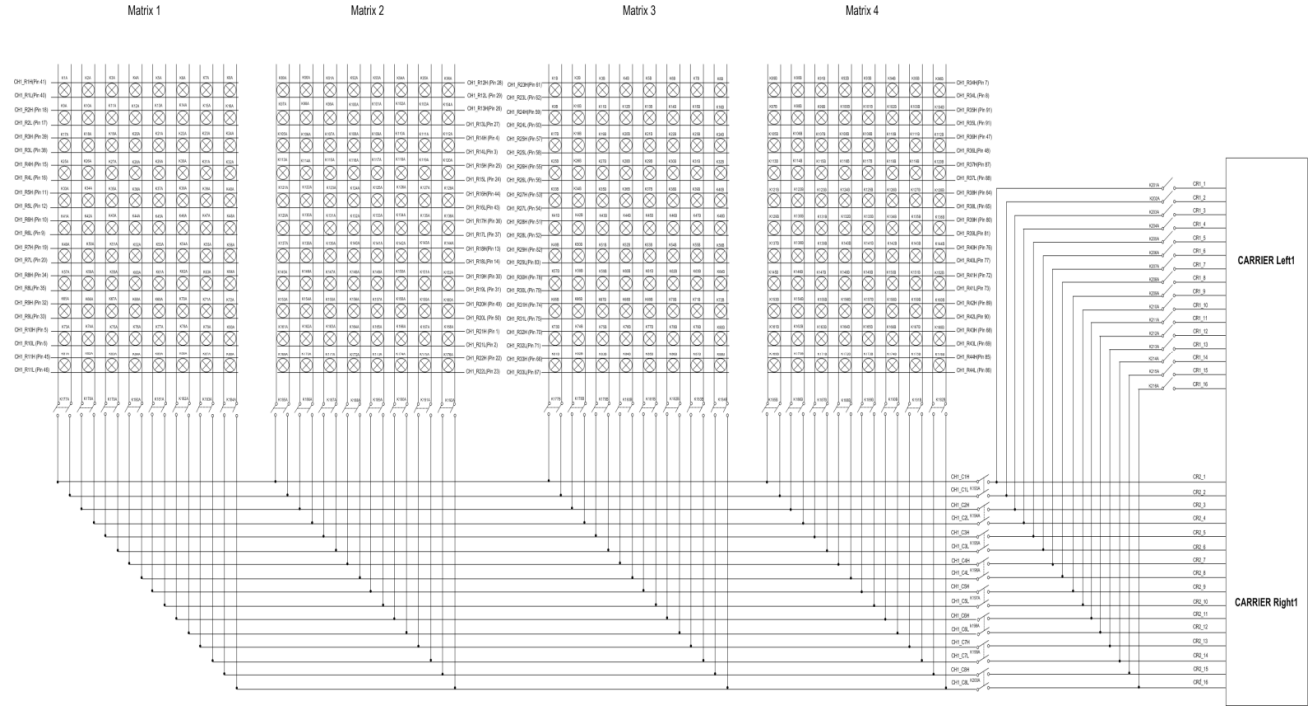



**FIGURE 4-78: EX1200-08442 SLOT1 LOGICAL DIAGRAM**

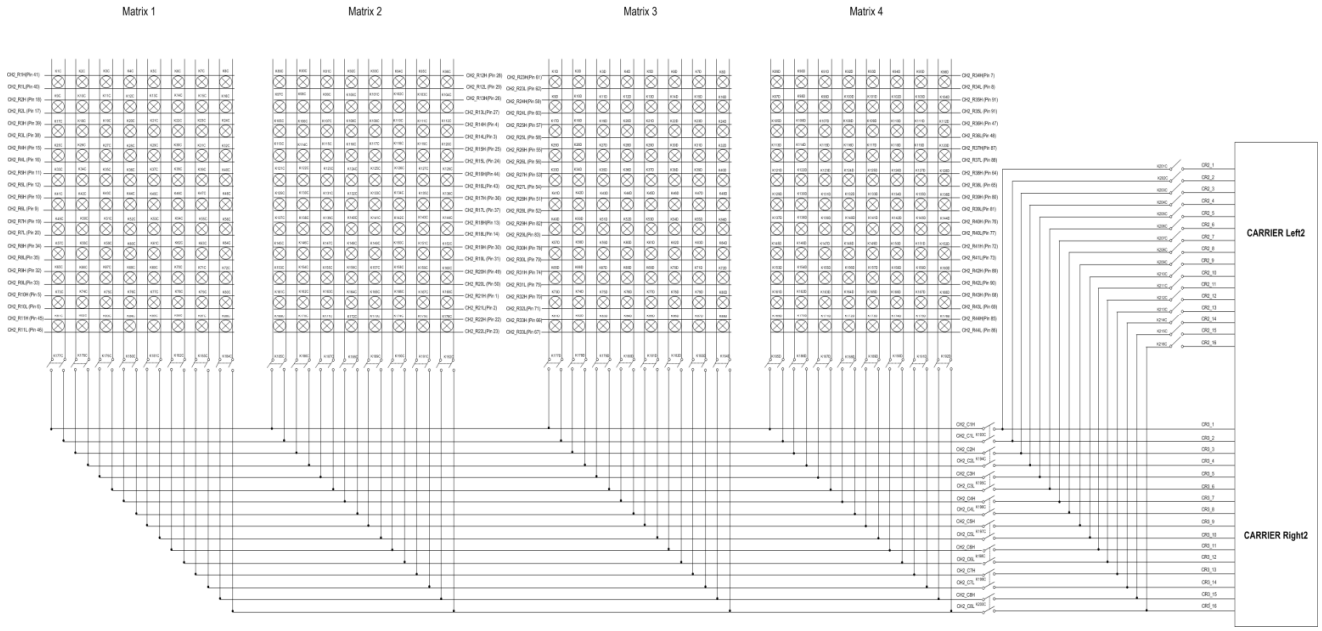



**FIGURE 4-79: EX1200-08442 SLOT2 LOGICAL DIAGRAM**

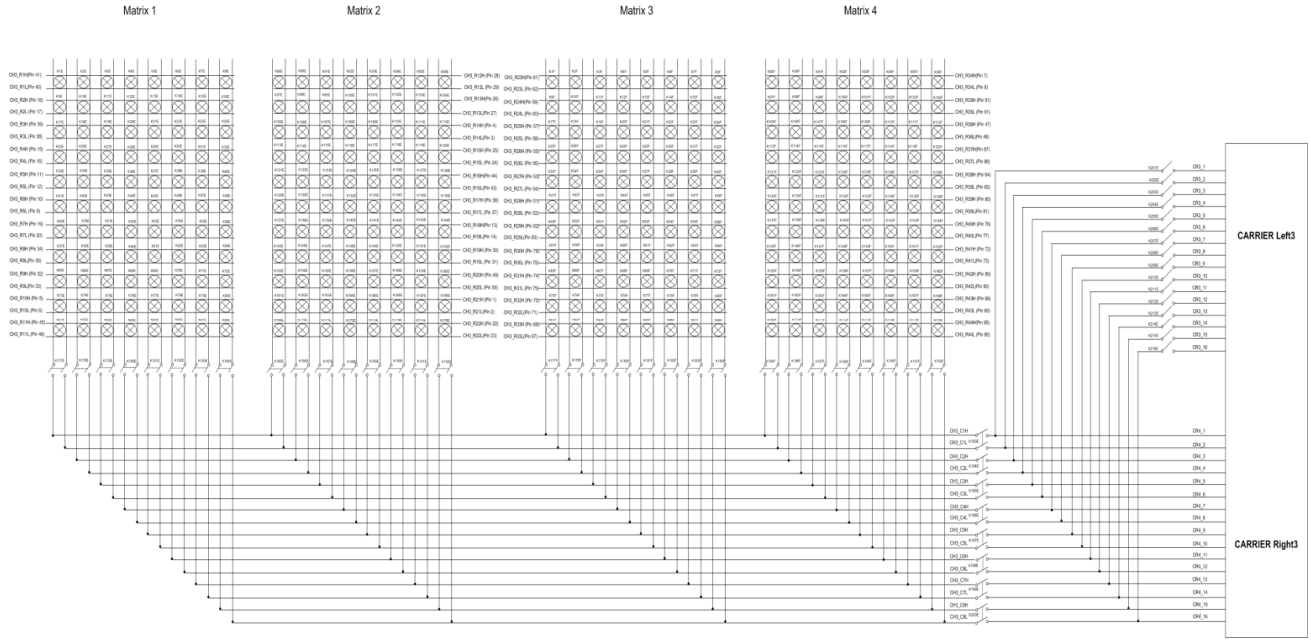



**FIGURE 4-80: EX1200-08442 SLOT3 LOGICAL DIAGRAM**

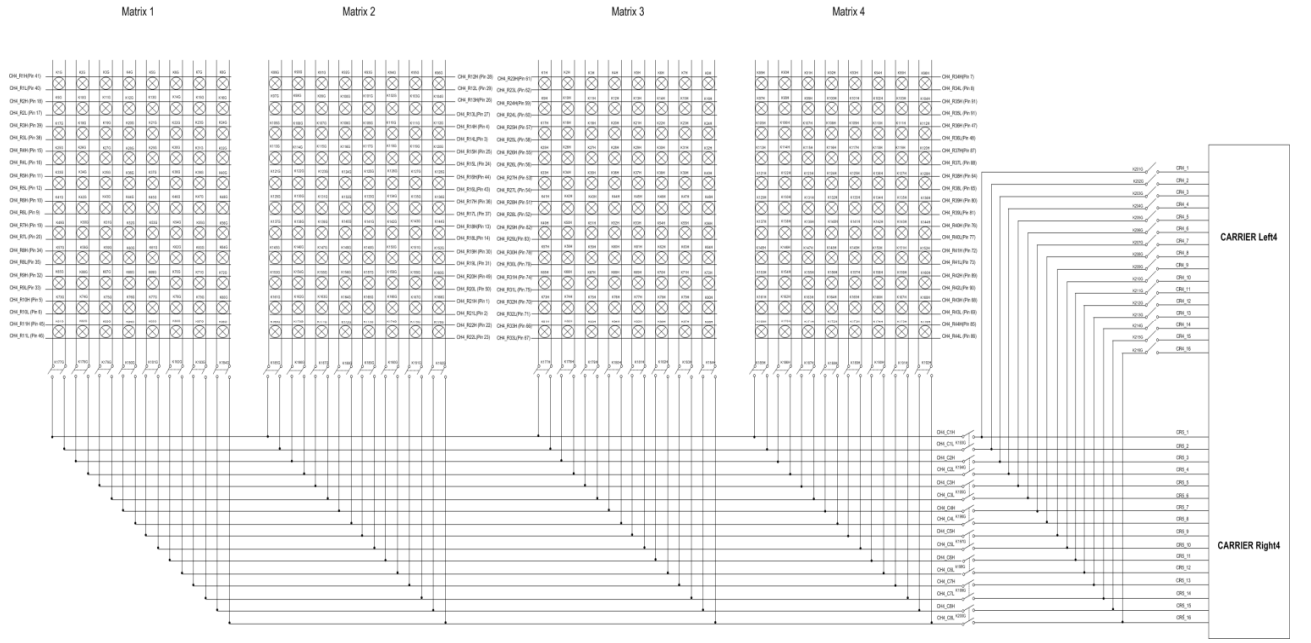



**FIGURE 4-81: EX1200-08442 SLOT4 LOGICAL DIAGRAM**

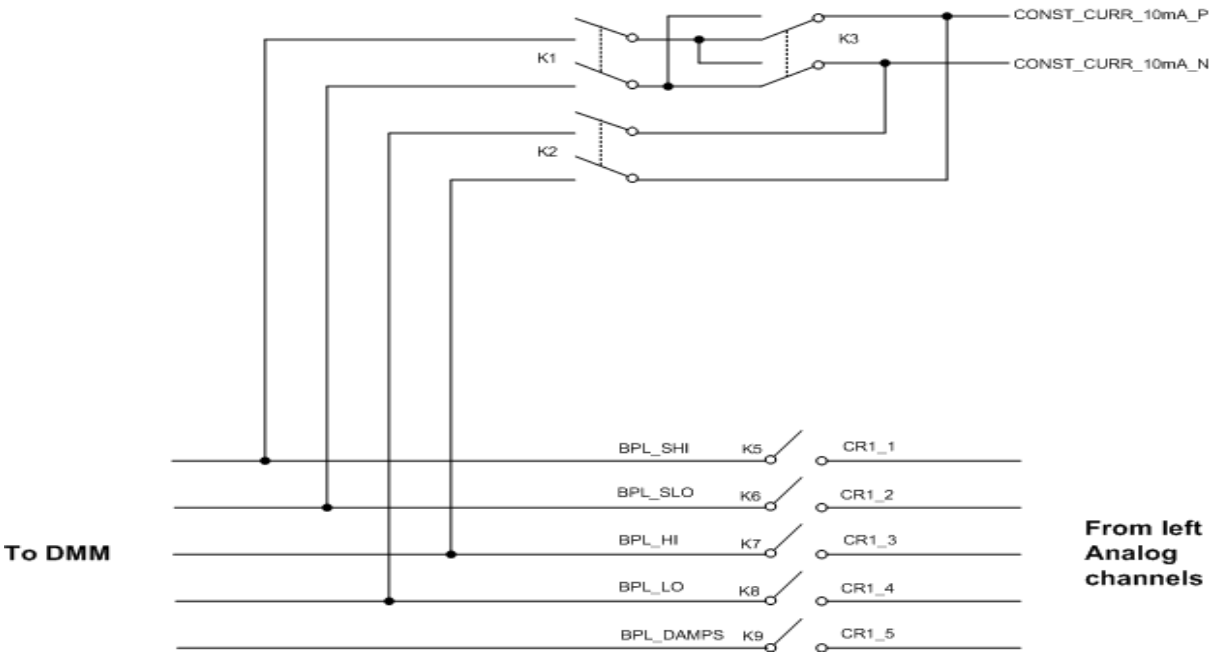



**FIGURE 4-82: EX1200-SMP4 CARRIER CARD LOGICAL DIAGRAM**

| TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin | TB Ref | Signal | Conn Pin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T1 | R_21H | 1 | T41 | R_17L | 37 | T81 | R_28L | 52 | T121 | R_37H | 87 |
| T2 | R_21L | 2 | T42 | R_3L | 38 | T82 | R_27H | 53 | T122 | R_37L | 88 |
| T3 | R_14L | 3 | T43 | R_3H | 39 | T83 | R_27L | 54 | T123 | R_42H | 89 |
| T4 | R_14H | 4 | T44 | R_1L | 40 | T84 | R_26H | 55 | T124 | R_42L | 90 |
| T5 | R_10H | 5 | T45 | R_1H | 41 | T85 | R_26L | 56 | T125 | R_35H | 91 |
| T6 | R_10L | 6 | T46 | USER_SHIELD | 42 | T86 | R_25H | 57 | T126 | R_35L | 92 |
| T7 | R_34H | 7 | T47 | UNUSED | N/A | T87 | R_25L | 58 | T127 | USER_SHIELD | 93 |
| T8 | R_34L | 8 | T48 | UNUSED | N/A | T88 | R_24H | 59 | T128 | R_29L | 83 |
| T9 | R_6L | 9 | T49 | UNUSED | N/A | T89 | R_24L | 60 | T129 | USER_SHIELD | 94 |
| T10 | R_6H | 10 | T50 | UNUSED | N/A | T90 | UNUSED | N/A | T130 | USER_SHIELD | 95 |
| T11 | R_5H | 11 | T51 | UNUSED | N/A | T91 | UNUSED | N/A | T131 | USER_SHIELD | 96 |
| T12 | R_5L | 12 | T52 | UNUSED | N/A | T92 | UNUSED | N/A | T132 | USER_SHIELD | 97 |
| T13 | R_18H | 13 | T53 | UNUSED | N/A | T93 | UNUSED | N/A | T133 | USER_SHIELD | 98 |
| T14 | R_18L | 14 | T54 | UNUSED | N/A | T94 | UNUSED | N/A | T134 | USER_SHIELD | 99 |
| T15 | R_4H | 15 | T55 | UNUSED | N/A | T95 | R_29H | 82 | T135 | USER_SHIELD | 100 |
