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Series 3700A Switch and Control Cards

Reference Manual

3700AS-909-01 Rev. C / July 2016

3700AS-909-01

A Greater Measure of Confidence

KEITHLEY
A Tektronix Company

Series 3700A

Switch and Control Cards

Reference Manual

Cleveland, Ohio, U.S.A.

Document number: 3700AS-909-01 Rev. C / July 2016

KEITHLEY
A Tektronix Company

Safety precautions

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley Instruments products are designed for use with electrical signals that are measurement, control, and data I/O connections, with low transient overvoltages, and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II (as referenced in IEC 60664) connections require protection for high transient overvoltages often associated with local AC mains connections. Certain Keithley measuring instruments may be connected to mains. These instruments will be marked as category II or higher.

Unless explicitly allowed in the specifications, operating manual, and instrument labels, do not connect any instrument to mains.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

For safety, instruments and accessories must be used in accordance with the operating instructions. If the instruments or accessories are used in a manner not specified in the operating instructions, the protection provided by the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories. Maximum signal levels are defined in the specifications and operating information and shown on the instrument panels, test fixture panels, and switching cards.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as protective earth (safety ground) connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a  screw is present, connect it to protective earth (safety ground) using the wire recommended in the user documentation.

The  symbol on an instrument means caution, risk of danger. The user must refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

The  symbol on an instrument means caution, risk of electric shock. Use standard safety precautions to avoid personal contact with these voltages.

The  symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The  symbol indicates a connection terminal to the equipment frame.

If this  symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The **WARNING** heading in the user documentation explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits — including the power transformer, test leads, and input jacks — must be purchased from Keithley Instruments. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. The detachable mains power cord provided with the instrument may only be replaced with a similarly rated power cord. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

Unless otherwise noted in product-specific literature, Keithley instruments are designed to operate indoors only, in the following environment: Altitude at or below 2,000 m (6,562 ft); temperature 0 °C to 50 °C (32 °F to 122 °F) ; and pollution degree 1 or 2.

To clean an instrument, use a damp cloth or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Safety precaution revision as of March 2016.

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Section 1

Introduction

In this section:

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Contact information

If you have any questions after you review the information in this documentation, please contact your local Keithley Instruments office, sales partner, or distributor. You can also call the corporate headquarters of Keithley Instruments (toll-free inside the U.S. and Canada only) at 1-800-935-5595, or from outside the U.S. at +1-440-248-0400. For worldwide contact numbers, visit the Keithley Instruments website (*http://www.tek.com/keithley*).

Safety precautions for connections

⚠ WARNING

Connection information for switching cards is intended for qualified service personnel. Do not attempt to connect DUT or external circuitry to a switching card unless qualified to do so.

To prevent electric shock that could result in serious injury or death, comply with these safety precautions:

Before making or breaking any connections to the switching card, make sure the Series 3700A is turned off and power is removed from all external circuitry.

Do not connect signals that will exceed the maximum specifications of any installed switching card.

If both the rear analog backplane connector of the Series 3700A and the switching card terminals are connected at the same time, the test lead insulation must be rated to the highest voltage that is connected. For example, if 300V is connected to the analog backplane connector, the test lead insulation for the switching card must also be rated for 300V.

Dangerous arcs of an explosive nature in a high-energy circuit can cause severe personal injury or death if contacted. If the multimeter is connected to a high-energy circuit when set to a current range, low resistance range, or any other low-impedance range, the circuit is virtually shorted. Dangerous arcing can result (even when the multimeter is set to a voltage range) if the minimum voltage spacing is reduced in the external connections. For details about how to safely make high energy measurements, see High-energy circuit safety precautions in the* Series 3700A Reference Manual*. As described in the International Electrotechnical Commission (IEC) Standard IEC 664, the Series 3700A is Installation Category I and must not be connected to mains.

Series 3700A documentation

Complete documentation for the Series 3700A System Switch/Multimeter instruments is available for download from the Keithley Downloads web page (*http://www.tek.com/downloads*). The following is a list of available documentation for the Series 3700A.

Document number	Document name	Content description
3700AS-903-01	Series 3700A System Switch/Multimeter Quick Start Guide	Hardware and software requirements, switching card installation instructions, and a brief description of front-panel and remote interface operation
3700AS-900-01	Series 3700A System Switch/Multimeter User's Manual	Information about scanning, reading, writing, and controlling channels
3700AS-901-01	Series 3700A System Switch/Multimeter Reference Manual	Information about controlling the Series 3700A from a remote interface
PA-949	Series 3700A Cables and Connector Kits Installation Instructions	Information about the different cables and connector kits that are used on the Series 3700A cards.
PA-955	Series 3700A Screw Terminal Assemblies Installation Instructions	Contains handling and installation instructions for Series 3700A screw terminal assemblies
PA-1021	Model 3732 Quad 4 × 28 Reed Relay Matrix Card Connection Information	Contains card-specific safety precautions, list of features and accessories, connection information, and measurement considerations

Section 2

Series 3700A cards general operation

In this section:

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Available cards

The next table shows a list of available cards for the Series 3700A System Switch/Multimeter.

Name	Description
Model 3720 dual 1 × 30 multiplexer card (on page 4-1)	Offers two independent banks of 1 × 30 two-pole multiplexers; ideal for general purpose switching, including temperature measurements.
Model 3721 dual 1 × 20 multiplexer card (on page 5-1)	Offers two independent banks of 1 × 20 two-pole multiplexers; ideal for general purpose switching, including temperature measurements.
Model 3722 dual 1 × 48 high density multiplexer card (on page 6-1)	Offers two independent banks of 1 × 48 two-pole multiplexers; ideal for applications that require a high channel count.
Model 3723 dual 1 × 30 high speed reed relay multiplexer card (on page 7-1)	Offers two independent banks of high speed 1 × 30 two-pole multiplexers; ideal for high speed scanning applications.
Model 3724 dual 1 × 30 FET multiplexer card (on page 8-1)	Provides two independent banks of solid-state relays arranged as 1 × 30 two-pole multiplexers; ideal for high reliability, high speed multipoint measurement applications, including temperature.
Model 3730 6 × 16 high density matrix card (on page 9-1)	Two-pole, 6 × 16 column matrix card; can connect up to six differential instrument channels to any combination of 16 DUTs.
Model 3731 6 × 16 high speed reed relay matrix card (on page 10-1)	Two-pole, 6 × 16 column reed relay matrix card; using high speed reed relays with actuation times of 0.5ms, this card meets the requirements of demanding throughput applications while offering the additional benefit of long life, exceeding one billion operations.
Model 3732 quad 4 × 28 ultra-high density reed relay matrix card (on page 11-1)	Ultra-high density matrix card; comprised of four banks, each with 4 × 28 columns or reed relays; provides 448 single-pole crosspoints for maximum connection versatility in high channel count applications.
Model 3740 general purpose card (on page 12-1)	Offers 28 general-purpose form C channels; ideal for routing power or other control devices.
Model 3750 multifunction control card (on page 13-1)	Offers control and monitoring of your automated test system; 40 digital I/O bits, four counters, and two analog outputs make it well-suited for a wide variety of system control applications.

Card installation

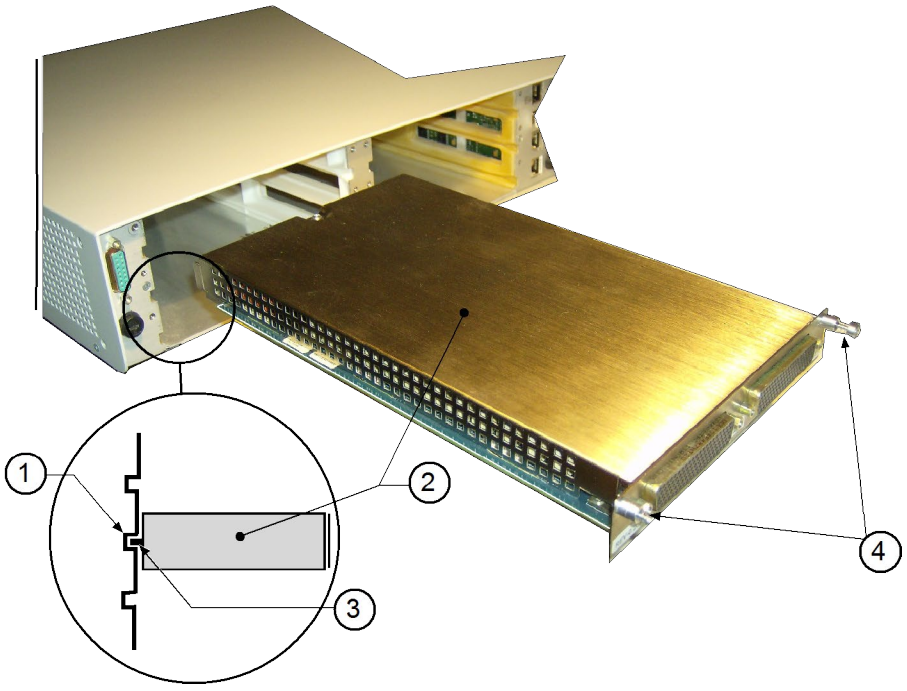
⚠ WARNING

Slot covers must be installed on unused slots to prevent personal contact with high voltage circuits.

Perform the following steps to install a switching card into the instrument mainframe:

1. Turn the instrument off and disconnect the power line cord and any other cables connected to the rear panel.
2. Position the instrument so that you are facing the rear panel.
3. Remove the slot cover plate from the desired mainframe slot. Retain the plate and screws for future use.
4. With the top cover of the switching card facing up, align the card's edge into the slot's card guide and slide in the card. For the last ¼ inch or so, press in firmly to mate the card connector to the mainframe connector.
5. On each side of the card, there is a mounting screw. Tighten these two screws to secure the card to the mainframe. Do not overtighten.
6. Reconnect the power line cable and any other cables to the rear panel.
7. Press the **SLOT** key to see the model numbers, description, and the firmware revision of the installed switching cards, along with the mainframe firmware and DMM (if present).

Figure 1: Typical module installation



Item	Description
1	Card guide (part of Series 3700A)
2	Card
3	Card edge (part of card)
4	Mounting screw (part of card)

Verifying card installation

To verify that the card was properly installed:

1. If the instrument is controlled remotely (REM is displayed), press **EXIT** to switch control to local.
2. Press **SLOT**. The name and firmware version of the instrument is displayed.
3. Press **SLOT** again. The name and firmware version of the card in slot 1 is displayed.
4. If you have more than one card installed, continue to press **SLOT** until the slot you just installed is displayed.
5. Confirm the name and firmware version.
6. Press **EXIT** to return to the operating display.

Connection safety

⚠ WARNING

Connection information for switching cards is intended for qualified service personnel. Do not attempt to connect DUT or external circuitry to a switching card unless qualified to do so.

To prevent electric shock that could result in serious injury or death, comply with these safety precautions:

Before making or breaking any connections to the switching card, make sure the instrument is turned off and power is removed from all external circuitry.

Do not connect signals that will exceed the maximum specifications of any installed switching card.

If both the rear analog backplane connector of the instrument and the switching card terminals are connected at the same time, the test lead insulation must be rated to the highest voltage that is connected. For example, if 300V is connected to the analog backplane connector, the test lead insulation for the switching card must also be rated for 300V.

Dangerous arcs of an explosive nature in a high-energy circuit can cause severe personal injury or death. If the multimeter is connected to a high-energy circuit when set to a current range, low resistance range, or any other low impedance range, the circuit is virtually shorted.

Dangerous arcing can result (even when the multimeter is set to a voltage range) if the minimum voltage spacing is reduced in the external connections. For details about how to safely make high-energy measurements, see High-energy circuit safety precautions.

As described in the International Electrotechnical Commission (IEC) Standard IEC 664, the instrument is Installation Category I and must not be connected to mains.

Pseudocards

You can perform open, close, and scan operations and configure your system without having an actual switching card installed in your instrument. Using the remote interface, you can assign a pseudocard to an empty switching card slot, allowing the instrument to operate as if a switching card were installed.

A pseudocard cannot be configured from the front panel. However, once the remote configuration is complete, you can take the instrument out of remote mode and use the front panel. Press the **EXIT** key to take the instrument out of remote mode.

When the instrument is turned off, the pseudocard is no longer assigned to the slot.

NOTE

A saved setup or created configuration script retains the model number of the card installed in each slot. The model number of a pseudocard is the same as the model number of an actual card (except for Model 3732 cards; see the "Pseudocard support for the Model 3732" topic in the *Series 3700 Switch and Control Cards Reference Manual* for details). This allows a saved setup or created configuration script to be recalled if the installed card (or pseudocard) matches the model number for the slot in the saved setup or created configuration script.

Installed pseudocards

A pseudocard can be "installed" in any empty slot. With the 3720 pseudocard "installed," the instrument operates as if a Model 3720 Thermocouple MUX card is installed in the slot. This allows you to configure a scan and exercise its operation before the switching module is installed in the Series 3700A. Use the following commands to install Series 3700A pseudocards in empty slots:

For no pseudocard selection (use to remove an existing pseudocard):

```
slot.PSEUDO_NONE or 0
```

Model 3720 for Dual 1 × 30 multiplexer card simulation:

```
slot.PSEUDO_3720 or 3720
```

Model 3721 for Dual 1 × 20 multiplexer card simulation:

```
slot.PSEUDO_3721 or 3721
```

Model 3722 for Dual 1 × 48 multiplexer card simulation:

```
slot.PSEUDO_3722 or 3722
```

Model 3723 Dual 1 × 30 reed multiplexer card simulation:

```
slot.PSEUDO_3723 or 3723
```

Model 3724 Dual 1 × 30 FET multiplexer card simulation:

```
slot.PSEUDO_3724 or 3724
```

Model 3730 6 × 16 high-density matrix card simulation:

```
slot.PSEUDO_3730 or 3730
```

Model 3740 32-channel isolated switch card:

```
slot.PSEUDO_3740 or 3740
```

Model 3750 multifunction I/O card simulation:

```
slot.PSEUDO_3750 or 3750
```

For example, to set the attribute to "install" the Model 3720 pseudocard in slot 6:

```
slot[6].pseudocard = slot.PSEUDO_3720
```

When queried, the return value has "Pseudo" before the card description. For example:

```
print(slot[3].idn) → 3720,Pseudo Dual 1x30 Multiplexer,00.00a
```

NOTE

The revision level of a pseudocard is always returned as 00.00 a.

Query the slot[X] attributes to determine the capabilities of the installed switching modules. For example, send the following query to determine if slot 1 supports common-side 4-wire Ω channels:

```
CommonSideOhms1 = slot[1].commonsideohms
```

Section 3

Series 3700A cards power usage

In this section:

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Maximum power usage with Series 3700A cards

The Series 3700A series offers a growing family of high-density and general-purpose plug-in cards that accommodates a broad range of signals at very competitive pricing. The Series 3700A supports applications as diverse as design validation, accelerated stress testing, data acquisition, and functional testing.

Plug-in cards are capable of switching many relays at once, which can take a substantial amount of system power. There is a limited amount of system power available for switching relays. Therefore, use care in order that Series 3700A maximum available power is not exceeded. The maximum power available is limited on a per-bank basis as follows:

Bank 1	**Bank 2**
Slot 1	Slot 4
Slot 2	Slot 5
Slot 3	Slot 6
12300 mW (max)	12300 mW (max)

Based on the previous table, the total power available for slots 1, 2, and 3 is 12,300 mW (12.3 W). Similarly, the total power available for slots 4, 5, and 6 is 12.3 W. Attempting to exceed these power levels results in the system performing as many of the operations as possible until these power limits are reached. An error message is then created and the remaining operations are not performed.

NOTE

There is also a maximum slot power limit of 10,500 mW. However, the maximum is rarely a consideration.

Power budgeting and calculation

Individual relay power consumption generally depends on the type of relay. Latching-type relays consume power only briefly in order to open or close. These types of relays are not of concern for power budgeting purposes. Nonlatching types of relays continuously consume power in order to maintain their state. These types of relays must be considered for power budgeting purposes.

Another power consideration is the fact that each plug-in card uses system power in order to operate. This continuous power draw is known as quiescent power. Quiescent power directly takes away from the power that is available to operate relays. So it must also be taken into account when budgeting for power consumption.

The following table shows the power consumption of channel and backplane relays for various Series 3700A plug-in cards. The quiescent power is also shown. For latching-type relays NA is used.

Model	Quiescent power (milliwatts)	Channel relay power consumption (milliwatts) each	Backplane relay power consumption (milliwatts) each
3720	975	NA	100
3721	1350	NA	100
3722	475	NA	100
3723	700	100 (2-Pole)	100
		50 (1-Pole)	100
3724	1150	20	100
3730	780	NA	100
3731	780	67	100
3732	780	17	100
3740	1000	NA (independent)	100
		200 (high current)	100
3750	3300 **NOTE**: The 3300 is reduced when power is disabled to each analog output channel (820 each) or disabled to the totalizers (730 for all 4; cannot be individually disabled) See Example 5 (on page 3-6), Example 6 (on page 3-7), and Example 7 (on page 3-7).	0 each (digital input channel) 365 each (digital output channel) 470 each (analog output) 0 each (totalizers)	

To determine if a given quantity of relay operations can be performed, the previous table must be used to calculate the total power required by applying the example equations:

$$P_{TS} = P_Q + (N_{CC} \times P_{CR}) + (N_{BC} \times P_{BR})$$

Where:

P_{TS} = Total Slot Power

P_Q = Quiescent power

N_{CC} = Number of closed channels

N_{BC} = Number of closed backplane channels

P_{CR} = Power per channel relay

P_{BR} = Power per backplane relay

$$\text{Total Bank \#1 Power} = \text{Slot 1 } P_{TS} + \text{Slot 2 } P_{TS} + \text{Slot 3 } P_{TS}$$

$$\text{Total Bank \#2 Power} = \text{Slot 4 } P_{TS} + \text{Slot 5 } P_{TS} + \text{Slot 6 } P_{TS}$$

To check power consumption, each slot power must be computed. The slot power for slots 1 through 3 is added. Also, slot power for slots 4 through 6 are added. The results are called bank powers and should be compared with the maximum limits. Some example calculations follow.

Power budgeting examples

Example 1

This example is for a fully loaded Model 3706A-S with Model 3723 cards (all 2-pole mode).

Slot #	Card	Channel relays closed	Backplane relays closed
Slot 1	3723	30	4
Slot 2	3723	30	4
Slot 3	3723	30	4
Slot 4	3723	30	4
Slot 5	3723	30	4
Slot 6	3723	30	4

This produces the following power consumption:

Slot 1 power consumed =	700	+	30 × 100	+	4 × 100	=	4100
Slot 2 power consumed =	700	+	30 × 100	+	4 × 100	=	4100
Slot 3 power consumed =	700	+	30 × 100	+	4 × 100	=	4100
Slot 4 power consumed =	700	+	30 × 100	+	4 × 100	=	4100
Slot 5 power consumed =	700	+	30 × 100	+	4 × 100	=	4100
Slot 6 power consumed =	700	+	30 × 100	+	4 × 100	=	4100

Totals for each bank are calculated:

	Slot 1		Slot 2		Slot 3		Total
Bank #1 power consumed =	4100	+	4100	+	4100	=	12300

	Slot 4		Slot 5		Slot 6		Total
Bank #2 power consumed =	4100	+	4100	+	4100	=	12300

NOTE

Since each bank did not exceed the maximum power, the power budget is within the limits.

Example 2

This example is for a partially loaded Model 3706A with Model 3723 cards (all 1-pole mode).

Slot #	Card	Channel relays closed	Backplane relays closed
Slot 1	3723	107	1
Slot 2	3723	107	1
Slot 3	Empty	0	0
Slot 4	3723	107	1
Slot 5	3723	107	1
Slot 6	Empty	0	0

This produces the following power consumption:

Slot 1 power consumed =	700	+	107 × 50	+	1 × 100	=	6150
Slot 2 power consumed =	700	+	107 × 50	+	1 × 100	=	6150
Slot 3 power consumed =	0	+	0	+	0	=	0
Slot 4 power consumed =	700	+	107 × 50	+	1 × 100	=	6150
Slot 5 power consumed =	700	+	107 × 50	+	1 × 100	=	6150
Slot 6 power consumed =	0	+	0	+	0	=	0

Totals for each bank are calculated:

	Slot 1		Slot 2		Slot 3		Total
Bank #1 power consumed =	6150	+	6150	+	0	=	12300

	Slot 4		Slot 5		Slot 6		Total
Bank #2 power consumed =	6150	+	6150	+	0	=	12300

NOTE

Since each bank did not exceed the maximum power, the power budget is within the limits.

Example 3

This example is for a fully loaded Model 3706A-S with Model 3723 cards (all 2-pole mode).

Slot #	Card	Channel relays closed	Backplane relays closed
Slot 1	3723	60	4
Slot 2	3723	60	4
Slot 3	3723	60	4
Slot 4	3723	60	4
Slot 5	3723	60	4
Slot 6	3723	60	4

This produces the following power consumption:

Slot 1 power consumed =	700	+	60 × 100	+	4 × 100	=	7100
Slot 2 power consumed =	700	+	60 × 100	+	4 × 100	=	7100
Slot 3 power consumed =	700	+	60 × 100	+	4 × 100	=	7100
Slot 4 power consumed =	700	+	60 × 100	+	4 × 100	=	7100
Slot 5 power consumed =	700	+	60 × 100	+	4 × 100	=	7100
Slot 6 power consumed =	700	+	60 × 100	+	4 × 100	=	7100

Totals for each bank are calculated:

	Slot 1		Slot 2		Slot 3		Total
Bank #1 power consumed =	7100	+	7100	+	7100	=	21300

	Slot 4		Slot 5		Slot 6		Total
Bank #2 power consumed =	7100	+	7100	+	7100	=	21300

NOTE

Since each bank exceeded the maximum power, some operations will not be performed and an error will be generated.

Example 4

This example is for a fully loaded Model 3706A-S with a mix of cards.

Slot #	Card	Channel relays closed	Backplane relays closed
Slot 1	3720	20	2
Slot 2	3721	20	2
Slot 3	3722	15 (2-pole)	4
Slot 4	3723	25 (HI current)	2
Slot 5	3730	10	4
Slot 6	3740	2	4

This produces the following power consumption:

Slot 1 power consumed =	975	+	0	+	2 × 100	=	1175
Slot 2 power consumed =	1350	+	0	+	2 × 100	=	1550
Slot 3 power consumed =	475	+	0	+	4 × 100	=	875
Slot 4 power consumed =	700	+	25 × 100	+	2 × 100	=	3400
Slot 5 power consumed =	780	+	0	+	4 × 100	=	1180
Slot 6 power consumed =	1000	+	2 × 200	+	4 × 100	=	1800

Totals for each bank are calculated:

	Slot 1		Slot 2		Slot 3		Total
Bank #1 power consumed =	1175	+	1550	+	875	=	3600
	Slot 4		**Slot 5**		**Slot 6**		**Total**
Bank #2 power consumed =	3400	+	1180	+	1800	=	6380

NOTE

Since each bank did not exceed the maximum power, the power budget is within the limits.

Example 5

This example demonstrates how to calculate the card power of the 3750.

Setup	Power	Notes
	3300	Static power required of card under default conditions (that is, all functions enabled)
CH 1,2,3 set as INPUT	0	
CH 4 set as OUTPUT	365	
CH 5 set as OUTPUT	365	
CH 10 = V mode	470	
CH 11 = I mode	470	
Total Power	4970 mW	Since total power per bank cannot exceed 12300 mW, only two 3750 cards per bank can be populated when used in the example configuration. This leaves spare power (12300 – (4970 * 2)) for controlling relays on a third card in the bank.

Example 6

This example demonstrates how to calculate the card power of the 3750 when used only as digital outputs.

Setup	Power	Notes
CH 1 through 5 set as OUTPUT	3300	Static power required of card under default conditions (that is, all functions enabled).
	365 * 5 = 1825	
CH 6 through 9 = disabled	-730	Static power is reduced by disabling the totalizers (channels cannot be individually disabled).
CH 10 = disabled	-820	Static power is reduced by disabling analog output channel.
CH 11 = disabled	-820	Static power is reduced by disabling analog output channel.
Total Power	2755 mW	Bank power would not be exceeded if three cards per bank were used in this manner.

Example 7

This example demonstrates how to calculate the card power of the 3750 for digital inputs and two analog voltage outputs.

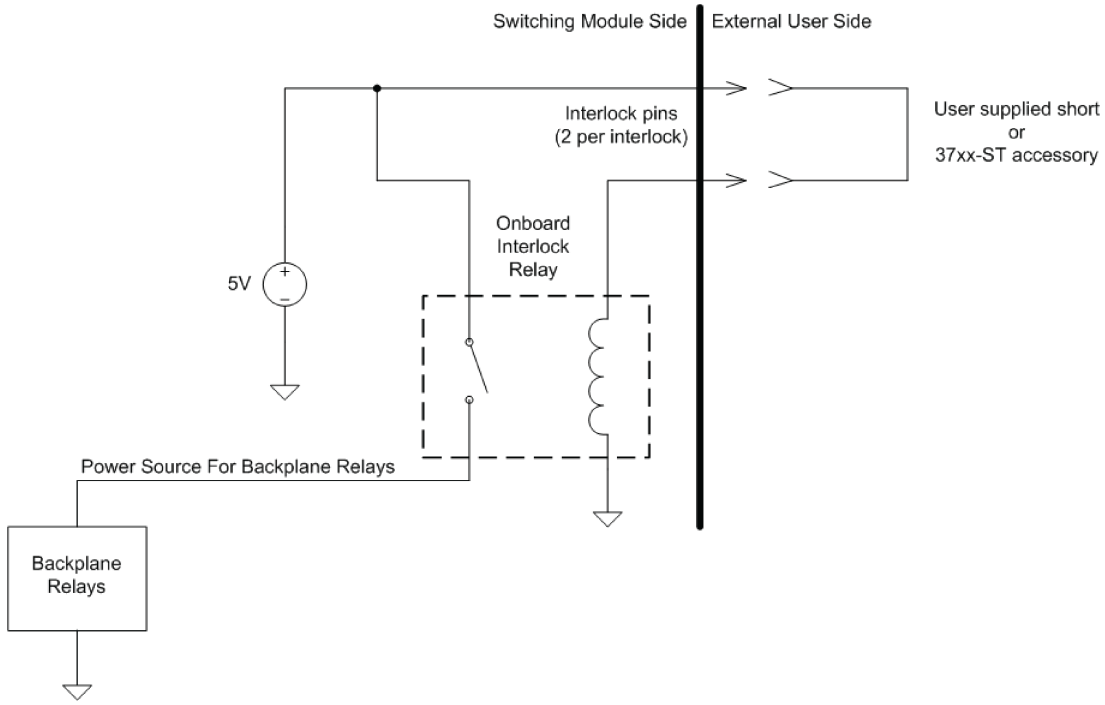
Setup	Power	Notes
CH 1 through 5 set as INPUT	3300	Static power required of card under default conditions (that is, all functions enabled).
	0	
CH 6 through 9 = disabled	-730	Static power is reduced by disabling the totalizers (channels cannot be individually disabled).
CH 10 = V mode	470	
CH 11 = V mode	470	
Total Power	3510 mW	Bank power would not be exceeded if three cards per bank were used in this manner.

Hardware interlocks

Some switching cards are capable of switching high-voltage signals. For safety reasons, hardware interlocks are provided. The hardware interlocks are present on the switching card itself and are designed to keep the switching card disconnected from the system backplane. This means that when the interlock circuit is disengaged, no measurements can be performed through a switching card. However, channel relays can continue to operate.

Below is a simplified schematic of the interlock circuit present on the applicable switching cards.

Figure 2: Simplified interlock circuit



Engaging hardware interlocks

To engage the hardware interlocks, you must provide a low-resistance path between the two applicable interlock pins as shown in the diagram. This path routes a 5 V power source to an onboard interlock relay which in turn enables power to the backplane relays. If a 37xxA-ST accessory terminal board is used, this low resistance path is provided to automatically engage the interlock circuit.

NOTE

Do not use the supplied 5 V power source for anything other than energizing the interlock relay. It is not designed for external circuit use.

Be sure to provide a low resistance path between the interlock pins for reliable operation. Significant resistance if present can cause the interlock circuit to fail to engage.

Interlock status

Some switching cards have more than one interlock. At any time, the current status of each interlock can be determined by using the appropriate `slot[X].interlock.state remote` ICL command. When the interlock status reports engaged, associated backplane relays are allowed to be energized. When the interlock status reports disengaged, associated backplane relays are prevented from being energized.

Refer to the *Series 3700A Reference Manual* (part number: 3700AS-901-01) for more information on interlock related commands and details.

Interlock pin numbers

The following table shows the interlock pin numbers for all applicable switching cards.

Model	Interlock circuit	Interlock pins	Backplane relays affected	Other relays affected
3720	Multiplexer #1	76, 78	n911 through n916	
	Multiplexer #2	76, 78	n921 through n926	
3721	Multiplexer #1, Amps, DMM	33, 50	n911 through n917	n041, n042 (Amps), n928 (DMM HI / SHI)
	Multiplexer #2	1, 34	n921 through n927	
3722	No Interlocks Present	-	-	
3723	Multiplexer #1	76, 78	n911 through n916	
	Multiplexer #2	76, 78	n921 through n926	
3724	Multiplexer #1	76, 78	n911 through n916	
	Multiplexer #2	76, 78	n921 through n926	
3730	Matrix #1	48, 50	n911 through n916	
3731	Matrix #1	38, 50	n911 through n916	
3732	Bank 1, 2, 3, 4	J-3-76, J3-78	s0911 through s0918	
3740	Independent Switch Bank #1	48, 50	n911 through n916	
3750	No interlocks present			

⚠ WARNING

Take special care not to inadvertently wire high-voltage analog signals to the interlock pins. Instrument damage or loss of functionality can occur.

Section 4

Model 3720 multiplexer card

In this section:

Model 3720 dual 1 × 30 multiplexer card 4-1

Model 3720 dual 1 × 30 multiplexer card

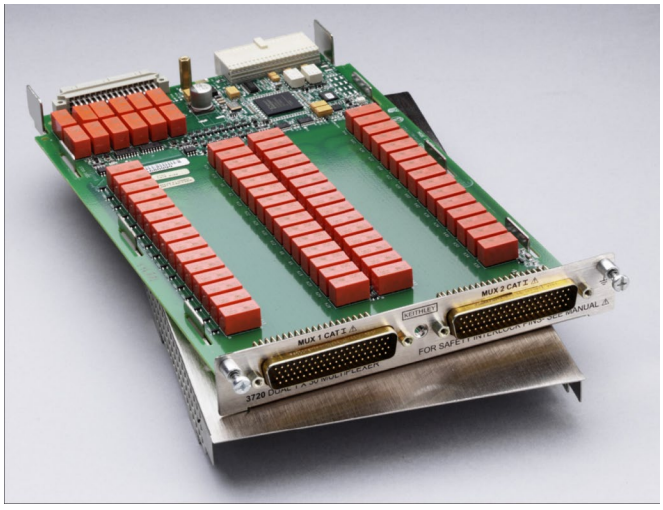
Introduction to the Model 3720 dual 1 × 30 multiplexer card

The Model 3720 offers two independent banks of 1×30 two-pole multiplexers (see next figure). It is ideal for general-purpose switching, including temperature measurements. The two banks can automatically be connected to the Series 3700A mainframe backplane and optional DMM through the analog backplane connection relays. This connection allows the mainframe to reconfigure the card to a single 1×60 two-pole multiplexer or to enable card-to-card expansion for even larger configurations.

Other features of the Model 3720 include its ability to be reconfigured to coordinated four-pole operation for additional measurement flexibility. Furthermore, the Model 3720 supports thermocouple-type temperature measurements with the Model 3720-ST (screw terminal) accessory providing automatic cold junction compensation (CJC).

The Model 3720 uses two 78-pin male D-sub connectors for signal connections. For screw terminal or automatic CJC, use the detachable Model 3720-ST accessory.

Figure 3: Model 3720



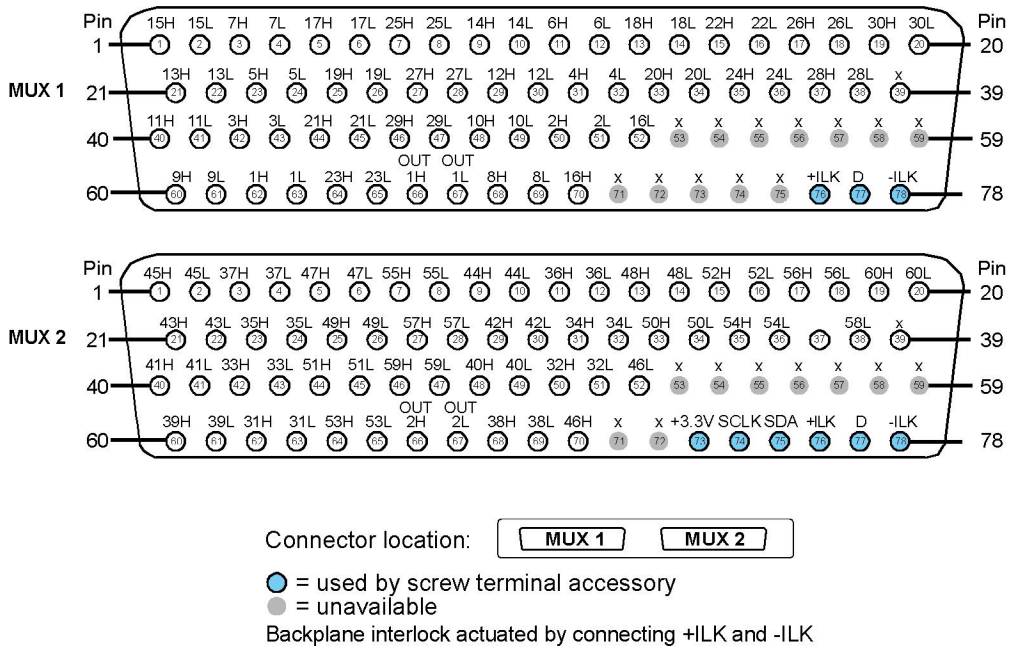
Available accessories: Model 3720

Accessory model number	Description
Model 3720-MTC-1.5	78-pin female-to-male D-sub cable assembly, 1.5 m (4.9 ft)
Model 3720-MTC-3	78-pin female-to-male D-sub cable assembly, 3 m (9.8 ft)
Model 3720-ST	Screw Terminal panel with CJC sensor
Model 3791-KIT78-R	78-pin female D-sub connector kit (solder cup contacts)
7401	Type K thermocouple wire kit

Connection information: Model 3720

Refer to the following figure for the Model 3720 D-sub connection information.

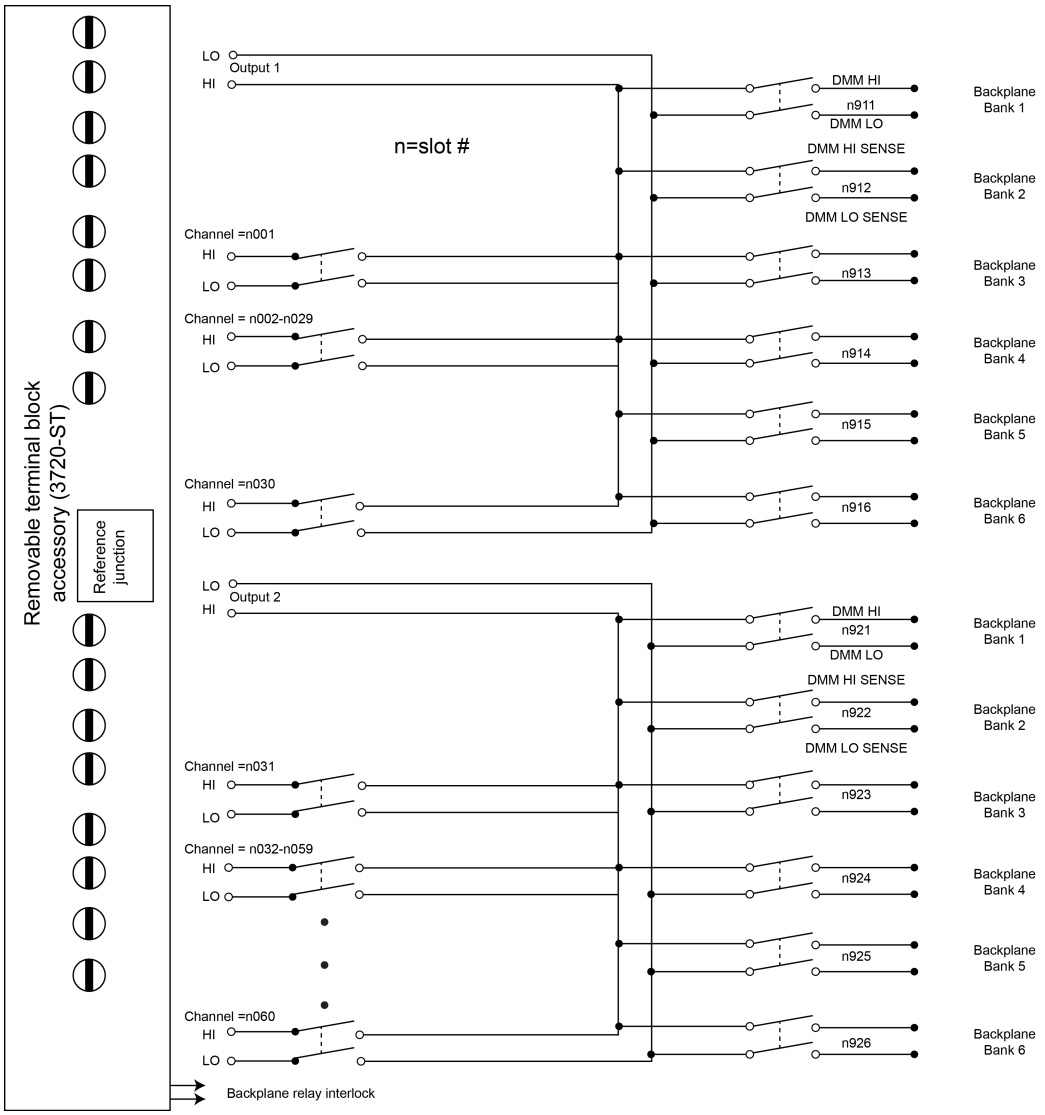
Figure 4: D-sub connection information for the Model 3720



Schematics: Model 3720

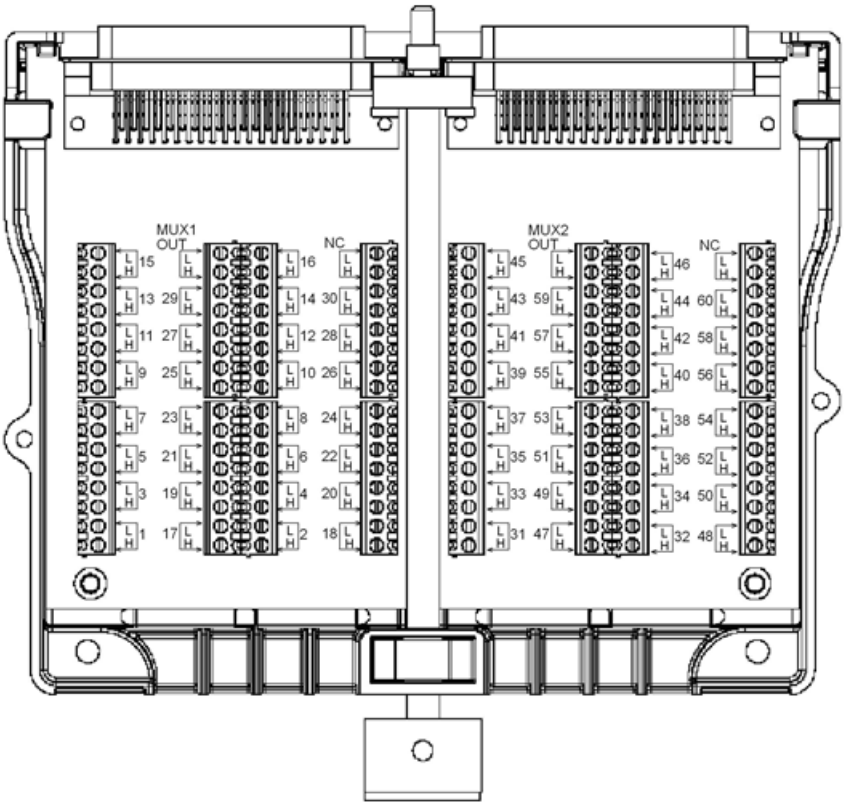
The following figure provides a switching schematic for the Model 3720.

Figure 5: Model 3720 schematic



The next figure is a diagram of the screw terminal assembly:

Figure 6: Model 3720 screw terminal assembly circuit board



Section 5

Model 3721 multiplexer card

In this section:

Model dual 1 × 20 multiplexer card 5-1

Model dual 1 × 20 multiplexer card

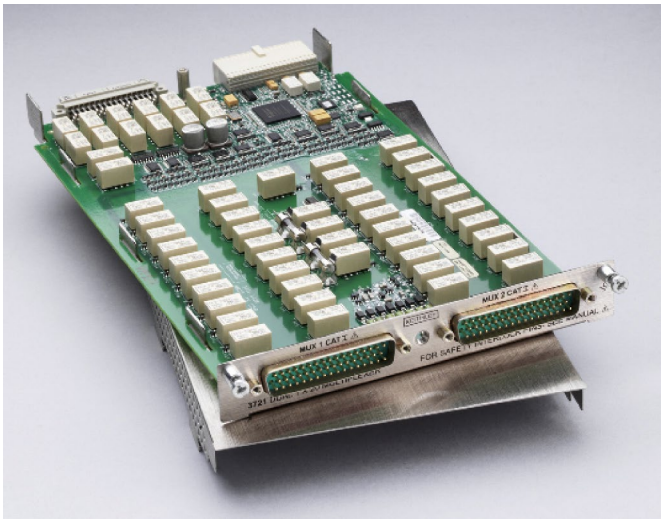
Introduction to the Model 3721 dual 1 × 20 multiplexer card

The Model 3721 provides 40 differential channels and automatic cold junction compensation (CJC) with the 3721-ST accessory. The Model 3721 has two independent banks of 1 × 20 two-pole multiplexers that are ideal for general-purpose switching, including temperature measurements.

The Model 3721 provides a number of other features. In addition to the 40 channels, two fused channels are supplied for current measurements. Also, the Model 3721 includes dedicated inputs that enable 40 channels of 4-wire commonside ohms measurements. For thermocouple-type measurements, automatic CJC is supported with the Model 3721-ST (screw terminal) accessory.

The Model 3721 uses two 50-pin male D-sub connectors for signal connections. For screw terminal or automatic CJC, use the detachable Model 3721-ST accessory.

Figure 7: Model 3721



Available accessories: Model 3721

Accessory model number	Description
Model 3721-MTC-1.5	50-pin female-to-male D-sub cable assembly, 1.5 m (4.9 ft)
Model 3721-MTC-3	50-pin female-to-male D-sub cable assembly, 3 m (9.8 ft)
Model 3721-ST	Screw terminal panel with CJC sensor
Model 3790-KIT50-R	50-pin female D-sub connector kit (solder cup contacts)
7401	Type K thermocouple wire kit

Model 3721-ST accessory board channel list

The following table shows the association between the Model 3721-ST accessory and each channel on the Model 3721.

