7002-HD

High Density Switch Mainframe and Cards

- **Cost-effective, high density switch mainframe and cards**
- **High density, half-rack switching mainframe, just 2U (3.5 in) high**
- **Differential 6×32 matrix card**
- **Differential quad 1×40 multiplexer card**
- **Analog backplane simplifies constructing larger matrix or multiplexer configurations**
- **Designed for easy integration with Keithley DMMs or SourceMeter® instruments**
- **200V, 1A signal handling capacity**
- **GPIB/IEEE-488 and Trigger Link interfaces**

The Model 7002-HD switch mainframe and high density switch cards provide a cost-effective, high density switching solution in a half-rack, 2U enclosure. This combination of compact size and high switching density makes the Model 7002-HD system one of the best switching values in the test and measurement industry.

The two-slot Model 7002-HD mainframe is an extension of the design used in Keithley's proven Series 7000 mainframes, combining the channel density of the ten-slot Model 7002 with the half-rack footprint of the Model 7001. To exploit the Model 7002-HD's high density architecture, Keithley has designed two new high density switch cards: the Model 7002-HD-MTX1 Differential 6×32 Matrix Card and the Model 7002-HD-MUX1 Differential Quad 1×40 Multiplexing Card. Matching or mixing these cards in the mainframe makes it simple to create a switch system with up to 384 matrix crosspoints or 320 multiplexer channels in a single half-rack, 2U (3.5 inch) instrument footprint.

Easy to Set Up, Simple to Operate

The Model 7002-HD's similarity to other Series 7000 mainframes simplifies system setup and programming—it shares the same operating firmware with the Model 7002. It's simple to program or operate the Model 7002-HD via either the front panel controls or over the IEEE-488 interface bus. This high density switch system is designed for easy integration with Keithley's Series 2000 Digital Multimeters and Series 2400 SourceMeter® instruments, providing a range of low cost, tightly integrated measurement packages.

Build Large Configurations Easily

An analog backplane in the Model 7002-HD mainframe can be used to make connections between cards when building large matrix or multiplexer configurations. The backplane eliminates intercard wiring, allowing greater configuration flexibility and higher signal integrity.

Built-in Scan Control

A built-in scan control function eliminates the need for the external controller to manage every step of the test procedure. It's easy to program the Model 7002-HD to control the channel spacing, scan spacing, and number of scans.

Store 500 Complete Switch Patterns

The Model 7002-HD has a non-volatile memory for saving and recalling relay setups, even after a power loss. Up to 500 switch patterns can be recalled and used directly from memory or used as part of a scan list. Sequencing through switch patterns in memory saves test time by eliminating the need to transfer this information over the GPIB bus, improving system throughput.

Trigger Link

Keithley's unique Trigger Link high speed trigger bus, included in virtually all modern Keithley instruments and switch mainframes, provides simple trigger coordination between different types of instruments. By providing access to six independent hardware trigger lines on a single cable, this bus eliminates GPIB communication delays during scanning, boosting overall system throughput.

APPLICATIONS

The Model 7002-HD mainframe and cards are well suited for a variety of high density switching applications, including:

- **Testing isolated and bussed resistor networks**
- **Wafer-level functional I-V testing**
- **Multi-terminal component testing**
- **Component array testing**
- **OLED array/stress testing**
- **Resistance/leakage testing**

7002-HD

High Density Switch Mainframe and Cards

Ordering Information

7002-HD
High Density Switch Mainframe

7002-HD-MUX1 Differential Quad 1×40 Multiplexer Card

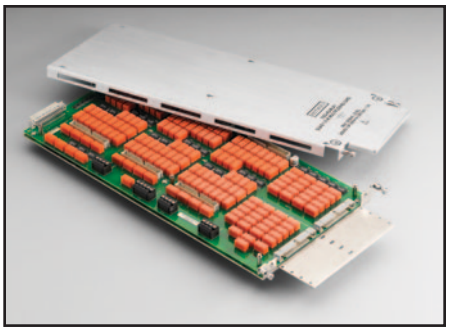
7002-HD-MTX1 Differential 6×32 Matrix Card

Accessories Supplied

Front rack-mount kit (Model 4288-2), rear rack-mount kit, line cord, and instruction manual

Model 7002-HD-MUX1 High Density Multiplexer Card

Each Model 7002-HD-MUX1 Differential Quad 1×40 Multiplexing Card has four 1×40 (two-pole) multiplexers, providing a total of 160 multiplexer channels per card. In addition, a unique 4×4 instrument connection matrix supports reconfigurable instrument connections. This instrument connection matrix connects to each of the four 1×40 multiplexer banks, allowing the card to be programmed as a quad 1×40, dual 1×80s, a single 1×160, or a 4×160 blocking matrix. In addition, each bank of multiplexers can be linked through a software configurable backplane relay, allowing even more configuration flexibility.