| T16 | UNUSED | N/A | T56 | UNUSED | N/A | T96 | UNUSED | N/A | T136 | USER_SHIELD | 101 |
| T17 | R_4L | 16 | T57 | UNUSED | N/A | T97 | R_38H | 64 | T137 | USER_SHIELD | 102 |
| T18 | R_2L | 17 | T58 | UNUSED | N/A | T98 | R_38L | 65 | T138 | UNUSED | N/A |
| T19 | R_2H | 18 | T59 | UNUSED | N/A | T99 | R_33H | 66 | T139 | UNUSED | N/A |
| T20 | R_7H | 19 | T60 | UNUSED | N/A | T100 | R_33L | 67 | T140 | UNUSED | N/A |
| T21 | R_7L | 20 | T61 | UNUSED | N/A | T101 | R_43H | 68 | T141 | UNUSED | N/A |
| T22 | USER_SHIELD | 21 | T62 | UNUSED | N/A | T102 | R_43L | 69 | T142 | UNUSED | N/A |
| T23 | R_22H | 22 | T63 | UNUSED | N/A | T103 | R_32H | 70 | T143 | UNUSED | N/A |
| T24 | R_22L | 23 | T64 | UNUSED | N/A | T104 | R_32L | 71 | T144 | UNUSED | N/A |
| T25 | R_15L | 24 | T65 | R_16L | 43 | T105 | R_41H | 72 | T145 | UNUSED | N/A |
| T26 | R_15H | 25 | T66 | R_16H | 44 | T106 | R_41L | 73 | T146 | UNUSED | N/A |
| T27 | R_13L | 26 | T67 | R_11H | 45 | T107 | R_31H | 74 | T147 | UNUSED | N/A |
| T28 | R_13H | 27 | T68 | R_11L | 46 | T108 | R_31L | 75 | T148 | UNUSED | N/A |
| T29 | R_12L | 28 | T69 | R_36H | 47 | T109 | R_40H | 76 | T149 | UNUSED | N/A |
| T30 | R_12H | 29 | T70 | R_36L | 48 | T110 | R_40L | 77 | T150 | UNUSED | N/A |
| T31 | R_19H | 30 | T71 | R_20H | 49 | T111 | R_30H | 78 | T151 | UNUSED | N/A |
| T32 | UNUSED | N/A | T72 | R_20L | 50 | T112 | UNUSED | N/A | T152 | UNUSED | N/A |
| T33 | R_23H | 61 | T73 | R_28H | 51 | T113 | R_30L | 79 | T153 | UNUSED | N/A |
| T34 | UNUSED | N/A | T74 | UNUSED | N/A | T114 | R_39H | 80 | T154 | UNUSED | N/A |
| T35 | R_19L | 31 | T75 | UNUSED | N/A | T115 | R_39L | 81 | T155 | USER_SHIELD | 63, 84 |
| T36 | R_9H | 32 | T76 | UNUSED | N/A | T116 | UNUSED | N/A | T156 | UNUSED | N/A |
| T37 | R_9L | 33 | T77 | UNUSED | N/A | T117 | UNUSED | N/A | T157 | USER_SHIELD | 103 |