Channel	3721-ST terminal board silkscreen label
Multiplexer # 1 Output	MUX 1 OUT
1 ... 20	1 ... 20
Multiplexer # 2 Output	MUX 2 OUT
21 ... 40	21 ... 40
Amps Channel 41	AMP1
Amps Channel 42	AMP2
DMM HI & SHI Channel n928	DMM
No Connect	NC

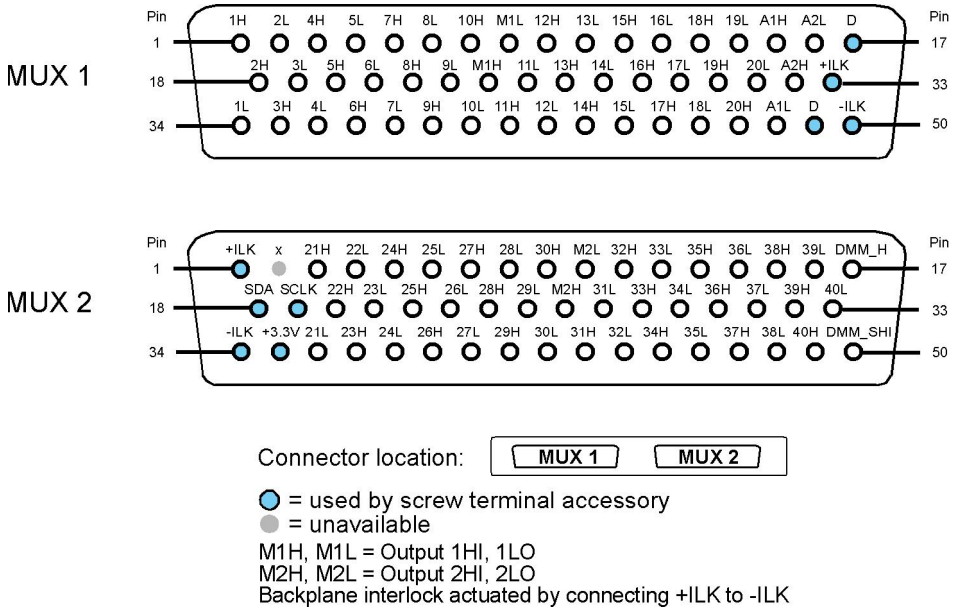
When viewing this table, remember:

- Multiplexer number 1 channels are labeled 1 through 20 and the multiplexer output is labeled MUX 1 OUT.
- Multiplexer number 2 channels are labeled 21 through 40 and the multiplexer output is labeled MUX 2 OUT.
- Amps channel 41 is labeled AMP1. This channel is accessed as "n041" where *n* is the slot number.
- Amps channel 42 is labeled AMP2. This channel is accessed as "n042" where *n* is the slot number.
- DMM HI & SHI channel is labeled DMM. This channel is accessed as "n928" where *n* is the slot number.
- No connect channels are labeled NC. Do not connect to these channels.

Connection information: Model 3721

Refer to the following figure for the Model 3721 D-sub connection information.

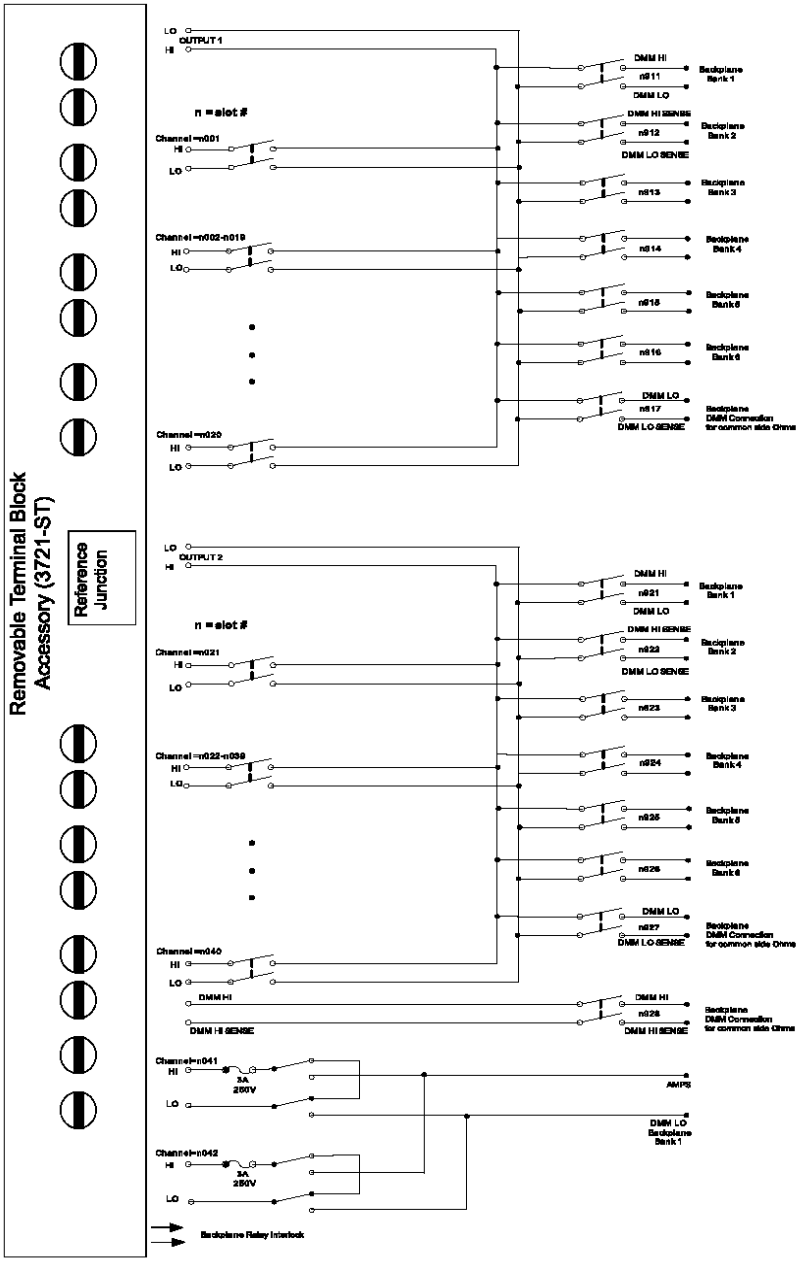
Figure 8: D-sub connection information for the Model 3721



Schematics: Model 3721

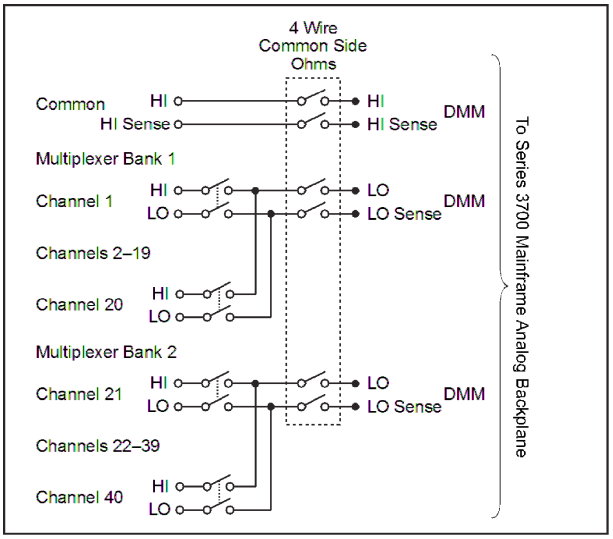
The following figure provides a switching schematic for the Model 3721 in two-pole mode.

Figure 9: Schematic of the Model 3721 in two-pole mode



The following figure provides a switching schematic for the Model 3721 in 4-wire commonside ohms mode.

Figure 10: Model 3721 schematic four-wire common side ohm mode



Programming Note

The Model 3721 card has three additional backplane relays for commonside ohms functionality. Use "`slotX`" or "`allslots`" to query settings on this card to return information for channels 1 to 40, 911 to 917, 921 to 928. In the response message, there will be three additional commonside ohms backplane relays listed based on bank location. For model 3721, 917 is listed with bank 1, and 927 and 928 are listed with bank 2 after the backplane relays.

For example, to print the channel images on this card when it is in slot 2 after a reset, send the following:

```
reset()
print(channel.getimage('slot2'))
```

Output from above code:

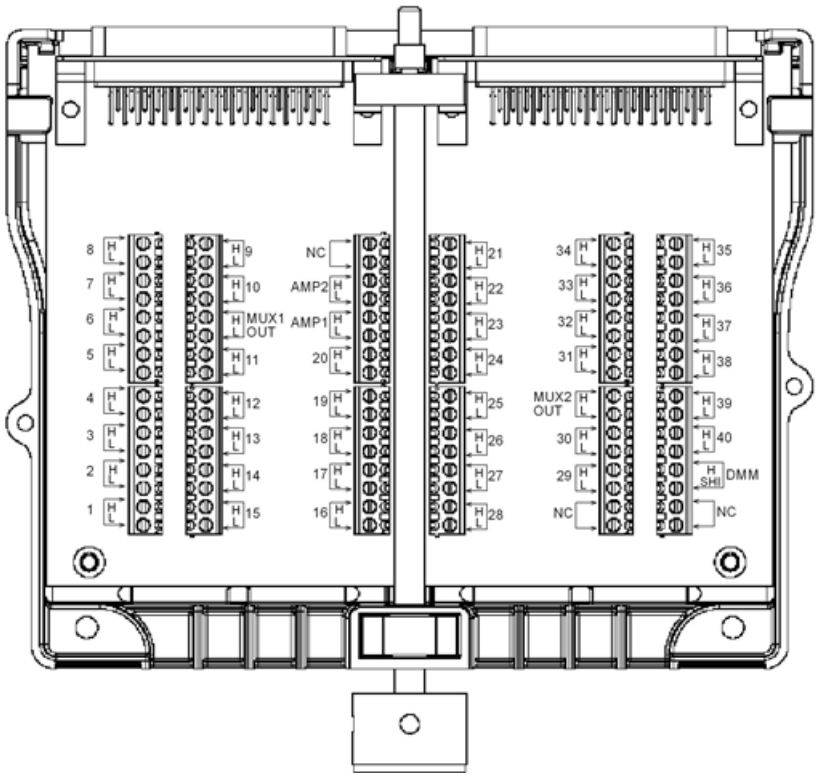
```
2001;2002;2003;2004;2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015;
2016;2017;2018;2019;2020;2021;2022;2023;2024;2025;2026;2027;2028;2029;2030;
2031;2032;2033;2034;2035;2036;2037;2038;2039;2040;2041;2042;2911;2912;2913;
2914;2915;2916;2921;2922;2923;2924;2925;2926;2917;2927;2928
```

NOTE

The commonside ohms backplane relays (2917, 2927, and 2928) are listed based on bank location.

The next figure is a diagram of the screw terminal assembly:

Figure 11: Model 3721 screw terminal assembly circuit board



Amps channel fuse replacement procedure

⚠ WARNING

Disconnect all external power from the equipment and the line cord before performing any maintenance on the Series 3700A.

Make sure that the Model 3721 card is removed from the system before replacing the amps fuse (see next figures).

⚠ CAUTION

Do not use a fuse with a higher current rating than specified or instrument damage can occur. If the Instrument repeatedly blows fuses, locate and correct the cause of the problem before replacing the fuse.

To replace the amps channel fuse:

1. Remove the top shield cover:
   a. Unscrew the number 4-40 screw (1) as shown in the "Shield removal" figure below.
   b. Slide the top cover in a direction away from the D-sub connectors, disengaging the cover from the printed circuit board.
   c. Lift the top shield cover off of the printed circuit board.

2. Set jumpers per options listed below.
3. Replace the top shield cover.
   - Slide the top cover in a direction toward the D-sub connectors, engaging the cover onto the printed circuit board, and securing with the number 4-40 screw (1).
4. The card can now be returned to service.

Figure 12: Model 3721 shield removal

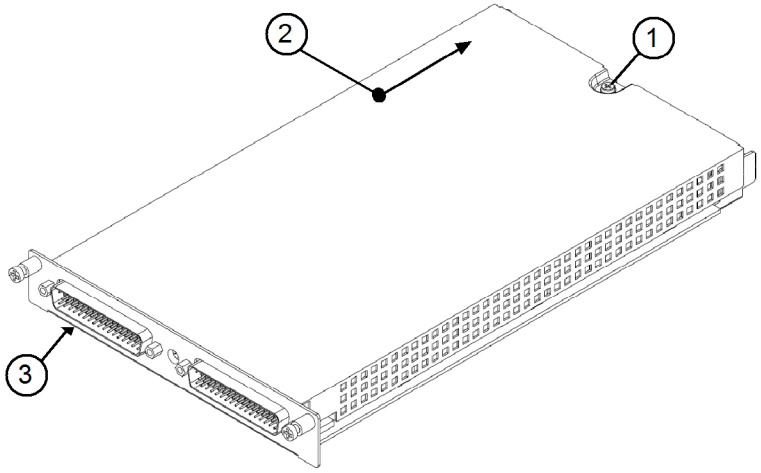
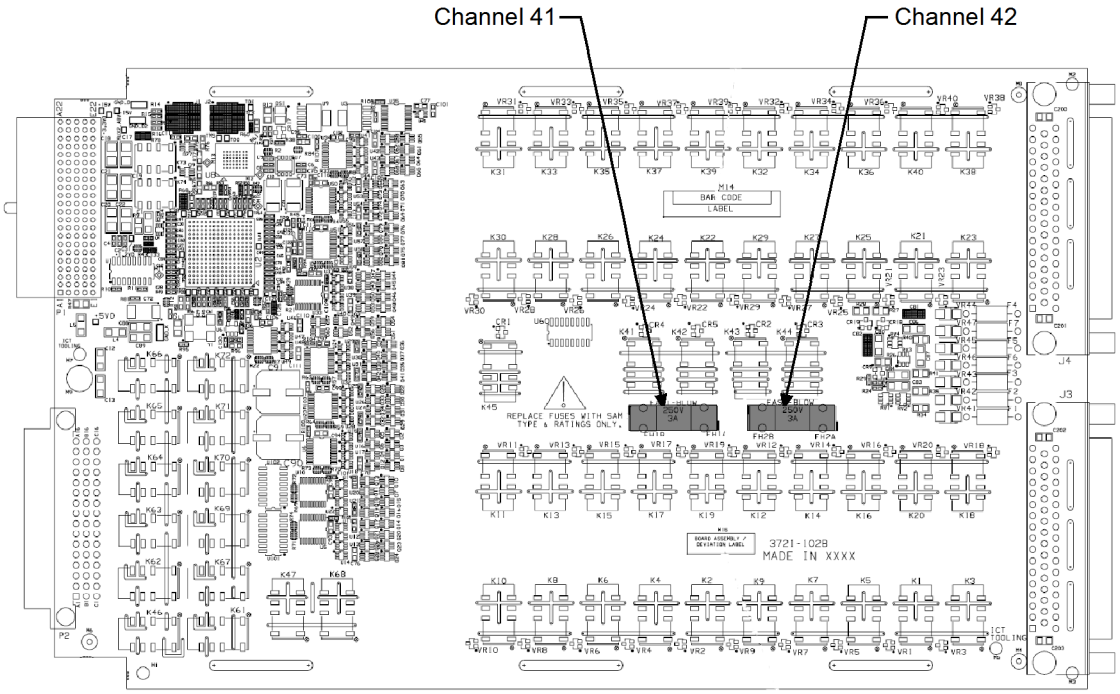


Figure 13: Fuse location



Rating	Type	Size	Keithley Instruments part number
250 V, 3A	Fast blow	5 × 20 mm	FU-99-1

Model 3721: AMPS channels fuse replacement

Channels 41 and 42 are protected by series fuses. In the event of an overload, both channels and the DMM input are protected. The two fuses are replaceable and are located on the printed circuit board of the Model 3721 switch card. The Model 3721 must be removed from the Series 3700A and all power disconnected in order to access these fuses.

Section 6

Model 3722 high-density multiplexer card

In this section:

Model 3722 dual 1 × 48 high-density multiplexer card 6-1

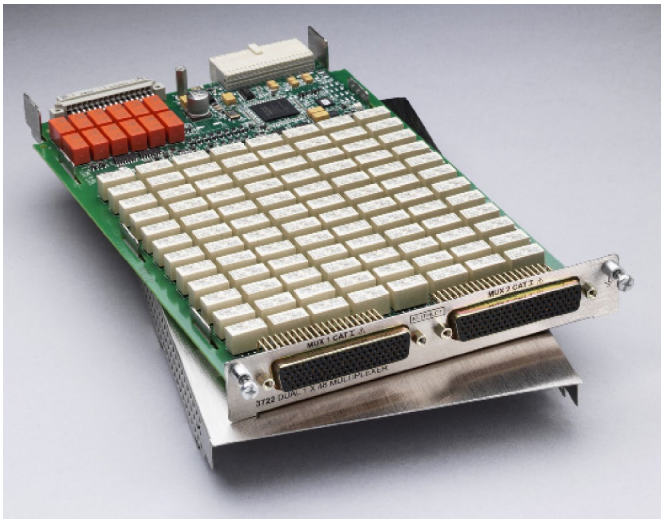
Model 3722 dual 1 × 48 high-density multiplexer card

Introduction to the Model 3722 card

The Model 3722 has two independent banks of 1 × 48 two-pole multiplexers, which is ideal for applications that require a high channel count. The two banks can automatically be connected to the Series 3700A mainframe backplane and optional digital multimeter (DMM) through the analog backplane connection relays. This connection allows the mainframe to reconfigure the card as a single 1×96 two-pole multiplexer, or to enable card-to-card expansion for even larger configurations. Another feature of this card is the latching electromechanical relays that can accommodate 300 V, 1 A switched signal levels.

The Model 3722 uses two 104-pin D-sub connectors for signal connections. A solder-style connector kit (Model 3792-KIT104-R) and pre-assembled cables (Models 3722-MTC-1.5 and 3722-MTC-3) are available for card connections.

Figure 14: Model 3722



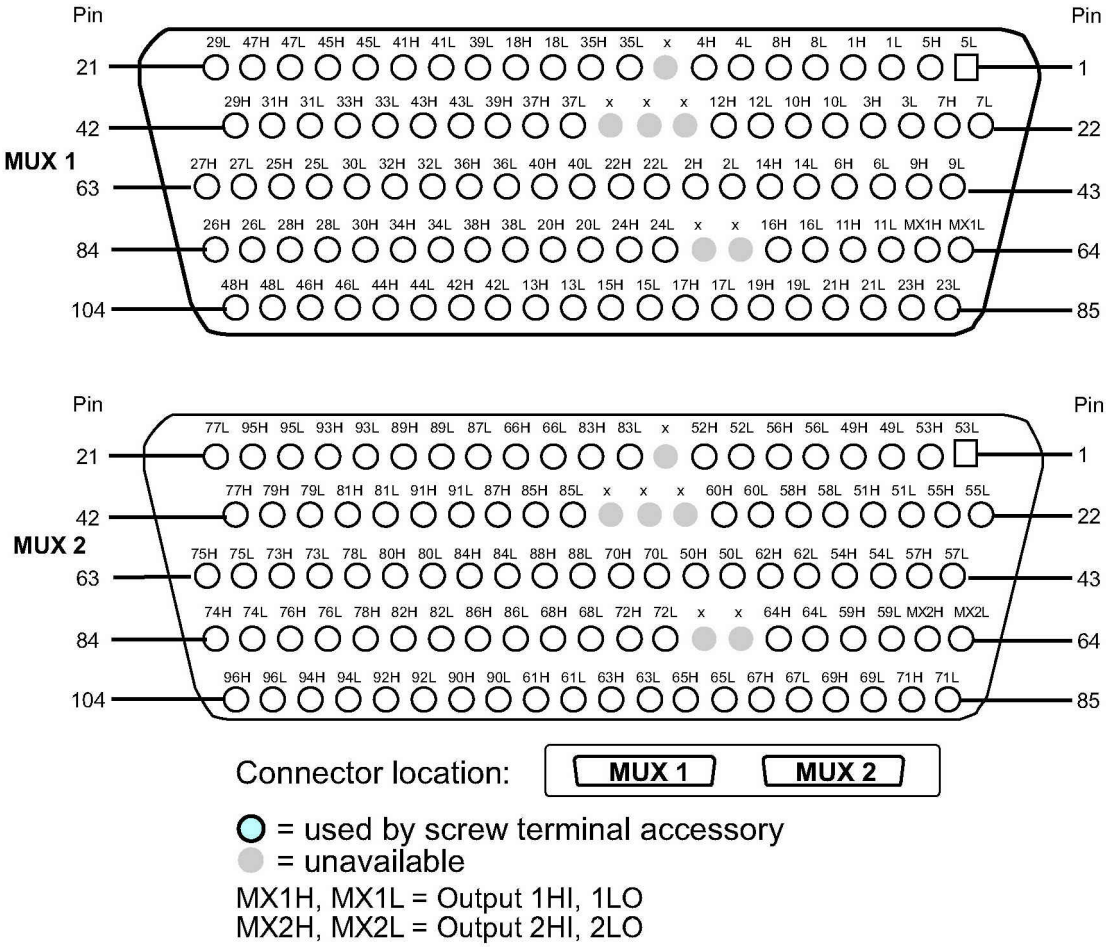
Available accessories: Model 3722

Accessory model number	Description
Model 3722-MTC-1.5	104-pin, male-to-female D-sub cable assembly, 1.5 m (4.9 ft)
Model 3722-MTC-3	104-pin, male-to-female D-sub cable assembly, 3 m (9.8 ft)
Model 3792-KIT104-R	104-pin, male, D-sub connector kit (solder-cup contacts)

Connection information: Model 3722

Refer to the following figure for the Model 3722 D-sub connection information.

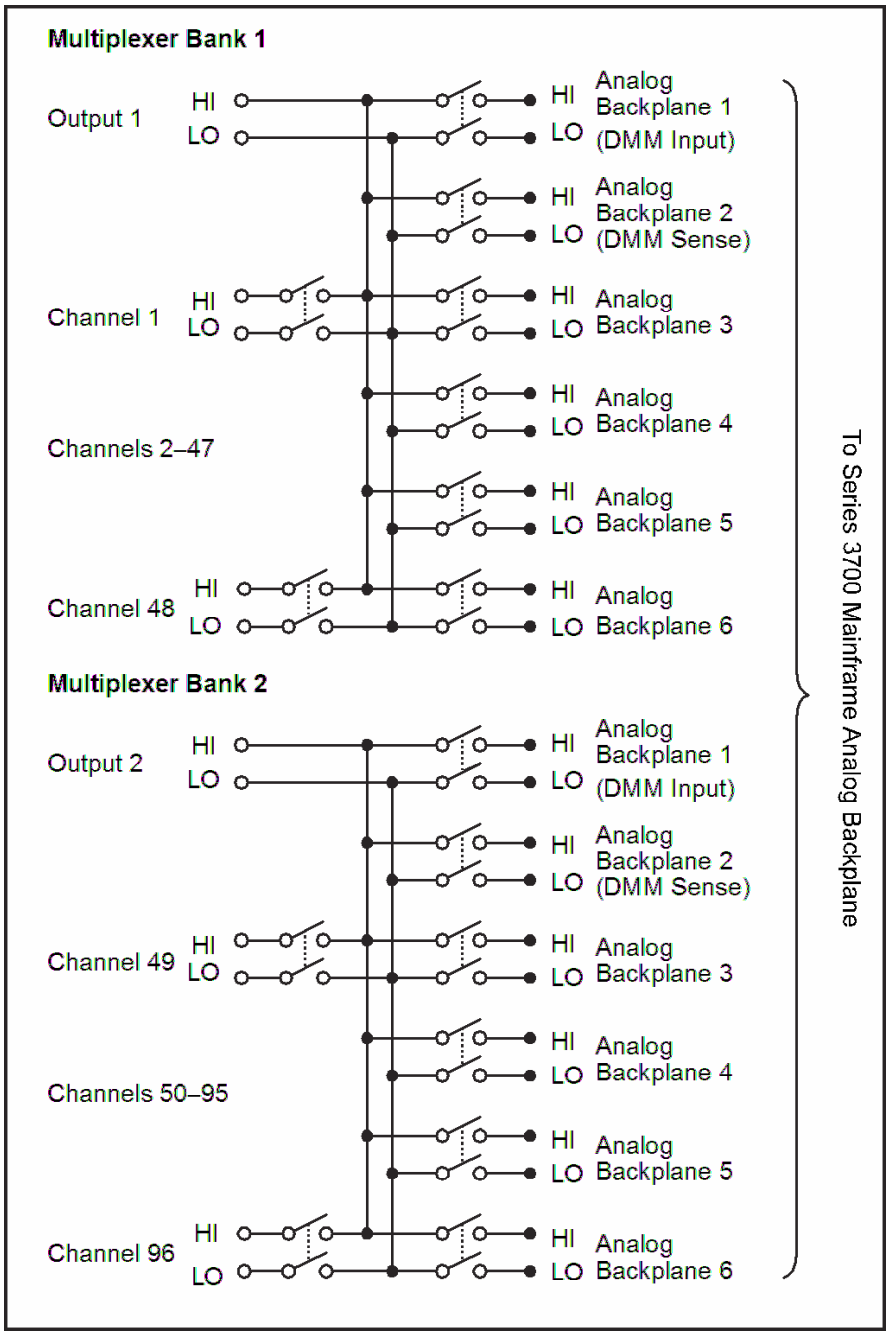
Figure 15: D-sub connection information the Model 3722



Schematics: Model 3722

The following figure provides a switching schematic for the Model 3722.

Figure 16: Schematic for the Model 3722



Section 7

Model 3723 high-speed reed relay multiplexer card

In this section:

Model 3723 dual 1 × 30 high-speed multiplexer card..... 7-1

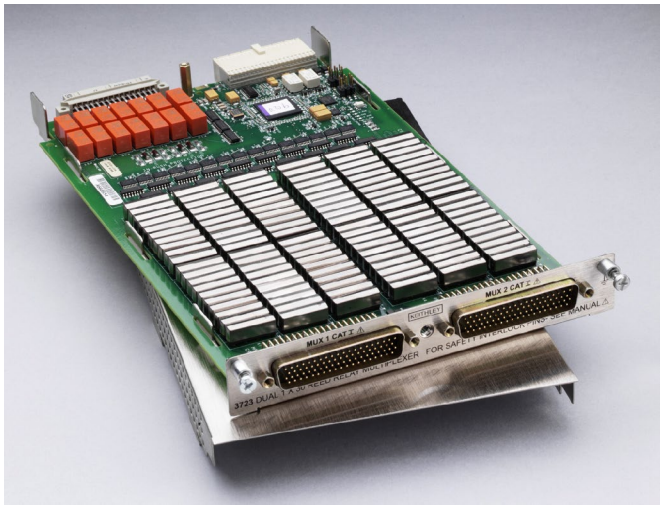
Model 3723 dual 1 × 30 high-speed multiplexer card

Introduction to the Model 3723 card

The Model 3723 has two independent banks of high-speed 1 × 30 two-pole multiplexers that are ideal for high-speed scanning applications (see next figure). The two banks can automatically be connected to the Series 3700A mainframe backplane and an optional digital multimeter (DMM) through the analog backplane connection relays. This connection allows the mainframe to reconfigure the Model 3723 as a single 1× 60 two-pole multiplexer or as a single 1 × 30 single-pole multiplexer. It also enables card-to-card expansion for even larger configurations.

By using high-speed reed relays with actuation times of less than 0.5 ms, this card can meet the requirements of demanding throughput applications. Another feature of the Model 3723 is its single-ended, one-pole mode, which supports up to 120 channels of single-wire measurements. The Model 3723 uses two 78-pin D-sub connectors for signal connections. For screw terminal connections, use the Model 3723-ST for two and four-pole configurations or the Model 3723-ST-1 for single-wire applications.

Figure 17: Model 3723



Available accessories: Model 3723

Accessory model number	Description
Model 3720-MTC-1.5	78-pin, female-to-male, D-sub cable assembly, 1.5 m (4.9 ft)
Model 3720-MTC-3	78-pin, female-to-male, D-sub cable assembly, 3 m (9.8 ft)
Model 3723-ST	Screw terminal panel
Model 3723-ST-1	Screw terminal panel (single-pole)
Model 3791-KIT78-R	78-pin, female, D-sub connector kit (solder cup contacts)

Connection information: Model 3723

Refer to the following figures for the Model 3723 D-sub connection information.

Figure 18: D-sub connection information for the Model 3723 (two-pole mode)

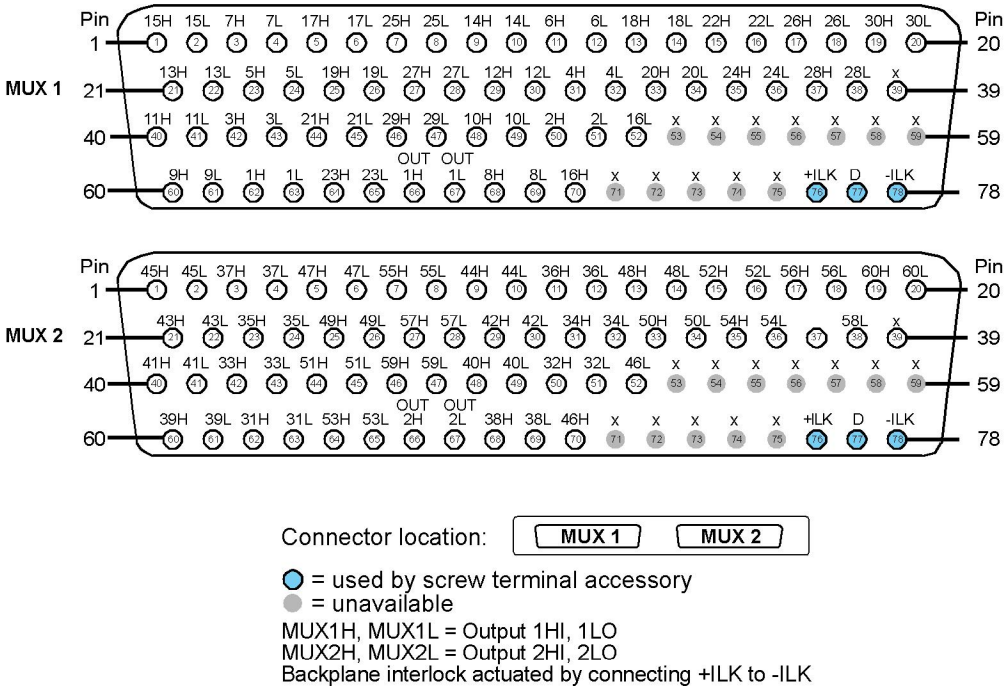
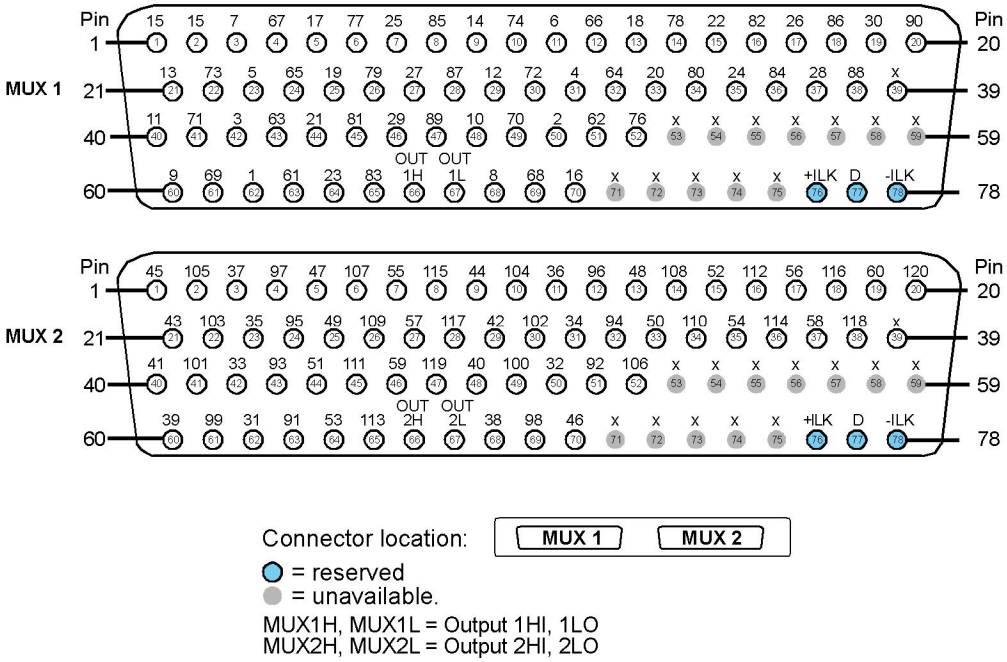


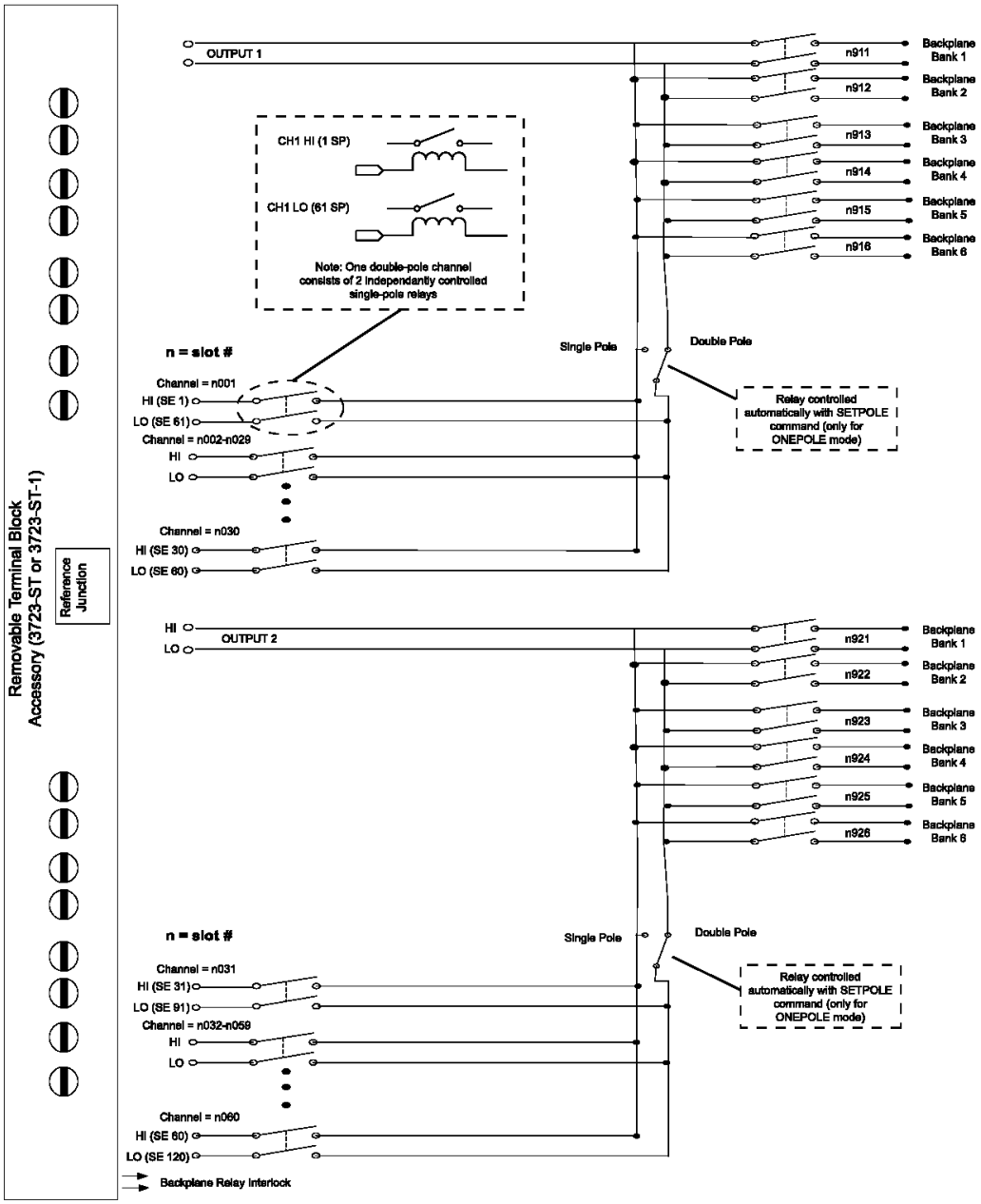
Figure 19: D-sub connection information for the Model 3723 (one-pole mode)



Schematics: Model 3723

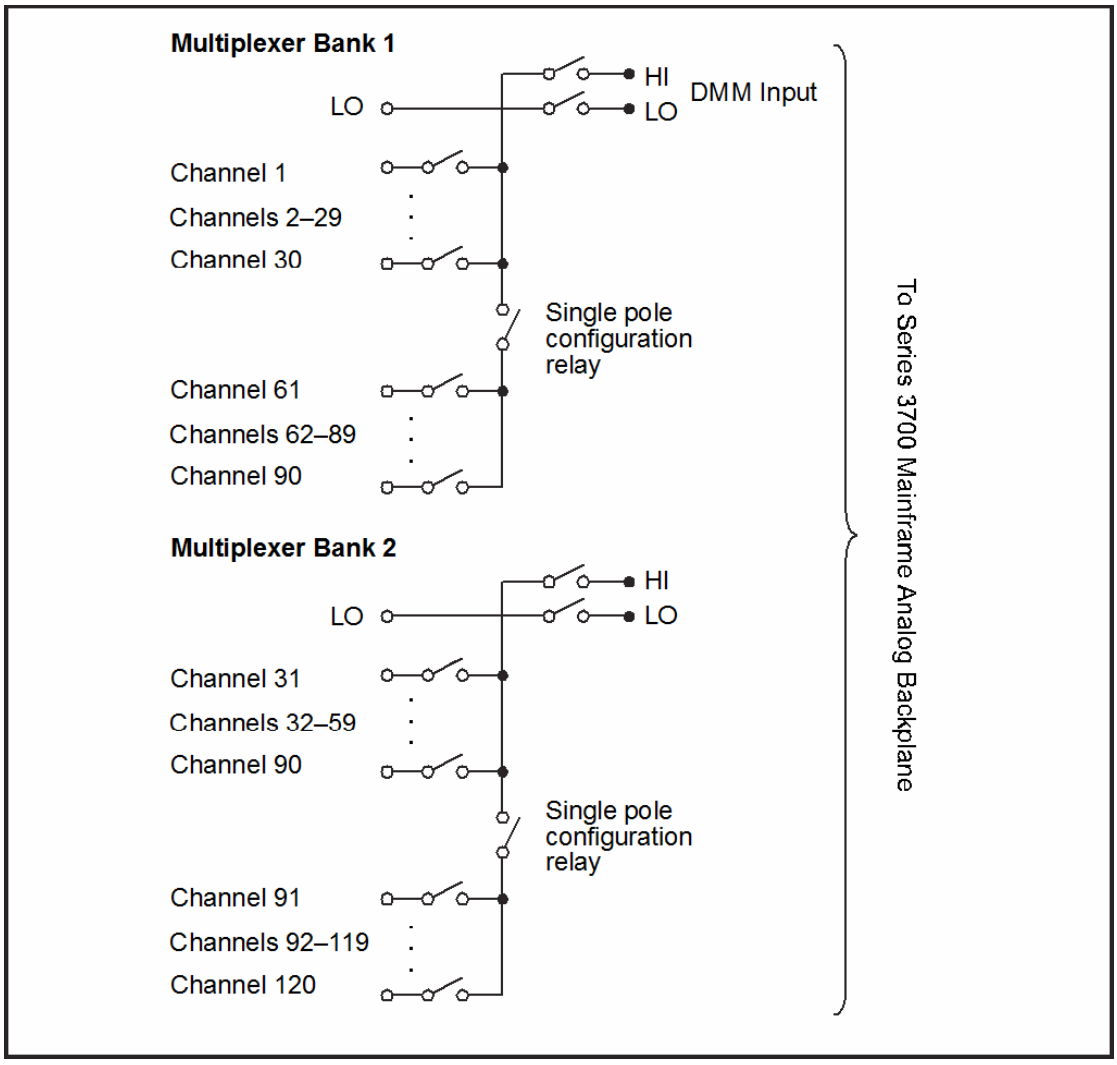
The following figure provides a switching schematic for the Model 3723 in two-pole mode.

Figure 20: Schematic for the Model 3723 in two-pole mode



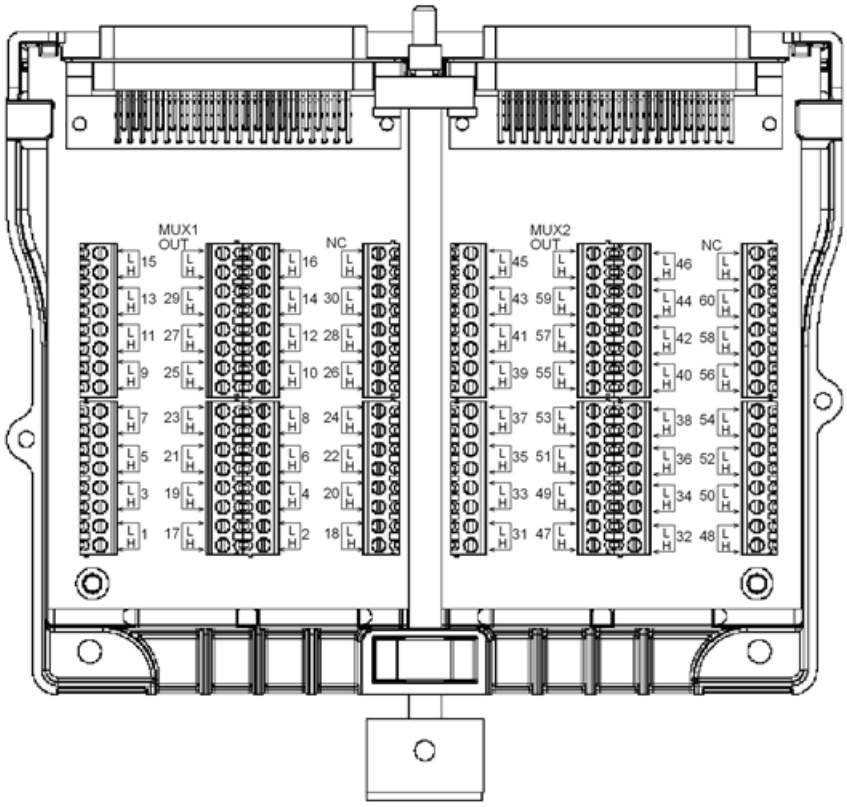
The following figure provides a switching schematic for the Model 3723 in single-pole mode.

Figure 21: Schematic: Model 3723 in one-pole mode



The next figure is a diagram of the screw terminal assembly:

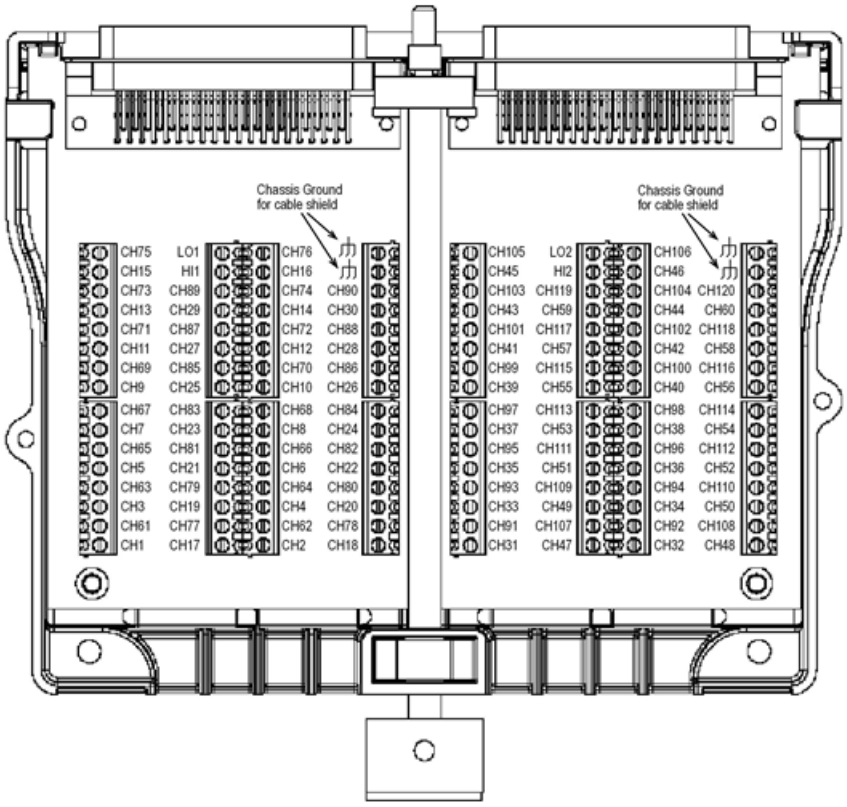
Figure 22: Model 3723 screw terminal assembly circuit board



NOTE

The Model 3723-ST-1 screw terminal assembly has a chassis ground connection for connecting a cable shield (see next figure).