| T38 | R_8H | 34 | T78 | UNUSED | N/A | T118 | UNUSED | N/A | T158 | UNUSED | N/A |
| T39 | R_8L | 35 | T79 | UNUSED | N/A | T119 | R_44H | 85 | T159 | USER_SHIELD | 104 |
| T40 | R_17H | 36 | T80 | R_23L | 62 | T120 | R_44L | 86 | T160 | UNUSED | N/A |

**TABLE 4-58: EX1200-TB160SE TERMINAL BLOCK TO EX1200-08442 PIN MAPPING**

# EX1200-08442 SPECIFICATIONS

| GENERAL SPECIFICATIONS | |
|---|---|
| **CHANNEL COUNT** | |
| | 44*8 2wire |
| **RELAY TYPE** | |
| | Electromechanical, 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<br>**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)<br>**This value is in reference to a resistive load. Minimum capacity changes depending on switching frequency and environmental conditions* |
| **RATED SWITCH OPERATIONS** | |
| **Mechanical** | $1 \times 10^8$ (no load) |
| **Electrical** | $1 \times 10^6$ @ 50 V dc, 0.1 A resistive or 10 V dc, 10 mA (resistive) |
| **SWITCHING TIME** | |
| | < 3 ms |
| **PATH RESISTANCE** | |
| | < 366 mΩ for one Slot<br>< 630 mΩ between SLOT1 and SLOT2<br>< 950 mΩ between SLOT1 and SLOT4 |
| **INSULATION RESISTANCE** | |
| | $> 1 \times 10^9$ Ω |
| **MAXIMUM THERMAL OFFSET PER CHANNEL (HI-LO)** | |
| | <1 µV |
| **CAPACITANCE** | |
| **High-low** | <240 pF |
| **BANDWIDTH (-3 dB)** | |
| | 30 MHz for SINGLE SLOT (Typical)<br>21 MHz between SLOT1 and SLOT2 (Typical)<br>15 MHz between SLOT1 and SLOT4 (Typical) |
| **CROSSTALK (TYPICAL)** | |
| **250 KHz** | < -26 dB |
| **1 MHz** | < -50 dB |
| **ISOLATION (TYPICAL)** | |
| **250 KHz** | < -28 dB |
| **1 MHz** | < -52 dB |

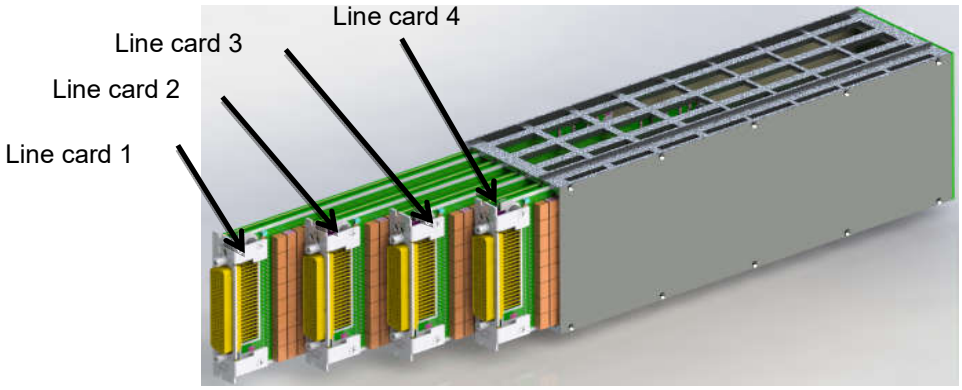



**FIGURE 4-83: IO MATRIX CARDS IN SMP-4 DIAGRAM**

**Procedure**: Align/Insert each line card in the Chassis guide ways and push in to the chassis gently and make sure, face plate of line card is in contact with front surface of chassis as shown above.