Figure 23: Model 3723-ST-1 screw terminal assembly



Section 8

Model 3724 FET multiplexer card

In this section:

Model 3724 dual 1 × 30 FET multiplexer card..... 8-1

Model 3724 dual 1 × 30 FET multiplexer card

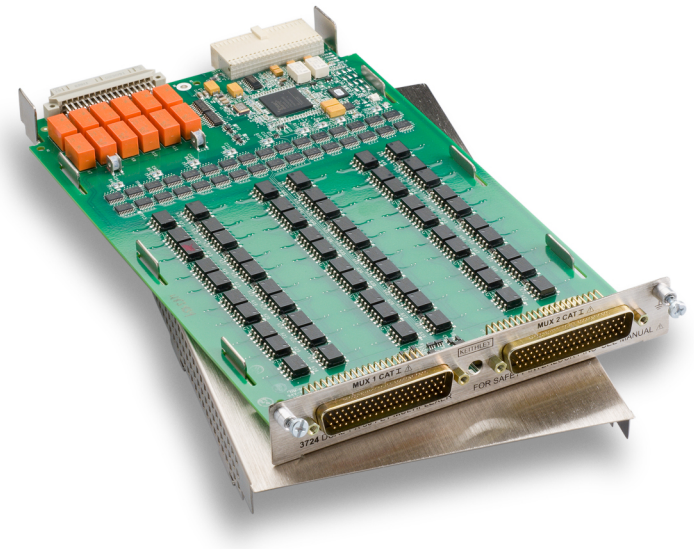
Introduction to the Model 3724 card

The Model 3724 has two independent banks of 1 × 30 2-pole multiplexers. It is ideal for general-purpose switching, including temperature measurements. The two banks can automatically be connected to the Series 3700A mainframe backplane and an optional digital multimeter (DMM) through the analog backplane connection relays. This connection allows the mainframe to reconfigure the card to a single 1 × 60 two-pole multiplexer, or to enable card-to-card expansion for even larger configurations.

Other features of the Model 3724 include its ability to be reconfigured to coordinated four-pole operation for additional measurement flexibility. Furthermore, the Model 3724 supports thermocouple-type temperature measurements with the Model 3724-ST (screw terminal) accessory, providing automatic cold junction compensation (CJC).

The Model 3724 uses two 78-pin male D-sub connectors for signal connections. For screw terminal or automatic CJC, use the detachable Model 3724-ST accessory.

Figure 24: Model 3724 Dual 1x30 FET Multiplexer



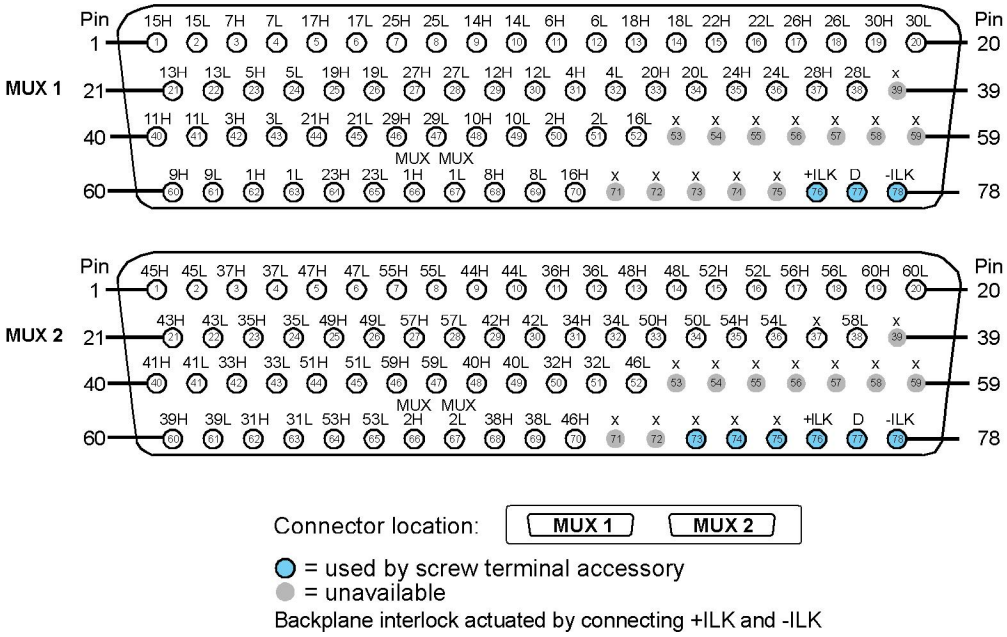
Available accessories: Model 3724

Accessory model number	Description
Model 3720-MTC-1.5	78-pin D-sub female-to-male cable, 1.5 m (4.9 ft)
Model 3720-MTC-3	78-pin D-sub female-to-male cable, 3 m (9.8 ft)
Model 3724-ST	Screw terminal panel
Model 3791-CIT	Contact insertion and extraction tool
Model 3791-KIT78-R	78-pin, female D-sub connector kit (contains 2 female D-sub connectors and 156 solder cups)

Connection information: Model 3724

Refer to the following figure for the Model 3724 D-sub connection information.

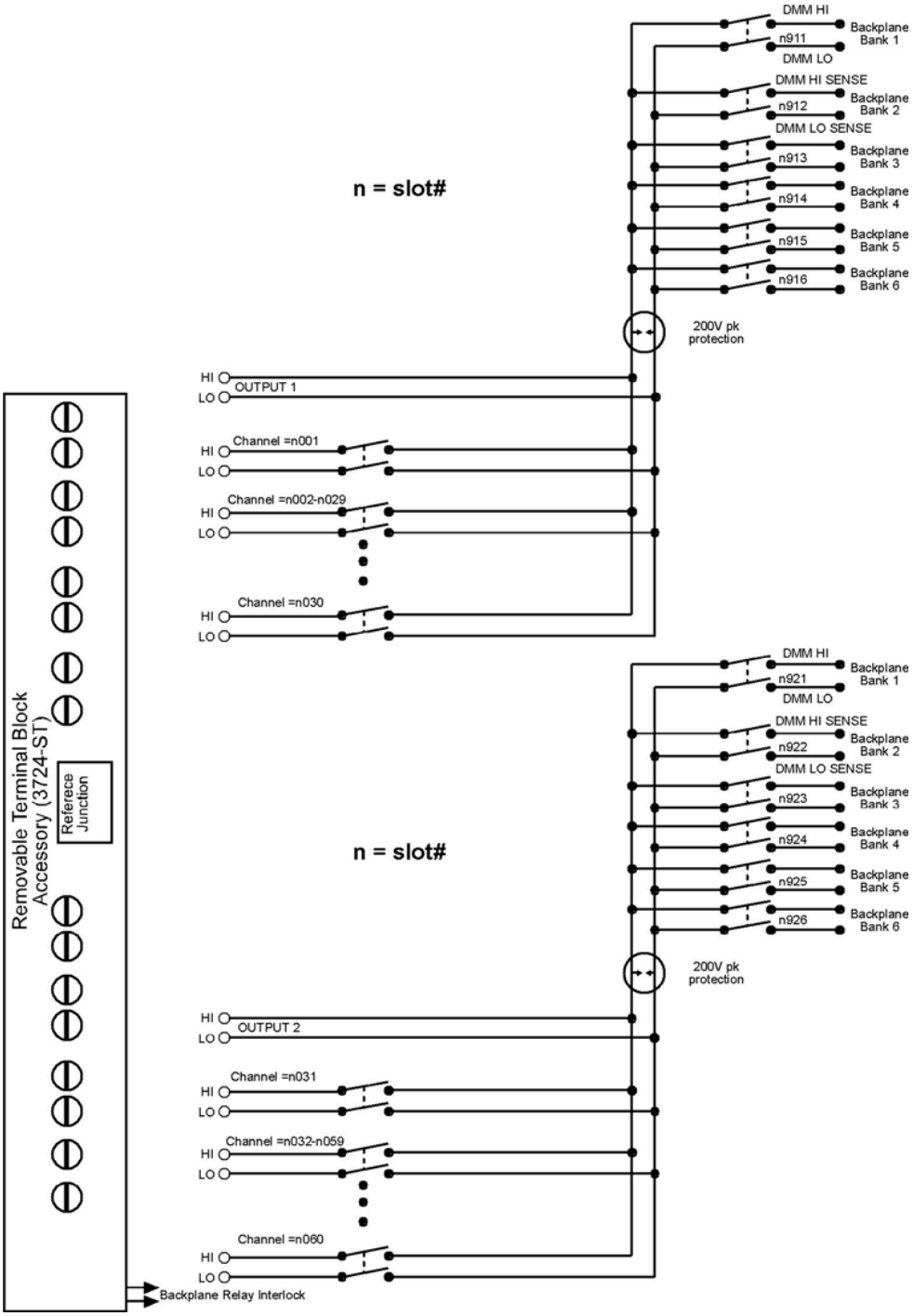
Figure 25: Model 3724 connection information



Schematics: Model 3724

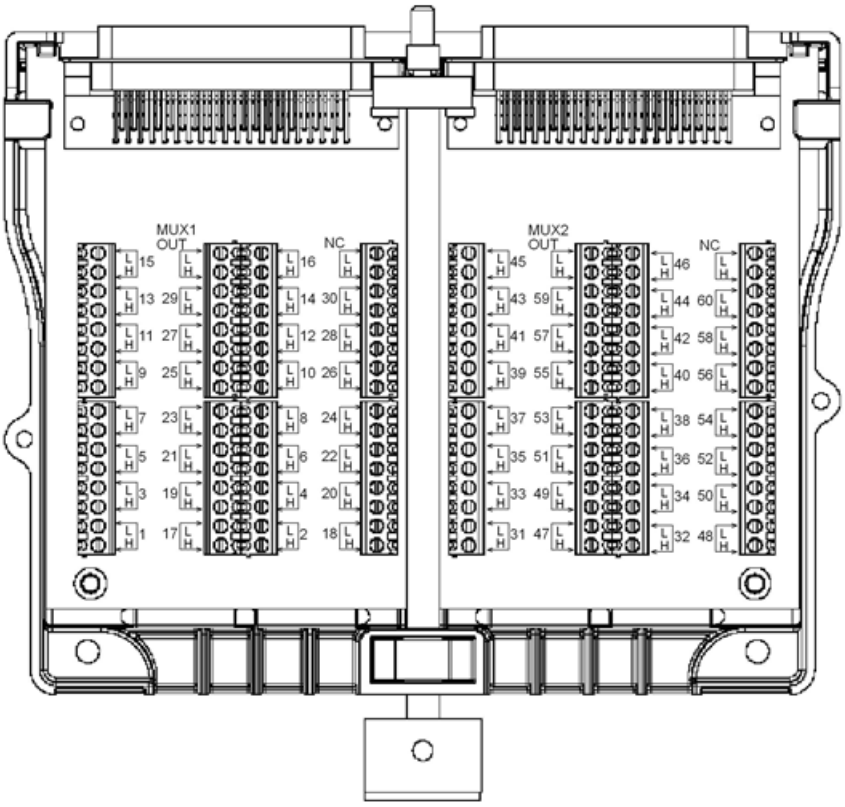
The following figure provides a switching schematic for the Model 3724.

Figure 26: Model 3724 schematic



The next Figure is a diagram of the screw terminal assembly:

Figure 27: Model 3724 screw terminal assembly circuit board



Section 9

Model 3730 high-density matrix card

In this section:

Model 3730 6 × 16 high-density matrix card 9-1

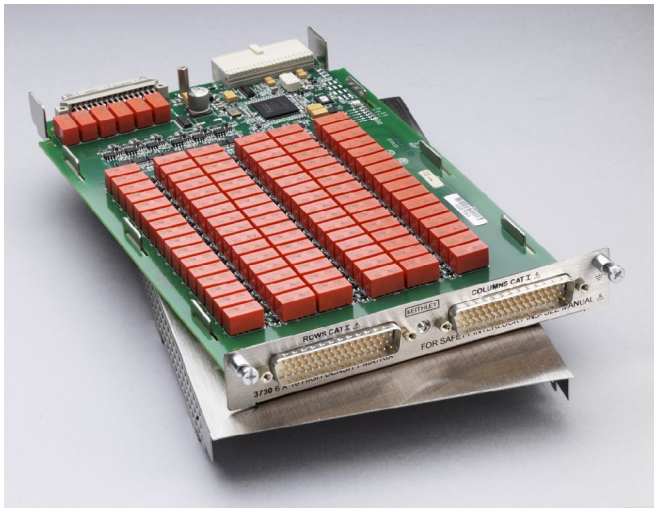
Model 3730 6 × 16 high-density matrix card

Introduction to the Model 3730 card

The Model 3730 is a two-pole, 6 × 16 column matrix card. It can connect up to six differential instrument channels to any combination of 16 devices under test (DUTs). Any row can be connected to the Series 3700A mainframe backplane by using the analog backplane connection relays. This allows for easy matrix column expansion. A matrix of up to six rows by 96 columns can be supported within a single Model 3706A mainframe (with six Model 3730 cards).

The Model 3730 uses two 50-pin male D-sub connectors for signal connections. For screw terminal connections, use the detachable Model 3730-ST accessory.

Figure 28: Model 3730



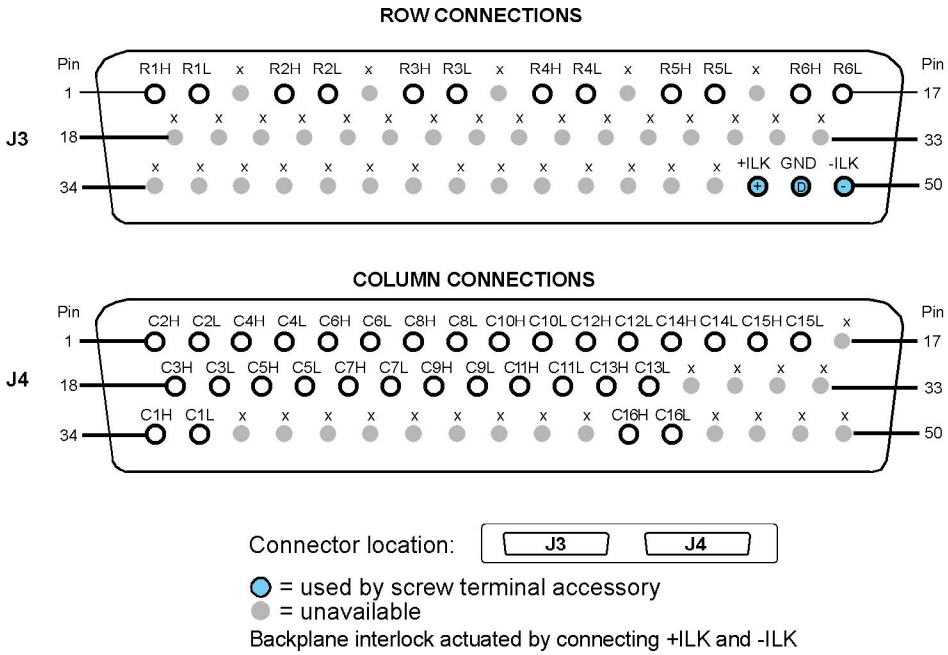
Available accessories: Model 3730

Accessory model number	Description
Model 3721-MTC-1.5	50-pin, female-to-male, D-sub cable assembly, 1.5 m (4.9 ft
Model 3721-MTC-3	50-pin, female-to-male, D-sub cable assembly, 3 m (9.8 ft)
Model 3730-ST	Screw terminal panel
Model 3790-KIT50-R	50-pin, female, D-sub connector kit (solder cup contacts)

Connection information: Model 3730

Refer to the following figure for the Model 3730 D-sub connection information.

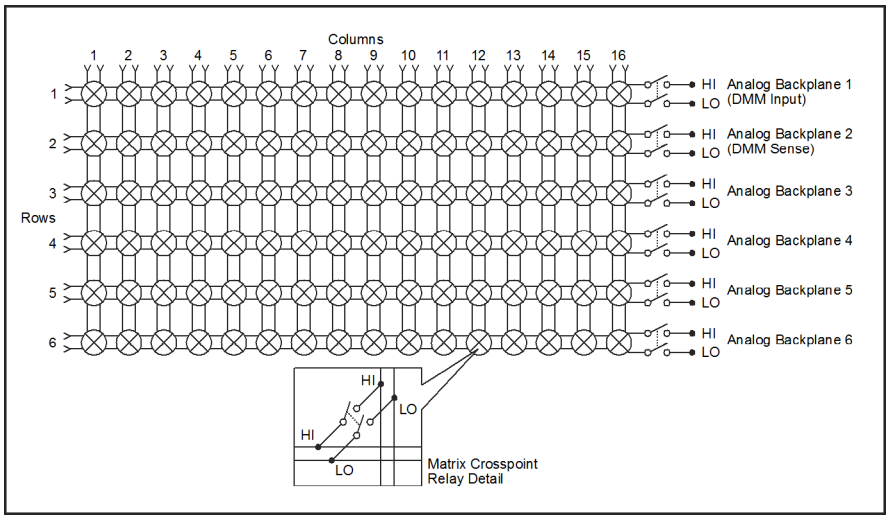
Figure 29: D-sub connection information for the Model 3730



Schematics: Model 3730

The following figure provides a relay schematic for the Model 3730.

Figure 30: Schematic of the Model 3730



The channels on the Model 3730 are matrix channels. Unlike multiplexer (MUX) channels, matrix channels do not have a DMM configuration associated with them. Therefore, specifying a matrix channel in the channel list parameter to the `dmm.setconfig()` function generates an error. To connect a DMM configuration to matrix channels, create a channel pattern with desired channels and analog backplane relays.

NOTE

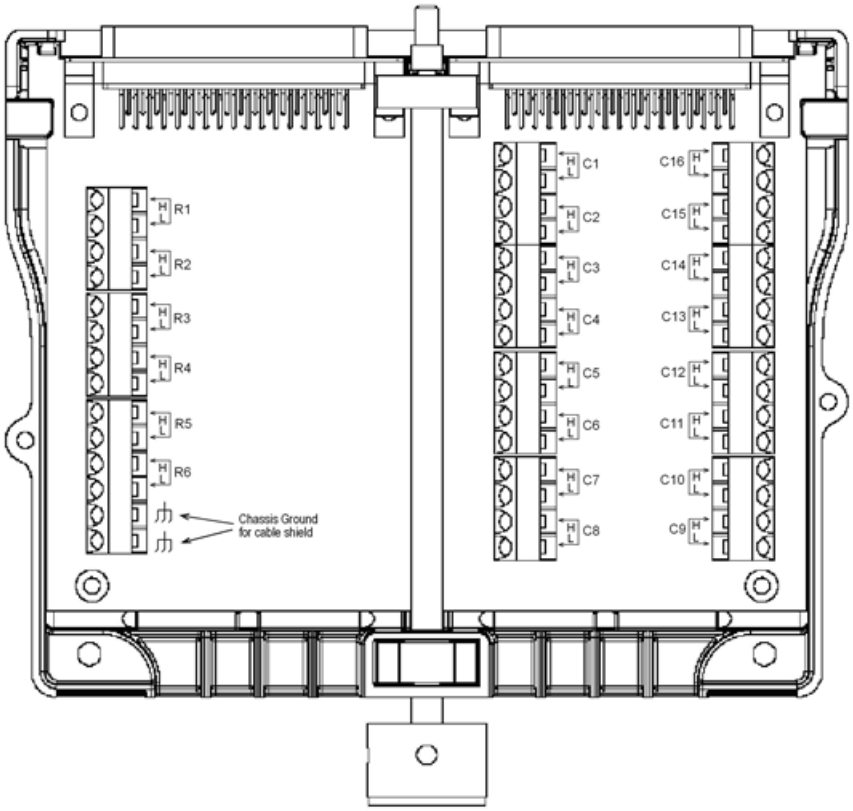
For channel patterns, the system does not verify if the pathway is correct, or if the correct analog backplane relays are specified for the desired function.

The next figure is a diagram of the screw terminal assembly:

NOTE

The Model 3730-ST screw terminal assembly has a chassis ground connection for connecting a cable shield.

Figure 31: Model 3730 screw terminal assembly circuit board



Section 10

Model 3731 high-speed reed relay matrix card

In this section:

Model 3731 6 × 16 high-speed reed matrix card..... 10-1

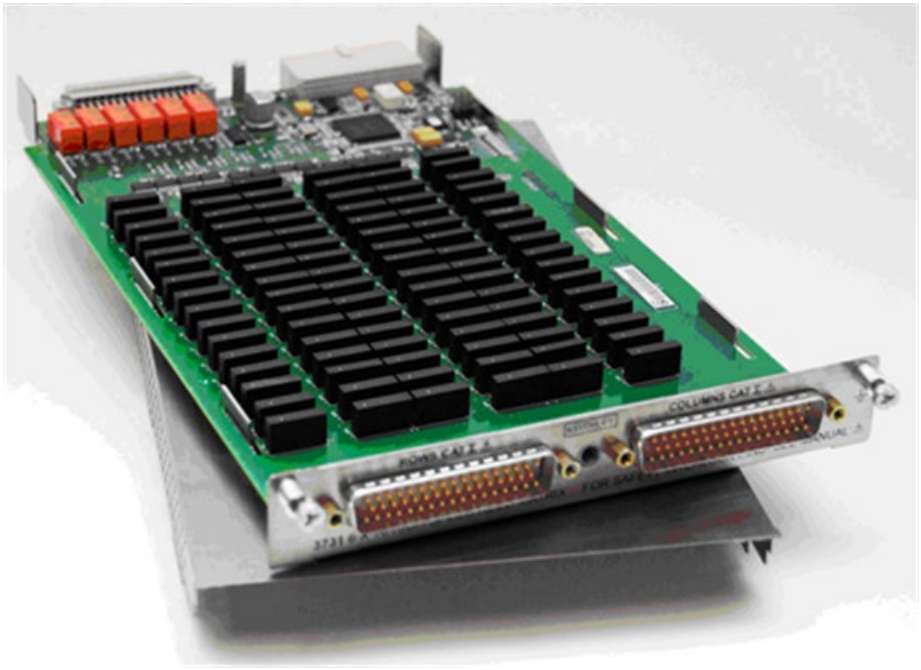
Model 3731 6 × 16 high-speed reed matrix card

Introduction to the Model 3731 card

The Model 3731 is a two-pole, six-row by 16-column reed relay matrix card. Using high-speed reed relays with actuation times of 0.5 ms, this card meets the requirements of demanding throughput applications. In addition, the Model 3731 is designed for long life, exceeding one billion operations.

The Model 3731 can connect up to six differential instrument channels to any combination of 16 devices under test (DUTs). Any row can be connected to the Series 3700A mainframe backplane using the analog backplane connection relays, allowing for matrix column expansion. A matrix of up to six rows by 96 columns can be supported within a single Model 3706A mainframe (using six Model 3731 cards).

Figure 32: Model 3731 card



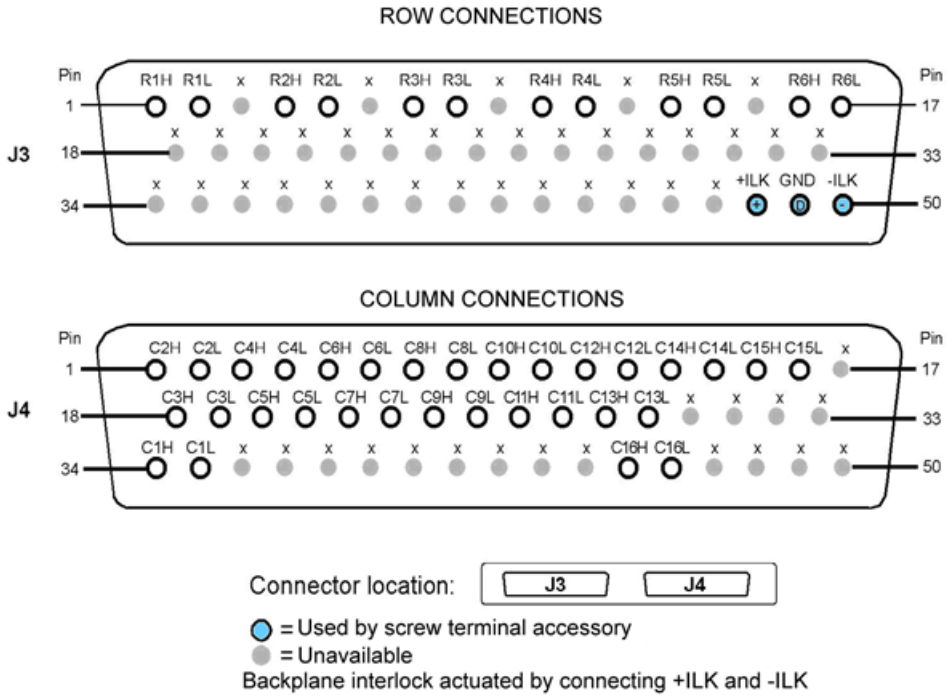
Available accessories: Model 3731

Accessory model number	Description
Model 3721-MTC-1.5	50-pin, female-to-male, D-sub cable assembly, 1.5 m (4.9 ft
Model 3721-MTC-3	50-pin, female-to-male, D-sub cable assembly, 3 m (9.8 ft)
Model 3731-ST	Screw terminal panel
Model 3731-KIT50-R	50-pin, female, D-sub connector kit (solder cup contacts)

Connection information: Model 3731

The Model 3731 uses two 50-pin male D-sub connectors for signal connections. Use the detachable Model 3731-ST accessory for screw terminal connections. Refer to the following figure for the Model 3731 D-sub connection information.

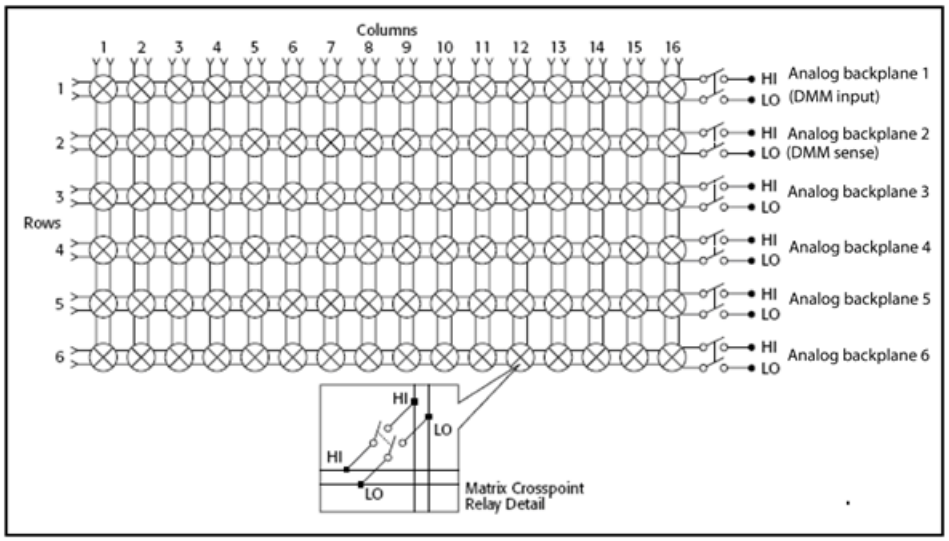
Figure 33: Model 3731 pin connections



Schematics: Model 3731

The following figure provides a relay schematic for the Model 3731.

Figure 34: Model 3731 simplified crosspoint relay schematic

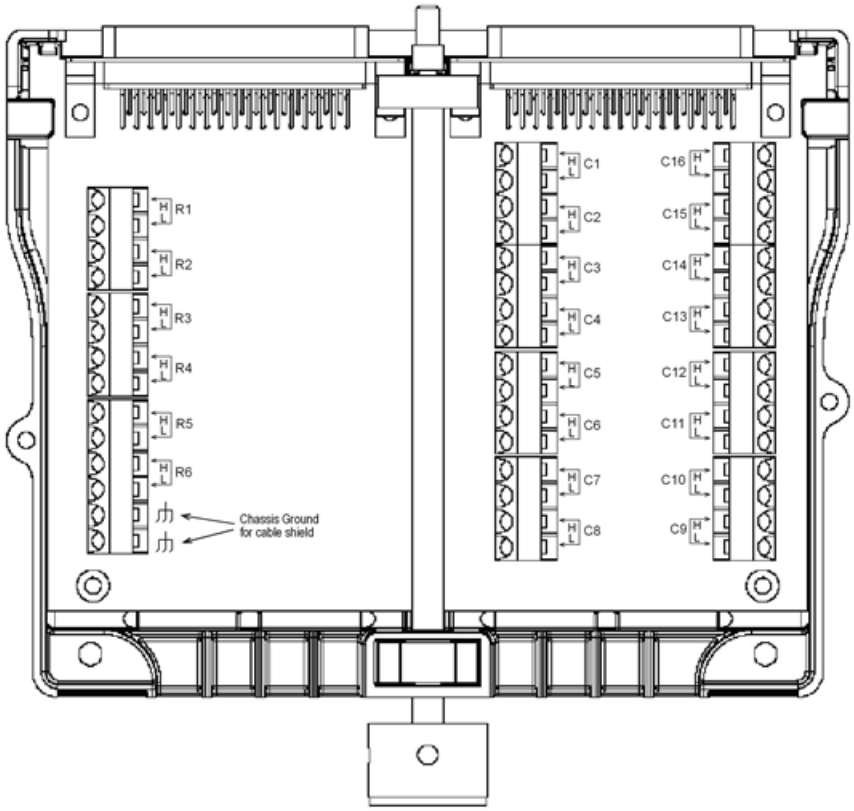


The next figure is a diagram of the screw terminal assembly:

NOTE

The Model 3731-ST screw terminal assembly has a chassis ground connection for connecting a cable shield.

Figure 35: Model 3731 screw terminal assembly circuit board



Section 11

Model 3732 quad 4 × 28 reed relay matrix card

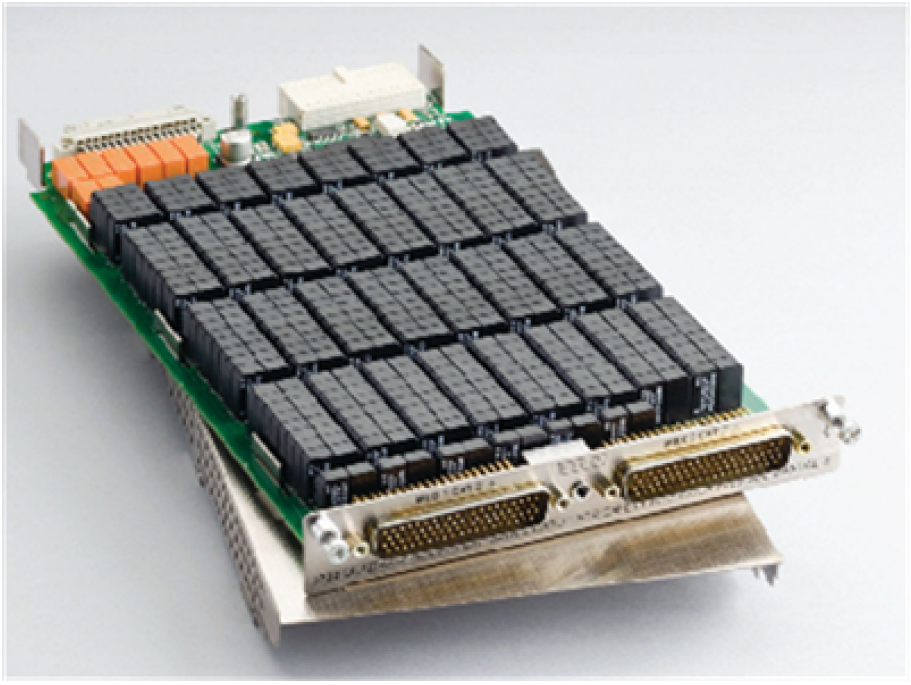
In this section:

Introduction 11-1
Accessories for Model 3732 11-2
Maximum power usage with Model 3732 cards 11-2
Measurement considerations 11-2
Card configurations 11-13
Model 3732 2-pole operation 11-34
Cross-card expansion 11-47
Using the Model 3732 with a digital multimeter 11-48
Using the Series 3700A front panel with the Model 3732 card 11-49
Pseudocard support for the Model 3732 11-49
Using remote commands from a remote interface 11-50

Introduction

The Model 3732 quad 4 × 28 ultra-high density reed relay matrix card has four independent banks of 4 × 28 single-pole, ultra-high density reed relay matrices (448 crosspoints) that can be configured using relays, jumpers, and screw-terminal assemblies to create five different switch matrix configurations.

Figure 36: Model 3732 card



Additional features

These additional features differentiate the Model 3732 card from other Series 3700A switching cards:

- Bank configuration relays mounted on the Model 3732 card allow you to automate bank connections, and the two-pole mode enables automatic channel pairing for differential (2-wire) measurements.
- Analog backplane relays can be used to connect rows to the Series 3700 mainframe backplane for larger matrix configurations that use multiple Model 3732 cards.
- The Model 3732 card has optimized reed relays that minimize switching errors and allow greater signal voltage and current dynamic range in automated test applications that require long life and fast actuation times.
- The Model 3732 card has two 78-pin D-sub connectors, and two optional screw terminal assemblies are available (Models 3732-ST-C and 3732-ST-R).

Accessories for Model 3732

Available accessories for the Keithley Instruments Model 3732 4 × 28 Ultra-High Density Reed Relay Matrix Card are listed in the table below.

Model 3732 available accessories

Accessory model number	Description
Model 3732-ST-C	Column expansion screw terminal assembly for quad 4 × 28, dual 5 × 56, and single 4 × 112 matrix configurations
Model 3732-ST-R	Row expansion screw terminal assembly for single 16 × 28 or dual 8 × 28 matrix configurations
Model 3732-MTC-1.5	78-pin D-sub female-to-male cable, 5 ft (1.5 m)
Model 3732-MTC-3	78-pin D-sub female-to-male cable, 10 ft (3 m)
Model 3791-CIT	Contact insertion and extraction tool
Model 3791-KIT78-R	78-pin, female D-sub connector kit; contains two female D-sub connectors and 156 solder-cup contacts

Maximum power usage with Model 3732 cards

Model 3732 cards are capable of switching many relays at once, which can use a substantial amount of system power. Because there is a limited amount of power available for switching relays, you must ensure that maximum available power is not exceeded.

Refer to the Model 3732 datasheet for model-specific power consumption and quiescent power information. For a more detailed explanation of power usage, budgeting, and calculation, see the "Series 3700A Module Schematics and Connections" section in the *Series 3700A Reference Manual* (part number 3700AS-900-01). Both of these documents are available for download from the Keithley Downloads web page (*http://www.tek.com/downloads*).

Measurement considerations

The Model 3732 uses two 78-pin male D-sub connectors for signal connections. The detachable Models 3732-ST-R and 3732-ST-C screw terminal assemblies can be used for row and column expansion (the Model 3732-ST-C can also be used for direct connections).

Channel specifiers

The Series 3700A mainframe supports a wide variety of cards. Functional elements on these cards are referred to as "channels." Individual elements on each card (switch, relay, digital to analog converter (DAC), digital I/O, and so on) are referenced with a channel specifier. These specifiers specify channels for use with close and open operations, scans, and channel patterns using the front panel, web, or remote command interface.

A channel specifier is a four or five-digit alphanumeric sequence. The first digit is always the slot number of the card in the mainframe. The remaining digits vary depending on the type of card.

Channel types

There are six channel types used to control relays:

- Multiplexer (MUX)
- Matrix
- Backplane
- Digital I/O
- Totalizer
- Digital analog converter (DAC)

The channels available on a card are defined by the type of card. The documentation for your specific card lists the available channels.

Specify multiple channels using lists and ranges (a sequence of channels). Lists and ranges build upon the individual channel specifier.

The following topics describe the channel specifier in more detail and provide generic examples (which may or may not be suitable for your installed cards).

Channel and backplane notation

There are four different notation styles used to control relays:

1. MUX (multiplexer) channel notation
2. Channel specifiers
3. Backplane relay notation
4. Digital I/O, totalizer, and DAC notation

MUX (multiplexer) channel notation

To specify channels using the multiplexer (MUX) card notation, use SCCC, where:

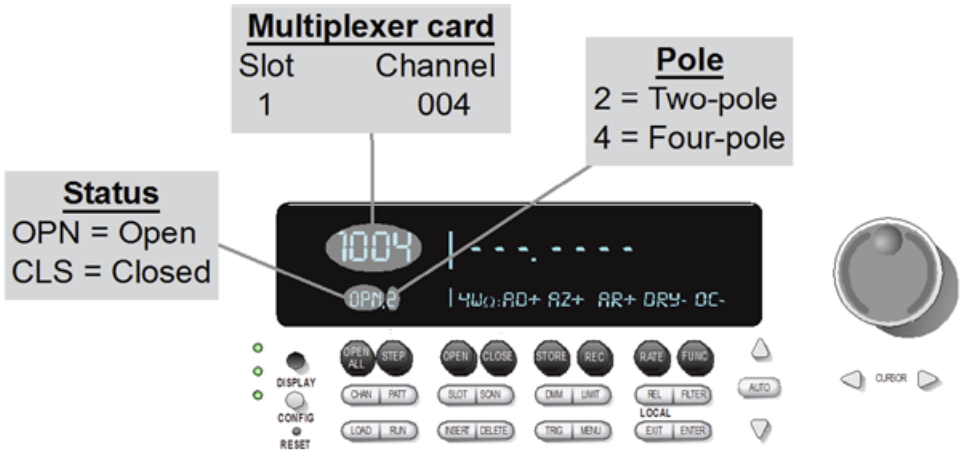
S = slot number

CCC = Channel number (always use 3 digits)

Multiplexer examples

References	Slot	Channel
1004	1	004
1020	1	020
2100	2	100
3003	3	003

Figure 37: Model 3732 multiplexer card display



Channel specifiers

The channels on the matrix cards are referred to by their slot, bank, row, and column numbers:

- Slot number: The number of the slot in which the card is installed.
- Bank: The bank number, if used by your card. See your card documentation.
- Row number: The row number is either 1 to 8 or A to Z. See your card documentation.
- Column number: Always two digits. For columns greater than 99, use A, B, C and so on to represent 10, 11, 12, …; the resulting counting sequence is: 98, 99, A0, A1, …, A8, A9, B0, B1,...

Matrix channel examples

Reference	Slot	Bank	Row	Column
1A05	1	N/A	1	05
1C05	1	N/A	3	05
3C12	3	N/A	3	12
1104	1	N/A	1	04
11104	1	1	1	04
1203	1	N/A	2	03
213A4	2	1	3	104
3112	3	N/A	1	12
62101	6	2	1	01

Figure 38: Model 3732 matrix card display showing channel identifier

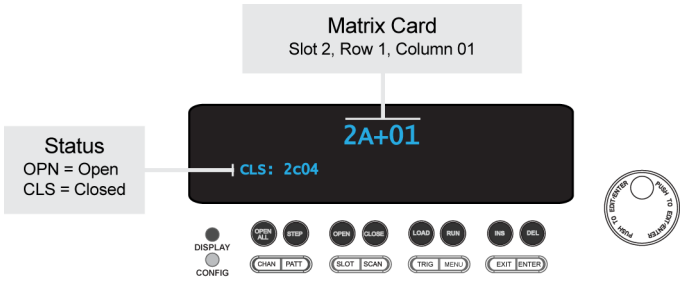
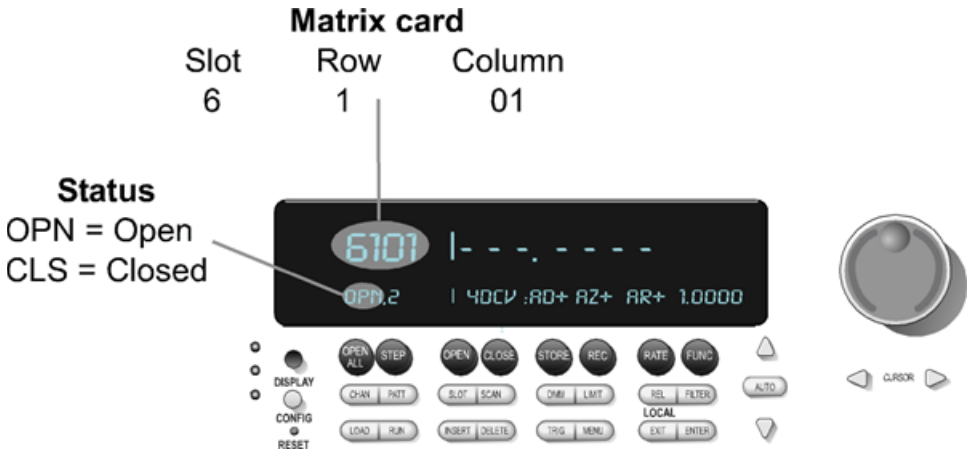


Figure 39: Model 3732 matrix card display slot 6



Backplane relay notation

To control analog backplane relays for slots with analog backplane relay channels, use S9BX where:

S = Slot number

9 = Backplane notation designation (always 9 when referencing a backplane relay)

B = Bank number

X = Analog backplane relay number

Analog backplane relays (bank 2 of Slot 1) examples

Reference	Slot
1921	analog backplane relay 1
1922	analog backplane relay 2
1923	analog backplane relay 3
1924	analog backplane relay 4
1925	analog backplane relay 5
1926	analog backplane relay 6

Digital I/O, totalizer, and DAC notation

To specify digital I/O, totalize, or digital-to-analog converter channels, use SIII, where:

S = Slot number

III = Index number (always use 3 digits)

Digital I/O, totalizer, and DAC examples

Reference	Slot	Channel
1004	1	004
1020	1	020
2100	2	100
3003	3	003

Configuration and connection choices overview

Before configuring your card, you will need to decide which base matrix configuration you will use, and how you want to wire the connections. The next table lists these options.

Configuration and connection choices

Configuration type	Mode	Matrix configurations	Wiring method	Accessory to use
Column expansion	1-pole	Quad 4 × 28, dual 4 × 56, single 4 × 112	Modular screw terminal assembly	Model 3732-ST-C
	2-pole	Dual 4 × 28, single 4 × 56		
Row expansion	1-pole	Dual 8 × 28, single 16 × 28	Modular screw terminal assembly	Model 3732-ST-R
	2-pole	Single 8 × 28		
Custom configuration	Any	User-defined	Direct wiring with prefabricated cable assemblies	Model 3732-MTC
			Direct wiring with D-sub connectors and solder-cup contacts	Model 3791-KIT78-R

Screw terminal assemblies

You can use screw terminal assemblies as an easy way to create matrix configurations without any direct wiring. There are two screw terminal assemblies available for use with the Model 3732 card: Model 3732-ST-C for column expansion, and Model 3732-ST-R for row expansion.