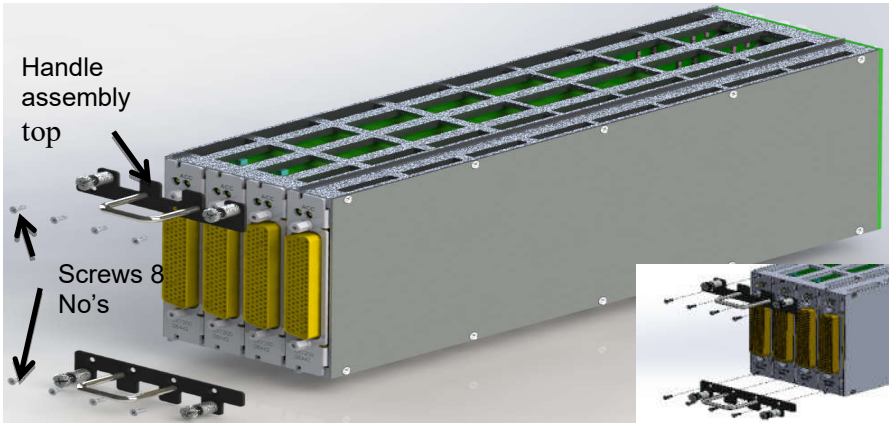



**FIGURE 4-84: EX1200-SMP4 CARRIER CARD WITH MATRIX CARDS DIAGRAM**

**Procedure**: Use 8 number of screws to fix Top/Bottom handle assemblies to module as shown above to complete the full assembly.

***Inserting SMP-4 Module into EX1268A Chassis***

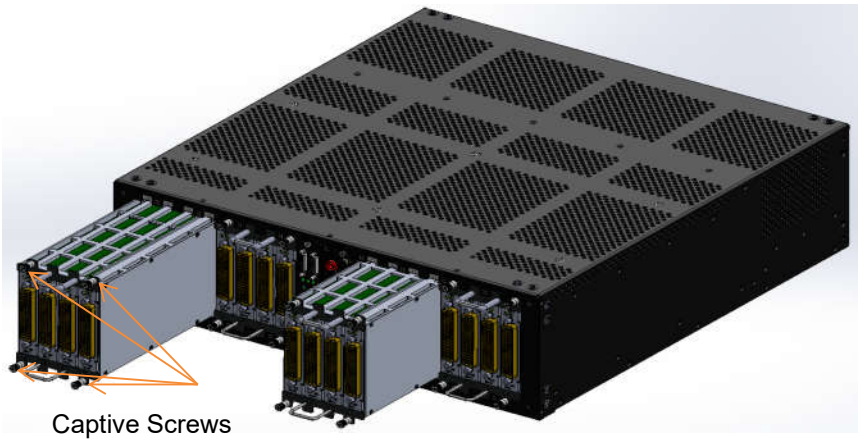



**FIGURE 4-85: EX1200-SMP4 MODULE IN EX1268A CHASSIS DIAGRAM**

**Procedure**: Align/Insert each SMP-4 Module in the EX1268A chassis guide ways and gently push in to the chassis and make sure, face plate of module is in contact with the front surface of chassis as shown above and drive the 4 no's of captive screws to fix the module rigidly to the chassis.

***Removing SMP-4 Module from the EX1268A Chassis***

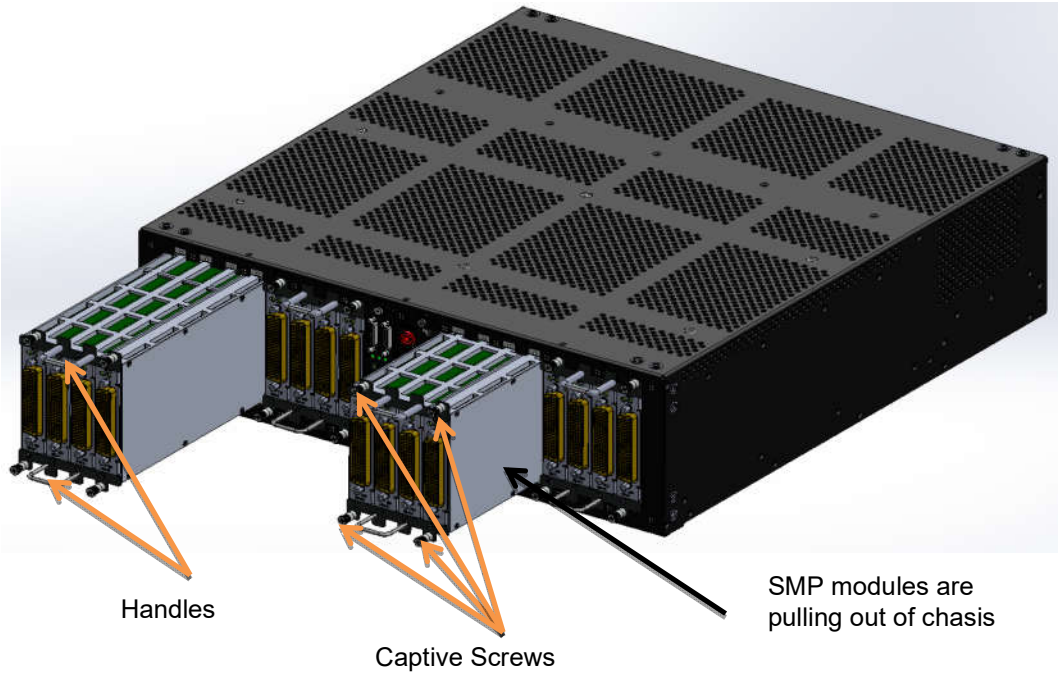



**FIGURE 4-86: EX1200-SMP4 MODULE FROM EX1268A CHASSIS DIAGRAM**

**Procedure**: Unscrew 4 no's of captive screws of each SMP-4 module assembly completely and pull the module with handle at top and bottom.

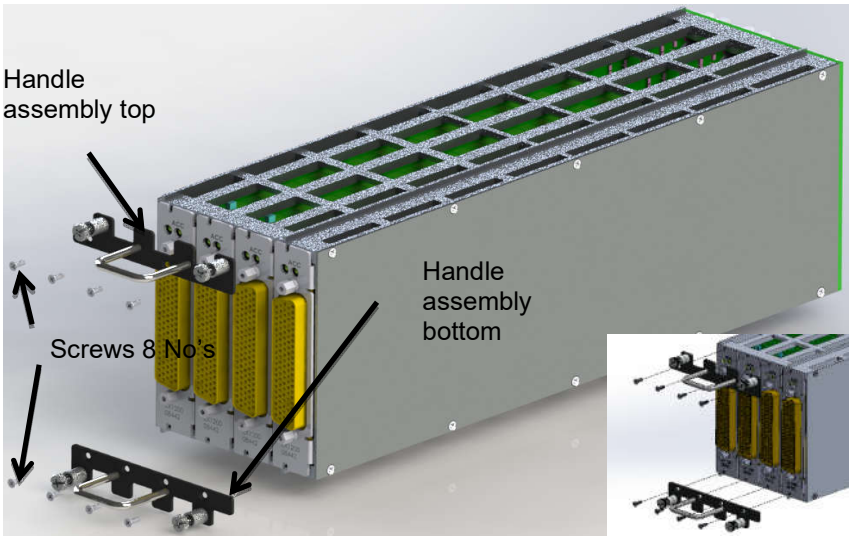



**FIGURE 4-87: REMOVING IO CARDS FROM SMP-4 MODULE DIAGRAM**

**Procedure**: Remove Handle assemblies at top and bottom by unscrewing 8 no's of screws as shown above.

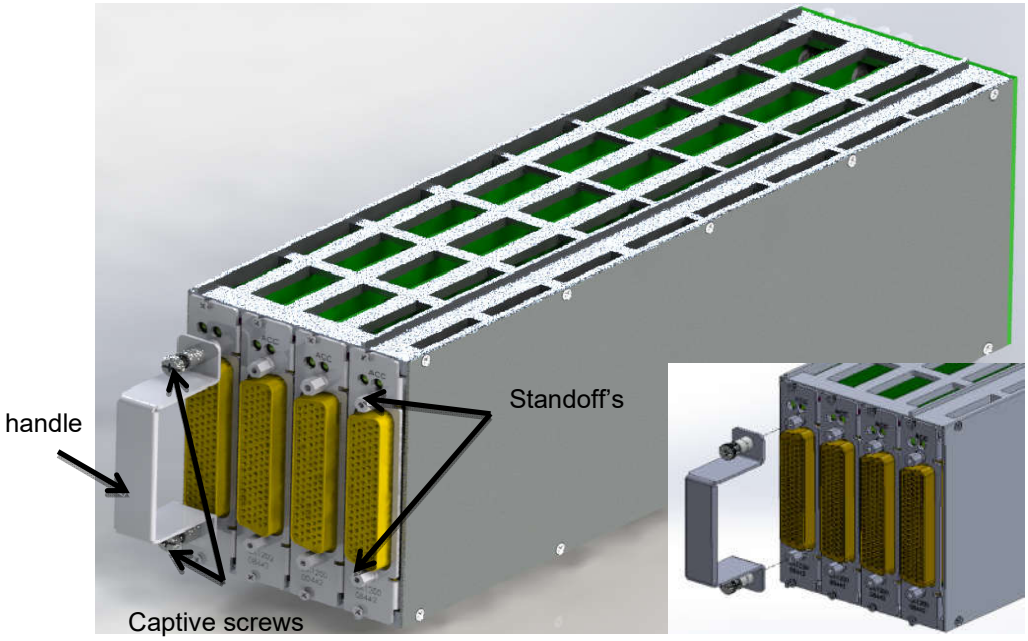



**FIGURE 4-88: REMOVE IO CARDS FROM SMP-4 MODULE DIAGRAM**

**Procedure**: Align the Handle with 2 no's of captive screws with two no's of standoff's on D-Sub connector on each Line card and drive the two captive screws completely to hold handle with the line card for pulling the cards assembly out from the module as shown above.

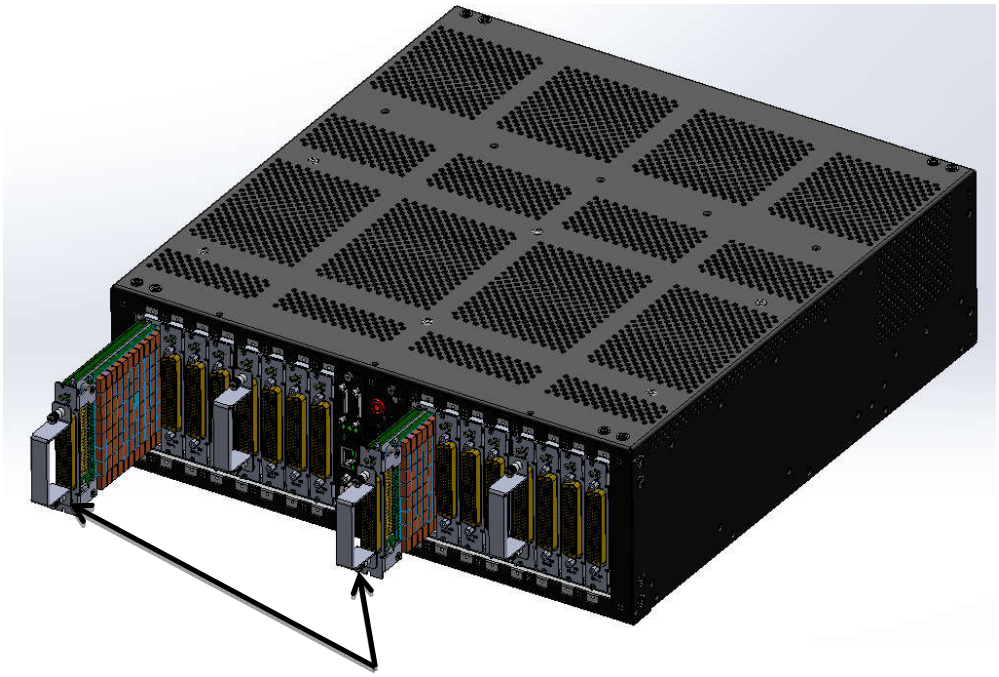



**FIGURE 4-89: MULTIPLE SMP4 MODULE IN EX1268A CHASSIS DIAGRAM**

## SMP FIRMWARE UPDATE PROCEDURE

SMP card is a high density matrix switch card suitable for ex1200 platform. Though it is switch cards, the card firmware has to be upgraded with new SMP image so that the carrier card will get detected in the ex12x7/ex12x8/ex12x9 or ex12x7A/ex12x8A/ex12x9A chassis. This firmware image is exclusively built for 8442 plugin cards connected in the carrier. The detection of carrier card required chassis firmware should be upgraded with the latest release image and then followed by upgrading the SMP card image connected in the carrier of that chassis.

Note: The user has to use the existing switch cards images for all other switch cards. Kindly refer the below screenshot for chassis & card upgrade image of EX1200 SMP.