⚠ CAUTION

Important configuration information:
The Series 3700A mainframe does not support "hot swapping" of cards, which means there is a possibility that the Model 3732 card may not be in the expected configuration when you turn on the instrument power after removing a screw terminal that was connected when the instrument was last turned on.
To ensure that you do not change your configuration, note that the Series 3700A instrument power must be turned on AND the interlock must be connected and activated when you make configuration changes. If the interlock is not activated when power is reapplied, the Model 3732 ID bits that define the card's configuration will not be read, and the default configuration will be what the configuration was the last time when the power was turned on with the interlock activated.

NOTE

Additional information about screw terminal assemblies is available in the Series 3700A Screw Terminal Assemblies Installation Instructions (part number PA-955), which can be downloaded from the Keithley Downloads web page (*http://www.tek.com/downloads*).

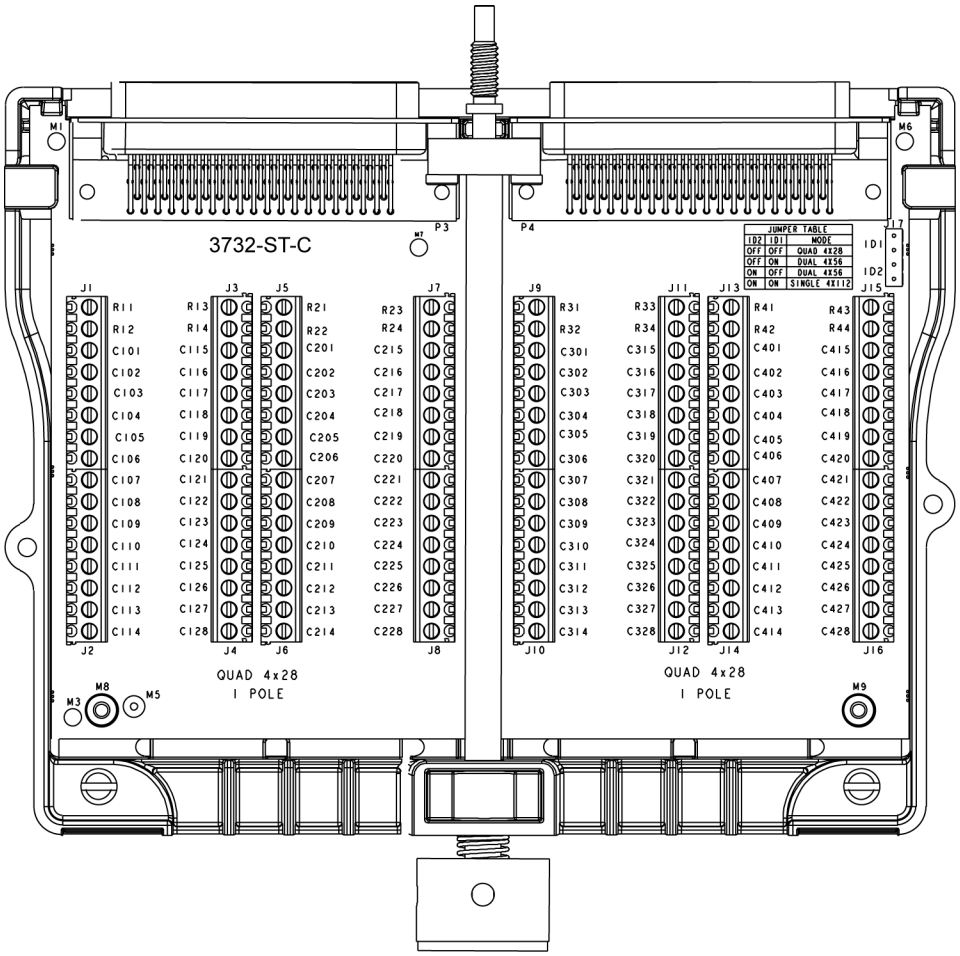
Model 3732-ST-C screw terminal assembly

The next figure is a diagram of the Model 3732-ST-C screw terminal assembly.

NOTE

The Model 3732-ST-C screw terminal assembly is labeled to show the correct connections for the default quad 4 × 28 configuration. Insertable overlays are provided with the screw terminal assembly that show the correct wiring for the dual 4 × 56, single 4 × 112, dual 4 × 18 (2-pole), and single 4 × 56 (2-pole) configurations.

Figure 40: Model 3732-ST-C screw terminal assembly circuit board



Model 3732-ST-C jumper settings

The next table shows the jumper settings for the configurations available using the Model 3732-ST-C screw terminal assembly with your Model 3732 card.

Model 3732-ST-C jumper settings

ID2	ID1	Configuration
OFF	OFF	Quad 4 × 28
OFF	ON	Dual 4 × 56
ON	OFF	Dual 4 × 56
ON	ON	Single 4 × 112

NOTE

These ID bits are only read when the instrument is turned on with the interlock activated.

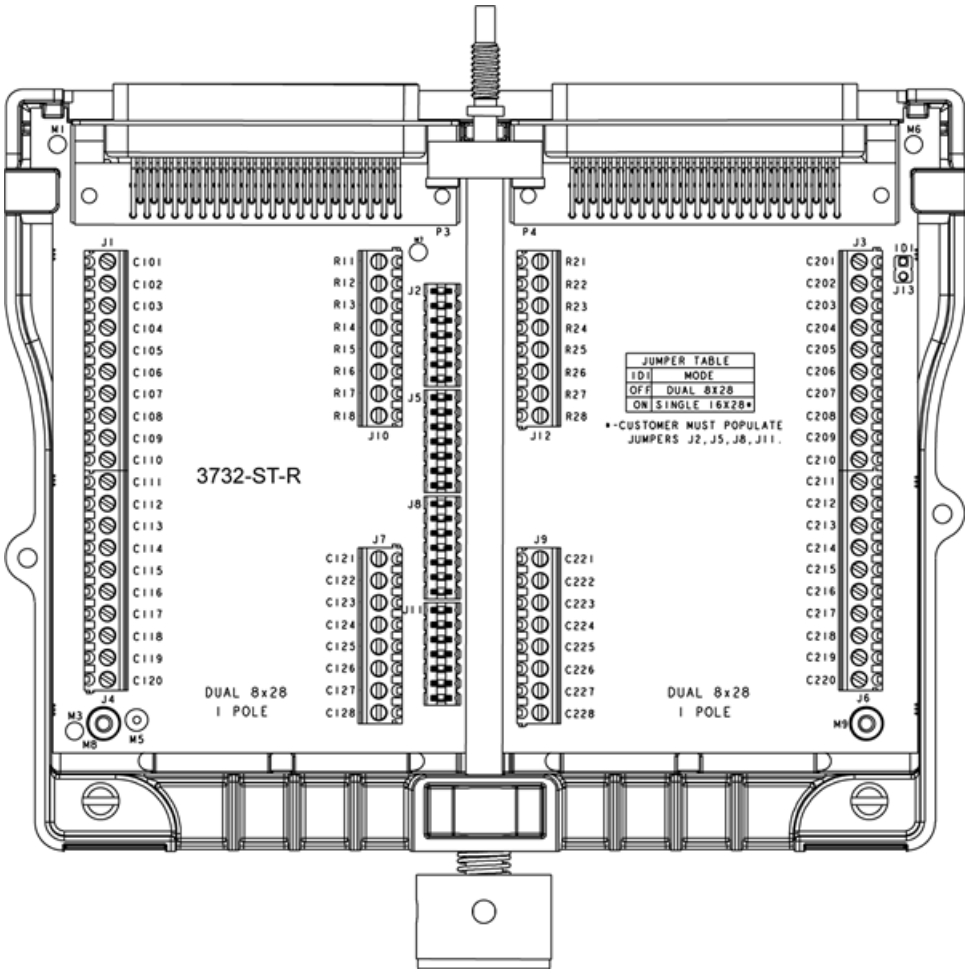
Model 3732-ST-R screw terminal assembly

The next figure is a diagram of the Model 3732-ST-R screw terminal assembly.

NOTE

The Model 3732-ST-R screw terminal assembly is labeled to show the correct connections for the dual 8 × 28 configuration. Insertable overlays are provided with the screw terminal assembly that show the correct wiring for the single 16 × 28 and single 8 × 28 (2-pole) configurations.

Figure 41: Model 3732-ST-R screw terminal assembly circuit board



Model 3732-ST-R jumper settings

ID1	Configuration
OFF	Dual 8 × 28
ON	Single 16 × 28

NOTE

These ID bits are only read when the instrument is turned on with the interlock activated.

Direct wiring

You can also use direct wiring to create custom connections to the Model 3732 card.

⚠ WARNING

Before making or breaking connections, make sure you turn off the Series 3700A and disconnect the line cord. Also, remove any other external power connected to the instrument, Series 3700A cards, or connected devices under test (DUTs). Failure to disconnect power before making or breaking connections may result in personal injury or death due to electric shock.

The next table shows modified jumper settings for direct wiring using the Model 3791-KIT78-R D-sub connector kit, Model 3720-MTC-3 cables, or Model 3720-MTC-1.5 cables to create different configurations.

Modified jumper settings and connections for direct wiring:

Signal	**Connector and pin location**	**Configuration**					
		Dual 4 × 56**				**Dual 8 × 28**	**Single 16 × 28**
BPID1	J4, Pin 76	Open*	Open	Open	J4, Pin 77	Open	J4, Pin 77
BPID2	J4, Pin 78	Open	J4, Pin 77	Open	J4, Pin 77	Not used	Not used
BPID3	J3, Pin 77	Open	Open	J4, Pin 77	Open	J4, Pin 77	J4, Pin 77
+IILK	J3, Pin 76	J3, Pin 78	J3, Pin 78	J3, Pin 78	J3, Pin 78	J3, Pin 78	J3, Pin 78
-ILK	J3, Pin 78	J3, Pin 76	J3, Pin 76	J3, Pin 76	J3, Pin 78	J3, Pin 76	J3, Pin 76

*Open = No connection
**There are two different ways to direct-wire the dual 4 × 56 configuration. The first column shows one way to connect and the second shows an alternative.

NOTE

For detailed D-sub connector pin assignment information, refer to the "Pin assignments and signal naming" tables for the desired configuration in the Card configurations (on page 11-13) topic.

Hardware interlocks

The Model 3732 card and Series 3700A have hardware interlocks to prevent unsafe exposure to high-voltage signals. These interlocks are designed to keep the Model 3732 disconnected from the system backplane. To close any Model 3732 backplane relays, the interlock circuit must be engaged by connecting the +ILK and -ILK signals. If you attempt to close a backplane relay without these signals connected, the relay will not close and an error message will be displayed.

Model 3732 interlock pin numbers

The next table shows the Model 3732 interlock pin numbers.

Model 3732 interlock pin numbers

Interlock circuit	Interlock pins	Backplane relays affected	Other relays affected
Bank 1, 2, 3, 4	J3-76, J3-78	s0911 through s0918	none

For detailed information about engaging hardware interlocks and determining interlock status, refer to the *Series 3700A System Switch/Multimeter Reference Manual* (part number 3700AS-901-01), available for download from the Keithley Downloads web page (*http://www.tek.com/downloads*).

Channel specifiers

To use the Model 3732 ultra-high density reed relay matrix card, you will need to understand channel specifiers and the two notation styles used with the Model 3732 card.

A channel specifier is a four or five-digit alphanumeric sequence that specifies channels for use with close and open operations, scans, and channel patterns. The first digit is always the slot number of the card in the mainframe. The remaining digits vary depending on the type of card. For the Model 3732 card, the channel descriptor for the matrix channel type has been extended, allowing you to denote the desired bank under some configurations.

NOTE

For complete information about all Series 3700A channel types and specifiers, refer to the *Series 3700A System Switch/Multimeter Reference Manual* (part number 3700AS-901-01), available for download from the Keithley Downloads web page (*http://www.tek.com/downloads*).

Notation styles

There are two notation styles used to control the Model 3732 card relays, Refer to the following for more information: *Matrix card notation* (on page 11-12) and Backplane relay notation (on page 11-12).

Matrix card notation

To specify channels using matrix card notation, use SBRCC, where:

S	Slot number
B	Bank
R	Row number* Some cards use a range of 1 to 4 or 1 to 8; other cards use a range of A to P (refer to the card's documentation)
CC	Column number (always use 2 digits) For columns greater than 99, use A0 for column 100, A1 for column 101, A2 for column 102, and so on, through A9 for column 109. Use B0 for column 110, B1 for column 111, and B2 for column 112.
*All Model 3732 configurations use numbers for the rows except the single 16 × 28 configuration, which uses numbers and the letters A and B for the rows.	

Matrix channel examples

The next table shows some examples of possible channel specifiers for the Model 3732 card using matrix card notation.

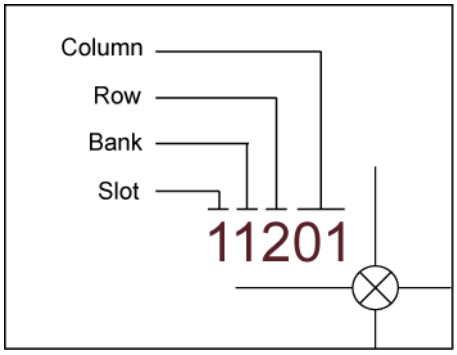
Example matrix card notation channel specifiers:

Reference	Slot	Bank	Row	Column
11104	1	1	1	04
213A4	2	1	3	104
62101	6	2	1	01
31J12	3	1	10	12

Channel numbering example

The next figure shows what the numbers represent in the crosspoint schematics that appear in each of the Model 3732 configuration descriptions that follow. Note that this specific example represents a Model 3732 card installed in slot 1, configured for the quad 4 × 28 configuration.

Figure 42: Channel numbering in matrix crosspoint schematics



Backplane relay notation

To control analog backplane relays for slots with analog backplane relay channels, use S091X, where:

S	Slot number
0	Always zero for Model 3732 backplane relays
9	Always 9 for Model 3732 backplane relays
1	Always 1 for Model 3732 backplane relays
X	Analog backplane relay number

Backplane relay examples

The next table shows the channel specifiers for the Model 3732 card using backplane relay notation. Note that this example represents the backplane relays of a card located in slot 1.

Example backplane relay notation channel specifiers:

Reference	Series 3700A mainframe analog backplane
10911	Analog backplane 1
10912	Analog backplane 2
10913	Analog backplane 3
10914	Analog backplane 4
10915	Analog backplane 5
10916	Analog backplane 6
10917	Analog backplane 1
10918	Analog backplane 2

Card configurations

The Model 3732 has five main configurations in 1-pole mode:

- Quad 4 × 28 configuration (on page 11-13)
- Dual 4 × 56 configuration (on page 11-18)
- Single 4 × 112 configuration (on page 11-22)
- Dual 8 × 28 configuration (on page 11-26)
- Single 16 × 28 configuration (on page 11-30)

You can also use 2-pole mode for three additional configurations:

- Dual 4 × 28 2-pole configuration (on page 11-35)
- Single 4 × 56 2-pole configuration (on page 11-39)
- Single 8 × 28 2-pole configuration (on page 11-43)

The following sections contain details for each configuration, including: D-sub connectors, pin assignments and signal naming, crosspoint relay schematics, and connection logs.

Single-pole configurations

The five main Model 3732 configurations (1-pole) are described in the sections that follow.

Quad 4 × 28 configuration

The quad 4 × 28 configuration, which is the default configuration for the Model 3732 card, allows you to connect four separate banks of 28 crosspoints using jumpers, relays, or the Model 3732-ST-C screw terminal assembly.

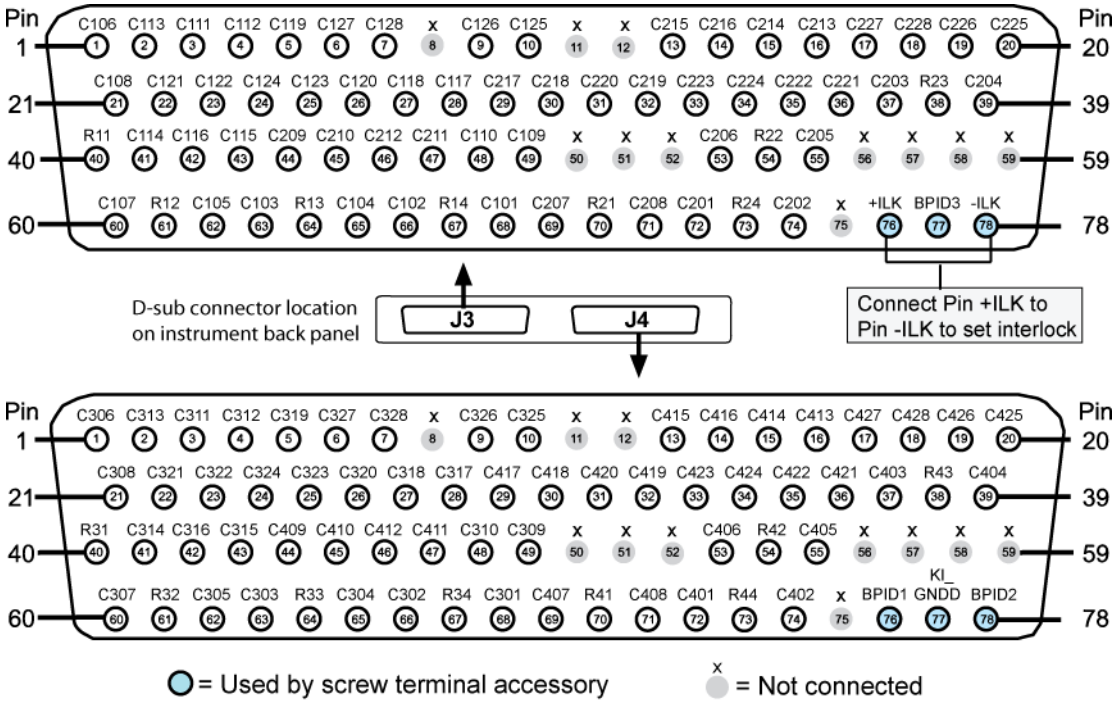
NOTE

Refer to the Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) topics for more information about jumper settings.

D-sub connections: Quad 4 × 28 configuration

The next figure shows the D-sub pin connections for the Model 3732 quad 4 × 28 configuration.

Figure 43: Quad 4 × 28 D-sub pin connections



Pin assignments and signal naming: Quad 4 × 28 configuration

The Model 3732 is set to the quad 4 × 28 configuration by default. The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the quad 4 × 28 configuration:

Figure 44: Model 3732 J3 D-sub connector pin assignments quad 4 × 28

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Row #
C106	1	1	6	C122	23	1	22	C211	47	2	11	R23	38	2	3
C113	2	1	13	C124	24	1	24	C110	48	1	10	R11	40	1	1
C111	3	1	11	C123	25	1	23	C109	49	1	9	R22	54	2	2
C112	4	1	12	C120	26	1	20	x	50	x	x	R12	61	1	2
C119	5	1	19	C118	27	1	18	x	51	x	x	R13	64	1	3
C127	6	1	27	C117	28	1	17	x	52	x	x	R14	67	1	4
C128	7	1	28	C217	29	2	17	C206	53	2	6	R21	70	2	1
x*	8	x	x	C218	30	2	18	C205	55	2	5	R24	73	2	4
C126	9	1	26	C220	31	2	20	x	56	x	x				
C125	10	1	25	C219	32	2	19	x	57	x	x				
x	11	x	x	C223	33	2	23	x	58	x	x				
x	12	x	x	C224	34	2	24	x	59	x	x				
C215	13	2	15	C222	35	2	22	C107	60	1	7				
C216	14	2	16	C221	36	2	21	C105	62	1	5				
C214	15	2	14	C203	37	2	3	C103	63	1	3				
C213	16	2	13	C204	39	2	4	C104	65	1	4				
C227	17	2	27	C114	41	1	14	C102	66	1	2				
C228	18	2	28	C116	42	1	16	C101	68	1	1				
C226	19	2	26	C115	43	1	15	C207	69	2	7				
C225	20	2	25	C209	44	2	9	C208	71	2	8				
C108	21	1	8	C210	45	2	10	C201	72	2	1				
C121	22	1	21	C212	46	2	12	C202	74	2	2				
								x	75	x	x				

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the quad 4 × 28 configuration:

Figure 45: Model 3732 J4 D-sub connector pin assignments quad 4 × 28

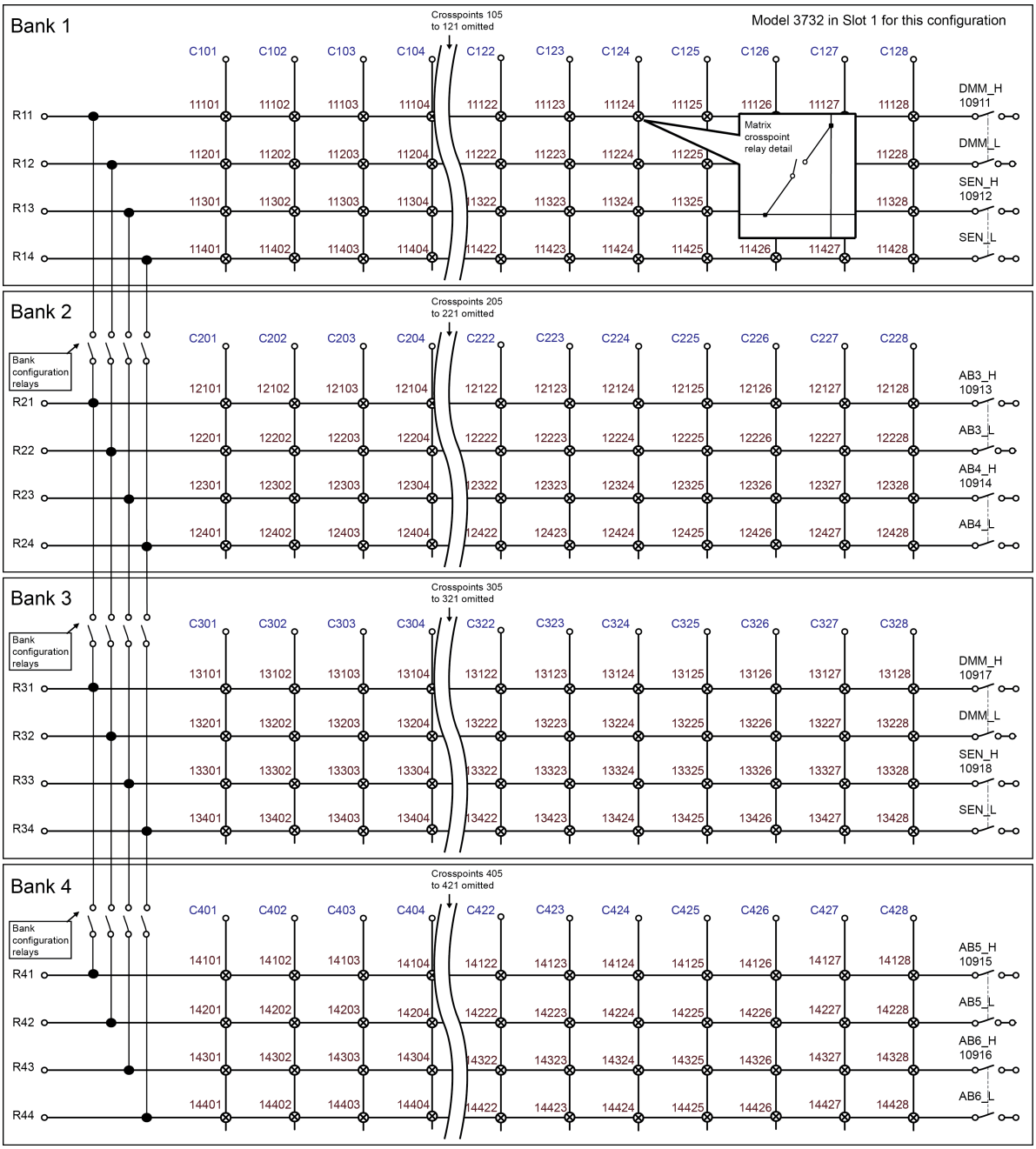
Columns												Rows			
Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name #	Pin #	Matrix location	
		Bank #	Column #			Bank #	Column #			Bank #	Column #			Bank #	Row#
C306	1	1	6	C322	23	1	22	C411	47	2	11	R43	38	2	3
C313	2	1	13	C324	24	1	24	C310	48	1	10	R31	40	1	1
C311	3	1	11	C323	25	1	23	C309	49	1	9	R42	54	2	2
C312	4	1	12	C320	26	1	20	x	50	x	x	R32	61	1	2
C319	5	1	19	C318	27	1	18	x	51	x	x	R33	64	1	3
C327	6	1	27	C317	28	1	17	x	52	x	x	R34	67	1	4
C328	7	1	28	C417	29	2	17	C406	53	2	6	R41	70	2	1
x*	8	x	x	C418	30	2	18	C405	55	2	5	R44	73	2	4
C326	9	1	26	C420	31	2	20	x	56	x	x				
C325	10	1	25	C419	32	2	19	x	57	x	x				
x	11	x	x	C423	33	2	23	x	58	x	x				
x	12	x	x	C424	34	2	24	x	59	x	x				
C415	13	2	15	C422	35	2	22	C307	60	1	7				
C416	14	2	16	C421	36	2	21	C305	62	1	5				
C414	15	2	14	C403	37	2	3	C303	63	1	3				
C413	16	2	13	C404	39	2	4	C304	65	1	4				
C427	17	2	27	C314	41	1	14	C302	66	1	2				
C428	18	2	28	C316	42	1	16	C301	68	1	1				
C426	19	2	27	C315	43	1	15	C407	69	2	7				
C425	20	2	25	C409	44	2	9	C408	71	2	8				
C308	21	1	8	C410	45	2	10	C402	74	2	2				
C321	22	1	21	C412	46	2	12	x	75	x	x				

* x indicates the pin is not connected in this configuration

Matrix crosspoint schematic: Quad 4 × 28 configuration

The next figure is a simplified crosspoint schematic of the quad 4 × 28 matrix configuration.

Figure 46: Model 3732 4 × 28 crosspoint matrix



Dual 4 × 56 configuration

The dual 4 × 56 configuration allows you to create two banks of 224 crosspoints using bank configuration relays mounted on the Model 3732 card. The columns of these two banks can then be connected using jumpers, relays, or the Model 3732 -ST-C screw terminal assembly.

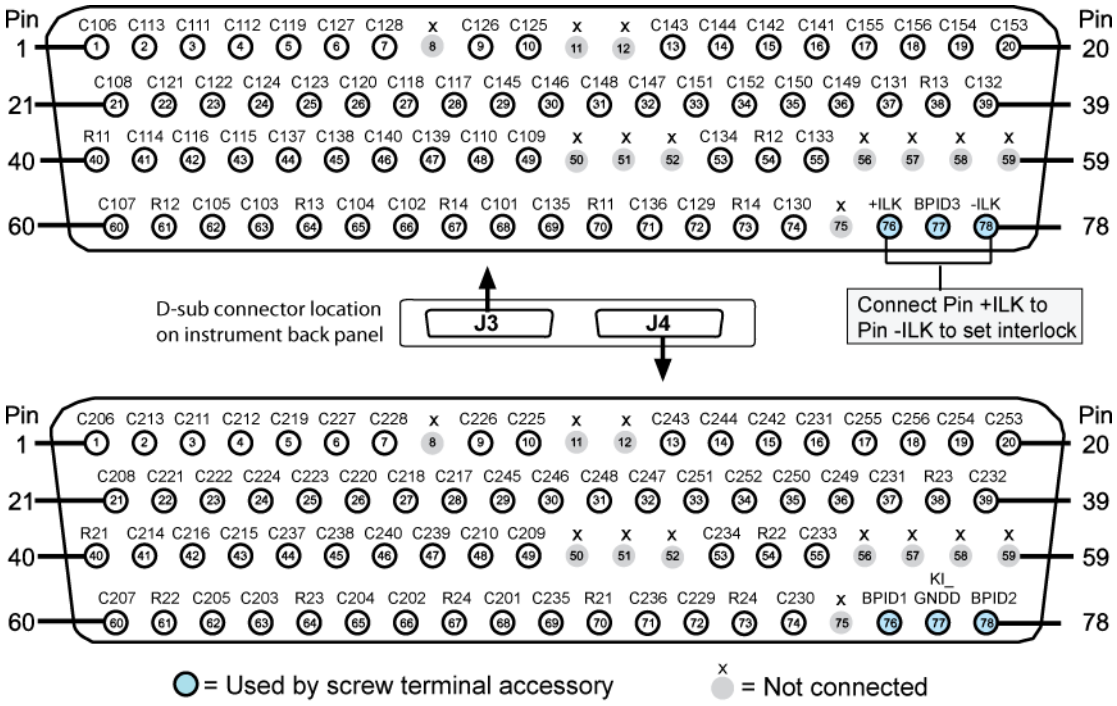
NOTE

Refer to the Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) topics for more information about jumper settings.

D-sub connections: Dual 4 × 56 configuration

The next figure shows the D-sub pin assignments for the dual 4 × 56 configuration.

Figure 47: Dual 4 × 56 D-sub pin connections



Pin assignments and signal naming: Dual 4 × 56 configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the dual 4 × 56 configuration:

Figure 48: Model 3732 J3 D-sub connector pin assignments quad 4 × 56

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank # Bank #	Row #
C106	1	1	6	C124	24	1	24	C109	49	1	9	R13	38	1	3
C113	2	1	13	C123	25	1	23	x	50	x	x	R11	40	1	1
C111	3	1	11	C120	26	1	20	x	51	x	x	R12	54	1	2
C112	4	1	12	C118	27	1	18	x	52	x	x	R12	61	1	2
C119	5	1	19	C117	28	1	17	C134	53	1	34	R13	64	1	3
C127	6	1	27	C145	29	1	45	C133	55	1	33	R14	67	1	4
C128	7	1	28	C146	30	1	46	x	56	x	x	R11	70	1	1
x *	8	x	x	C148	31	1	48	x	57	x	x	R14	73	1	4
C126	9	1	26	C147	32	1	47	x	58	x	x				
C125	10	1	25	C151	33	1	51	x	59	x	x				
x	11	x	x	C152	34	1	52	C107	60	1	7				
x	12	x	x	C150	35	1	50	C105	62	1	5				
C143	13	1	43	C149	36	1	49	C103	63	1	3				
C144	14	1	44	C131	37	1	31	C104	65	1	4				
C142	15	1	42	C132	39	1	32	C102	66	1	2				
C141	16	1	41	C114	41	1	14	C101	68	1	1				
C155	17	1	55	C116	42	1	16	C135	69	1	35				
C156	18	1	56	C115	43	1	15	C136	71	1	36				
C154	19	1	54	C137	44	1	37	C129	72	1	29				
C153	20	1	53	C138	45	1	38	C130	74	1	30				
C108	21	1	8	C140	46	1	40	x	75	x	x				
C121	22	1	21	C139	47	1	39								
C122	23	1	22	C110	48	1	10								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the dual 4 × 56 configuration:

Figure 49: Model 3732 J4 D-sub connector pin assignments dual 4 × 56

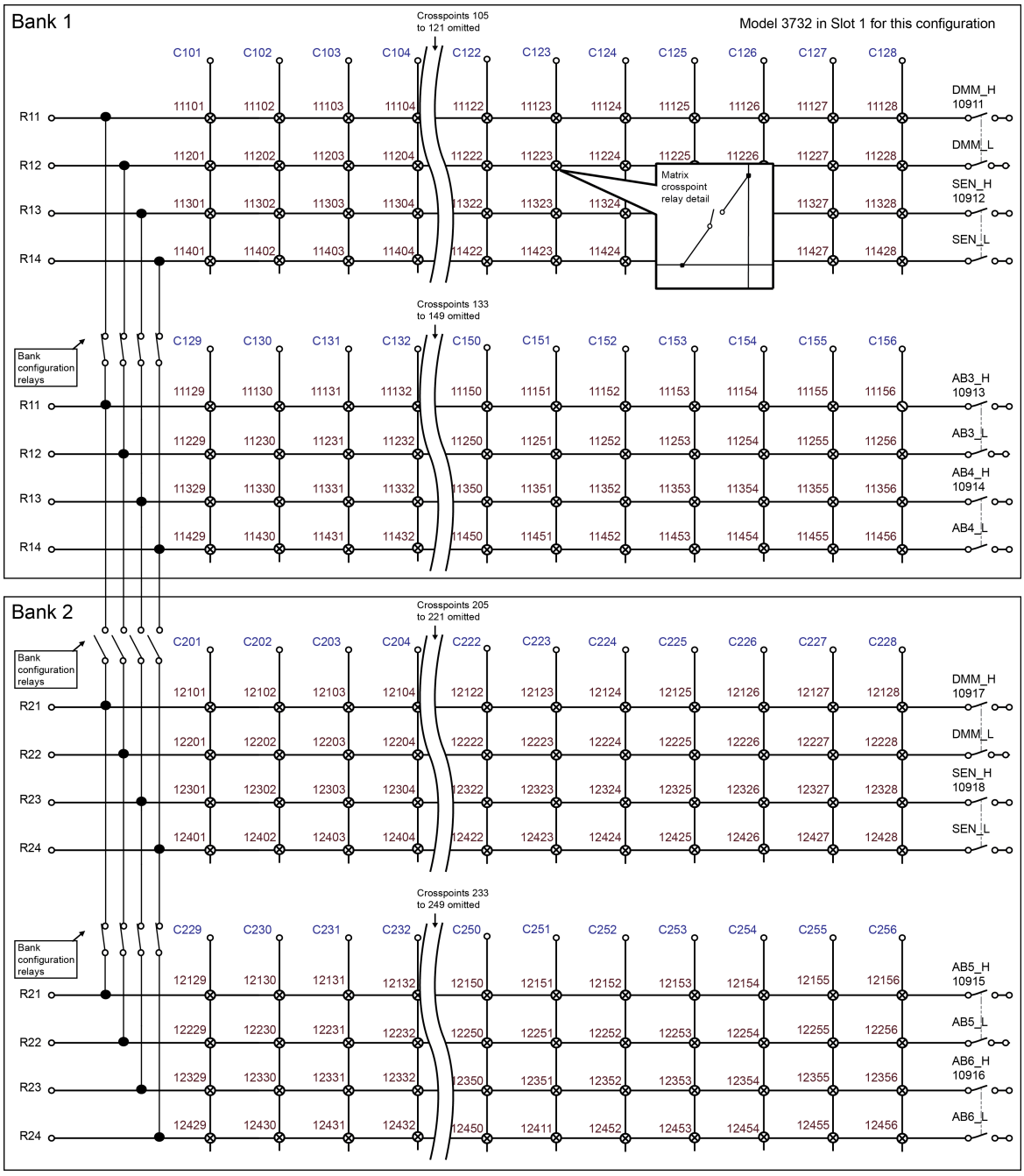
Columns												Rows			
Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name #	Pin #	Matrix location	
		Bank #	Column #			Bank #	Column #			Bank #	Column #			Bank # Bank #	Row #
C206	1	2	6	C224	24	2	24	C209	49	2	9	R23	38	2	3
C213	2	2	13	C223	25	2	23	x	50	x	x	R21	40	2	1
C211	3	2	11	C220	26	2	20	x	51	x	x	R22	54	2	2
C212	4	2	12	C218	27	2	18	x	52	x	x	R22	61	2	2
C219	5	2	19	C217	28	2	17	C234	53	2	34	R23	64	2	3
C227	6	2	27	C245	29	2	45	C233	55	2	33	R24	67	2	4
C228	7	2	28	C246	30	2	46	x	56	x	x	R21	70	2	1
x	8	x	x	C248	31	2	48	x	57	x	x	R24	73	2	4
C226	9	2	26	C247	32	2	47	x	58	x	x				
C225	10	2	25	C251	33	2	51	x	59	x	x				
x	11	x	x	C252	34	2	52	C207	60	2	7				
x	12	x	x	C250	35	2	50	C205	62	2	5				
C243	13	2	43	C249	36	2	49	C203	63	2	3				
C244	14	2	44	C231	37	2	31	C204	65	2	4				
C242	15	2	42	C232	39	2	32	C202	66	2	2				
C231	16	2	31	C214	41	2	14	C201	68	2	1				
C255	17	2	55	C216	42	2	16	C235	69	2	35				
C256	18	2	56	C215	43	2	15	C236	71	2	36				
C254	19	2	54	C237	44	2	37	C229	72	2	29				
C253	20	2	53	C238	45	2	38	C230	74	2	30				
C208	21	2	8	C240	46	2	40	x	75	x	x				
C221	22	2	21	C239	47	2	39								
C222	23	2	22	C210	48	2	10								

* x indicates the pin is not connected in this configuration

Schematic: Dual 4 × 56 configuration

The next figure is a simplified crosspoint schematic of the dual 4 × 56 matrix configuration.

Figure 50: Dual 4 × 56 simplified crosspoint schematic



Single 4 × 112 configuration

The single 4 × 112 configuration allows you to connect four banks of 112 crosspoints into a single matrix of 448 crosspoints using bank configuration relays mounted on the Model 3732 card. The columns of these four banks can then be connected using jumpers, relays, or the Model 3732-ST-C screw terminal assembly.

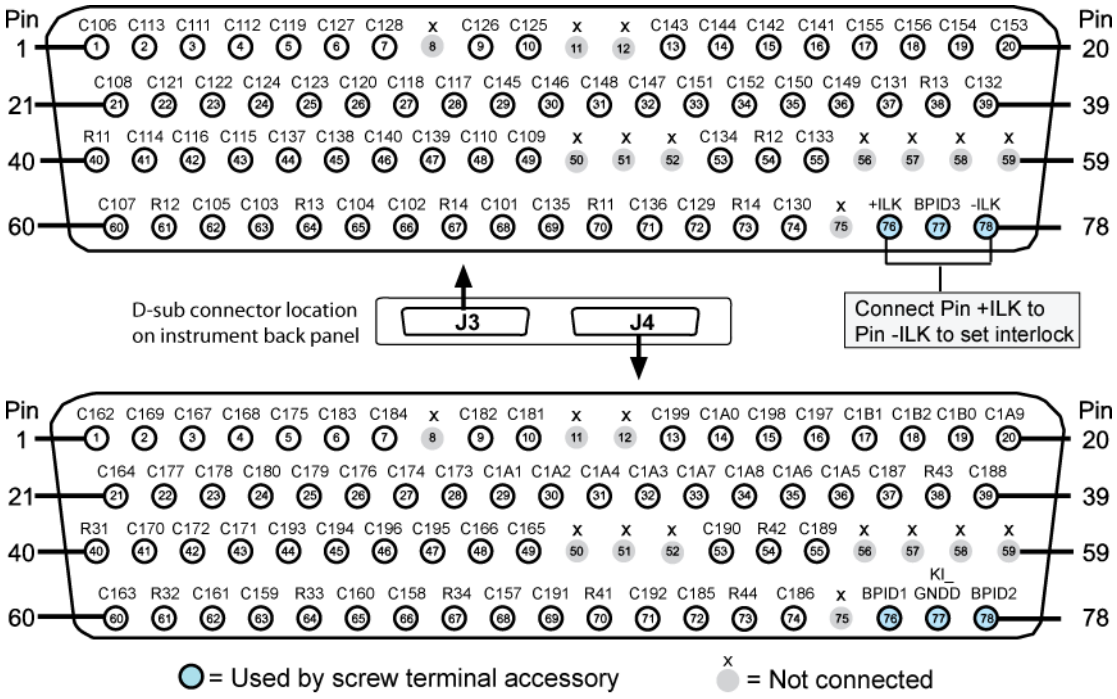
NOTE

Refer to the Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) topics for more information about jumper settings.

D-sub connections: Single 4 × 112 configuration

The next figure shows the D-sub pin assignments for the single 4 × 112 configuration.

Figure 51: Single 4 × 112 D-sub pin connections



Pin assignments and signal naming: Single 4 × 112 configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the single 4 × 112 configuration:

Figure 52: Model 3732 J3 D-sub connector pin assignments quad 4 × 112

Columns												Rows			
Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name #	Pin #	Matrix location	
		Bank #	Column #			Bank #	Column #			Bank #	Column #			Bank # Bank #	Row #
C106	1	1	6	C124	24	1	24	C109	49	1	9	R13	38	1	3
C113	2	1	13	C123	25	1	23	x	50	x	x	R11	40	1	1
C111	3	1	11	C120	26	1	20	x	51	x	x	R12	54	1	2
C112	4	1	12	C118	27	1	18	x	52	x	x	R12	61	1	2
C119	5	1	19	C117	28	1	17	C134	53	1	34	R13	64	1	3
C127	6	1	27	C145	29	1	45	C133	55	1	33	R14	67	1	4
C128	7	1	28	C146	30	1	46	x	56	x	x	R11	70	1	1
x *	8	x	x	C148	31	1	48	x	57	x	x	R14	73	1	4
C126	9	1	26	C147	32	1	47	x	58	x	x				
C125	10	1	25	C151	33	1	51	x	59	x	x				
x	11	x	x	C152	34	1	52	C107	60	1	7				
x	12	x	x	C150	35	1	50	C105	62	1	5				
C143	13	1	43	C149	36	1	49	C103	63	1	3				
C144	14	1	44	C131	37	1	31	C104	65	1	4				
C142	15	1	42	C132	39	1	32	C102	66	1	2				
C141	16	1	41	C114	41	1	14	C101	68	1	1				
C155	17	1	55	C116	42	1	16	C135	69	1	35				
C156	18	1	56	C115	43	1	15	C136	71	1	36				
C154	19	1	54	C137	44	1	37	C129	72	1	29				
C153	20	1	53	C138	45	1	38	C130	74	1	30				
C108	21	1	8	C140	46	1	40	x	75	x	x				
C121	22	1	21	C139	47	1	39								
C122	23	1	22	C110	48	1	10								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the single 4 × 112 configuration:

Figure 53: Model 3732 J4 D-sub connector pin assignments quad 4 × 112

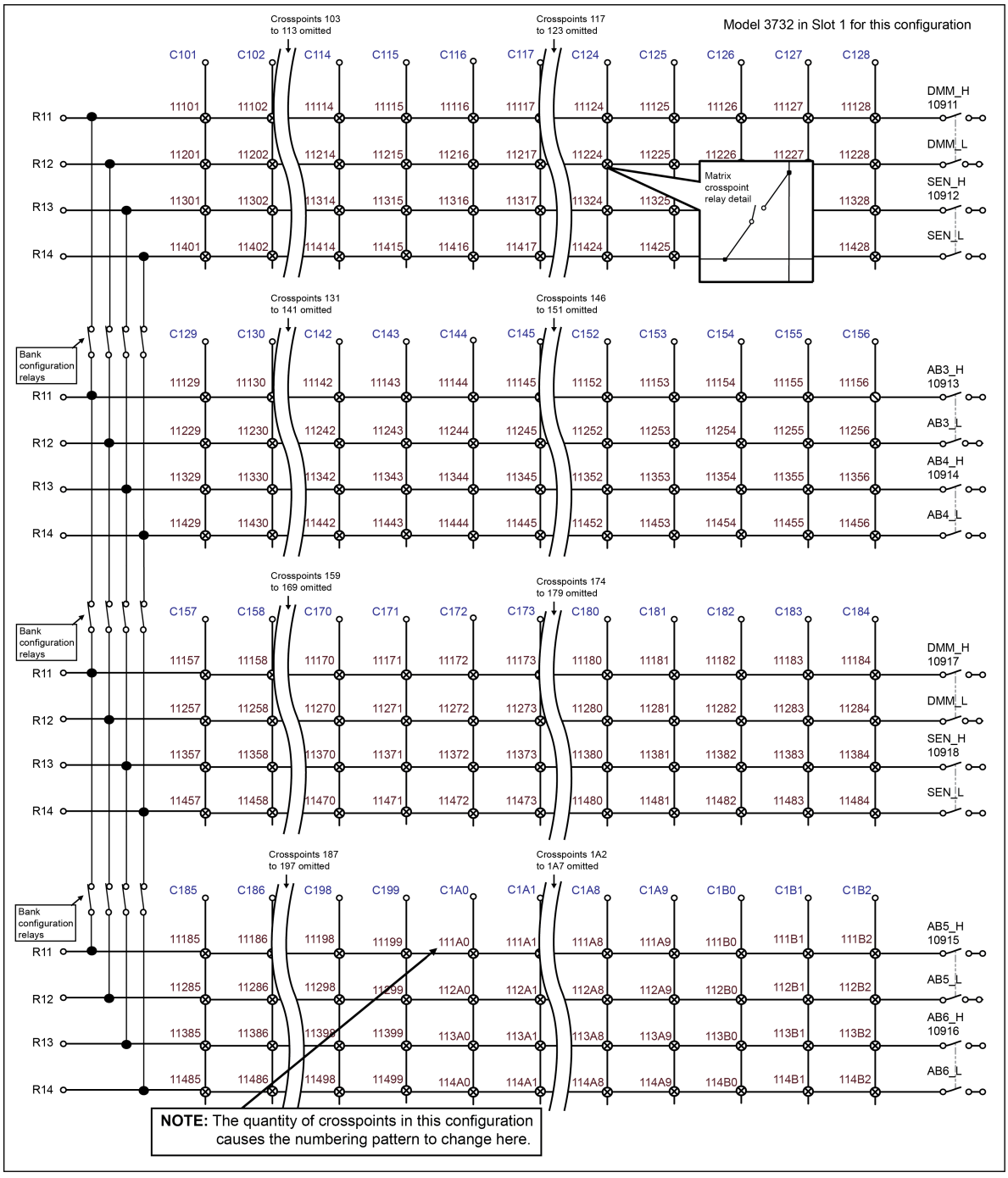
Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank # Bank #	Row #
C162	1	1	62	C180	24	1	80	C165	49	1	65	R43	38	1	3
C169	2	1	69	C179	25	1	79	x	50	x	x	R31	40	1	1
C167	3	1	67	C176	26	1	76	x	51	x	x	R42	54	1	2
C168	4	1	68	C174	27	1	74	x	52	x	x	R32	61	1	2
C175	5	1	75	C173	28	1	73	C190	53	1	90	R33	64	1	3
C183	6	1	83	C1A1	29	1	A1	C189	55	1	89	R34	67	1	4
C184	7	1	84	C1A2	30	1	A2	x	56	x	x	R41	70	1	1
x*	8	x	x	C1A4	31	1	A4	x	57	x	x	R44	73	1	4
C182	9	1	82	C1A3	32	1	A3	x	58	x	x				
C181	10	1	81	C1A7	33	1	A7	x	59	x	x				
x	11	x	x	C1A8	34	1	A8	C163	60	1	63				
x	12	x	x	C1A6	35	1	A6	C161	62	1	61				
C199	13	1	99	C1A5	36	1	A5	C159	63	1	59				
C1A0	14	1	A0	C187	37	1	87	C160	65	1	60				
C198	15	1	98	C188	39	1	88	C158	66	1	58				
C197	16	1	97	C170	41	1	70	C157	68	1	57				
C1B1	17	1	B1	C172	42	1	72	C191	69	1	91				
C1B2	18	1	B2	C171	43	1	71	C192	71	1	92				
C1B0	19	1	B0	C193	44	1	93	C185	72	1	85				
C1A9	20	1	A9	C194	45	1	94	C186	74	1	86				
C164	21	1	64	C196	46	1	96	x	75	x	x				
C177	22	1	77	C195	47	1	95								
C178	23	1	78	C166	48	1	66								

* x indicates the pin is not connected in this configuration

Schematic: Single 4 × 112 configuration

The next figure is a simplified crosspoint schematic of the single 4 × 112 matrix configuration.

Figure 54: Single 4 × 112 simplified crosspoint schematic



Dual 8 × 28 configuration

The dual 8 × 28 configuration allows you to use row expansion to create two banks of 224 crosspoints (each bank consisting of 8 rows and 28 columns) using jumpers, relays, or the Model 3732-ST-R screw terminal assembly.

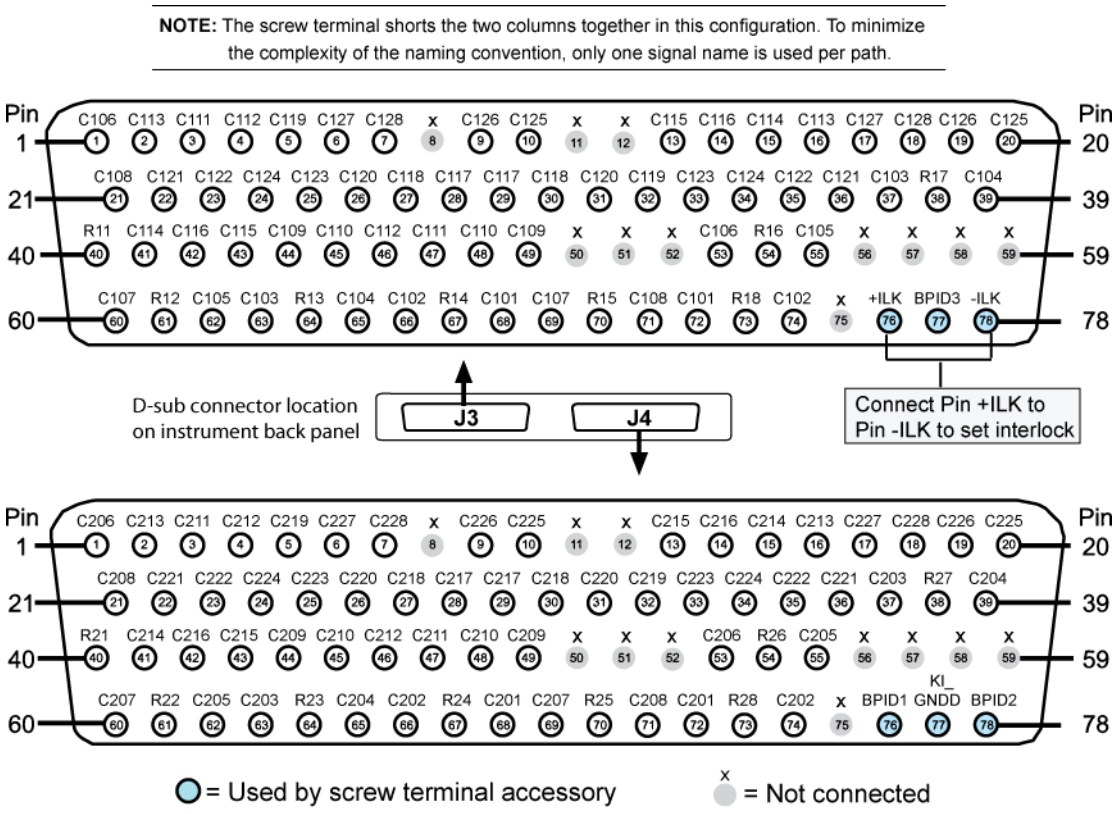
NOTE

Refer to the Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) topics for more information about jumper settings.

D-sub connections: Dual 8 × 28 configuration

The next figure shows the D-sub pin assignments for the dual 8 × 28 configuration.

Figure 55: Dual 8 × 28 D-sub pin connections



NOTE

The pinouts in the previous figure represent the pin connections that are made when the Model 3732-ST-R screw terminal is attached to the Model 3732 J3 and J4 connectors. If the Model 3732-ST-R is not attached, you must connect the pins with the same name together externally; they are not connected on the Model 3732 card for this mode.

Pin assignments and signal naming: Dual 8 × 28 configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the dual 8 × 28 configuration:

Figure 56: Model 3732 J3 D-sub connector pin assignments dual 8 × 28

Columns												Rows			
Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name #	Pin #	Matrix location	
		Bank #	Column #			Bank #	Column #			Bank #	Column #			Bank # Bank #	Row #
C106	1	1	6	C124	24	1	24	C109	49	1	9	R17	38	1	7
C113	2	1	13	C123	25	1	23	x	50	x	x	R11	40	1	1
C111	3	1	11	C120	26	1	20	x	51	x	x	R16	54	1	6
C112	4	1	12	C118	27	1	18	x	52	x	x	R12	61	1	2
C119	5	1	19	C117	28	1	17	C106	53	1	6	R13	64	1	3
C127	6	1	27	C117	29	1	17	C105	55	1	5	R14	67	1	4
C128	7	1	28	C118	30	1	18	x	56	x	x	R15	70	1	5
x*	8	x	x	C120	31	1	20	x	57	x	x	R18	73	1	8
C126	9	1	26	C119	32	1	19	x	58	x	x				
C125	10	1	25	C123	33	1	23	x	59	x	x				
x	11	x	x	C124	34	1	24	C107	60	1	7				
x	12	x	x	C122	35	1	22	C105	62	1	5				
C115	13	1	15	C121	36	1	21	C103	63	1	3				
C116	14	1	16	C103	37	1	3	C104	65	1	4				
C114	15	1	14	C104	39	1	4	C102	66	1	2				
C113	16	1	13	C114	41	1	14	C101	68	1	1				
C127	17	1	27	C116	42	1	16	C107	69	1	7				
C128	18	1	28	C115	43	1	15	C108	71	1	8				
C126	19	1	26	C109	44	1	9	C101	72	1	1				
C125	20	1	25	C110	45	1	10	C102	74	1	2				
C108	21	1	8	C112	46	1	12	x	75	x	x				
C121	22	1	21	C111	47	1	11								
C122	23	1	22	C110	48	1	10								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the dual 8 × 28 configuration:

Figure 57: Model 3732 J4 D-sub connector pin assignments dual 8 × 28

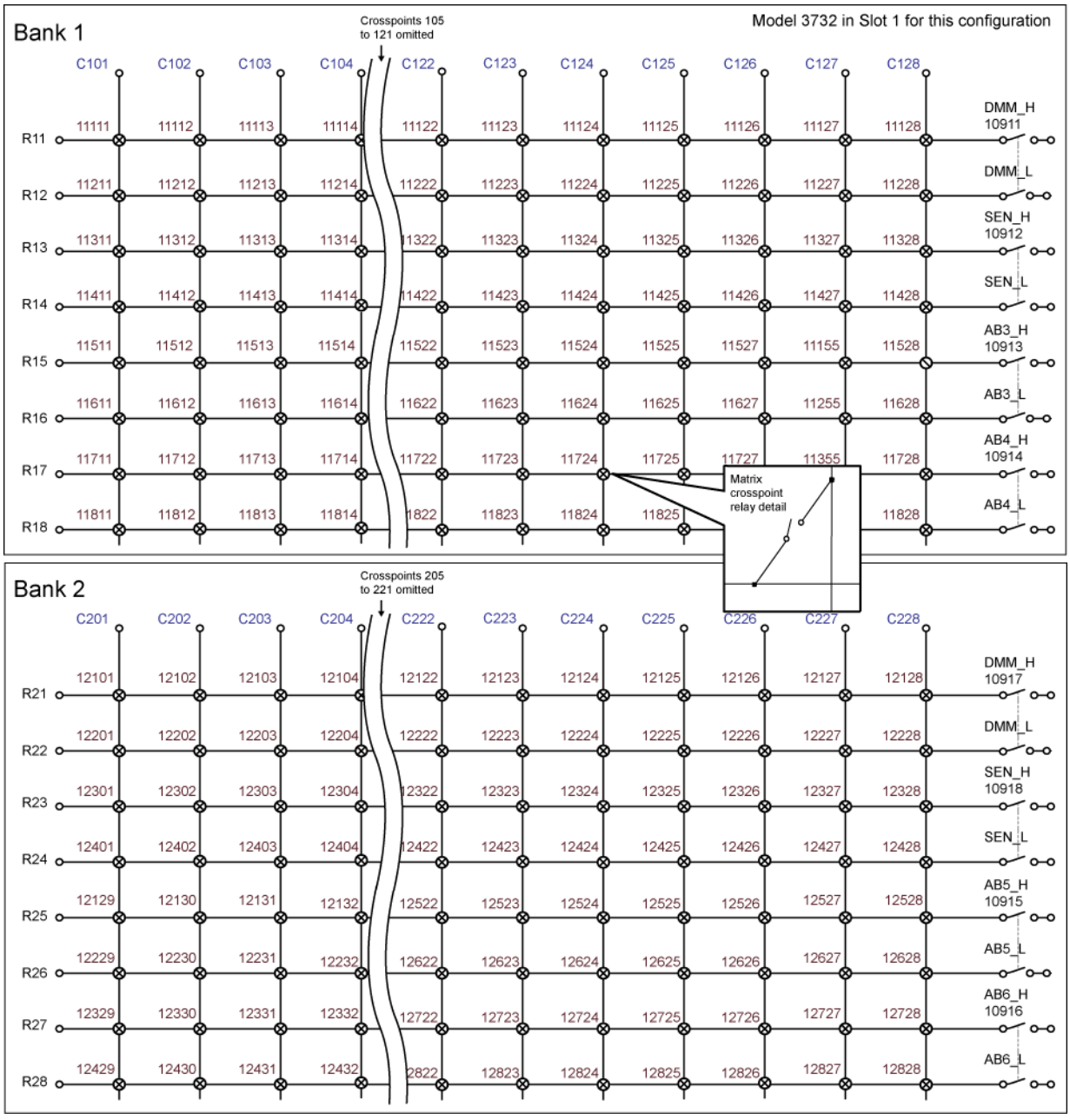
Columns												Rows			
Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name #	Pin #	Matrix location	
		Bank #	Column #			Bank #	Column #			Bank #	Column #			Bank #	Row #
C206	1	2	6	C224	24	2	24	C209	49	2	9	R27	38	2	7
C213	2	2	13	C223	25	2	23	x	50	x	x	R21	40	2	1
C211	3	2	11	C220	26	2	20	x	51	x	x	R26	54	2	6
C212	4	2	12	C218	27	2	18	x	52	x	x	R22	61	2	2
C219	5	2	19	C217	28	2	17	C206	53	2	6	R23	64	2	3
C227	6	2	27	C217	29	2	17	C205	55	2	5	R24	67	2	4
C228	7	2	28	C218	30	2	18	x	56	x	x	R25	70	2	5
x*	8	x	x	C220	31	2	20	x	57	x	x	R28	73	2	8
C226	9	2	26	C219	32	2	19	x	58	x	x				
C225	10	2	25	C223	33	2	23	x	59	x	x				
x	11	x	x	C224	34	2	24	C207	60	2	7				
x	12	x	x	C222	35	2	22	C205	62	2	5				
C215	13	2	15	C221	36	2	21	C203	63	2	3				
C216	14	2	16	C203	37	2	3	C204	65	2	4				
C214	15	2	14	C204	39	2	4	C202	66	2	2				
C213	16	2	13	C214	41	2	14	C201	68	2	1				
C227	17	2	27	C216	42	2	16	C207	69	2	7				
C228	18	2	28	C215	43	2	15	C208	71	2	8				
C226	19	2	26	C209	44	2	9	C201	72	2	1				
C225	20	2	25	C210	45	2	10	C202	74	2	2				
C208	21	2	8	C212	46	2	12	x	75	x	x				
C221	22	2	21	C211	47	2	11								
C222	23	2	22	C210	48	2	10								

* x indicates the pin is not connected in this configuration

Schematic: Dual 8 × 28 configuration

The next figure is a simplified crosspoint schematic of the dual 8 × 28 matrix configuration.

Figure 58: Dual 8 × 28 simplified crosspoint schematic



Single 16 × 28 configuration

The single 16 × 28 configuration allows you to use row expansion to create a single bank consisting of 16 rows and 28 columns using jumpers, relays, or the Model 3732-ST-R screw terminal assembly.

NOTE

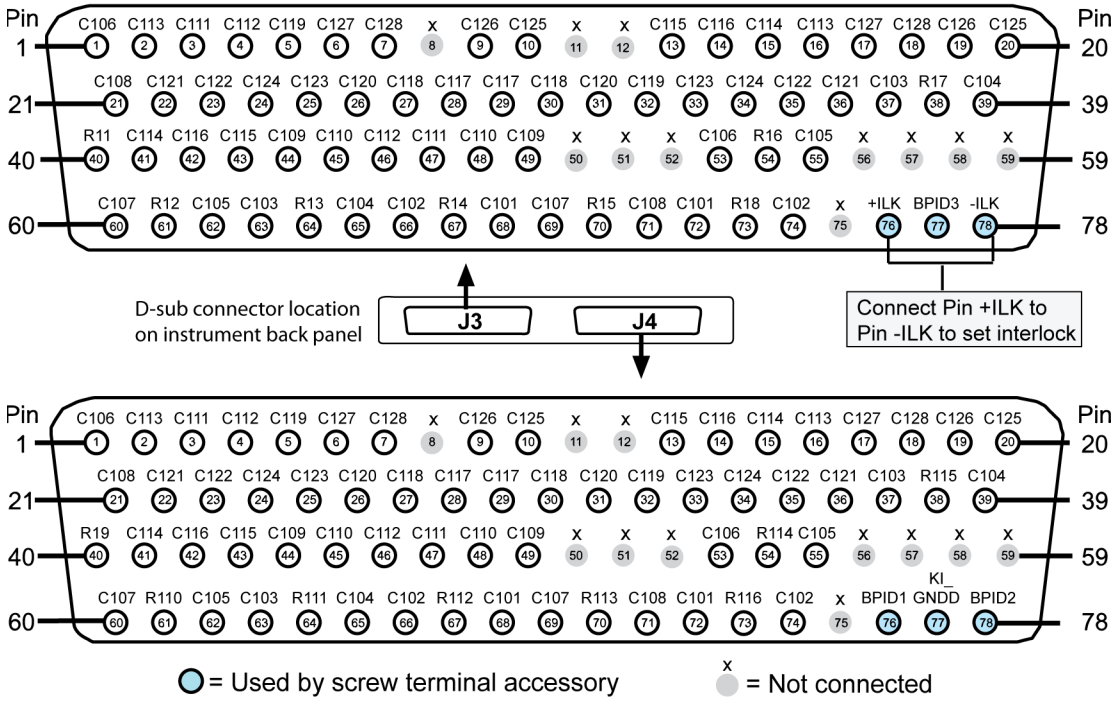
Refer to the Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) topics for more information about jumper settings.

D-sub connections: Single 16 × 28 configuration

The next figure shows the D-sub pin assignments for the single 16 × 28 configuration.

Figure 59: Single 16 × 28 D-sub pin connections

NOTE: The screw terminal shorts the two columns together in this configuration. To minimize the complexity of the naming convention, only one signal name is used per path.



Pin assignments and signal naming: Single 16 × 28 configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the single 16 × 28 configuration:

Figure 60: Model 3732 J3 D-sub connector pin assignments single 16 × 28

Columns												Rows			
Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name	Pin #	Matrix location		Pin signal name #	Pin #	Matrix location	
		Bank #	Column #			Bank #	Column #			Bank #	Column #			Bank # Bank #	Row #
C106	1	1	6	C124	24	1	24	C109	49	1	9	R17	38	1	7
C113	2	1	13	C123	25	1	23	x	50	x	x	R11	40	1	1
C111	3	1	11	C120	26	1	20	x	51	x	x	R16	54	1	6
C112	4	1	12	C118	27	1	18	x	52	x	x	R12	61	1	2
C119	5	1	19	C117	28	1	17	C106	53	1	6	R13	64	1	3
C127	6	1	27	C117	29	1	17	C105	55	1	5	R14	67	1	4
C128	7	1	28	C118	30	1	18	x	56	x	x	R15	70	1	5
x*	8	x	x	C120	31	1	20	x	57	x	x	R18	73	1	8
C126	9	1	26	C119	32	1	19	x	58	x	x				
C125	10	1	25	C123	33	1	23	x	59	x	x				
x	11	x	x	C124	34	1	24	C107	60	1	7				
x	12	x	x	C122	35	1	22	C105	62	1	5				
C115	13	1	15	C121	36	1	21	C103	63	1	3				
C116	14	1	16	C103	37	1	3	C104	65	1	4				
C114	15	1	14	C104	39	1	4	C102	66	1	2				
C113	16	1	13	C114	41	1	14	C101	68	1	1				
C127	17	1	27	C116	42	1	16	C107	69	1	7				
C128	18	1	28	C115	43	1	15	C108	71	1	8				
C126	19	1	26	C109	44	1	9	C101	72	1	1				
C125	20	1	25	C110	45	1	10	C102	74	1	2				
C108	21	1	8	C112	46	1	12	x	75	x	x				
C121	22	1	21	C111	47	1	11								
C122	23	1	22	C110	48	1	10								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the single 16 × 28 configuration:

Figure 61: Model 3732 J4 D-sub connector pin assignments single 16 × 28

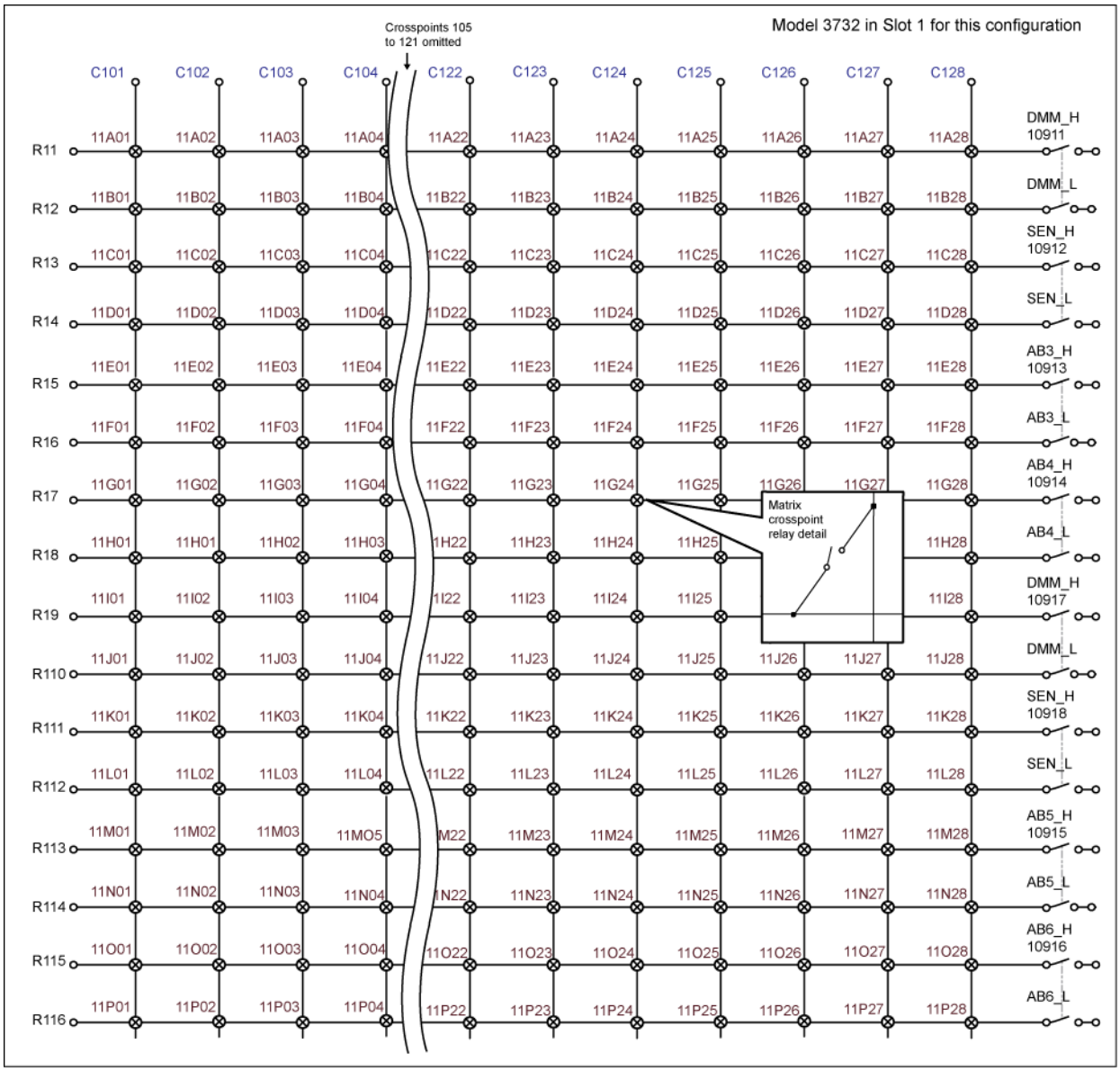
Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank # Bank #	Row #
C106	1	1	6	C124	24	1	24	C109	49	1	9	R115	38	1	15
C113	2	1	13	C123	25	1	23	x	50	x	x	R19	40	1	9
C111	3	1	11	C120	26	1	20	x	51	x	x	R114	54	1	14
C112	4	1	12	C118	27	1	18	x	52	x	x	R110	61	1	10
C119	5	1	19	C117	28	1	17	C106	53	1	6	R111	64	1	11
C127	6	1	27	C117	29	1	17	C105	55	1	5	R112	67	1	12
C128	7	1	28	C118	30	1	18	x	56	x	x	R113	70	1	13
x*	8	x	x	C120	31	1	20	x	57	x	x	R116	73	1	16
C126	9	1	26	C119	32	1	19	x	58	x	x				
C125	10	1	25	C123	33	1	23	x	59	x	x				
x	11	x	x	C124	34	1	24	C107	60	1	7				
x	12	x	x	C122	35	1	22	C105	62	1	5				
C115	13	1	15	C121	36	1	21	C103	63	1	3				
C116	14	1	16	C103	37	1	3	C104	65	1	4				
C114	15	1	14	C104	39	1	4	C102	66	1	2				
C113	16	1	13	C114	41	1	14	C101	68	1	1				
C127	17	1	27	C116	42	1	16	C107	69	1	7				
C128	18	1	28	C115	43	1	15	C108	71	1	8				
C126	19	1	26	C109	44	1	9	C101	72	1	1				
C125	20	1	25	C110	45	1	10	C103	74	1	3				
C108	21	1	8	C112	46	1	12	x	75	x	x				
C121	22	1	21	C111	47	1	11								
C122	23	1	22	C110	48	1	10								

* x indicates the pin is not connected in this configuration

Schematic: Single 16 × 28 configuration

The next figure is a simplified crosspoint schematic of the single 16 × 28 matrix configuration.

Figure 62: Single 16 × 28 simplified crosspoint schematic



Model 3732 2-pole operation

There are three additional Model 3732 2-pole configurations available using Series 3700A software with the Model 3732 card:

- Dual 4 × 28 2-pole configuration (on page 11-35)
- Single 4 × 56 2-pole configuration (on page 11-39)
- Single 8 × 28 2-pole configuration (on page 11-43)

The Model 3732 uses single-pole relays and operates in single-pole mode by default. However, three Model 3732 configurations can operate in 2-pole mode (using Series 3700A software).

In 2-pole operation, one relay bank is used for the high signals, and the adjacent relay bank is used for the low signals. When the Model 3732 is configured for 2-pole operation, closing a channel on the first (high) bank causes the automatic closure of the corresponding channel on the second (low) bank (channel pairing).

NOTE

When viewing the crosspoint matrix for your 2-pole configuration in the Series 3700A web interface on your computer, the low crosspoint in a channel pair will appear unavailable (gray). If you attempt to click on the low crosspoint, you will receive an error message stating the channel is not active.

To set up the Model 3732 card for 2-pole operation, you first configure the card's hardware for the appropriate 1-pole operation, and then enable 2-pole operation using the Series 3700A software. shows the necessary base hardware configuration (1-pole) to accomplish each 2-pole configuration using the Series 3700A software.

Base 1-pole hardware settings for 2-pole configurations

Model 3732 1-pole configuration	Model 3732 2-pole configuration using Series 3700A software
Quad 4 × 28	Dual 4 × 28 (2-pole)
Dual 8 × 28	Single 8 × 28 (2-pole)
Dual 4 × 56	Single 4 × 56 (2-pole)

Configure the Model 3732 hardware for the appropriate 1-pole operation by setting the ID jumpers on the screw terminal assembly or direct wiring the ID bit connections (if you are not using a screw terminal assembly).

Once the hardware is configured, use the Series 3700A's software to select 2-pole operation (using the `channel.setpole` command). Refer to the "Close/Open Overview" section of the *Series 3700A Reference Manual* for detailed information about configuring channels for 2-pole operation.

NOTE

Two-pole operation can be specified on some channels and not others, but it is more common to operate the entire card in 2-pole mode. The schematics, connection diagrams, and connection logs in the following sections assume the entire card is set to 2-pole operation.

Two-pole configurations

The three available 2-pole configurations are described in the following sections.

Dual 4 × 28 2-pole configuration

The dual 4 × 28 2-pole configuration allows you to automatically link four contact sets to act as two pairs. Using the internal relays, you can create a matrix consisting of two banks of paired crosspoints, each with four rows and up to 28 columns. Using the Model 3732-ST-C screw terminal assembly is optional in this configuration.

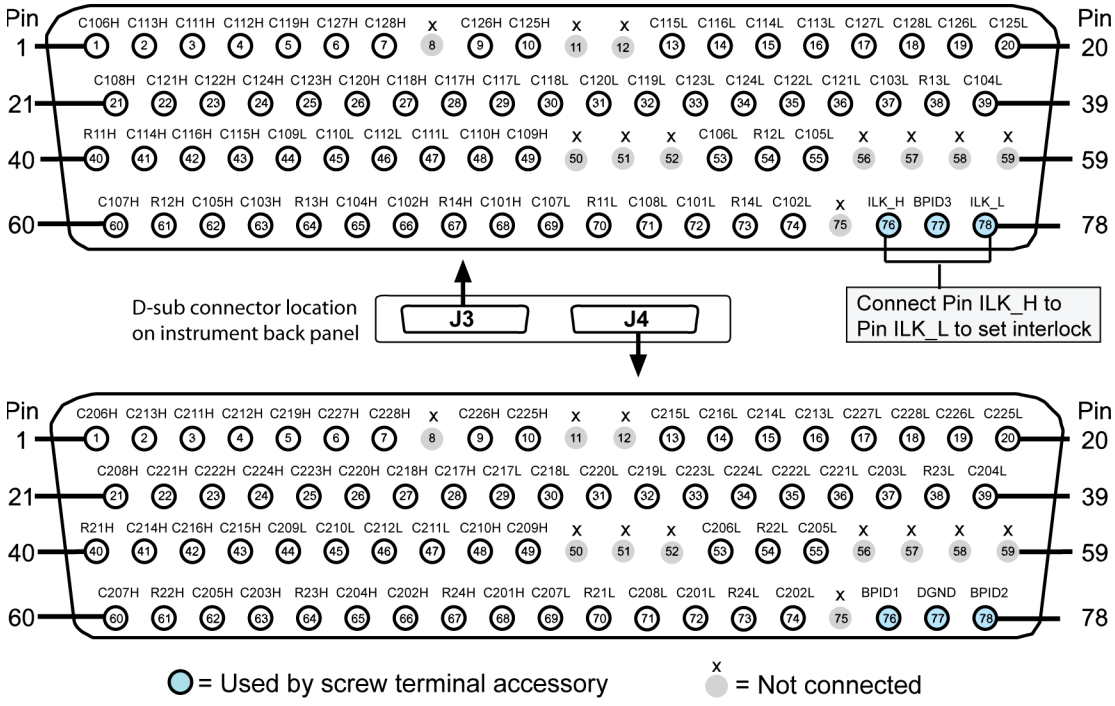
NOTE

Refer to the Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) topics for more information about jumper settings.

D-sub connections: Dual 4 × 28 2-pole configuration

The next figure shows the D-sub pin assignments for the dual 4 × 28 2-pole configuration.

Figure 63: Dual 4 × 28 2-pole D-sub pin connections



Pin assignments and signal naming: Dual 4 × 28 2-pole configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the dual 4 × 28 2-pole configuration:

Figure 64: Model 3732 J3 D-sub connector pin assignments dual 4 × 28

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank #	Row #
C106H	1	1	6H	C124H	24	1	24H	C109H	49	1	9H	R13L	38	1	3L
C113H	2	1	13H	C123H	25	1	23H	x	50	x	x	R11H	40	1	1H
C111H	3	1	11H	C120H	26	1	20H	x	51	x	x	R12L	54	1	2L
C112H	4	1	12H	C118H	27	1	18H	x	52	x	x	R12H	61	1	2H
C119H	5	1	19H	C117H	28	1	17H	C106L	53	1	6L	R13H	64	1	3H
C127H	6	1	27H	C117L	29	1	17L	C105L	55	1	5L	R14H	67	1	4H
C128H	7	1	28H	C118L	30	1	18L	x	56	x	x	R11L	70	1	1L
x*	8	x	x	C120L	31	1	20L	x	57	x	x	R14L	73	1	4L
C126H	9	1	26H	C119L	32	1	19L	x	58	x	x				
C125H	10	1	25H	C123L	33	1	23L	x	59	x	x				
x	11	x	x	C124L	34	1	24L	C107H	60	1	7H				
x	12	x	x	C122L	35	1	22L	C105H	62	1	5H				
C115L	13	1	15L	C121L	36	1	21L	C103H	63	1	3H				
C116L	14	1	16L	C103L	37	1	3L	C104H	65	1	4H				
C114L	15	1	14L	C104L	39	1	4L	C102H	66	1	2H				
C113L	16	1	13L	C114H	41	1	14H	C101H	68	1	1H				
C127L	17	1	27L	C116H	42	1	16H	C107L	69	1	7L				
C128L	18	1	28L	C115H	43	1	15H	C108L	71	1	8L				
C126L	19	1	26L	C109L	44	1	9L	C101L	72	1	1L				
C125L	20	1	25L	C110L	45	1	10L	C102L	74	1	2L				
C108H	21	1	8L	C112L	46	1	12L	x	75	x	x				
C121H	22	1	21H	C111L	47	1	11L								
C122H	23	1	22H	C110H	48	1	10H								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the dual 4 × 28 2-pole configuration:

Figure 65: Model 3732 J4 D-sub connector pin assignments dual 4 × 28

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank #	Row #
C106H	1	1	6H	C124H	24	1	24H	C109H	49	1	9H	R13L	38	1	3L
C113H	2	1	13H	C123H	25	1	23H	x	50	x	x	R11H	40	1	1H
C111H	3	1	11H	C120H	26	1	20H	x	51	x	x	R12L	54	1	2L
C112H	4	1	12H	C118H	27	1	18H	x	52	x	x	R12H	61	1	2H
C119H	5	1	19H	C117H	28	1	17H	C106L	53	1	6L	R13H	64	1	3H
C127H	6	1	27H	C117L	29	1	17L	C105L	55	1	5L	R14H	67	1	4H
C128H	7	1	28H	C118L	30	1	18L	x	56	x	x	R11L	70	1	1L
x*	8	x	x	C120L	31	1	20L	x	57	x	x	R14L	73	1	4L
C126H	9	1	26H	C119L	32	1	19L	x	58	x	x				
C125H	10	1	25H	C123L	33	1	23L	x	59	x	x				
x	11	x	x	C124L	34	1	24L	C107H	60	1	7H				
x	12	x	x	C122L	35	1	22L	C105H	62	1	5H				
C115L	13	1	15L	C121L	36	1	21L	C103H	63	1	3H				
C116L	14	1	16L	C103L	37	1	3L	C104H	65	1	4H				
C114L	15	1	14L	C104L	39	1	4L	C102H	66	1	2H				
C113L	16	1	13L	C114H	41	1	14H	C101H	68	1	1H				
C127L	17	1	27L	C116H	42	1	16H	C107L	69	1	7L				
C128L	18	1	28L	C115H	43	1	15H	C108L	71	1	8L				
C126L	19	1	26L	C109L	44	1	9L	C101L	72	1	1L				
C125L	20	1	25L	C110L	45	1	10L	C102L	74	1	2L				
C108H	21	1	8L	C112L	46	1	12L	x	75	x	x				
C121H	22	1	21H	C111L	47	1	11L								
C122H	23	1	22H	C110H	48	1	10H								

* x indicates the pin is not connected in this configuration

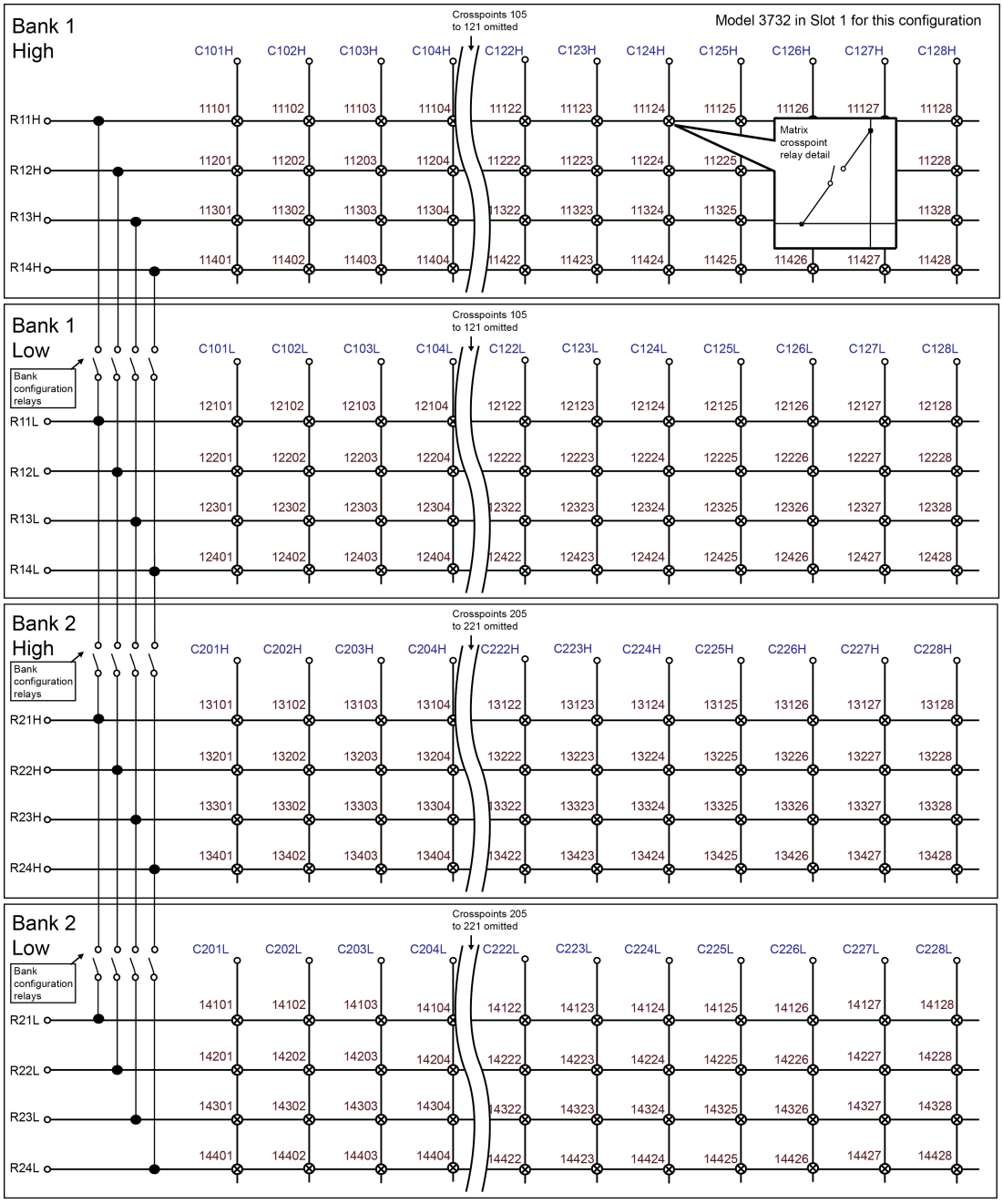
Schematic: Dual 4 × 28 2-pole configuration

The next table is a simplified crosspoint schematic of the dual 4 × 28 2-pole matrix configuration.

NOTE

When viewing the crosspoint matrix for your 2-pole configuration in the Series 3700A web interface on your computer, the low crosspoint in a channel pair will appear unavailable (gray). If you attempt to click on the low crosspoint, you will receive an error message stating the channel is not active.

Figure 66: Dual 4 × 28 2-pole simplified crosspoint schematic



Single 4 × 56 2-pole configuration

The single 4 × 56 2-pole configuration allows you to automatically link two contact sets to act as one pair. Using either direct cabling or the Model 3732-ST-C screw terminal assembly, you can create a matrix consisting of one bank of paired crosspoints with four rows and up to 56 columns.

NOTE

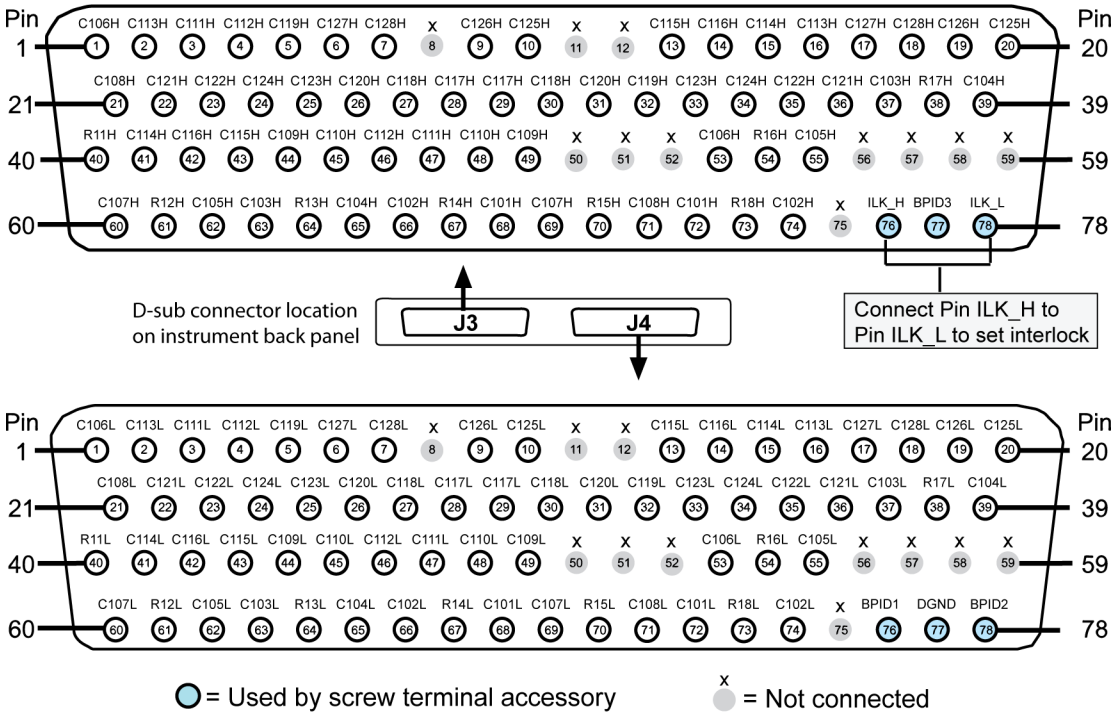
Refer to Screw terminal assemblies (on page 11-7) and Direct wiring (on page 11-10) for more information about jumper settings.

D-sub connections: Single 4 × 56 2-pole configuration

The next figure shows the D-sub pin assignments for the single 4 × 56 2-pole configuration.