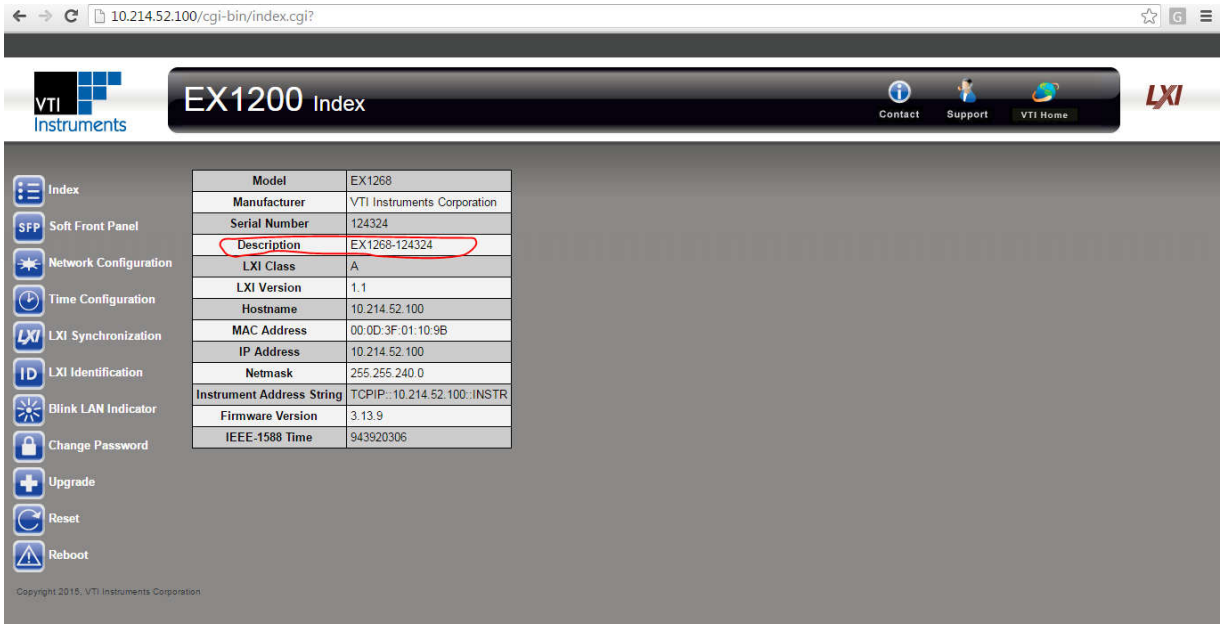



**FIGURE 4-90: IDENTIFICATION OF EX1268A CHASSIS DIAGRAM**

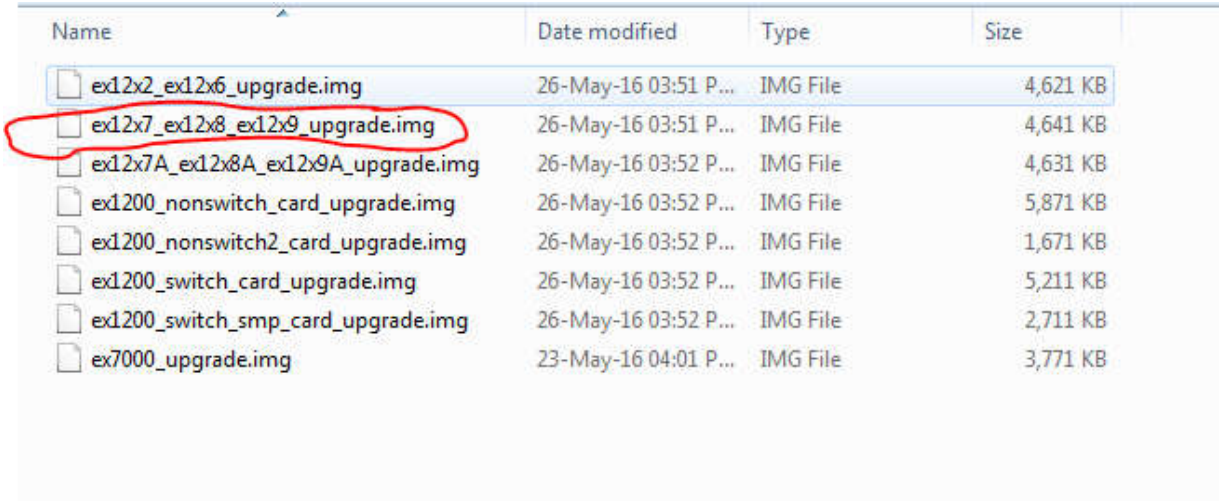



**FIGURE 4-91: FIRMWARE IMAGE FOR EX1268A CHASSIS DIAGRAM**

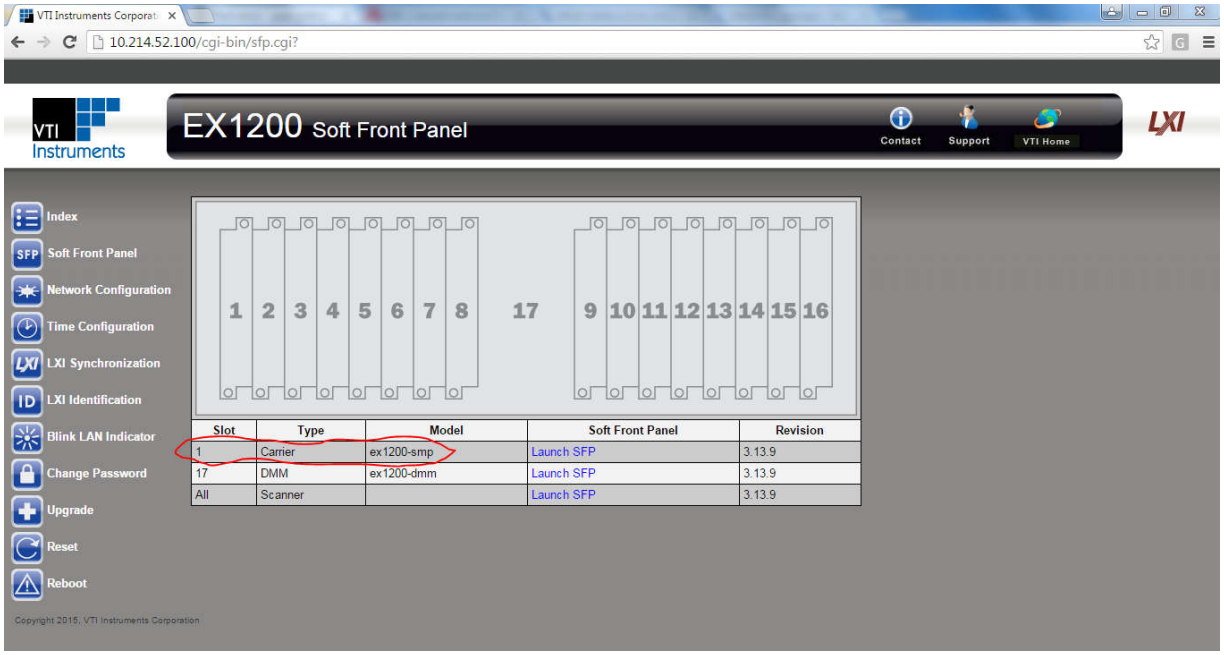



FIGURE 4-92: CARRIER SMP4 MODULE DETECTED IN EX1268A CHASSIS DIAGRAM

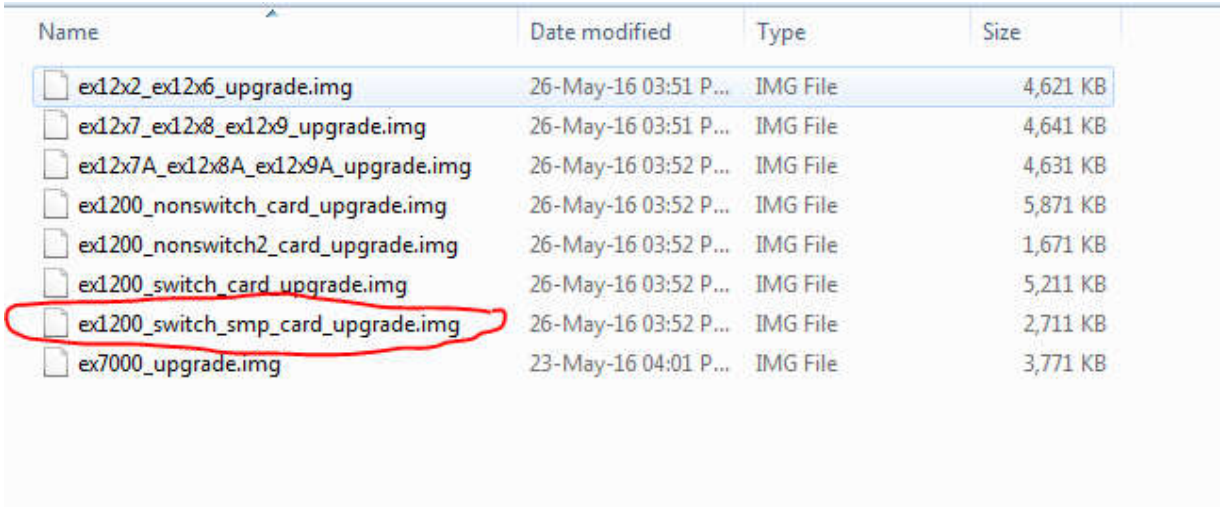



FIGURE 4-93: IO CARDS UPGRADE IMAGE FOR CARRIER SLOTS DIAGRAM

# APPENDIX A

# POWER CONSUMPTION AND WEIGHT

## REFERENCE TABLES

The following reference table provides power consumption and weight information for the EX1200 series card. The EX1200 mainframe power specifications are also provided to assist in determining available power.