Figure 67: Single 4 × 56 2-pole D-sub pin connections

NOTE: The screw terminal shorts the two columns together in this configuration. To minimize the complexity of the naming convention, only one signal name is used per path.



Pin assignments and signal naming: Single 4 × 56 2-pole configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the single 4 × 56 2-pole configuration:

Figure 68: Model 3732 J3 D-sub connector pin assignments single 4 × 56

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank # Bank #	Row #
C106H	1	1	6H	C124H	24	1	24H	C109H	49	1	9H	R13H	38	1	3H
C113H	2	1	13H	C123H	25	1	23H	x	50	x	x	R11H	40	1	1H
C111H	3	1	11H	C120H	26	1	20H	x	51	x	x	R12H	54	1	2H
C112H	4	1	12H	C118H	27	1	18H	x	52	x	x	R12H	61	1	2H
C119H	5	1	19H	C117H	28	1	17H	C134H	53	1	34H	R13H	64	1	3H
C127H	6	1	27H	C145H	29	1	45H	C133H	55	1	33H	R14H	67	1	4H
C128H	7	1	28H	C146H	30	1	46H	x	56	x	x	R11H	70	1	1H
x *	8	x	x	C148H	31	1	48H	x	57	x	x	R14H	73	1	4H
C126H	9	1	26H	C147H	32	1	47H	x	58	x	x				
C125H	10	1	25H	C151H	33	1	51H	x	59	x	x				
x	11	x	x	C152H	34	1	52H	C107H	60	1	7H				
x	12	x	x	C150H	35	1	50H	C105H	62	1	5H				
C143H	13	1	43H	C149H	36	1	49H	C103H	63	1	3H				
C144H	14	1	44H	C131H	37	1	31H	C104H	65	1	4H				
C142H	15	1	42H	C132H	39	1	32H	C102H	66	1	2H				
C141H	16	1	41H	C114H	41	1	14H	C101H	68	1	1H				
C155H	17	1	55H	C116H	42	1	16H	C135H	69	1	35H				
C156H	18	1	56H	C115H	43	1	15H	C136H	71	1	36H				
C154H	19	1	54H	C137H	44	1	37H	C129H	72	1	29H				
C153H	20	1	53H	C138H	45	1	38H	C130H	74	1	30H				
C108H	21	1	8H	C140H	46	1	40H	x	75	x	x				
C121H	22	1	21H	C139H	47	1	39H								
C122H	23	1	22H	C110H	48	1	10H								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the single 4 × 56 2-pole configuration:

Figure 69: Model 3732 J4 D-sub connector pin assignments single 4 × 56

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name #	Pin #	Bank # Bank #	Row #
C106L	1	2	6L	C124L	24	2	24L	C109L	49	2	9L	R13L	38	2	3L
C113L	2	2	13L	C123L	25	2	23L	x	50	x	x	R11L	40	2	1L
C111L	3	2	11L	C120L	26	2	20L	x	51	x	x	R12L	54	2	2L
C112L	4	2	12L	C118L	27	2	18L	x	52	x	x	R12L	61	2	2L
C119L	5	2	19L	C117L	28	2	17L	C134L	53	2	34L	R13L	64	2	3L
C127L	6	2	27L	C145L	29	2	45L	C133L	55	2	33L	R14L	67	2	4L
C128L	7	2	28L	C146L	30	2	46L	x	56	x	x	R11L	70	2	1L
x*	8	x	x	C148L	31	2	48L	x	57	x	x	R14L	73	2	4L
C126L	9	2	26L	C147L	32	2	47L	x	58	x	x				
C125L	10	2	25L	C151L	33	2	51L	x	59	x	x				
x	11	x	x	C152L	34	2	52L	C107L	60	2	7L				
x	12	x	x	C150L	35	2	50L	C105L	62	2	5L				
C143L	13	2	43L	C149L	36	2	49L	C103L	63	2	3L				
C144L	14	2	44L	C131L	37	2	31L	C104L	65	2	4L				
C142L	15	2	42L	C132L	39	2	32L	C102L	66	2	2L				
C131L	16	2	31L	C114L	41	2	14L	C101L	68	2	1L				
C155L	17	2	55L	C116L	42	2	16L	C135L	69	2	35L				
C156L	18	2	56L	C115L	43	2	15L	C136L	71	2	36L				
C154L	19	2	54L	C137L	44	2	37L	C129L	72	2	29L				
C153L	20	2	53L	C138L	45	2	38L	C130L	74	2	30L				
C108L	21	2	8L	C140L	46	2	40L	x	75	x	x				
C121L	22	2	21L	C139L	47	2	39L								
C122L	23	2	22L	C110L	48	2	10L								

* x indicates the pin is not connected in this configuration

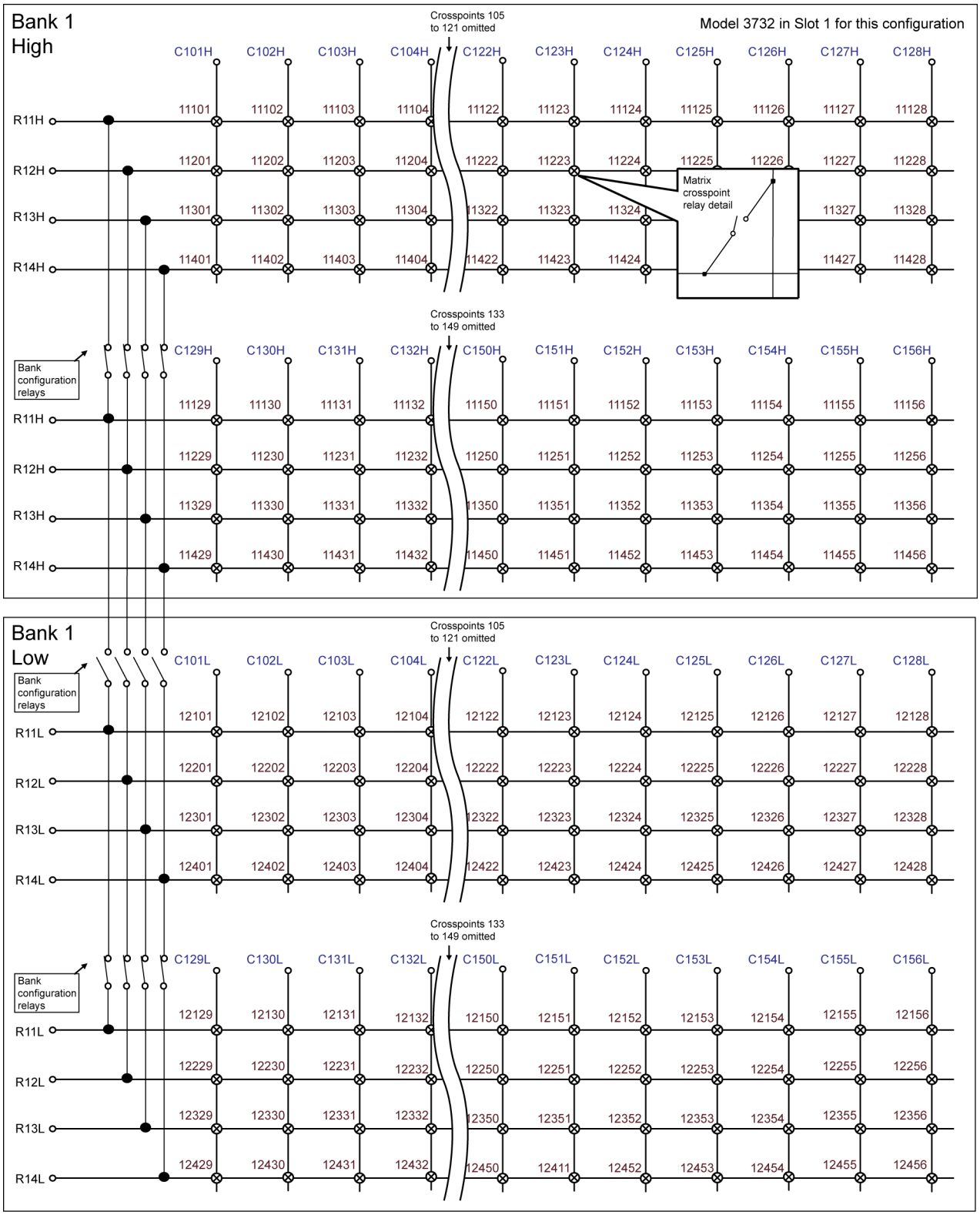
Schematic: Single 4 × 56 2-pole configuration

The next figure is a simplified crosspoint schematic of the single 4 × 56 2-pole matrix configuration.

NOTE

When viewing the crosspoint matrix for your 2-pole configuration in the Series 3700A web interface on your computer, the low crosspoint in a channel pair will appear unavailable (gray). If you attempt to click on the low crosspoint, you will receive an error message stating the channel is not active.

Figure 70: Single 4 × 56 simplified crosspoint schematic



Single 8 × 28 2-pole configuration

The single 8 × 28 2-pole configuration allows you to automatically link two contact sets to act as one pair. Using the Model 3732-ST-R screw terminal assembly, you can create a matrix consisting of one bank of paired crosspoints with eight rows and up to 28 columns.

NOTE

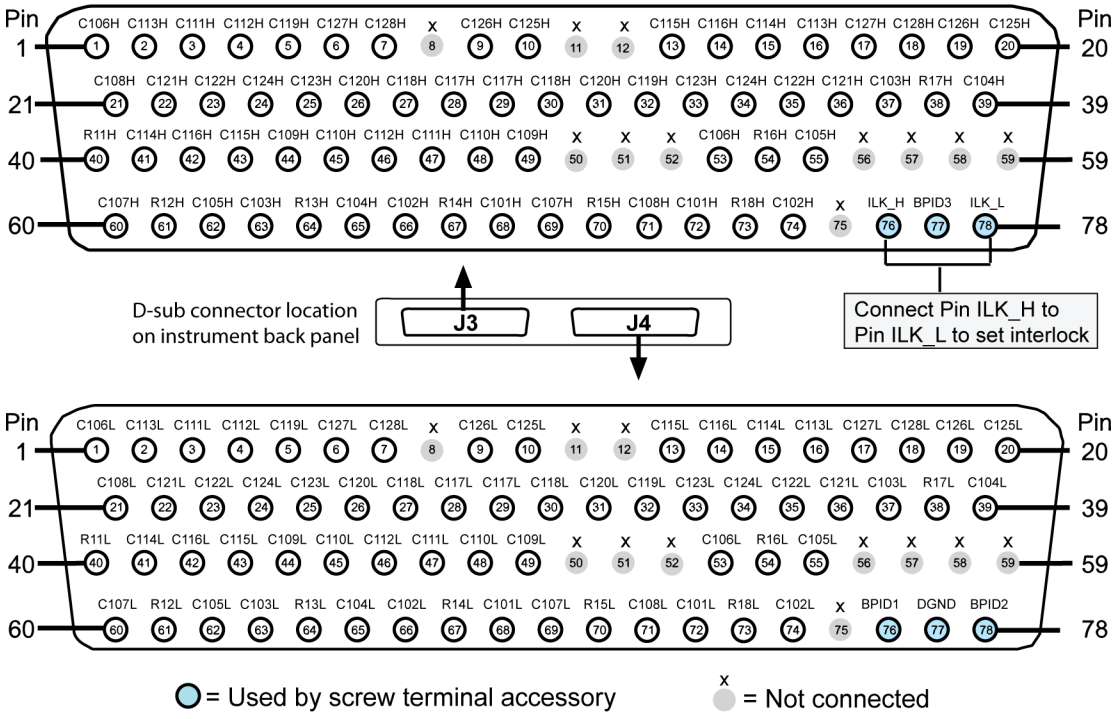
To create this configuration, you must use the Model 3732-ST-R screw terminal assembly. Refer to the Screw terminal assemblies (on page 11-7) topic for more information about jumper settings.

D-sub connections: Single 8 × 28 2-pole configuration

The next figure shows the D-sub pin assignments for the single 8 × 28 2-pole configuration.

Figure 71: Model 3732 single 8 × 28 D-sub conn (2-pole)

NOTE: The screw terminal shorts the two columns together in this configuration. To minimize the complexity of the naming convention, only one signal name is used per path.



Pin assignments and signal naming: Single 8 × 28 2-pole configuration

The next tables show the pin signal name for each pin on each of the D-sub connectors, and list the location of the connection in the switch matrix.

J3 D-sub connector pin assignments for the single 8 × 28 2-pole configuration:

Figure 72: Model 3732 J3 D-sub connector pin assignments single 8 × 28

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Row #
C106H	1	1	6H	C124H	24	1	24H	C109H	49	1	9H	R17H	38	1	7H
C113H	2	1	13H	C123H	25	1	23H	x	50	x	x	R11H	40	1	1H
C111H	3	1	11H	C120H	26	1	20H	x	51	x	x	R16H	54	1	6H
C112H	4	1	12H	C118H	27	1	18H	x	52	x	x	R12H	61	1	2H
C119H	5	1	19H	C117H	28	1	17H	C106H	53	1	6H	R13H	64	1	3H
C127H	6	1	27H	C117H	29	1	17H	C105H	55	1	5H	R14H	67	1	4H
C128H	7	1	28H	C118H	30	1	18H	x	56	x	x	R15H	70	1	5H
x*	8	x	x	C120H	31	1	20H	x	57	x	x	R18H	73	1	8H
C126H	9	1	26H	C119H	32	1	19H	x	58	x	x				
C125H	10	1	25H	C123H	33	1	23H	x	59	x	x				
x	11	x	x	C124H	34	1	24H	C107H	60	1	7H				
x	12	x	x	C122H	35	1	22H	C105H	62	1	5H				
C115H	13	1	15H	C121H	36	1	21H	C103H	63	1	3H				
C116H	14	1	16H	C103H	37	1	3H	C104H	65	1	4H				
C114H	15	1	14H	C104H	39	1	4H	C102H	66	1	2H				
C113H	16	1	13H	C114H	41	1	14H	C101H	68	1	1H				
C127H	17	1	27H	C116H	42	1	16H	C107H	69	1	7H				
C128H	18	1	28H	C115H	43	1	15H	C108H	71	1	8H				
C126H	19	1	26H	C109H	44	1	9H	C101H	72	1	1H				
C125H	20	1	25H	C110H	45	1	10H	C102H	74	1	2H				
C108H	21	1	8H	C112H	46	1	12H	x	75	x	x				
C121H	22	1	21H	C111H	47	1	11H								
C122H	23	1	22H	C110H	48	1	10H								

* x indicates the pin is not connected in this configuration

J4 D-sub connector pin assignments for the single 8 × 28 2-pole configuration:

Figure 73: Model 3732 J4 D-sub connector pin assignments single 8 × 28

Columns												Rows			
		Matrix location				Matrix location				Matrix location				Matrix location	
Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Column #	Pin signal name	Pin #	Bank #	Row #
C106H	1	1	6H	C124H	24	1	24H	C109H	49	1	9H	R17H	38	1	7H
C113H	2	1	13H	C123H	25	1	23H	x	50	x	x	R11H	40	1	1H
C111H	3	1	11H	C120H	26	1	20H	x	51	x	x	R16H	54	1	6H
C112H	4	1	12H	C118H	27	1	18H	x	52	x	x	R12H	61	1	2H
C119H	5	1	19H	C117H	28	1	17H	C106H	53	1	6H	R13H	64	1	3H
C127H	6	1	27H	C117H	29	1	17H	C105H	55	1	5H	R14H	67	1	4H
C128H	7	1	28H	C118H	30	1	18H	x	56	x	x	R15H	70	1	5H
x*	8	x	x	C120H	31	1	20H	x	57	x	x	R18H	73	1	8H
C126H	9	1	26H	C119H	32	1	19H	x	58	x	x				
C125H	10	1	25H	C123H	33	1	23H	x	59	x	x				
x	11	x	x	C124H	34	1	24H	C107H	60	1	7H				
x	12	x	x	C122H	35	1	22H	C105H	62	1	5H				
C115H	13	1	15H	C121H	36	1	21H	C103H	63	1	3H				
C116H	14	1	16H	C103H	37	1	3H	C104H	65	1	4H				
C114H	15	1	14H	C104H	39	1	4H	C102H	66	1	2H				
C113H	16	1	13H	C114H	41	1	14H	C101H	68	1	1H				
C127H	17	1	27H	C116H	42	1	16H	C107H	69	1	7H				
C128H	18	1	28H	C115H	43	1	15H	C108H	71	1	8H				
C126H	19	1	26H	C109H	44	1	9H	C101H	72	1	1H				
C125H	20	1	25H	C110H	45	1	10H	C102H	74	1	2H				
C108H	21	1	8H	C112H	46	1	12H	x	75	x	x				
C121H	22	1	21H	C111H	47	1	11H								
C122H	23	1	22H	C110H	48	1	10H								

* x indicates the pin is not connected in this configuration

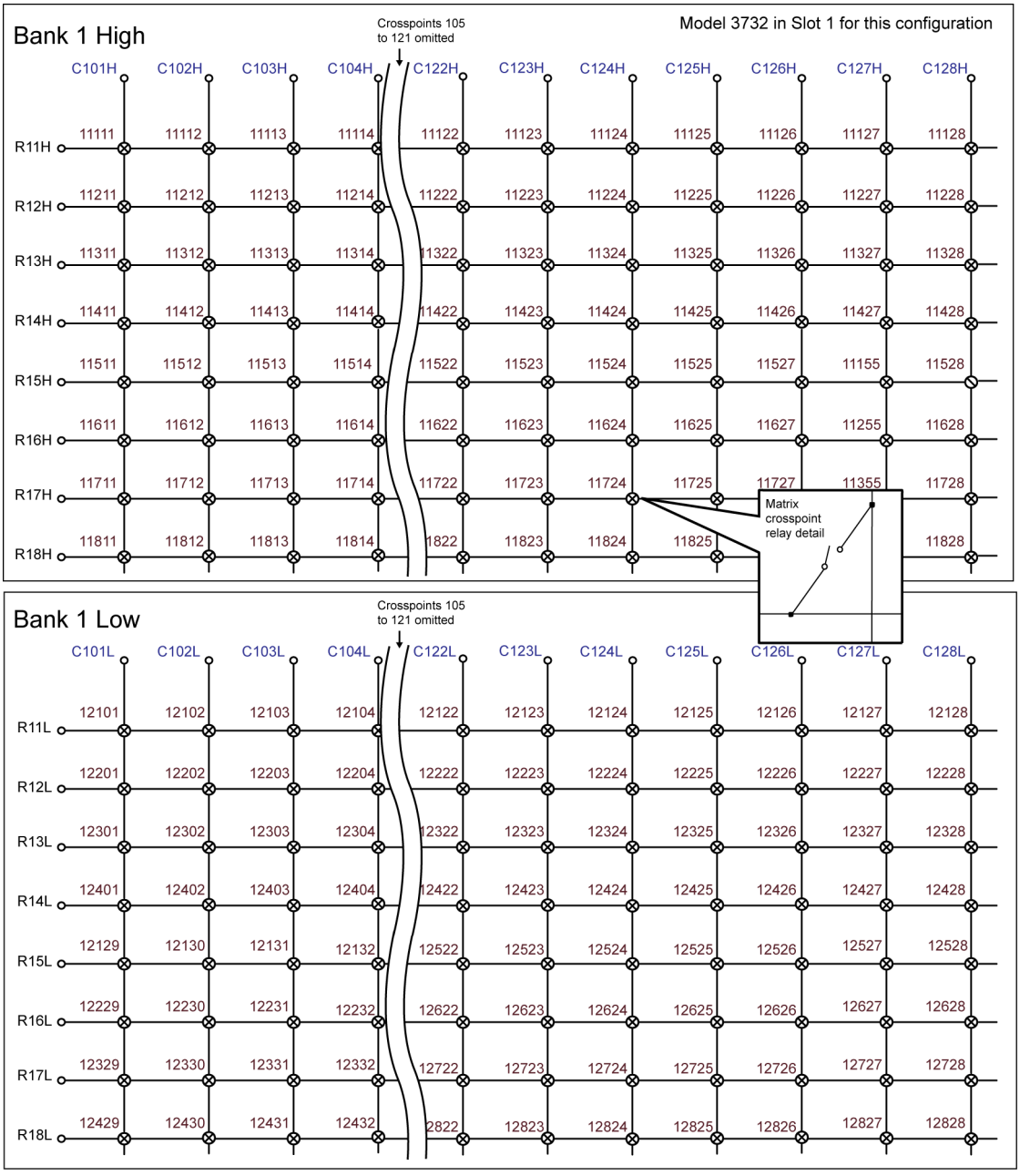
Schematic: Single 8 × 28 2-pole configuration

The next figure is a simplified crosspoint schematic of the single 8 × 28 2-pole matrix configuration.

NOTE

When viewing the crosspoint matrix for your 2-pole configuration in the Series 3700A web interface on your computer, the low crosspoint in a channel pair will appear unavailable (gray). If you attempt to click on the low crosspoint, you will receive an error message stating the channel is not active.

Figure 74: Single 8 × 28 simplified crosspoint schematic



Cross-card expansion

You can use the Series 3700A analog backplane to expand the number of columns in a system beyond the capacity of a single Model 3732 card. The signal paths on the backplane can be used to interconnect the rows on up to six Model 3732 cards by closing the appropriate backplane relays on all of the cards.

Because the Series 3700A backplane has six dual paths (12 signal paths), cross-card column expansion is limited to 12 rows. If you need to expand the columns by more than 12 rows, use external wiring to make the necessary row interconnections for the remaining rows.

NOTE

When the Series 3700A backplane is used for column expansion, it is unavailable for use by other cards to connect to the DMM exclusively. It can be used to route the expanded card signals to the DMM as long as the proper rows are used.

The next table shows the possible column expansion configurations using two Model 3732 cards.

Column expansion configurations with two Model 3732 cards:

Column expansion configuration	Mode
4 × 224	1-pole
8 × 112	1-pole
12 × 56	1-pole
4 × 112	2-pole

Cross-card expansion examples

The following examples describe cross-card expansion using the Series 3700A with two Model 3732 cards installed in slots 1 and 2.

Example 1: Configure an expanded 4 × 224 1-pole matrix

1. Configure both Model 3732 cards as single 4 × 112 matrices.
2. Close backplane relays 10911, 10912, 20911, and 20912 to interconnect the rows on the two cards.

Example 2: Configure an expanded 12 × 56 1-pole matrix

1. Configure both Model 3732 cards as single 16 × 28 matrices.
2. Close backplane relays 10911, 10912, 10913, 10914, 10915, 10916, 20911, 20912, 20913, 20914, 20915, and 20916.

NOTE

Because the backplane has 12 signal paths in this configuration, relay bank 3 is not used on either Model 3732 card. Because relay bank 3 shares the same backplane connections as relay bank 1, relay bank 3 cannot be used in this configuration. With all backplane relays closed, relay bank 1 is in parallel with relay bank 3, requiring all relays in bank 3 to be left open in this configuration.

Example 3: Configure an expanded 4 × 112 2-pole matrix

1. Configure both Model 3732 cards as single 4 × 56 2-pole matrices.
2. Close backplane relays 10913, 10914, 10915, 10916, 20913, 20914, 20915, and 20916.

Using the Model 3732 with a digital multimeter

There are two main connection options for using the Model 3732 with the Series 3700A digital multimeter (DMM):

- Use external wiring to connect Model 3732 rows to the Series 3700A DMM terminals in the 15-pin rear panel analog backplane connector.
- Connect to the Series 3700A DMM through the Series 3700A backplane by programmatically closing the appropriate backplane relays.

External wiring connection method

The recommended approach is to make external connections between the rows of the Model 3732 and the 15-pin analog backplane connector on the Series 3700A rear panel. This allows you to make most efficient use of all crosspoints on the Model 3732, and allows automatic channel pairing on the Series 3700A for 2-pole mode.

External wiring example

For this example, assume that a Model 3732 card is in installed in slot 1 of the Series 3700A, and has been configured using the jumpers on the ID pins to be a quad 4 × 28 matrix. The Model 3732 card is then configured by software to be a dual 4 × 28 matrix in 2-pole mode on all channels. In this configuration, closing channel 11101 will also automatically close channel 12101, and closing channel 13102 will automatically close channel 14102.

Programmatic connection method

DMM connections can also be made using the backplane relays on the Model 3732 card. This method eliminates the requirement to make external connections to the analog backplane connector. Note that there are two disadvantages to this connection method:

1. Model 3732 crosspoints are used less efficiently because of the way the backplane signals are connected to the matrix rows.
2. Two-pole mode should not be used in this configuration, because the DMM-to-backplane connection mapping is not compatible with 2-pole mode.

To establish accurate connections when using the backplane relays to connect from Model 3732 rows to the Series 3700A, use 1-pole mode for all channels, and use channel patterns to close both the channel relays and appropriate backplane relays.

Alternative jumper connection method

An alternative jumper connection method may be appropriate in some situations. Jumpers can be installed on the Series 3700A 15-pin analog backplane connector to route DMM connections from their default location to one or more of the other backplane signal paths.

Jumper connection method example

To put DMM HI on bank 2, row 1 and DMM LO on bank 4, row 1, connect the Series 3700A analog backplane connector from DMM HI to analog backplane 3 HI, and from DMM LO to analog backplane 5 HI. Then close analog backplanes 3 and 5 to complete the path. Using this technique will allow you to make jumper connections to all of the Model 3732 cards in the Series 3700A chassis.

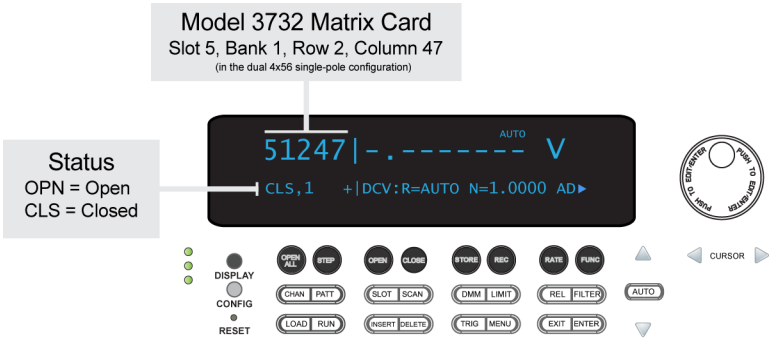
Using the Series 3700A front panel with the Model 3732 card

Because of the change in channel specifiers for the Model 3732 card, the front panel now displays an extra digit (see next figure). When editing the channel, press the navigation wheel to sequence through editing the slot, bank, row, and column numbers. Rotating the navigation wheel will move through the valid selections.

NOTE

In earlier Series 3700A firmware versions, a plus (+) sign was located on the top line of the display, after the selected channel number. In versions after the introduction of the Model 3732 card, the plus (+) sign has been moved to the second line. This change applies to all cards.

Figure 75: Matrix card display example



Also, you can now press the DISPLAY button to navigate from the main screen to a screen showing the closed channels on the system. If there are more channels than fit on one screen, use the navigation wheel to scroll through the channels. Press the DISPLAY button to navigate back through the menus to the main screen.

Pseudocard support for the Model 3732

Traditionally, pseudocard numbers have been the same as the desired card model number. Because of the different Model 3732 configurations, a digit has been added to the model number to specify the desired configuration.

NOTE

The command to create a pseudocard is `slot[x].pseudocard`; for detailed information about using pseudocards, refer to the *Series 3700A System Switch/Multimeter Reference Manual* (part number 3700AS-901-01), available for download on the Keithley Downloads web page (*http://www.tek.com/downloads*).

Five additional pseudocards have been added to support the Model 3732 card:

Description	Pseudocard number
Quad 4 × 28 matrix	37320 or 3732A
Dual 4 × 56 matrix	37321
Single 4 × 112 matrix	37322
Dual 8 × 28 matrix	37323
Single 16 × 28 matrix	37324

Using remote commands from a remote interface

Series 3700A instruments can be controlled from a remote interface using remote commands. Detailed information about using remote commands is located in the *Series 3700A System Switch/Multimeter Reference Manual* (part number 3700AS-901-01), available for download from the Keithley Downloads web page (*http://www.tek.com/downloads*).

New remote commands

Two new remote commands have been added to the Series 3700A Command reference (see the "Command reference" section in the *Series 3700A Reference Manual* for complete command descriptions). These commands apply to all cards, but are most helpful when creating scripts using a Model 3732 card:

- `channel.createspecifier()`
- `scan.addimagestep()`

Section 12

Model 3740 general purpose card

In this section:

Model 3740 32-channel isolated switch card 12-1

Model 3740 32-channel isolated switch card

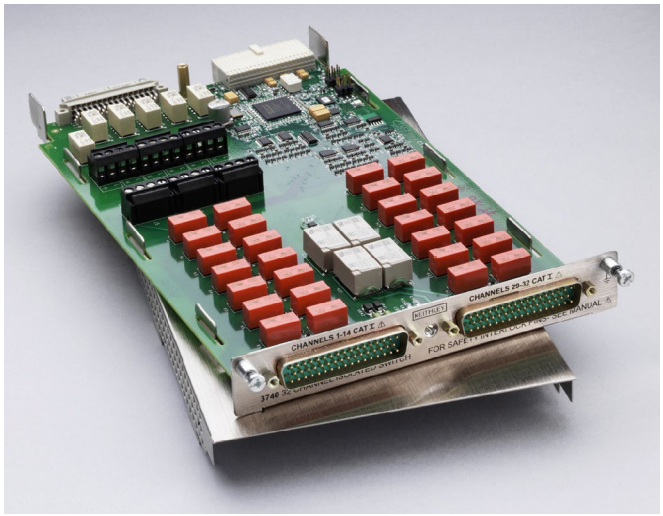
Introduction to the Model 3740 card

The Model 3740 offers 28 general-purpose form C channels that are ideal for routing power or other control devices (see next figure). For higher power applications of up to 7 A, four additional high-current form A channels are provided.

If any general-purpose signal requires routing to the Series 3700A mainframe backplane, terminal blocks that can be enabled through jumpers are located on the card. Custom configurations can be created with the user-accessible terminal blocks. For additional protection, an onboard temperature sensor notifies the mainframe when the card's operating temperature exceeds 70 °C, compromising system specifications.

The Model 3740 uses two 50-pin male D-sub connectors for signal connections. For screw terminal connections, use the detachable Model 3740-ST accessory.

Figure 76: Model 3740



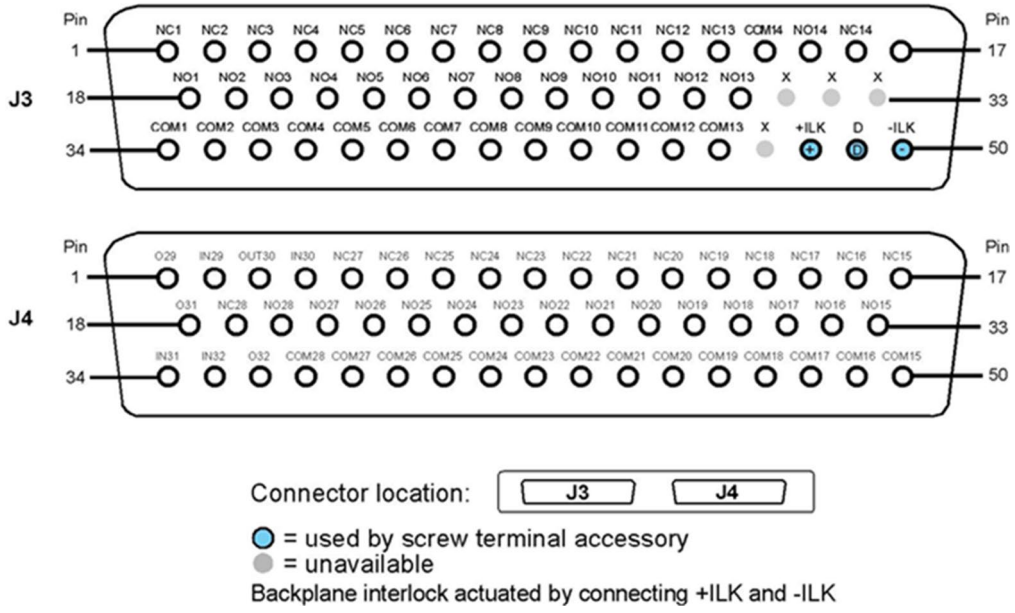
Available accessories: Model 3740

Accessory model number	Description
Model 3721-MTC-1.5	50-pin, female-to-male, D-sub cable assembly, 1.5 m (4.9 ft)
Model 3721-MTC-3	50-pin, female-to-male, D-sub cable assembly, 3 m (9.8 ft)
Model 3740-ST	Screw terminal panel
Model 3790-KIT50-R	50-pin, female, D-sub connector kit (solder cup contacts)

Connection information: Model 3740

Refer to the following figure for Model 3740 D-sub connection information.

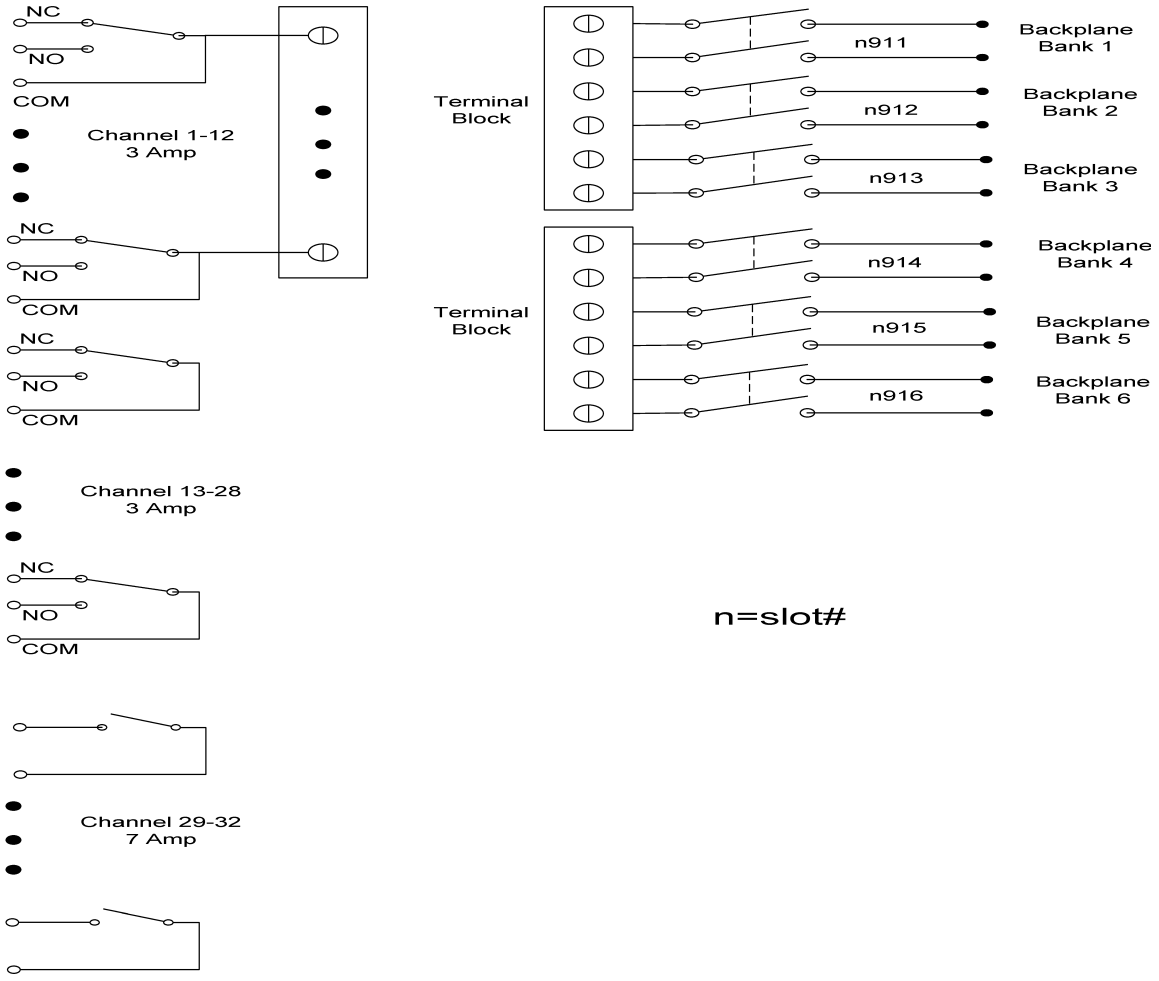
Figure 77: D-sub connection information for the Model 3740



Schematics: Model 3740

The following figure provides a switching schematic for the Model 3740.

Figure 78: Schematic for the Model 3740

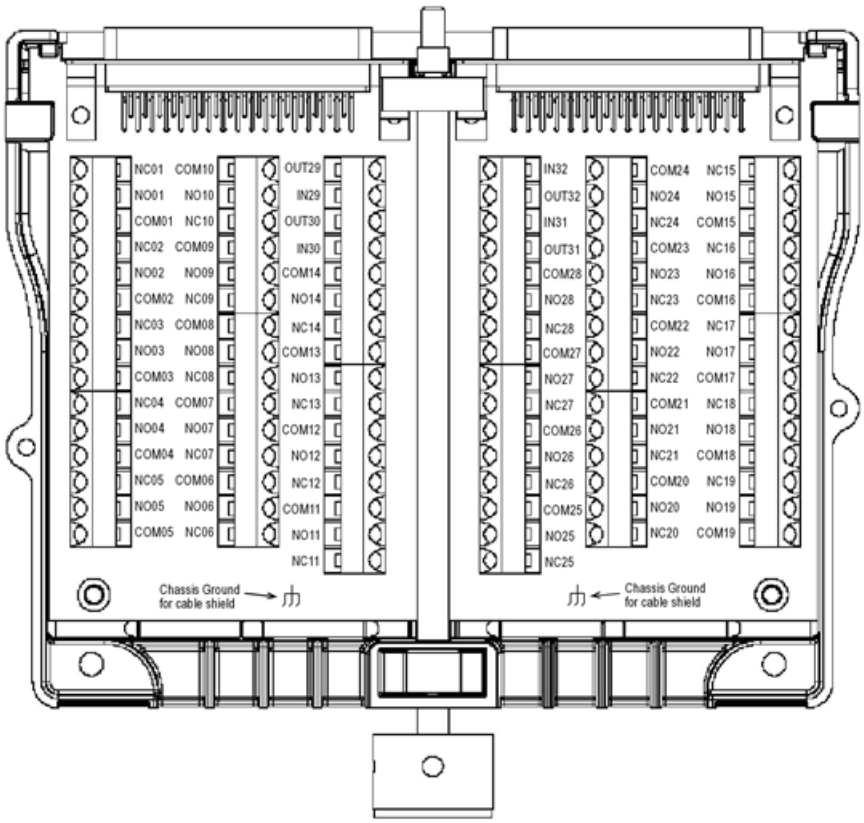


The next figure is a diagram of the screw terminal assembly:

NOTE

The Model 3740-ST screw terminal assembly has a chassis ground connection for connecting a cable shield.

Figure 79: Model 3740 screw terminal assembly circuit board



Section 13

Model 3750 multifunction control card

In this section:

Model 3750 multifunction I/O card..... 13-1
Model 3750 additional information 13-4

Model 3750 multifunction I/O card

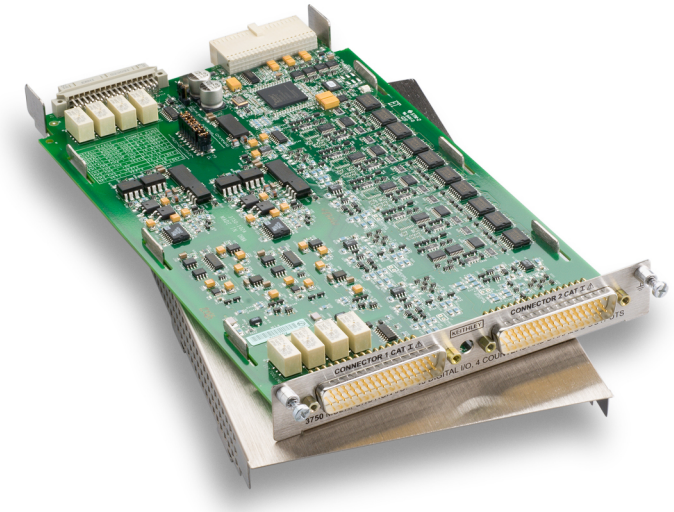
Introduction to the Model 3750 Card

The Model 3750 Multifunction I/O Card has 40 bidirectional digital I/O bits arranged in five banks of eight bits each. Each bank can be configured as either inputs or outputs. One bank of I/O is equivalent to one system channel.

The two analog outputs of the Model 3750 can be individually configured as either voltage outputs (±12 V) or as current outputs (0 mA to 20 mA or 4 mA to 20 mA).

Four 32-bit counters are provided with a maximum input range of 1 MHz. Each counter has a gate input for control of event counting.

Figure 80: Model 3750 Multifunction I/O Card



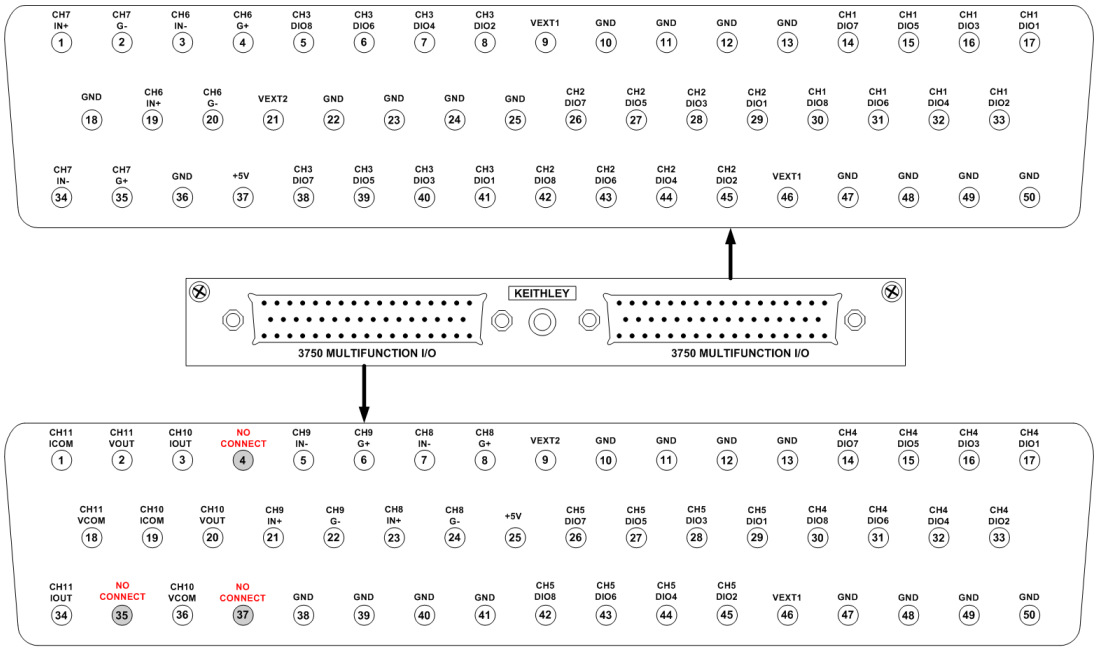
Available accessories: Model 3750

Accessory model number	Description
Model 3721-MTC-1.5	50-pin, female-to-male, D-sub cable assembly, 1.5 m (4.9 ft
Model 3721-MTC-3	50-pin, female-to-male, D-sub cable assembly, 3 m (9.8 ft)
Model 3750-ST	Screw terminal panel
Model 3790-KIT50-R	50-pin, female, D-sub connector kit (solder cup contacts)

Connection information: Model 3750

Refer to the following figure for the Model 3750 D-sub connection information.