| POWER SPECIFICATIONS | | | |
|---|---|---|---|
| **AVAILABLE POWER** | | | |
| **EX1202/06/62/66** | 120 W | | |
| **EX1208/68*** | 120 W per segment | | |

**The EX12x8 mainframe is powered by four power supplies and each power supply is used for a finite number of mainframe slots. For more information, see* Appendix B *of the* EX1200 Series User's Manual.

| **MAXIMUM CURRENT PER RAIL[1,2]** | **3.3 V** | **5 V** | **24 V** |
|---|---|---|---|
| **EX1202/EX1206** | 6.00 A | 13.420 A | 3.320 A |
| **EX1262/EX1266** | 6.00 A | 13.410 A | 3.074 A |
| **EX1208/68 (Slots 1 – 5)** | 14.99 A | 13.582 A | 2.950 A |
| **EX1208/68 (Slots 6 – 10)** | 14.99 A | 13.362 A | 2.950 A |
| **EX1208/68(Slots 11 – 16)** | 14.99 A | 13.355 A | 2.950 A |

*Note[1]: For more information on calculating power consumption, please refer to the* Power Consumption discussion *in* Appendix B *of the* EX1200 Series User's Manual.
*Note[2]: These values indicate the maximum current provided by the power supply. This value is limited by the carrying capacity for that rail. See the* Maximum Current Carrying Capacity per Slot *specification of the* EX1200 Series User's Manual *for more information.*

| Switch Module | +3.3 V | +5 V | +24 V | Weight lbs (kg) | Notes |
|---|---|---|---|---|---|
| **EX1200-2001** | 0.131 A | 0.0037 A* | 0 A | 1.47 (0.67) | *Add 75 mA per relay closure on 5 V |
| **EX1200-2002** | 0.131 A | 0.0037 A* | 0 A | 0.49 (0.23) | *Add 75 mA per relay closure on 5 V |
| **EX1200-2007A** | 0.135 A | 0.0041 A* | 0 A | 1.05 (0.48) | *Add 40 mA per relay closure on 5 V |
| **EX1200-2008H** | 0.140 A | 0.005 A* | 0 A | 0.76 (0.35) | *Add 17 mA per relay closure on 5 V |
| **EX1200-3001** | 0.135 A | 0.0041 A* | 0 A | 1.01 (0.46) | *Add 26 mA per relay closure on 5 V |
| **EX1200-3048** | 0.129 A | 0.0041 A* | 0 A | 0.39 (0.18) | *Add 23 mA per relay closure on 5 V |
| **EX1200-3048S** | 0.131 A | 0.0041 A | 0 A | 0.28 (0.13) | N/A |
| **EX1200-3072** | 0.129 A | 0.0041 A* | 0 A | 0.35 (0.16) | *Add 23 mA per relay closure on 5 V |
| **EX1200-3096** | 0.140 A | 0.005 A* | 0 A | 0.83 (0.38) | *Add 28 mA per relay closure on 5 V |
| **EX1200-3164** | 0.129 A | 0.0041 A* | 0 A | 0.44 (0.20) | *Add 23 mA per relay closure on 5 V |
| **EX1200-4003** | 0.137 A | 0.0040 A* | 0 A | 0.40 (0.18) | *Add 25 mA per relay closure on 5 V |
| **EX1200-4128** | 0.129 A | 0.0041 A* | 0 A | 0.69 (0.32) | *Add 28 mA per relay closure on 5 V |
| **EX1200-4260** | 0.014 A | 0.005 A* | 0 A | Unavailable | *Add 28 mA per relay closure on 5 V |
| **EX1200-4264** | 0.014 A | 0.005 A* | 0 A | Unavailable | *Add 28 mA per relay closure on 5 V |
| **EX1200-5001** | 0.129 A | 0.0041 A* | 0 A | 0.41 (0.19) | *Add 23 mA per relay closure on 5 V |
| **EX1200-5002** | 0.129 A | 0.0041 A* | 0 A | 0.33 (0.15) | *Add 23 mA per relay closure on 5 V |
| **EX1200-5006** | 0.140 A | 0.005 A* | 0 A | 0.79 (0.36) | *Add 28 mA per relay closure on 5 V |
| **EX1200-6101** | 0.140 A | 0.005 A* | 0 A | 0.93 (0.42) | *Add 28 mA per relay closure on 5 V |
| **EX1200-6111** | 0.140 A | 0.005 A* | 0 A | 0.74 (0.34) | *Add 28 mA per relay closure on 5 V |
| **EX1200-6216** | 0.129 A | 0.0041 A* | 0 A | 0.90 (0.41) | *Add 28 mA per relay closure on 5 V |
| **EX1200-6216HV** | 0.140 A | 0.005 A* | 0 A | 0.94 (0.43) | *Add 67 mA per relay closure on 5 V |
| **EX1200-7100** | 0.131 A | 0.0037 A | 0 A | 0.63 (0.29) | Values for carrier only |
| **7102 plug-in** | 0.131 A | 0.0037 A | 0.005A* | 0.25 (0.12) | *Add 140 mA per relay closure on 24 V |

| Switch Module | +3.3 V | +5 V | +24 V | Weight lbs (kg) | Notes |
|---|---|---|---|---|---|
| **7104 plug-in** | 0.131 A | 0.0037 A | 0.005A* | 0.25 (0.12) | *Add 140 mA per relay closure on 24 V |
| **7106 plug-in** | 0.131 A | 0.0037 A | 0.005A* | 0.25 (0.12) | *Add 140 mA per relay closure on 24 V |
| **7122 plug-in** | 0.131 A | 0.0037 A | 0.005A* | 0.25 (0.12) | *Add 280 mA per relay closure on 24 V |

# 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 EX1200 series switch cards.

### *26-pin Connector*

These accessories should be used with the EX1200-6101, EX1200-6102, EX1200-6111, and EX1200-6216, and EX1200-6216HV.

| ACCESSORIES | |
|---|---|
| **MATING CONNECTOR** | |
| **Description** | 26-pin connector housing with strain relief (2 required) |
| **VTI Part Number** | 70-0150-000R |
| **Manufacturer/Part Number** | TE connectivity / 201359-1 (connector) and 201845-1 (strain relief) |
| **FERRULE KIT** | |
| **Description** | 10-pin/ferrule kit (RG 316 50 Ω) |
| **VTI Part Number** | 70-0149-000R |
| **Manufacturer/Part Number** | TE connectivity / 1-332056-0 (ferrule) and 226537-1 (contact) |
| **Description** | 10-pin/ferrule kit (RG 178 50 Ω) |
| **VTI Part Number** | 70-0149-001R |
| **Manufacturer/Part Number** | TE connectivity / 1-332057-0 (ferrule) and 226537-2 (contact) |
| **CRIMP TOOL (FOR RG316 COAX)** | |
| **Description** | Crimp tool, coax RG316 (50 Ω) |
| **VTI Part Number** | 46-0018-001R |
| **Manufacturer/Part Number** | TE connectivity / 354940-1(Crimp tool), 91911-3(Die) |
| **CRIMP TOOL (FOR RG178 COAX)** | |
| **Description** | Crimp tool, coax RG178 (50 Ω) |
| **VTI Part Number** | 46-0018-000 |
| **Manufacturer/Part Number** | TE connectivity / 69656-2 |
| **EXTRACTION TOOL** | |
| **Description** | Tool, pin extractor, size 16 contact, AMP M series |
| **VTI Part Number** | 46-0021-000 |
| **Manufacturer/Part Number** | TE connectivity / 305183 |

These accessories should be used with the EX1200-2001 and EX1200-2002.

| ACCESSORIES | |
|---|---|
| **CONNECTOR KIT** | |
| **Description** | Connector kit (includes 1 each connector and backshell plus 44 pins) |
| **VTI Part Number** | 70-0190-001R |
| **CONNECTOR INFORMATION** | |
| **Description** | Connector, power, female with backshell, insulated, 41 PLC |
| **VTI Part Number** | 27-0087-041 |
| **Manufacturer/Part Number** | Positronic / GMCT41F0E100J0/AA |
| **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** | Positronic / FC114N2/AA |
| **CRIMP TOOL INFORMATION** | |
| **Description** | Crimp tool and turret head |
| **VTI Part Number** | 46-0012-000 |
| **Manufacturer/Part Number** | Positronic / 9501-0-0-0 and 9502-1-0-0 |
| **INSERTION TOOL** | |
| **Description** | Tool, contact insertion, size 16 contact, AMP M series |
| **VTI Part Number** | 46-0014-000 |
| **Manufacturer/Part Number** | Positronic / 9099-0-0-0 |
| **EXTRACTION TOOL** | |
| **Description** | Tool, pin extractor, power/coaxial |
| **VTI Part Number** | 46-0015-000 |
| **Manufacturer/Part Number** | Positronic / 9081-0-0-0 |
| **UNTERMINATED CABLE ASSEMBLY** | |
| **Description** | 41-pin, unterminated cable assembly, 3 ft |
| **VTI Part Number** | 70-0363-506R |

### *104-pin Connector*

These accessories should be used with the EX1200-3048, EX1200-3048S, EX1200-4003, and EX1200-5002.

| ACCESSORIES | |
|---|---|
| **MATING CONNECTOR KIT** | |
| **Description** | 104-pin HD D-sub mating connector and backshell, with 3 ft unterminated 24 AWG wire |
| **VTI Part Number** | 70-0363-501R |
| **MATING CONNECTOR** | |
| **Description** | 104-pin HD D-sub mating connector with hood and pins, fixed contacts (no crimp tool required) |
| **VTI Part Number** | 27-0389-104 |
| **Manufacturer/Part Number** | Positronic / ODD104M210GEX/AA |
| **MATING CONNECTOR** | |
| **Description** | 104-pin HD D-sub mating connector, backshell and pins, crimp style |
| **VTI Part Number** | 27-0390-104 |
| **Manufacturer/Part Number** | Positronic / ODD104M10Y0X/AA |
| **CRIMP TOOL** | |
| **Description** | Crimp tooling, includes handle and positioner, 22 – 28 AWG |
| **VTI Part Number** | 70-0297-001R |
| **Manufacturer/Part Number** | Positronic / 9507-0-0-0 (tool) and 9502-4-0-0 (positioner) |
| **UNTERMINATED CABLE ASSEMBLY** | |
| **Description** | 104-pin, unterminated cable assembly, 3 ft |
| **VTI Part Number** | 70-0363-501R |
| **TERMINAL BLOCK (EX1200-3048, EX1200-3048S, AND EX1200-4003 ONLY)** | |
| **Description** | EX1200-TB104, differential module |
| **VTI Part Number** | 70-0367-001R |
| **TERMINAL BLOCK (EX1200-5002 , EX1200-08442)** | |
| **Description** | EX1200-TB104SE, single-ended module |
| **VTI Part Number** | 70-0367-003R |
| **HANDLE FOR REMOVAL OF LINE CARDS FROM EX1200 SMP-4 MODULE** | |
| **Description** | Handle for Removal of Line cards from EX1200 SMP-4 Module |
| **VTI Part Number** | 41-0618-002R |

These accessories should be used with the EX1200-2007A, EX1200-2008H, EX1200-3001, EX1200-3001DS, EX1200-3072, EX1200-3164, EX1200-4128, EX1200-4260, EX1200-4264, EX1200-5001, and EX1200-5006. Because the EX1200-2007A and EX1200-2008H are 160-pin connectors that have been modified to have only 80 pins, quantities should be adjusted accordingly.

| Accessories | |
|---|---|
| **Strain Relief Bracket Kit (Includes Connector)** | |
| **VTI Part Number** | 70-0363-504R (recommended accessory) |
| **Strain Relief Bracket Kit (Without Connector)** | |
| **VTI Part Number** | 70-0363-503R |
| **Crimp Pin** | |
| **VTI Part Number** | 52-0109-000R (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 |
| **VTI Part Number** | 70-0363-505R |
| **Unterminated Cable Assembly (All 80-pin Connectors – High-Voltage)** | |
| **Description** | 160-pin to 80-pin, unterminated cable assembly, 3 ft |
| **VTI Part Number** | 70-0363-507R |
| **Terminal Block Information (EX1200-3072 Only)** | |
| **Description** | EX1200-TB160-1, differential module |
| **VTI Part Number** | 70-0367-002R |
| **Terminal Block Information (EX1200-3164 Only)** | |
| **Description** | EX1200-TB160-2, differential module |
| **VTI Part Number** | 70-0367-008R |
| **Terminal Block Information (EX1200-3001 Only)** | |
| **Description** | EX1200-TB160-3, differential module |
| **VTI Part Number** | 70-0367-009R |
| **Terminal Block Information (EX1200-4128, EX1200-5001, EX1200-7500 Only)** | |
| **Description** | EX1200-TB160SE, single-ended module |
| **VTI Part Number** | 70-0367-005R |

### *200-pin Connector*

These accessories should be used with the EX1200-3096.

| Accessories | |
|---|---|
| **Strain Relief Bracket** | |
| **VTI Part Number** | 41-0472-034R |
| **Mating Connector** | |
| **Description** | 200-pin mating connector |
| **VTI Part Number** | 27-0388-200 |
| **Manufacturer/Part Number** | Molex / 0717193000 |
| **Crimp Pin** | |
| **VTI Part Number** | 27-0391-050 |
| **Manufacturer/Part Number** | Molex / 0717154002 |
| **Terminal Block** | |
| **Description** | EX1200-TB200, differential module |
| **VTI Part Number** | 70-0367-004R |

### *50-pin Connector*

These accessories should be used with the EX1200-5004.

| ACCESSORIES | |
|---|---|
| **CONNECTOR KIT** | |
| **Description** | Connector kit (includes two 50-pin connector, two backshells, and 104 crimp pins) |
| **VTI Part Number** | 52-0195-000R |
| **MATING CONNECTOR** | |
| **Description** | 50-pin mating connector and backshells – two required |
| **VTI Part Number** | 27-0026-050 |
| **Manufacturer/Part Number** | Positronic / SGMC50MOE1OOJO/AA |
| **HAND CRIMP TOOL** | |
| **VTI Part Number** | 46-0024-000 |
| **Manufacturer/Part Number** | Positronic / 9507-0-0-0 |
| **CONTACT INSERTION TOOL** | |
| **VTI Part Number** | 46-0037-000 |
| **Manufacturer/Part Number** | Positronic / 9099-1-0-0 |
| **CONTACT EXTRACTION TOOL** | |
| **VTI Part Number** | 46-0036-000 |
| **Manufacturer/Part Number** | Positronic / 9081-1-0-0 |
| **TURRET HEAD POSITIONER TOOL** | |
| **VTI Part Number** | 46-0025-000 |
| **Manufacturer/Part Number** | Positronic / 9502-12-0-0 |