Figure 81: Model 3750 connection information



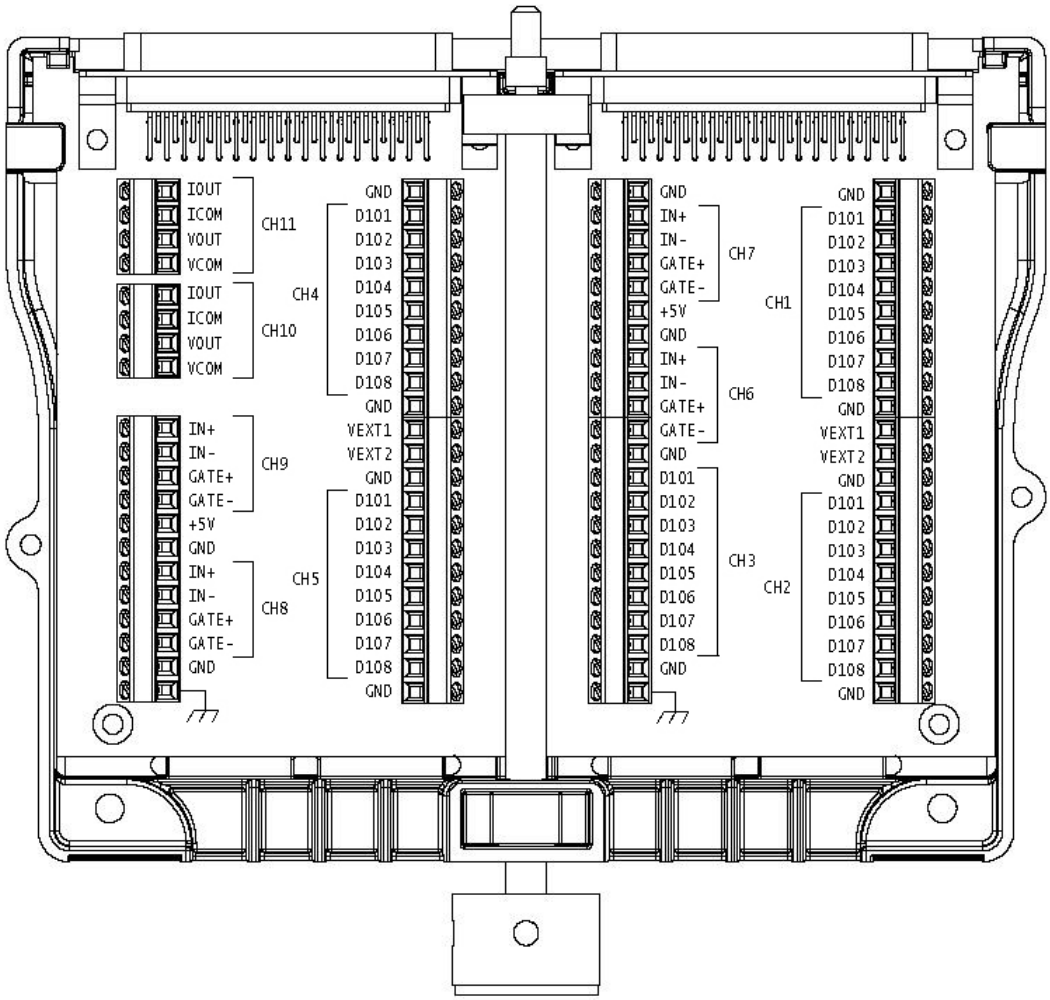
Schematics: Model 3750

The next figure is a diagram of the screw terminal assembly:

NOTE

The Model 3750-ST screw terminal assembly has a chassis ground connection for connecting a cable shield.

Figure 82: Model 3750 screw terminal schematic



Model 3750 additional information

Digital I/O

⚠ CAUTION

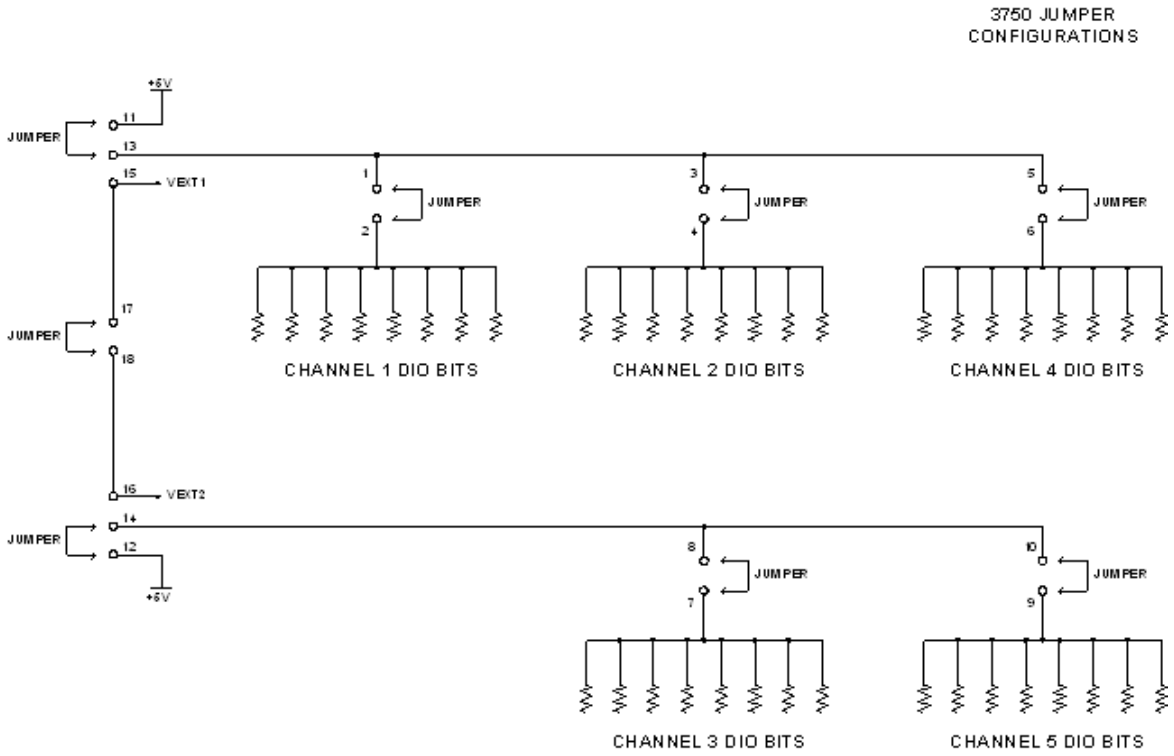
Do not exceed the maximum rated voltages and currents for the digital I/O banks. Do not apply negative voltages to any of the inputs. Unused inputs should not be left floating, but should be tied to either a ground or a positive DC voltage.

The Model 3750 offers 40 digital I/O bits arranged in 5 banks. Each bank is referenced as a channel from 1 through 5. The 8 bits in each bank or channel can be programmed as either input or output. Additional features include scanning capabilities, such as writing a unique output pattern or reading inputs as part of a scan. Also, pattern matching is available that supports generating events that can then be used for triggering system events, such as starting a scan.

Simplified jumper configuration model

Digital outputs can be jumpered to either an internal +5 V or an external voltage. The diagram below shows a simplified schematic.

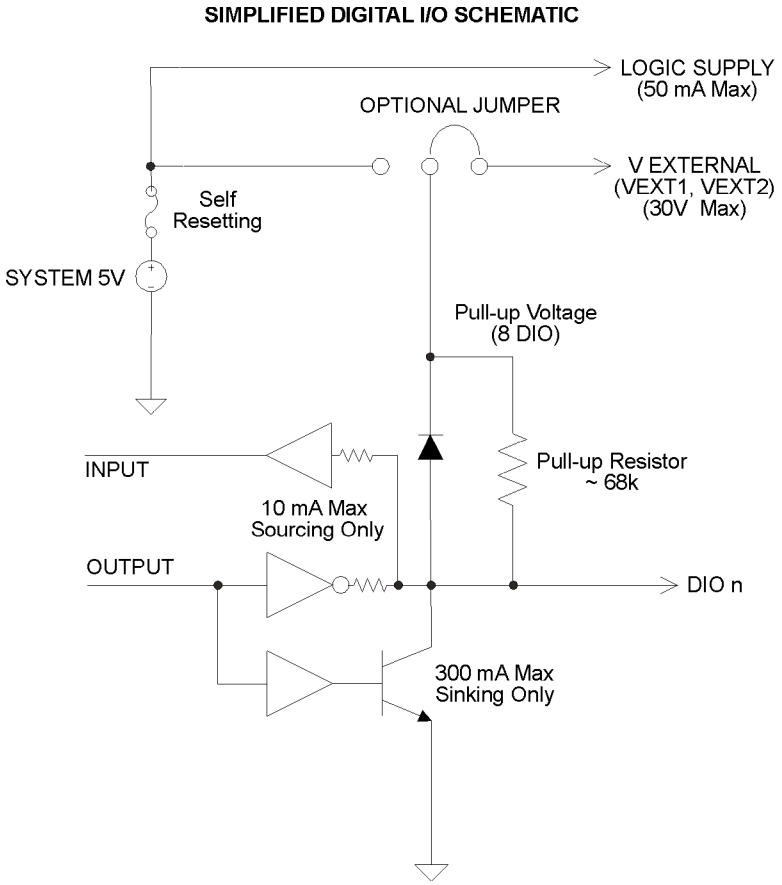
Figure 83: Simplified schematic of the jumper configuration



The factory default jumpers are set as follows:

- Connects the digital lines on each bank to the internal pull-up resistors.
- Connects those pull-up resistors to the internal +5 V.
- Connects VEXT1 to VEXT2. Removing the jumper allows for two different external voltage sources. They are grouped according to the D-SUB connector from which they are accessed (that is, channels 1, 2, and 4 are on one D-SUB, while channels 3 and 5 are on the other).

Figure 84: Simplified schematic of a digital I/O channel



The figure shows a simplified schematic for one bit of a digital I/O channel. Each I/O bit has an optional pullup resistor in parallel with a diode that is used to clamp flyback voltages from inductive devices like electro-mechanical relays. However, when the optional jumper is removed, both the pullup resistor and diode are removed from the circuit. The pullup resistor is considered “weak” and can easily be overdriven by the external circuit.

⚠ CAUTION

When driving the digital I/O channel with 5 V or higher, be sure to avoid driving the line higher than the pullup voltage (5 V or VEXT). Otherwise, the internal flyback diode will become forward biased, possibly causing a high current situation.

Sourcing current to an external load

When outputs are set to logic high, they are capable of sourcing up to 10 mA of current and maintaining a logic high state on the output. The outputs are protected against short circuits to ground, but do not generate a fault condition if that occurs. The logic high outputs cannot sink current.

Sinking current and overload protection

When outputs are set to logic low and the output current becomes greater than about 500 mA, the output driver limits the current at this level to restrict internal power dissipation. The Model 3750 detects this condition and generates a fault condition. The action following the fault condition is determined by the auto protect mode state. Do not allow such current limit situations to exist in the normal course of operation. Ensure that the external circuits limit the sinking current to a level within the specifications.

Using auto protect mode

Built into the Model 3750 is the capability to auto protect the digital outputs. It is a selectable mode (turned on by default) that protects the outputs by re-configuring them as inputs in order to limit the stresses on both the external driving circuits and the internal output drivers.

Using external user logic circuits

Limited +5 V is available and is intended for powering logic circuits. It is fused to prevent damage if the output is shorted. The fuse is a resettable type whose recovery time depends on ambient temperature. The higher the temperature, the longer it takes to reset. The maximum time presented in the Model 3750 specifications is for a "worst case" scenario. Checking for +5 V after the fault has been cleared avoids this lengthy delay in most cases.

Programming overview

There are five banks of 8 bits each on the Model 3750 card. The following examples apply to the card as shipped, as the jumpers are set to the position that pulls them up internally to +5 V.

To read the banks

After power up, the digital I/O default state is configured as digital input. Use the channel.setmode() command to explicitly set a bank as inputs:

```
channel.setmode("1005", channel.MODE_INPUT)
```

To read the eight bits associated with bank 5, use the channel.read() command:

```
chan5 = channel.read("1005")
```

To read up to four banks at the same time, use the optional `width` parameter. For example, to read four banks at the same time, use:

```
big_read = channel.read("1001", 4)
```

This causes banks 1, 2, 3, and 4 to be read at the same time and returned. The specified channel to the command is returned in the least significant byte and subsequent ascending channels are returned in the adjacent bytes. For example, if `big_read` contains the value 1144201745 (hexadecimal value of 44332211), this means that bank 1 was 17 (hexadecimal 11), bank 2 was 34 (hexadecimal 22), bank 3 was 51 (hexadecimal 33), and bank 4 was 68 (hexadecimal 44).

To write to the banks

Because the default state of a digital I/O bank is configured as an input, the mode needs to be changed so that it is ready to accept `write` commands by using the channel.setmode() command:

```
channel.setmode("1005", channel.MODE_OUTPUT)
```

To write a single bank of 8 bits associated with channel 5, send the channel.write() command:

```
channel.write("1005", 9)
```

Writing the value of 9 causes bits 1 and 4 to go high, while the rest remain low.

To write multiple banks at the same time, use the optional `width` parameter to indicate how many banks to affect. For example, the following command outputs 1 (hexadecimal 01) to bank 1, 2 (hexadecimal 02) to bank 2, 3 (hexadecimal 03) to bank 3, and 4 (hexadecimal 04) to bank 4.

```
channel.write("1001", 67305985, 4)
```

To read and write banks using a scan

Any input bank or totalizer channel that is included in a scan list is read when that channel is scanned. The value is saved to the buffer specified for the scan. For digital inputs, the width defaults to 1. For totalizers, the full count is read. For example, to read totalizer 1 on card 2 after scanning all channels of a slot 1 multiplexer, use the scan.create() command:

```
scan.create("1001:1060, 2006")
```

To read more than one bank at a time, the `width` needs to be specified with the scan.add() command. For example, to read 32 bits of digital input on slot 2 after scanning 60 channels on slot 1:

```
scan.create("1001:1060")
scan.add("2001", 4)
```

To write to either a digital output or an analog channel, use the scan.addwrite() command, which includes a parameter for the data value to be written and an optional width parameter. For example, to program DAC channel 1 on the slot 2 card to go to +5 V after scanning 60 channels on slot 1:

```
scan.create("1001:1060")
scan.addwrite("2010", "5")
```

Power consumption information

You can power off the totalizers if they are not being used, which reduces the power required of the card. The card has a default static power draw of 3300 mW, which includes powering the totalizer channels and both analog output channels. If the totalizer channels are powered off, they reduce the 3300 mW draw by 730 mW. This power can then be used for closing relays on other cards within the bank. See Series 3700A Module Schematics and Connections for more information on power handling information and examples.

NOTE

The four totalizers are either all powered on or all powered off. Changing the power state of one affects them all. The command for controlling power is `channel.setpowerstate(channelList, state)`, where `state` is either `"channel.ON"` or `"channel.OFF"`. See channel.setpowerstate() for more information.

Counter/totalizer

⚠ CAUTION

Do not exceed the maximum voltage and currents as listed on the Model 3750 specifications. Unused inputs should not be left floating but should be tied to ground or an appropriate DC voltage.

There are four separate totalizer channels, numbered 6 through 9, on a Model 3750 card. The threshold voltage is programmable and can be either 0 V or a TTL level (1.5 V). Counting occurs when the rising or falling edge on the input signal passes through the defined threshold. The edge to be counted can be programmed to be either rising or falling. The power on default is rising edge, TTL level threshold.

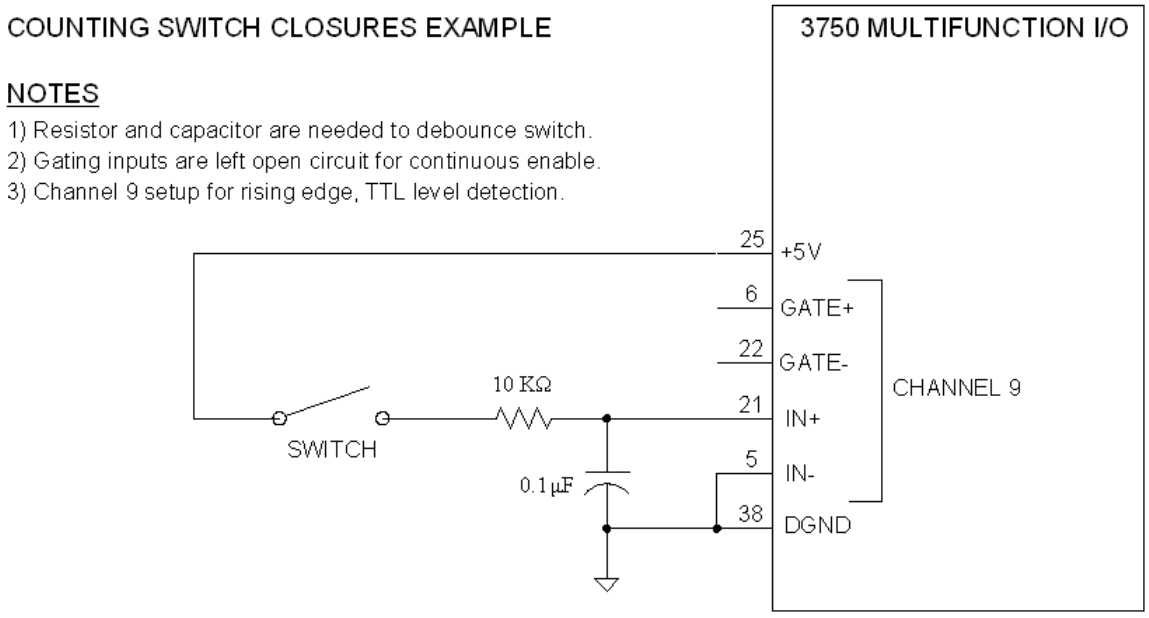
NOTE

When setting up the edge to be detected or changing the threshold, any existing counts are cleared.

Using the card to count closures

The following examples demonstrate how to use the card to count closures of a door switch connected to the first totalizer in Slot 1, using the Channel 1005.

Figure 85: Switch count example



- To read the current total closure counts:

```
channel.setmode("1009", channel.MODE_RISING_TTL_EDGE)
count = channel.read("1009")
```

- To reset the counter to zero using an explicit command:

```
channel.write("1009", 0)
```

- To preset the counter to a value (for example, 100) using an explicit command:

```
channel.write("1009", 100)
```

- To automatically reset the counter back to zero for a read command:

```
channel.setmode("1009", channel.MODE_RISING_TTL_EDGE_READ_RESET)
```

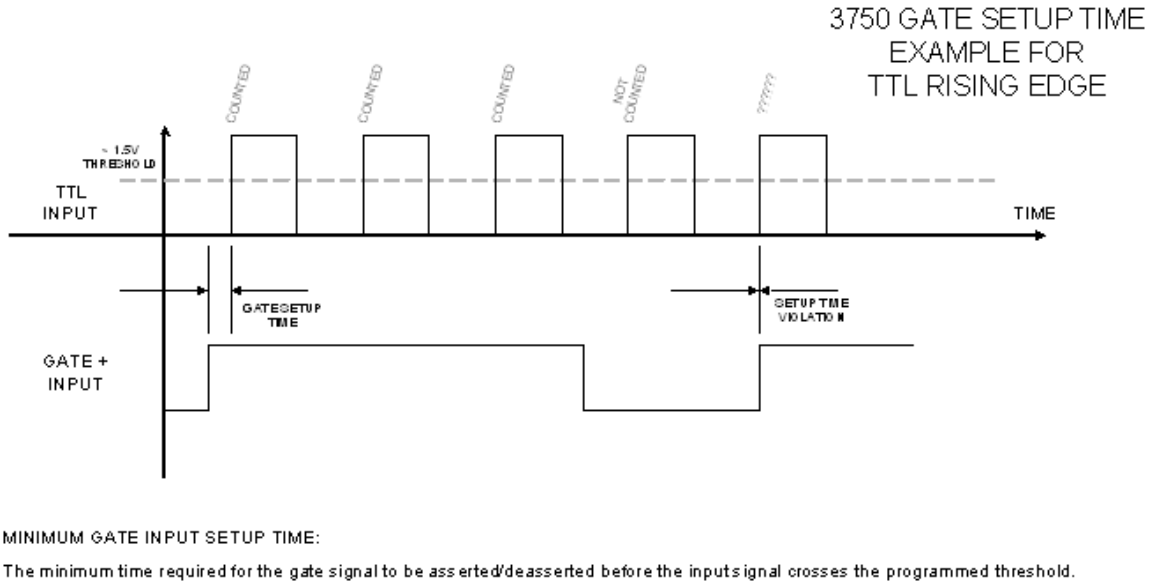
Using the gating function

The gate input determines whether the totalizer ignores or counts when the appropriate totalizer threshold is crossed. Gating is enabled by default; that is, the two inputs that control gating are biased to the appropriate level so that no connections have to be made for the totalizer to count. Gating of the count is accomplished in one of two ways:

- Driving the GATE + input below a TTL threshold (inhibit counting).
- Driving the GATE - input above a TTL threshold (inhibit counting).

The following diagram illustrates how gating works using the GATE + input with a totalizer configured for TTL threshold and a rising edge trigger.

Figure 86: Model 3750 Gate Setup Time Example



MINIMUM GATE INPUT SETUP TIME:

The minimum time required for the gate signal to be asserted/deasserted before the input signal crosses the programmed threshold.

NOTE

The minimum gate input setup time must be satisfied for the event to be counted.

Analog output

There are two channels of isolated analog outputs on the Model 3750 card. Each channel can be configured for either voltage output or current output. Voltage output provides for +/- 12 V and is capable of providing up to 20 mA of current. Current output can be either 0-20 mA or 4-20 mA. The voltage outputs also support programming of up to 1% over the full scale range. This can be used to compensate for constant voltage drops in the system and cabling.

Each channel has its own separate common return line that provides the reference point for the output. These lines are labeled as “VCOM” for the voltage output and “ICOM” for the current output. If the outputs are to be referenced to some other point such as earth ground, the respective common return signals must be connected appropriately.

Each output is connected through an onboard output relay. Both the output signal and its corresponding return are connected at the same time that the output becomes enabled. Disabling the output opens this output relay.

The following examples use the first analog output channel of a card in Slot 1, so the nomenclature for the channel is `'1010'`.

Configuring the card for output type

The analog output channels default to voltage outputs. To configure them as current outputs:

```
channel.setmode('1010', channel.MODE_CURRENT_1)
```

NOTE

MODE_CURRENT_1 specifies 0-20 mA and MODE_CURRENT_2 specifies 4-20 mA.

To reconfigure the analog output as a voltage output:

```
channel.setmode('1010', channel.MODE_VOLTAGE_1)
```

NOTE

The analog output channels can only operate in one mode at a time. Specify either voltage output or current output.

The outputs default to being disabled. To enable them:

```
channel.setoutputenable('1010', channel.ON)
```

Once the channel is enabled, any values written to the channel are seen on the output pins. To disable the outputs:

```
channel.setoutputenable('1010', channel.OFF)
```

Using the card when configured as voltage outputs

To set the analog voltage output level to -3.5 volts:

```
channel.setmode('1010', channel.MODE_VOLTAGE_1)
channel.setoutputenable('1010', channel.ON)
channel.write('1010', -3.5)
```

Once the output voltage is set and the output is enabled, the output attempts to drive the external circuitry to the value specified. If the output voltage attempts to deliver more than the specified overload current, a fault condition exists.

To determine whether the output is in a fault condition:

```
circuit_fault = channel.getstate('1010', channel.IND_OVERLOAD)
```

If this returned value is true, then the output is either currently in a fault condition or was in a fault condition in the past if the fault state is latched. See Latching values (on page 13-19) for more information.

If auto protect mode is enabled, the output relay disconnects after approximately one second of sensing a persistent fault condition. This output disable removes any overload current-related fault condition. We strongly recommend that the voltage output is used in auto protect mode. When enabled, this mode prevents the output from experiencing prolonged stresses during some fault conditions. These stresses can cause potentially long thermal recovery times after the fault has been cleared.

To use the output in auto protect mode:

```
channel.setmode('1010', channel.MODE_PROTECT_VOLTAGE_1)
```

Using the card when configured as current outputs

To set a current output to 10mA:

```
channel.setmode('1010', channel.MODE_CURRENT_1)
channel.setoutputenable('1010', channel.ON)
channel.write('1010', 10e-3)
```

Once the output current is set and the output is enabled, the output attempts to drive the external circuitry to the value specified. If the output current drives a load that causes the output voltage to exceed the specified compliance voltage, a fault condition exists.

To determine whether the output is in a fault condition:

```
circuit_fault = channel.getstate('1010', channel.IND_OVERLOAD)
```

If this returned value is true, then the output is either currently in a fault condition or was in a fault condition in the past if the fault state is latched. See Latching values (on page 13-19) for more information.

If auto protect mode is enabled, the output relay disconnects after approximately one second of sensing a persistent fault condition. This output disable removes any overload current-related fault condition. We strongly recommended that you use the current output in auto protect mode. When enabled, this mode prevents the output from experiencing prolonged stresses during some fault conditions. These stresses can cause potentially long thermal recovery times after the fault has been cleared.

To use the output in auto protect mode:

```
channel.setmode('1010', channel.MODE_PROTECT_CURRENT_1)
```

Output loading precautions

In addition to the maximum specified loads for the output voltage and current, note several other precautions:

- Excessive amounts of capacitance present on the voltage output nodes can affect their normal behavior. For example, exceeding the specified output capacitance for the voltage output can cause a stability problem and result in a noisy output. The Model 3750 voltage output stage is compensated for a significant amount of capacitance that far exceeds the normal expected amount due to cables, circuits, and loads.
- Another consideration for the voltage output is load current. Inevitable resistance in the series path of the voltage output experiences a voltage drop when current flows. At levels of 10 mA or more, this can be a significant portion of the accuracy specification.

  For example, only 0.1 Ohms of stray resistance causes 1 mV of error at 10 mA of load current.

  To avoid this additional error, keep circuit loading to a minimum and use short heavy connections where possible. For voltage drops that are constant, programming additional voltage can help compensate.
- For current outputs, excessive amounts of series resistance can also cause a problem if the output voltage rises to near the compliance level. At voltages above the specified compliance level, the output may experience higher offsets and ultimately result in a clamped value.
- Because both outputs are electrically isolated from earth potential, they can float or be driven to some arbitrary reference point. Do not exceed the maximum ratings stated for the card on any of the channels under all operating conditions.

Hardware configuration

To configure digital I/O pull-up resistors and VEXT sources, you must remove and partially disassemble the Model 3750 as shown.

⚠ CAUTION

Be sure to use proper anti-static procedures while handling the Model 3750. Take care not to stress or flex the printed circuit board and do not touch other circuitry.

1. Remove the top shield cover:
   - Unscrew the number 4-40 screw (1) as shown in the "Shield removal" figure below.
   - Slide the top cover in a direction away from the D-sub connectors, disengaging the cover from the printed circuit board.
   - Lift the top shield cover off of the printed circuit board.
2. Set jumpers per options listed below.
3. Replace the top shield cover.
   - Slide the top cover in a direction toward the D-sub connectors, engaging the cover onto the printed circuit board, and securing with the number 4-40 screw (1).
4. The card can now be returned to service.

Figure 87: Removing the top shield

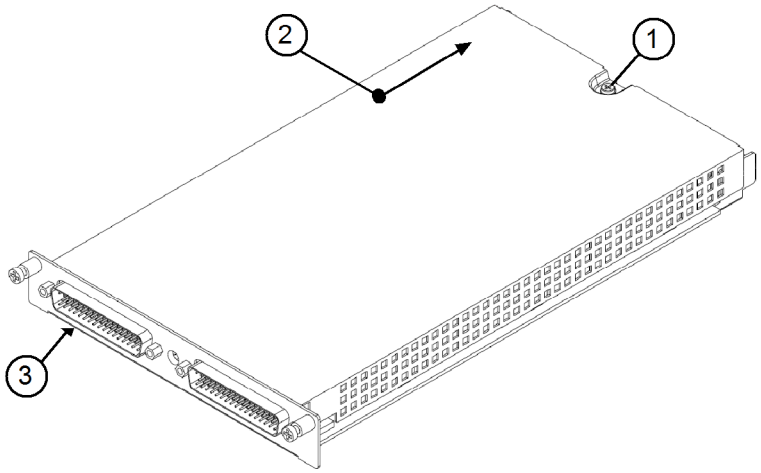
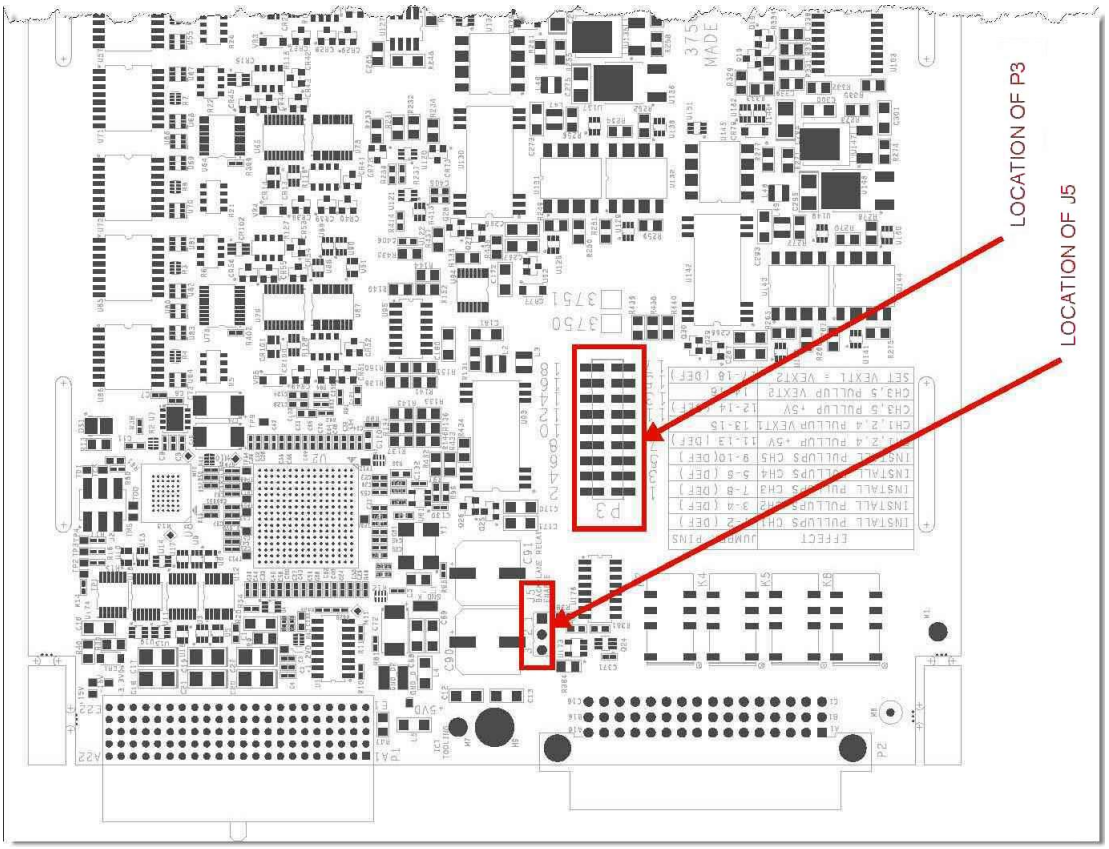


Figure 88: Location of P3 and J5 jumpers



The connector labeled P3 contains all of the jumpers needed to configure digital I/O and VEXT1, VEXT2. The connector labeled J5 contains a single jumper option that configures the backplane relays. See the following table for individual jumper locations and effects.

Desired effect	P3 pin numbers
Install all 8 pull-up resistors on CH1	Jumper 1 - 2
Install all 8 pull-up resistors on CH2	Jumper 3 - 4
Install all 8 pull-up resistors on CH3	Jumper 7 - 8
Install all 8 pull-up resistors on CH4	Jumper 5 - 6
Install all 8 pull-up resistors on CH5	Jumper 9 - 10
CH1, CH2, CH4 connect pull-up voltage to +5 V	Jumper 11 - 13
CH1, CH2, CH4 connect pull-up voltage to VEXT1	Jumper 13 - 15
CH3, CH5 connect pull-up voltage to +5 V	Jumper 12 - 14
CH3, CH5 connect pull-up voltage to VEXT2	Jumper 14 - 16
Connect VEXT1 to VEXT2	Jumper 17 - 18

For backplane configuration at J5, jumper pins 2-3 to allow the Model 3750 to make backplane connections during calibration with a system DMM. If you do not want to ever physically allow the Model 3750 to make backplane connections, jumper pins 1-2. By populating this jumper in this way, an additional amount of safety is provided to a system that may have high voltage connections made to the backplane.

Calibration

To maintain specified performance over time, the analog output channels and the counter channels might need to be calibrated. The Model 3750 supports automatic in-system calibration if a DMM is present. Otherwise, an external DMM of 6.5 digits of accuracy or better can be used.

NOTE

When performing a user calibration, final accuracy is determined by the standards used. Always verify the calibration results with a calibrated instrument capable of making measurements that exceed the specifications of the Model 3750.

We recommend that the Model 3750 is calibrated in the end application whenever possible so that the thermal and electrical operating environments can be accounted for. Best results will be obtained whenever this can be done and up to 8x improvements in offsets are typical.

Preparing for calibration

Before performing the calibration steps, be sure that the Model 3750 is properly disconnected from all external circuits. If an in-system DMM is to be used, disconnect the external ABUS from other mainframes and instruments that might be connected. If possible, disconnect all Model 3750 cables as well. Excessive capacitance on the counter channels can cause that part of calibration to fail. If a Model 3750-ST accessory is used, you can keep this connected as long as external circuits are disconnected.

Prior to calibration, the channel must be unlocked for calibration.

```
channel.calibration.unlock(<ch_list>, <password>)
```

The actual calibration is performed in several steps. In each step, the hardware outputs a value and expects a measured value to be entered. Once all the steps are complete, the Model 3750 calculates new calibration constants to be used until the next calibration takes place.

The following topics describe a list of steps to be performed to calibrate the Model 3750.

Calibration steps for analog output channels

For DAC channels, a calibration sequence includes these steps:

1. Set voltage, –12 V to +12 V range, generate negative point 1.
2. Send reading.
3. Set voltage, –12 V to +12 V range, generate negative point 2.
4. Send reading.
5. Set voltage, –12 V to +12 V range, generate positive point 1.
6. Send reading.
7. Set voltage, –12 V to +12 V range, generate positive point 2.
8. Send reading.
9. Set current, 0 mA to +20 mA range, generate point 1.
10. Send reading.
11. Set current, 0 mA to +20 mA range, generate point 2.
12. Send reading.
13. Set current, +4 mA to +20 mA range, generate point 1.
14. Send reading.
15. Set current, +4 mA to +20 mA range, generate point 2.
16. Send reading.

Calibration steps for counter/totalizer channels

For totalizer channels, a calibration sequence includes these steps:

1. Calibrate 0 V totalizer threshold.
2. Calibrate 1.5 V totalizer threshold.

You must save the calibration after calibrating and before locking. Use `channel.calibration.save()` to execute this function.

NOTE

All calibration progress is lost if the calibration data is not saved!

After calibration, the channel must be locked.

```
channel.calibration.lock(<channelList>, <password>)
```

Calibration example script

The following script creates two functions. You can use `"cal_dac"` and `"cal_tot"` to calibrate the analog outputs channels and counter channels respectively.

```
loadscript cal
-- Create a function called cal_dac that takes slot number
-- and channel number as parameters.
-- Be sure to disconnect all external circuits before executing calibration!
function cal_dac(slot_num,chan_num)
   channel_num = (1000 * slot_num) + chan_num
-- first unlock the calibration
   channel.calibration.unlock("slot" .. slot_num,"KI3706")
-- Set up internal DMM
   dmm.func="dcvolts"
   dmm.range=10
   dmm.nplc=1
   dmm.filter.count=100
   dmm.filter.enable=1
-- Perform the 16 steps of calibration using the internal
-- DMM readings changing ranges where appropriate
-- Provide delays before taking readings to allow
-- for settling
-- Write the reading/value into the appropriate step number
   channel.calibration.step("" .. channel_num,1)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,2,rdg)
   dmm.range=1
   channel.calibration.step("" .. channel_num,3)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,4,rdg)
   dmm.range=10
   channel.calibration.step("" .. channel_num,5)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
```

```
   channel.calibration.step("" .. channel_num,6,rdg)
   dmm.range=1
   channel.calibration.step("" .. channel_num,7)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,8,rdg)
-- The current mode calibration follows
-- in a similar fashion
   dmm.func="dccurrent"
   dmm.range=.001
   dmm.nplc=1
   dmm.filter.count=100
   dmm.filter.enable=1
   channel.calibration.step("" .. channel_num,9)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,10,rdg)
   dmm.range=.1
   channel.calibration.step("" .. channel_num,11)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,12,rdg)
   dmm.range=.01
   channel.calibration.step("" .. channel_num,13)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,14,rdg)
   dmm.range=.1
   channel.calibration.step("" .. channel_num,15)
   delay(6)
   rdg=dmm.measure()
   print(rdg)
   channel.calibration.step("" .. channel_num,16,rdg)
-- Final steps are to save and lock the calibration.
-- New calibration data is not used
-- if it is not saved.
   channel.calibration.save()
   channel.calibration.lock()
-- Clean up to restore analog channels to
-- an idle, unconnected state
   channel.setmode("" .. (1000 * slot_num + 10),channel.MODE_PROTECT_VOLTAGE_1)
   channel.setmode("" .. (1000 * slot_num + 11),channel.MODE_PROTECT_VOLTAGE_1)
   channel.setoutputenable("" .. (1000 * slot_num + 10) ,channel.OFF)
   channel.setoutputenable("" .. (1000 * slot_num + 11) ,channel.OFF)
   channel.write("" .. (1000 * slot_num + 10), 0)
   channel.write("" .. (1000 * slot_num + 10), 0)
end
-- Create a function called cal_tot that takes
-- slot number and channel number as parameters
-- No external measurements need to be taken
-- to calibrate the counter channels.
-- Be sure to disconnect all external circuits
-- before executing calibration!
```

```
function cal_tot(slot_num,chan_num)
   channel_num = (1000 * slot_num) + chan_num
   channel.calibration.unlock("slot" .. slot_num,"KI3706")
   channel.calibration.step("" .. channel_num,1)
   channel.calibration.step("" .. channel_num,2)
   channel.calibration.save()
   channel.calibration.lock()
end
endscript
```

Before running these calibration scripts, you must build the functions `cal_dac()` and `cal_tot()` by typing `cal()`. Now you can calibrate any channel using this script.

Typing `cal_dac(1,10)` runs an internal DMM calibration on Slot 1, Channel 10.

Typing `cal_tot(2,6)` runs the totalizer calibration for Slot 2, Channel 6.

Power consumption information

You can power off each analog channel if it is not being used to reduce the power required of the card with `channel.setpowerstate()`. The card has a default static power draw of 3300 mW, which includes powering the totalizer channels and both analog output channels. If an analog channel is powered off, it reduces the 3300 mW draw by 820 mW for each channel that is powered off. This power can then be used for closing relays on other cards within a bank. See Series 3700A Module Schematics and Connections for more information on power handling information and examples.

The command for controlling power is `channel.setpowerstate(<ch_list>, <state>)`, where `<state>` is either `'channel.ON'` or `'channel.OFF'`.

NOTE

If an analog channel has been turned off, the specified warmup time is required after being turned back on in order to meet its specified accuracies.

Using match counts

Match counts apply to digital inputs and counter/totalizer channels.

Setting and meeting match counts

Matching allows you to set a state or generate an event when achieving a match, instead of continually reading the totalizer count. For example, you can set a totalizer count match and the summary does not change until that match count is met.

For example, we want to know when a totalizer count reaches 50 for the first totalizer in Slot 1 (that is, Channel 1006). First set the match type for that channel:

```
channel.setmatchtype('1006', channel.MATCH_EXACT)
```

Next, program the match count:

```
channel.setmatch('1006', 50)
```

Once the match count is met in the totalizer, the `channel.IND_MATCH` bit is set and can be read using

```
match_value = channel.getstate('1006')
```

Because the default setting for the state is for it to latch, the value remains even after the count moves beyond the match value. To clear it, use:

```
channel.resetstatelatch('1006', channel.IND_MATCH)
```

Using match counts to generate an event

A match can cause an event in the system that can then be used to initiate a scan. For example:

```
-- Define a scan
scan.create("6001:6030")
channel.trigger[1].set('1006', channel.IND_MATCH)
scan.trigger.arm.stimulus = channel.trigger[1].EVENT_ID
-- Start the scan so that it is waiting for the event
scan.background()
```

Once the count matches, the event triggers and satisfies `arm.stimulus`, which allows the scan to proceed.

Latching values

Channels support a status/state concept. The status of a channel indicates what conditions are present on that channel at that point in time. Examples of channel status are:

- An overload condition exists on that channel
- A channel is presently matching a pre-determined match condition
- The counter/totalizer channel's count has overflowed.

To read the present status of a channel, send:

```
status_now = channel.getstate('1001')
```

If the digital I/O matches a present match value, the `status_now` value would be `channel.IND_MATCH`.

Status latching builds on this so that the status read by `channel.getstate()` remembers what has happened. For example, status latching tracks if the condition EVER happened since its last reset so that you know that the status occurred but is not now present. Manipulating the status so that it either latches or not is accomplished with the following commands:

```
channel.setstatelatch()
channel.resetstatelatch()
```

The setting of the state latch can be read using `channel.getstate()`.

Power consumption implications

The Model 3750 draws a significant amount of power from the Model 3706 mainframe in order to perform all of its functions. In cases where multiple Model 3750 cards are used, it is possible that not all Model 3750 functions can be executed at the same time. The Model 3706 mainframe keeps track of power requirements in real time and provides a notification if a power limit has been exceeded. This notification is in the form of one or more error messages.

See Power budgeting and calculation (on page 3-2) for more information.

While operating the Model 3750, if a requested operation would consume an amount of power that is not available, one of the following errors is generated:

- #5513 "Not enough total power to complete requested card operation."
- #5514 "Not enough bank power to complete requested card operation."
- #5515 "Not enough slot power to complete requested card operation."

These errors mean that there was not enough available reserve power to complete the requested operation on a total, bank, and slot basis, respectively. As a result, the requested operation would not have been performed. To perform the requested operation, more available reserve power is needed as described in Options for working with power consumption limitations (on page 13-20).

Options for working with power consumption limitations

If the system is experiencing power limitations, there are two ways to possibly improve the power capability of the system.

- Turn off modes of operation or functions when they are not in use. For example, backplane relays on switch cards and any non-latching relay types that do not need to remain closed all the time. This conserves power and results in more reserves available. Another example is to turn all digital I/O as inputs when they are not needed as outputs.
- Balance the power across banks. In the Model 3706 mainframe, the power limitations are on a bank (3-slot) basis. By placing equal numbers of Model 3750 cards in each bank, the power constraints for the troublesome bank may be relaxed. For example, a 4-card system would have Model 3750 cards installed in slots 2,3 and 5,6, instead of slots 1, 2, 3, and 4. Additionally, system planning could result in a system where a Model 3750 that uses the highest amount of power would be located in the bank with the most reserve available.

See Power budgeting and calculation (on page 3-2) for more information.

Appendix A

Series 3700 cards connection logs

In this appendix:

Series 3700 cards connection logs.....A-2

Series 3700 cards connection logs

Model 3720 connection log

The following figures provide a sample of a connection log that can be used to record the wiring scheme for this module.

Figure 89: Sample Model 3720 connection log (1 of 2)

Channel		Color	Description
OUTPUT 1	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		
CH20	H		
	L		
CH21	H		
	L		
CH22	H		
	L		
CH23	H		
	L		
CH24	H		
	L		
CH25	H		
	L		
CH26	H		
	L		
CH27	H		
	L		
CH28	H		
	L		
CH29	H		
	L		

Figure 90: Sample Model 3720 connection log (2 of 2)

Channel (cont.)		Color	Description
CH30	H		
	L		
OUTPUT 2	H		
	L		
CH31	H		
	L		
CH32	H		
	L		
CH33	H		
	L		
CH34	H		
	L		
CH35	H		
	L		
CH36	H		
	L		
CH37	H		
	L		
CH38	H		
	L		
CH39	H		
	L		
CH40	H		
	L		
CH41	H		
	L		
CH42	H		
	L		
CH43	H		
	L		
CH44	H		
	L		
CH45	H		
	L		
CH46	H		
	L		
CH47	H		
	L		
CH48	H		
	L		
CH49	H		
	L		
CH50	H		
	L		
CH51	H		
	L		
CH52	H		
	L		
CH53	H		
	L		
CH54	H		
	L		
CH55	H		
	L		
CH56	H		
	L		
CH57	H		
	L		
CH58	H		
	L		
CH59	H		
	L		
CH60	H		
	L		

Model 3721 connection log

The following figures provide a sample of a connection log that can be used to record the wiring scheme for this module.

Figure 91: Sample Model 3721 connection log (1 of 2)

Channel		Color	Description
OUTPUT 1	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		
CH20	H		
	L		
OUTPUT 2	H		
	L		
CH21	H		
	L		
CH22	H		
	L		
CH23	H		
	L		
CH24	H		
	L		
CH25	H		
	L		
CH26	H		
	L		
CH27	H		
	L		
CH28	H		
	L		
CH29	H		
	L		

Figure 92: Sample Model 3721 connection log (2 of 2)

Channel (cont.)		Color	Description
CH30	H		
	L		
CH31	H		
	L		
CH32	H		
	L		
CH33	H		
	L		
CH34	H		
	L		
CH35	H		
	L		
CH36	H		
	L		
CH37	H		
	L		
CH38	H		
	L		
CH39	H		
	L		
CH40	H		
	L		
AMPS41	H		
	L		
AMPS42	H		
	L		

Model 3722 connection log

The following figures provide a sample of a connection log that can be used to record the wiring scheme for this module.

Figure 93: Sample Model 3722 connection log (1 of 3)

Channel		Color	Description
OUTPUT 1	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		
CH20	H		
	L		
CH21	H		
	L		
CH22	H		
	L		
CH23	H		
	L		
CH24	H		
	L		
CH25	H		
	L		
CH26	H		
	L		
CH27	H		
	L		
CH28	H		
	L		
CH29	H		
	L		

Figure 94: Sample Model 3722 connection log (2 of 3)

Channel (cont.)		Color	Description
CH30	H		
	L		
CH31	H		
	L		
CH32	H		
	L		
CH33	H		
	L		
CH34	H		
	L		
CH35	H		
	L		
CH36	H		
	L		
CH37	H		
	L		
CH38	H		
	L		
CH39	H		
	L		
CH40	H		
	L		
CH41	H		
	L		
CH42	H		
	L		
CH43	H		
	L		
CH44	H		
	L		
CH45	H		
	L		
CH46	H		
	L		
CH47	H		
	L		
CH48	H		
	L		
OUTPUT 2	H		
	L		
CH49	H		
	L		
CH50	H		
	L		
CH51	H		
	L		
CH52	H		
	L		
CH53	H		
	L		
CH54	H		
	L		
CH55	H		
	L		
CH56	H		
	L		
CH57	H		
	L		
CH58	H		
	L		
CH59	H		
	L		
CH60	H		
	L		
CH61			
	L		
CH62	H		
	L		
CH63	H		
	L		

Figure 95: Sample Model 3722 connection log (3 of 3)

Channel (cont.)		Color	Description
CH64	H		
	L		
CH65	H		
	L		
CH66	H		
	L		
CH67	H		
	L		
CH68	H		
	L		
CH69	H		
	L		
CH70	H		
	L		
CH71	H		
	L		
CH72	H		
	L		
CH73	H		
	L		
CH74	H		
	L		
CH75	H		
	L		
CH76	H		
	L		
CH77	H		
	L		
CH78	H		
	L		
CH79	H		
	L		
CH80	H		
	L		
CH81	H		
	L		
CH82	H		
	L		
CH83	H		
	L		
CH84	H		
	L		
CH85	H		
	L		
CH86	H		
	L		
CH87	H		
	L		
CH88	H		
	L		
CH89	H		
	L		
CH90	H		
	L		
CH91	H		
	L		
CH92	H		
	L		
CH93	H		
	L		
CH94	H		
	L		
CH95	H		
	L		
CH96	H		
	L		

Model 3723 connection logs

Model 3723 connection log (60-channel)

The following figures provide a sample of a connection log that can be used to record the wiring scheme for this module.

Figure 96: Sample Model 3723 connection log (60-channel) (1 of 2)

Channel		Color	Description
OUTPUT 1	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		
CH20	H		
	L		
CH21	H		
	L		
CH22	H		
	L		
CH23	H		
	L		
CH24	H		
	L		
CH25	H		
	L		
CH26	H		
	L		
CH27	H		
	L		
CH28	H		
	L		
CH29	H		
	L		

Figure 97: Sample Model 3723 connection log (60-channel) (2 of 2)

Channel (cont.)		Color	Description
CH30	H		
	L		
OUTPUT 2	H		
	L		
CH31	H		
	L		
CH32	H		
	L		
CH33	H		
	L		
CH34	H		
	L		
CH35	H		
	L		
CH36	H		
	L		
CH37	H		
	L		
CH38	H		
	L		
CH39	H		
	L		
CH40	H		
	L		
CH41	H		
	L		
CH42	H		
	L		
CH43	H		
	L		
CH44	H		
	L		
CH45	H		
	L		
CH46	H		
	L		
CH47	H		
	L		
CH48	H		
	L		
CH49	H		
	L		
CH50	H		
	L		
CH51	H		
	L		
CH52	H		
	L		
CH53	H		
	L		
CH54	H		
	L		
CH55	H		
	L		
CH56	H		
	L		
CH57	H		
	L		
CH58	H		
	L		
CH59	H		
	L		
CH60	H		
	L		

Model 3723 connection log (120-channel)

The following figures provide a sample of a connection log that can be used to record the wiring scheme for this module.

Figure 98: Sample Model 3723 connection log (120-channel) (1 of 4)

Channel		Color	Description
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		
CH20	H		
	L		
CH21	H		
	L		
CH22	H		
	L		
CH23	H		
	L		
CH24	H		
	L		
CH25	H		
	L		
CH26	H		
	L		
CH27	H		
	L		
CH28	H		
	L		
CH29	H		
	L		

Figure 99: Sample Model 3723 connection log (120-channel) (2 of 4)

Channel (cont.)		Color	Description
CH30	H		
	L		
CH31	H		
	L		
CH32	H		
	L		
CH33	H		
	L		
CH34	H		
	L		
CH35	H		
	L		
CH36	H		
	L		
CH37	H		
	L		
CH38	H		
	L		
CH39	H		
	L		
CH40	H		
	L		
CH41	H		
	L		
CH42	H		
	L		
CH43	H		
	L		
CH44	H		
	L		
CH45	H		
	L		
CH46	H		
	L		
CH47	H		
	L		
CH48	H		
	L		
CH49	H		
	L		
CH50	H		
	L		
CH51	H		
	L		
CH52	H		
	L		
CH53	H		
	L		
CH54	H		
	L		
CH55	H		
	L		
CH56	H		
	L		
CH57	H		
	L		
CH58	H		
	L		
CH59	H		
	L		
CH60	H		
	L		

Figure 100: Sample Model 3723 connection log (120-channel) (3 of 4)

Channel (cont.)		Color	Description
CH61	H		
	L		
CH62	H		
	L		
CH63	H		
	L		
CH64	H		
	L		
CH65	H		
	L		
CH66	H		
	L		
CH67	H		
	L		
CH68	H		
	L		
CH69	H		
	L		
CH70	H		
	L		
CH71	H		
	L		
CH72	H		
	L		
CH73	H		
	L		
CH74	H		
	L		
CH75	H		
	L		
CH76	H		
	L		
CH77	H		
	L		
CH78	H		
	L		
CH79	H		
	L		
CH80	H		
	L		
CH81	H		
	L		
CH82	H		
	L		
CH83	H		
	L		
CH84	H		
	L		
CH85	H		
	L		
CH86	H		
	L		
CH87	H		
	L		
CH88	H		
	L		
CH89	H		
	L		
CH90	H		
	L		

Figure 101: Sample Model 3723 connection log (120-channel) (4 of 4)

Channel (cont.)		Color	Description
CH91	H		
	L		
CH92	H		
	L		
CH93	H		
	L		
CH94	H		
	L		
CH95	H		
	L		
CH96	H		
	L		
CH97	H		
	L		
CH98	H		
	L		
CH99	H		
	L		
CH100	H		
	L		
CH101	H		
	L		
CH102	H		
	L		
CH103	H		
	L		
CH104	H		
	L		
CH105	H		
	L		
CH106	H		
	L		
CH107	H		
	L		
CH108	H		
	L		
CH109	H		
	L		
CH110	H		
	L		
CH111	H		
	L		
CH112	H		
	L		
CH113	H		
	L		
CH114	H		
	L		
CH115	H		
	L		
CH116	H		
	L		
CH117	H		
	L		
CH118	H		
	L		
CH119	H		
	L		
CH120	H		
	L		

Model 3724 connection log

The following table provides a sample of a connection log that can be used to record the wiring scheme for this module.

LChannel		Color	Pin Number
OUTPUT 1	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		

LChannel		Color	Pin Number
CH20	H		
	L		
CH21	H		
	L		
CH22	H		
	L		
CH23	H		
	L		
CH24	H		
	L		
CH25	H		
	L		
CH26	H		
	L		
CH27	H		
	L		
CH28	H		
	L		
CH29	H		
	L		
CH30	H		
	L		
OUTPUT 2	H		
	L		
CH31	H		
	L		
CH32	H		
	L		
CH33	H		
	L		
CH34	H		
	L		
CH35	H		
	L		
CH36	H		
	L		
CH37	H		
	L		
CH38	H		
	L		
CH39	H		
	L		
CH40	H		
	L		
CH41	H		
	L		
CH42	H		
	L		

LChannel		Color	Pin Number
CH43	H		
	L		
CH44	H		
	L		
CH45	H		
	L		
CH46	H		
	L		
CH47	H		
	L		
CH48	H		
	L		
CH49	H		
	L		
CH50	H		
	L		
CH51	H		
	L		
CH52	H		
	L		
CH53	H		
	L		
CH54	H		
	L		
CH55	H		
	L		
CH56	H		
	L		
CH57	H		
	L		
CH58	H		
	L		
CH59	H		
	L		
CH60	H		
	L		

Model 3730 connection log

The following figures provide a sample of a connection log that can be used to record the wiring scheme for this module.

Figure 102: Sample Model 3730 connection log

Connection		Color	Description
ROW 1	H		
	L		
ROW 2	H		
	L		
ROW 3	H		
	L		
ROW 4	H		
	L		
ROW 5	H		
	L		
ROW 6	H		
	L		
COLUMN 1	H		
	L		
COLUMN 2	H		
	L		
COLUMN 3	H		
	L		
COLUMN 4	H		
	L		
COLUMN 5	H		
	L		
COLUMN 6	H		
	L		
COLUMN 7	H		
	L		
COLUMN 8	H		
	L		
COLUMN 9	H		
	L		
COLUMN 10	H		
	L		
COLUMN 11	H		
	L		
COLUMN 12	H		
	L		
COLUMN 13	H		
	L		
COLUMN 14	H		
	L		
COLUMN 15	H		
	L		
COLUMN 16	H		
	L		

Model 3732 connection logs

Dual 4 × 28 2-pole configuration connection logs

The next tables are examples of connection logs you can use to record the wiring scheme for the Model 3732 in the dual 4 × 28 2-pole configuration.

Model 3732 connection log for the dual 4 × 28 2-pole configuration (1 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Row 1 High	R11H		
1	Row 2 High	R12H		
1	Row 3 High	R13H		
1	Row 4 High	R14H		
1	Column 1 High	C101H		
1	Column 2 High	C102H		
1	Column 3 High	C103H		
1	Column 4 High	C104H		
1	Column 5 High	C105H		
1	Column 6 High	C106H		
1	Column 7 High	C107H		
1	Column 8 High	C108H		
1	Column 9 High	C109H		
1	Column 10 High	C110H		
1	Column 11 High	C111H		
1	Column 12 High	C112H		
1	Column 13 High	C113H		
1	Column 14 High	C114H		
1	Column 15 High	C115H		
1	Column 16 High	C116H		
1	Column 17 High	C117H		
1	Column 18 High	C118H		
1	Column 19 High	C119H		
1	Column 20 High	C120H		
1	Column 21 High	C121H		
1	Column 22 High	C122H		
1	Column 23 High	C123H		
1	Column 24 High	C124H		
1	Column 25 High	C125H		
1	Column 26 High	C126H		
1	Column 27 High	C127H		
1	Column 28 High	C128H		

Model 3732 connection log for the dual 4 × 28 2-pole configuration (2 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Row 1 Low	R11L		
1	Row 2 Low	R12L		
1	Row 3 Low	R13L		
1	Row 4 Low	R14L		
1	Column 1 Low	C101L		
1	Column 2 Low	C102L		
1	Column 3 Low	C103L		
1	Column 4 Low	C104L		
1	Column 5 Low	C105L		
1	Column 6 Low	C106L		
1	Column 7 Low	C107L		
1	Column 8 Low	C108L		
1	Column 9 Low	C109L		
1	Column 10 Low	C110L		
1	Column 11 Low	C111L		
1	Column 12 Low	C112L		
1	Column 13 Low	C113L		
1	Column 14 Low	C114L		
1	Column 15 Low	C115L		
1	Column 16 Low	C116L		
1	Column 17 Low	C117L		
1	Column 18 Low	C118L		
1	Column 19 Low	C119L		
1	Column 20 Low	C120L		
1	Column 21 Low	C121L		
1	Column 22 Low	C122L		
1	Column 23 Low	C123L		
1	Column 24 Low	C124L		
1	Column 25 Low	C125L		
1	Column 26 Low	C126L		
1	Column 27 Low	C127L		
1	Column 28 Low	C128L		

Model 3732 connection log for the dual 4 × 28 2-pole configuration (3 of 4):

Bank	Connection	Pin signal name	Color	Description
2	Row 1 High	R21H		
2	Row 2 High	R22H		
2	Row 3 High	R23H		
2	Row 4 High	R24H		
2	Column 1 High	C201H		
2	Column 2 High	C202H		
2	Column 3 High	C203H		
2	Column 4 High	C204H		
2	Column 5 High	C205H		
2	Column 6 High	C206H		
2	Column 7 High	C207H		
2	Column 8 High	C208H		
2	Column 9 High	C209H		
2	Column 10 High	C210H		
2	Column 11 High	C211H		
2	Column 12 High	C212H		
2	Column 13 High	C213H		
2	Column 14 High	C214H		
2	Column 15 High	C215H		
2	Column 16 High	C216H		
2	Column 17 High	C217H		
2	Column 18 High	C218H		
2	Column 19 High	C219H		
2	Column 20 High	C220H		
2	Column 21 High	C221H		
2	Column 22 High	C222H		
2	Column 23 High	C223H		
2	Column 24 High	C224H		
2	Column 25 High	C225H		
2	Column 26 High	C226H		
2	Column 27 High	C227H		
2	Column 28 High	C228H		

Model 3732 connection log for the dual 4 × 28 2-pole configuration (4 of 4):

Bank	Connection	Pin signal name	Color	Description
2	Row 1 Low	R21L		
2	Row 2 Low	R22L		
2	Row 3 Low	R23L		
2	Row 4 Low	R24L		
2	Column 1 Low	C201L		
2	Column 2 Low	C202L		
2	Column 3 Low	C203L		
2	Column 4 Low	C204L		
2	Column 5 Low	C205L		
2	Column 6 Low	C206L		
2	Column 7 Low	C207L		
2	Column 8 Low	C208L		
2	Column 9 Low	C209L		
2	Column 10 Low	C210L		
2	Column 11 Low	C211L		
2	Column 12 Low	C212L		
2	Column 13 Low	C213L		
2	Column 14 Low	C214L		
2	Column 15 Low	C215L		
2	Column 16 Low	C216L		
2	Column 17 Low	C217L		
2	Column 18 Low	C218L		
2	Column 19 Low	C219L		
2	Column 20 Low	C220L		
2	Column 21 Low	C221L		
2	Column 22 Low	C222L		
2	Column 23 Low	C223L		
2	Column 24 Low	C224L		
2	Column 25 Low	C225L		
2	Column 26 Low	C226L		
2	Column 27 Low	C227L		
2	Column 28 Low	C228L		

Quad 4 × 28 configuration connection logs

The next tables are examples of connection logs that you can use to record the wiring scheme for the Model 3732 in the quad 4 × 28 configuration.

Model 3732 connection log for the quad 4 × 28 configuration (1 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Row 1	R11		
1	Row 2	R12		
1	Row 3	R13		
1	Row 4	R14		
1	Column 1	C101		
1	Column 2	C102		
1	Column 3	C103		
1	Column 4	C104		
1	Column 5	C105		
1	Column 6	C106		
1	Column 7	C107		
1	Column 8	C108		
1	Column 9	C109		
1	Column 10	C110		
1	Column 11	C111		
1	Column 12	C112		
1	Column 13	C113		
1	Column 14	C114		
1	Column 15	C115		
1	Column 16	C116		
1	Column 17	C117		
1	Column 18	C118		
1	Column 19	C119		
1	Column 20	C120		
1	Column 21	C121		
1	Column 22	C122		
1	Column 23	C123		
1	Column 24	C124		
1	Column 25	C125		
1	Column 26	C126		
1	Column 27	C127		
1	Column 28	C128		

Model 3732 connection log for the quad 4 × 28 configuration (2 of 4):

Bank	Connection	Pin signal name	Color	Description
2	Row 1	R21		
2	Row 2	R22		
2	Row 3	R23		
2	Row 4	R24		
2	Column 1	C201		
2	Column 2	C202		
2	Column 3	C203		
2	Column 4	C204		
2	Column 5	C205		
2	Column 6	C206		
2	Column 7	C207		
2	Column 8	C208		
2	Column 9	C209		
2	Column 10	C210		
2	Column 11	C211		
2	Column 12	C212		
2	Column 13	C213		
2	Column 14	C214		
2	Column 15	C215		
2	Column 16	C216		
2	Column 17	C217		
2	Column 18	C218		
2	Column 19	C219		
2	Column 20	C220		
2	Column 21	C221		
2	Column 22	C222		
2	Column 23	C223		
2	Column 24	C224		
2	Column 25	C225		
2	Column 26	C226		
2	Column 27	C227		
2	Column 28	C228		

Model 3732 connection log for the quad 4 × 28 configuration (3 of 4):

Bank	Connection	Pin signal name	Color	Description
3	Row 1	R31		
3	Row 2	R32		
3	Row 3	R33		
3	Row 4	R34		
3	Column 1	C301		
3	Column 2	C302		
3	Column 3	C303		
3	Column 4	C304		
3	Column 5	C305		
3	Column 6	C306		
3	Column 7	C307		
3	Column 8	C308		
3	Column 9	C309		
3	Column 10	C310		
3	Column 11	C311		
3	Column 12	C312		
3	Column 13	C313		
3	Column 14	C314		
3	Column 15	C315		
3	Column 16	C316		
3	Column 17	C317		
3	Column 18	C318		
3	Column 19	C319		
3	Column 20	C320		
3	Column 21	C321		
3	Column 22	C322		
3	Column 23	C323		
3	Column 24	C324		
3	Column 25	C325		
3	Column 26	C326		
3	Column 27	C327		
3	Column 28	C328		

Model 3732 connection log for the quad 4 × 28 configuration (4 of 4):

Bank	Connection	Pin signal name	Color	Description
4	Row 1	R41		
4	Row 2	R42		
4	Row 3	R43		
4	Row 4	R44		
4	Column 1	C401		
4	Column 2	C402		
4	Column 3	C403		
4	Column 4	C404		
4	Column 5	C405		
4	Column 6	C406		
4	Column 7	C407		
4	Column 8	C408		
4	Column 9	C409		
4	Column 10	C410		
4	Column 11	C411		
4	Column 12	C412		
4	Column 13	C413		
4	Column 14	C414		
4	Column 15	C415		
4	Column 16	C416		
4	Column 17	C417		
4	Column 18	C418		
4	Column 19	C419		
4	Column 20	C420		
4	Column 21	C421		
4	Column 22	C422		
4	Column 23	C423		
4	Column 24	C424		
4	Column 25	C425		
4	Column 26	C426		
4	Column 27	C427		
4	Column 28	C428		

Single 4 × 56 2-pole configuration connection logs

The next tables are examples of connection logs that you can use to record the wiring scheme for the Model 3732 in the single 4 × 56 2-pole configuration.

Model 3732 connection log for the single 4 × 56 2-pole configuration (1 of 4)

Bank	Connection	Pin signal name	Color	Description
1	Row 1 High	R11H		
1	Row 2 High	R12H		
1	Row 3 High	R13H		
1	Row 4 High	R14H		
1	Column 1 High	C101H		
1	Column 2 High	C102H		
1	Column 3 High	C103H		
1	Column 4 High	C104H		
1	Column 5 High	C105H		
1	Column 6 High	C106H		
1	Column 7 High	C107H		
1	Column 8 High	C108H		
1	Column 9 High	C109H		
1	Column 10 High	C110H		
1	Column 11 High	C111H		
1	Column 12 High	C112H		
1	Column 13 High	C113H		
1	Column 14 High	C114H		
1	Column 15 High	C115H		
1	Column 16 High	C116H		
1	Column 17 High	C117H		
1	Column 18 High	C118H		
1	Column 19 High	C119H		
1	Column 20 High	C120H		
1	Column 21 High	C121H		
1	Column 22 High	C122H		
1	Column 23 High	C123H		
1	Column 24 High	C124H		
1	Column 25 High	C125H		
1	Column 26 High	C126H		
1	Column 27 High	C127H		
1	Column 28 High	C128H		

Model 3732 connection log for the single 4 × 56 2-pole configuration (2 of 4)

Bank	Connection	Pin signal name	Color	Description
1	Column 29 High	C129H		
1	Column 30 High	C130H		
1	Column 31 High	C131H		
1	Column 32 High	C132H		
1	Column 33 High	C133H		
1	Column 34 High	C134H		
1	Column 35 High	C135H		
1	Column 36 High	C136H		
1	Column 37 High	C137H		
1	Column 38 High	C138H		
1	Column 39 High	C139H		
1	Column 40 High	C140H		
1	Column 41 High	C141H		
1	Column 42 High	C142H		
1	Column 43 High	C143H		
1	Column 44 High	C144H		
1	Column 45 High	C145H		
1	Column 46 High	C146H		
1	Column 47 High	C147H		
1	Column 48 High	C148H		
1	Column 49 High	C149H		
1	Column 50 High	C150H		
1	Column 51 High	C151H		
1	Column 52 High	C152H		
1	Column 53 High	C153H		
1	Column 54 High	C154H		
1	Column 55 High	C155H		
1	Column 56 High	C156H		

Model 3732 connection log for the single 4 × 56 2-pole configuration (3 of 4)

Bank	Connection	Pin signal name	Color	Description
1	Row 1 Low	R11L		
1	Row 2 Low	R12L		
1	Row 3 Low	R13L		
1	Row 4 Low	R14L		
1	Column 1 Low	C101L		
1	Column 2 Low	C102L		
1	Column 3 Low	C103L		
1	Column 4 Low	C104L		
1	Column 5 Low	C105L		
1	Column 6 Low	C106L		
1	Column 7 Low	C107L		
1	Column 8 Low	C108L		
1	Column 9 Low	C109L		
1	Column 10 Low	C110L		
1	Column 11 Low	C111L		
1	Column 12 Low	C112L		
1	Column 13 Low	C113L		
1	Column 14 Low	C114L		
1	Column 15 Low	C115L		
1	Column 16 Low	C116L		
1	Column 17 Low	C117L		
1	Column 18 Low	C118L		
1	Column 19 Low	C119L		
1	Column 20 Low	C120L		
1	Column 21 Low	C121L		
1	Column 22 Low	C122L		
1	Column 23 Low	C123L		
1	Column 24 Low	C124L		
1	Column 25 Low	C125L		
1	Column 26 Low	C126L		
1	Column 27 Low	C127L		
1	Column 28 Low	C128L		

Model 3732 connection log for the single 4 × 56 2-pole configuration (4 of 4)

Bank	Connection	Pin signal name	Color	Description
1	Column 29 Low	C129L		
1	Column 30 Low	C130L		
1	Column 31 Low	C131L		
1	Column 32 Low	C132L		
1	Column 33 Low	C133L		
1	Column 34 Low	C134L		
1	Column 35 Low	C135L		
1	Column 36 Low	C136L		
1	Column 37 Low	C137L		
1	Column 38 Low	C138L		
1	Column 39 Low	C139L		
1	Column 40 Low	C140L		
1	Column 41 Low	C141L		
1	Column 42 Low	C142L		
1	Column 43 Low	C143L		
1	Column 44 Low	C144L		
1	Column 45 Low	C145L		
1	Column 46 Low	C146L		
1	Column 47 Low	C147L		
1	Column 48 Low	C148L		
1	Column 49 Low	C149L		
1	Column 50 Low	C150L		
1	Column 51 Low	C151L		
1	Column 52 Low	C152L		
1	Column 53 Low	C153L		
1	Column 54 Low	C154L		
1	Column 55 Low	C155L		
1	Column 56 Low	C156L		

Dual 4 × 56 configuration connection logs

The next tables are examples of connection logs that you can use to record the wiring scheme for the Model 3732 in the dual 4 × 56 configuration.

Model 3732 connection log for the dual 4 × 56 configuration (1 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Row 1	R11		
1	Row 2	R12		
1	Row 3	R13		
1	Row 4	R14		
1	Column 1	C101		
1	Column 2	C102		
1	Column 3	C103		
1	Column 4	C104		
1	Column 5	C105		
1	Column 6	C106		
1	Column 7	C107		
1	Column 8	C108		
1	Column 9	C109		
1	Column 10	C110		
1	Column 11	C111		
1	Column 12	C112		
1	Column 13	C113		
1	Column 14	C114		
1	Column 15	C115		
1	Column 16	C116		
1	Column 17	C117		
1	Column 18	C118		
1	Column 19	C119		
1	Column 20	C120		
1	Column 21	C121		
1	Column 22	C122		
1	Column 23	C123		
1	Column 24	C124		
1	Column 25	C125		
1	Column 26	C126		
1	Column 27	C127		
1	Column 28	C128		

Model 3732 connection log for the dual 4 × 56 configuration (2 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Column 29	C129		
1	Column 30	C130		
1	Column 31	C131		
1	Column 32	C132		
1	Column 33	C133		
1	Column 34	C134		
1	Column 35	C135		
1	Column 36	C136		
1	Column 37	C137		
1	Column 38	C138		
1	Column 39	C139		
1	Column 40	C140		
1	Column 41	C141		
1	Column 42	C142		
1	Column 43	C143		
1	Column 44	C144		
1	Column 45	C145		
1	Column 46	C146		
1	Column 47	C147		
1	Column 48	C148		
1	Column 49	C149		
1	Column 50	C150		
1	Column 51	C151		
1	Column 52	C152		
1	Column 53	C153		
1	Column 54	C154		
1	Column 55	C155		
1	Column 56	C156		

Model 3732 connection log for the dual 4 × 56 configuration (3 of 4):

Bank	Connection	Pin signal name	Color	Description
2	Row 1	R21		
2	Row 2	R22		
2	Row 3	R23		
2	Row 4	R24		
2	Column 1	C201		
2	Column 2	C202		
2	Column 3	C203		
2	Column 4	C204		
2	Column 5	C205		
2	Column 6	C206		
2	Column 7	C207		
2	Column 8	C208		
2	Column 9	C209		
2	Column 10	C210		
2	Column 11	C211		
2	Column 12	C212		
2	Column 13	C213		
2	Column 14	C214		
2	Column 15	C215		
2	Column 16	C216		
2	Column 17	C217		
2	Column 18	C218		
2	Column 19	C219		
2	Column 20	C220		
2	Column 21	C221		
2	Column 22	C222		
2	Column 23	C223		
2	Column 24	C224		
2	Column 25	C225		
2	Column 26	C226		
2	Column 27	C227		
2	Column 28	C228		

Model 3732 connection log for the dual 4 × 56 configuration (4 of 4):

Bank	Connection	Pin signal name	Color	Description
2	Column 29	C229		
2	Column 30	C230		
2	Column 31	C231		
2	Column 32	C232		
2	Column 33	C233		
2	Column 34	C234		
2	Column 35	C235		
2	Column 36	C236		
2	Column 37	C237		
2	Column 38	C238		
2	Column 39	C239		
2	Column 40	C240		
2	Column 41	C241		
2	Column 42	C242		
2	Column 43	C243		
2	Column 44	C244		
2	Column 45	C245		
2	Column 46	C246		
2	Column 47	C247		
2	Column 48	C248		
2	Column 49	C249		
2	Column 50	C250		
2	Column 51	C251		
2	Column 52	C252		
2	Column 53	C253		
2	Column 54	C254		
2	Column 55	C255		
2	Column 56	C256		

Single 4 × 112 configuration connection logs

The next tables are examples of connection logs that you can use to record the wiring scheme for the Model 3732 in the single 4 × 112 configuration.

Model 3732 connection log for the single 4 × 112 configuration (1 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Row 1	R11		
1	Row 2	R12		
1	Row 3	R13		
1	Row 4	R14		
1	Column 1	C101		
1	Column 2	C102		
1	Column 3	C103		
1	Column 4	C104		
1	Column 5	C105		
1	Column 6	C106		
1	Column 7	C107		
1	Column 8	C108		
1	Column 9	C109		
1	Column 10	C110		
1	Column 11	C111		
1	Column 12	C112		
1	Column 13	C113		
1	Column 14	C114		
1	Column 15	C115		
1	Column 16	C116		
1	Column 17	C117		
1	Column 18	C118		
1	Column 19	C119		
1	Column 20	C120		
1	Column 21	C121		
1	Column 22	C122		
1	Column 23	C123		
1	Column 24	C124		
1	Column 25	C125		
1	Column 26	C126		
1	Column 27	C127		
1	Column 28	C128		

Model 3732 connection log for the single 4 × 112 configuration (2 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Column 29	C129		
1	Column 30	C130		
1	Column 31	C131		
1	Column 32	C132		
1	Column 33	C133		
1	Column 34	C134		
1	Column 35	C135		
1	Column 36	C136		
1	Column 37	C137		
1	Column 38	C138		
1	Column 39	C139		
1	Column 40	C140		
1	Column 41	C141		
1	Column 42	C142		
1	Column 43	C143		
1	Column 44	C144		
1	Column 45	C145		
1	Column 46	C146		
1	Column 47	C147		
1	Column 48	C148		
1	Column 49	C149		
1	Column 50	C150		
1	Column 51	C151		
1	Column 52	C152		
1	Column 53	C153		
1	Column 54	C154		
1	Column 55	C155		
1	Column 56	C156		
1	Column 57	C157		
1	Column 58	C158		
1	Column 59	C159		
1	Column 60	C160		

Model 3732 connection log for the single 4 × 112 configuration (3 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Column 61	C161		
1	Column 62	C162		
1	Column 63	C163		
1	Column 64	C164		
1	Column 65	C165		
1	Column 66	C166		
1	Column 67	C167		
1	Column 68	C168		
1	Column 69	C169		
1	Column 70	C170		
1	Column 71	C171		
1	Column 72	C172		
1	Column 73	C173		
1	Column 74	C174		
1	Column 75	C175		
1	Column 76	C176		
1	Column 77	C177		
1	Column 78	C178		
1	Column 79	C179		
1	Column 80	C180		
1	Column 81	C181		
1	Column 82	C182		
1	Column 83	C183		
1	Column 84	C184		
1	Column 85	C185		
1	Column 86	C186		
1	Column 87	C187		
1	Column 88	C188		
1	Column 89	C189		
1	Column 90	C190		
1	Column 91	C191		
1	Column 92	C192		

Model 3732 connection log for the single 4 × 112 configuration (4 of 4):

Bank	Connection	Pin signal name	Color	Description
1	Column 93	C193		
1	Column 94	C194		
1	Column 95	C195		
1	Column 96	C196		
1	Column 97	C197		
1	Column 98	C198		
1	Column 99	C199		
1	Column 100	C1A0		
1	Column 101	C1A1		
1	Column 102	C1A2		
1	Column 103	C1A3		
1	Column 104	C1A4		
1	Column 105	C1A5		
1	Column 106	C1A6		
1	Column 107	C1A7		
1	Column 108	C1A8		
1	Column 109	C1A9		
1	Column 110	C1B0		
1	Column 111	C1B1		
1	Column 112	C1B2		

Single 8 × 28 2-pole configuration connection logs

The next tables are examples of connection logs you can use to record the wiring scheme for the Model 3732 in the single 8 × 28 2-pole configuration.

Model 3732 connection log for the single 8 × 28 2-pole configuration (1 of 2):

Bank	Connection	Pin signal name	Color	Description
1	Row 1 High	R11H		
1	Row 2 High	R12H		
1	Row 3 High	R13H		
1	Row 4 High	R14H		
1	Row 5 High	R15H		
1	Row 6 High	R16H		
1	Row 7 High	R17H		
1	Row 8 High	R18H		
1	Column 1 High	C101H		
1	Column 2 High	C102H		
1	Column 3 High	C103H		
1	Column 4 High	C104H		
1	Column 5 High	C105H		
1	Column 6 High	C106H		
1	Column 7 High	C107H		
1	Column 8 High	C108H		
1	Column 9 High	C109H		
1	Column 10 High	C110H		
1	Column 11 High	C111H		
1	Column 12 High	C112H		
1	Column 13 High	C113H		
1	Column 14 High	C114H		
1	Column 15 High	C115H		
1	Column 16 High	C116H		
1	Column 17 High	C117H		
1	Column 18 High	C118H		
1	Column 19 High	C119H		
1	Column 20 High	C120H		
1	Column 21 High	C121H		
1	Column 22 High	C122H		
1	Column 23 High	C123H		
1	Column 24 High	C124H		
1	Column 25 High	C125H		
1	Column 26 High	C126H		

Model 3732 connection log for the single 8 × 28 2-pole configuration (2 of 2):

Bank	Connection	Pin signal name	Color	Description
1	Column 27 High	C127H		
1	Column 28 High	C128H		
1	Row 1 Low	R11L		
1	Row 2 Low	R12L		
1	Row 3 Low	R13L		
1	Row 4 Low	R14L		
1	Row 5 Low	R15L		
1	Row 6 Low	R16L		
1	Row 7 Low	R17L		
1	Row 8 Low	R18L		
1	Column 1 Low	C101L		
1	Column 2 Low	C102L		
1	Column 3 Low	C103L		
1	Column 4 Low	C104L		
1	Column 5 Low	C105L		
1	Column 6 Low	C106L		
1	Column 7 Low	C107L		
1	Column 8 Low	C108L		
1	Column 9 Low	C109L		
1	Column 10 Low	C110L		
1	Column 11 Low	C111L		
1	Column 12 Low	C112L		
1	Column 13 Low	C113L		
1	Column 14 Low	C114L		
1	Column 15 Low	C115L		
1	Column 16 Low	C116L		
1	Column 17 Low	C117L		
1	Column 18 Low	C118L		
1	Column 19 Low	C119L		
1	Column 20 Low	C120L		
1	Column 21 Low	C121L		
1	Column 22 Low	C122L		
1	Column 23 Low	C123L		
1	Column 24 Low	C124L		
1	Column 25 Low	C125L		
1	Column 26 Low	C126L		
1	Column 27 Low	C127L		
1	Column 28 Low	C128L		

Dual 8 × 28 configuration connection logs

The next tables are examples of connection logs that you can use to record the wiring scheme for the Model 3732 in the dual 8 × 28 configuration.

Model 3732 connection log for the dual 8 × 28 configuration (1 of 3):

Bank	Connection	Pin signal name	Color	Description
1	Row 1	R11		
1	Row 2	R12		
1	Row 3	R13		
1	Row 4	R14		
1	Row 5	R15		
1	Row 6	R16		
1	Row 7	R17		
1	Row 8	R18		
1	Column 1	C101		
1	Column 2	C102		
1	Column 3	C103		
1	Column 4	C104		
1	Column 5	C105		
1	Column 6	C106		
1	Column 7	C107		
1	Column 8	C108		
1	Column 9	C109		
1	Column 10	C110		
1	Column 11	C111		
1	Column 12	C112		
1	Column 13	C113		
1	Column 14	C114		
1	Column 15	C115		
1	Column 16	C116		
1	Column 17	C117		
1	Column 18	C118		
1	Column 19	C119		
1	Column 20	C120		
1	Column 21	C121		
1	Column 22	C122		
1	Column 23	C123		
1	Column 24	C124		

Model 3732 connection log for the dual 8 × 28 configuration (2 of 3):

Bank	Connection	Pin signal name	Color	Description
1	Column 25	C125		
1	Column 26	C126		
1	Column 27	C127		
1	Column 28	C128		
2	Row 1	R21		
2	Row 2	R22		
2	Row 3	R23		
2	Row 4	R24		
2	Row 5	R25		
2	Row 6	R26		
2	Row 7	R27		
2	Row 8	R28		
2	Column 1	C201		
2	Column 2	C202		
2	Column 3	C203		
2	Column 4	C204		
2	Column 5	C205		
2	Column 6	C206		
2	Column 7	C207		
2	Column 8	C208		
2	Column 9	C209		
2	Column 10	C210		
2	Column 11	C211		
2	Column 12	C212		
2	Column 13	C213		
2	Column 14	C214		
2	Column 15	C215		
2	Column 16	C216		
2	Column 17	C217		
2	Column 18	C218		
2	Column 19	C219		
2	Column 20	C220		

Model 3732 connection log for the dual 8 × 28 configuration (3 of 3):

Bank	Connection	Pin signal name	Color	Description
2	Column 21	C221		
2	Column 22	C222		
2	Column 23	C223		
2	Column 24	C224		
2	Column 25	C225		
2	Column 26	C226		
2	Column 27	C227		
2	Column 28	C228		

Single 16 × 28 configuration connection logs

The next tables are examples of connection logs you can use to record the wiring scheme for the Model 3732 in the single 16 × 28 configuration.

Model 3732 connection log for the single 16 × 28 configuration (1 of 2):

Bank	Connection	Pin signal name	Color	Description
1	Row 1	R11		
1	Row 2	R12		
1	Row 3	R13		
1	Row 4	R14		
1	Row 5	R15		
1	Row 6	R16		
1	Row 7	R17		
1	Row 8	R18		
1	Row 9	R19		
1	Row 10	R110		
1	Row 11	R111		
1	Row 12	R112		
1	Row 13	R113		
1	Row 14	R114		
1	Row 15	R115		
1	Row 16	R116		
1	Column 1	C101		
1	Column 2	C102		
1	Column 3	C103		
1	Column 4	C104		
1	Column 5	C105		
1	Column 6	C106		
1	Column 7	C107		
1	Column 8	C108		
1	Column 9	C109		
1	Column 10	C110		
1	Column 11	C111		
1	Column 12	C112		
1	Column 13	C113		
1	Column 14	C114		
1	Column 15	C115		
1	Column 16	C116		

Model 3732 connection log for the single 16 × 28 configuration (2 of 2):

Bank	Connection	Pin signal name	Color	Description
1	Column 17	C117		
1	Column 18	C118		
1	Column 19	C119		
1	Column 20	C120		
1	Column 21	C121		
1	Column 22	C122		
1	Column 23	C123		
1	Column 24	C124		
1	Column 25	C125		
1	Column 26	C126		
1	Column 27	C127		
1	Column 28	C128		

Model 3740 connection log

The next table is an examples of a connection log you can use to record the wiring scheme for the Model 3740 card configuration.

Figure 103: Sample Model 3740 connection log (1 of 2)

Channel		Color	Description
CH1	NC		
	NO		
	COM		
CH2	NC		
	NO		
	COM		
CH3	NC		
	NO		
	COM		
CH4	NC		
	NO		
	COM		
CH5	NC		
	NO		
	COM		
CH6	NC		
	NO		
	COM		
CH7	NC		
	NO		
	COM		
CH8	NC		
	NO		
	COM		
CH9	NC		
	NO		
	COM		
CH10	NC		
	NO		
	COM		
CH11	NC		
	NO		
	COM		
CH12	NC		
	NO		
	COM		
CH13	NC		
	NO		
	COM		
CH14	NC		
	NO		
	COM		
CH15	NC		
	NO		
	COM		
CH16	NC		
	NO		
	COM		
CH17	NC		
	NO		
	COM		
CH18	NC		
	NO		
	COM		
CH19	NC		
	NO		
	COM		
CH20	NC		
	NO		
	COM		

Figure 104: Sample Model 3740 connection log (2 of 2)

Channel (continued)		Color	Description
CH21	NC		
	NO		
	COM		
CH22	NC		
	NO		
	COM		
CH23	NC		
	NO		
	COM		
CH24	NC		
	NO		
	COM		
CH25	NC		
	NO		
	COM		
CH26	NC		
	NO		
	COM		
CH27	NC		
	NO		
	COM		
CH28	NC		
	NO		
	COM		
CH29	H		
	L		
CH30	H		
	L		
CH31	H		
	L		
CH32	H		
	L		

Model 3750 connection log

The next table is an examples of a connection log you can use to record the wiring scheme for the Model 3750 card configuration.

Channel	Color	Pin Number
CH1 - DIO1		
CH1 - DIO2		
CH1 - DIO3		
CH1 - DIO4		
CH1 - DIO5		
CH1 - DIO6		
CH1 - DIO7		
CH1 - DIO8		
CH2 - DIO1		
CH2 - DIO2		
CH2 - DIO3		
CH2 - DIO4		
CH2 - DIO5		
CH2 - DIO6		
CH2 - DIO7		
CH2 - DIO8		
CH3 - DIO1		
CH3 - DIO2		
CH3 - DIO3		
CH3 - DIO4		
CH3 - DIO5		
CH3 - DIO6		
CH3 - DIO7		
CH3 - DIO8		
CH4 - DIO1		
CH4 - DIO2		
CH4 - DIO3		
CH4 - DIO4		
CH4 - DIO5		
CH4 - DIO6		
CH4 - DIO7		
CH4 - DIO8		
CH5 - DIO1		
CH5 - DIO2		
CH5 - DIO3		
CH5 - DIO4		
CH5 - DIO5		
CH5 - DIO6		
CH5 - DIO7		
CH5 - DIO8		
CH6 - Gate+		
CH6 - Gate-		
CH6 - Input+		

Channel	Color	Pin Number
CH6 - Input-		
CH7 - Gate+		
CH7 - Gate-		
CH7 - Input+		
CH7 - Input-		
CH8 - Gate+		
CH8 - Gate-		
CH8 - Input+		
CH8 - Input-		
CH9 - Gate+		
CH9 - Gate-		
CH9 - Input+		
CH9 - Input-		
CH10 - Vout		
CH10 - V com		
CH10 - Iout		
CH10 - I com		
CH11 - Vout		
CH11 - V com		
CH11 - Iout		
CH11 - I com		
GND		
+5v		
Vext 1		
Vext 2		

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