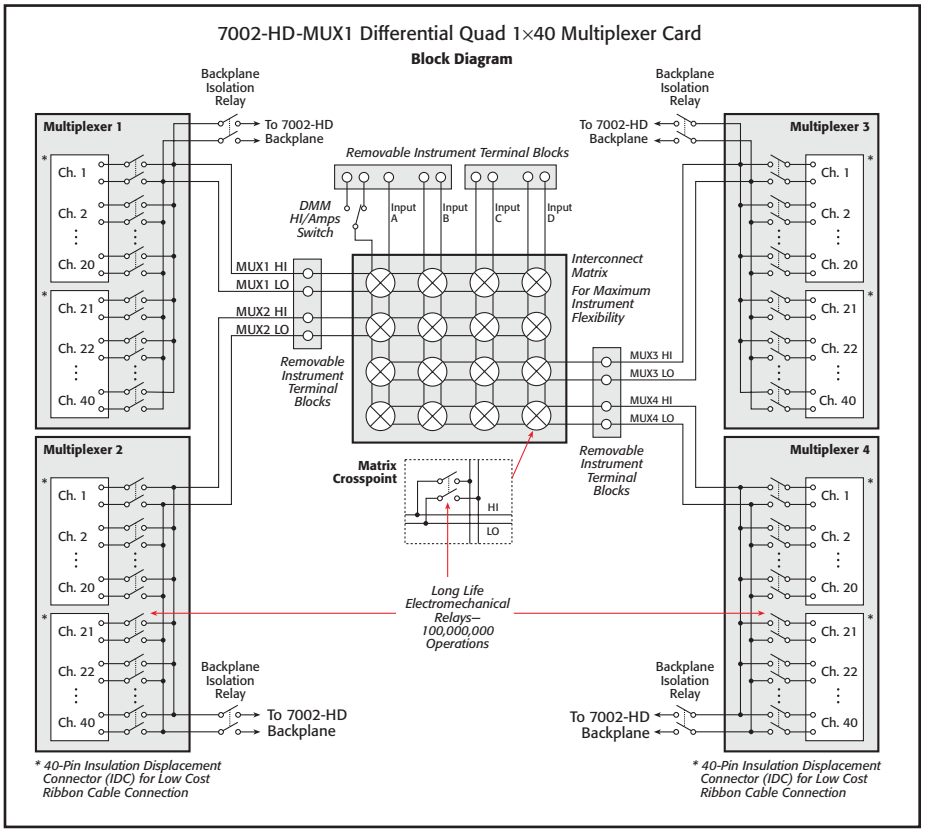


Figure 1. Functional block diagram of Model 7002-HD-MUX1 card

ACCESSORIES AVAILABLE

COMMUNICATION INTERFACES AND CABLES

7007-1	Double Shielded, Premium GPIB Cable, 1m
7007-2	Double Shielded, Premium GPIB Cable, 2m
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus
KUSB-488A	IEEE-488 USB-to-GPIB Interface Adapter

RACK KIT

4288-1	Fixed Rack Mount Kit

TRIGGERING

8501-1	Trigger Link Cable, DIN-to-DIN, 1m
8501-2	Trigger Link Cable, DIN-to-DIN, 2m
8502	Trigger Link to BNC Break-out Box
8503	Trigger Link Cable, DIN-to-dual BNC, 1m
8505	Male to 2-Female Y-DIN Cable for Trigger Link

SERVICES AVAILABLE

7002-HD-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
7002-HD-MTX1-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
7002-HD-MUX1-3Y-EW	1-year factory warranty extended to 3 years from date of shipment

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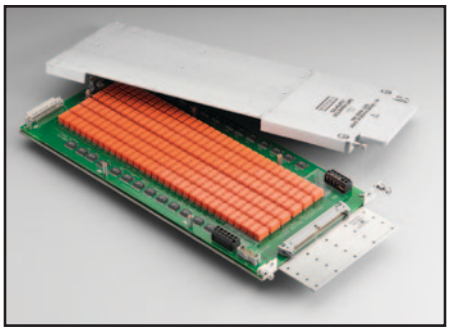
High Density Switch Mainframe and Cards

Model 7002-HD-MTX1 High Density Matrix Card

Each Model 7002-HD-MTX1 card provides a differential 6 row by 32 column non-blocking switching matrix. Each row is connected to the mainframe's analog backplane by software configurable isolation relays, so a single mainframe can provide a 6 row by 64 column matrix. This reduces the number of interconnecting cables required, which helps maintain signal integrity in high density matrix systems. Similarly, an external row connection allows easy matrix expansion between two or more 7002-HD mainframes.



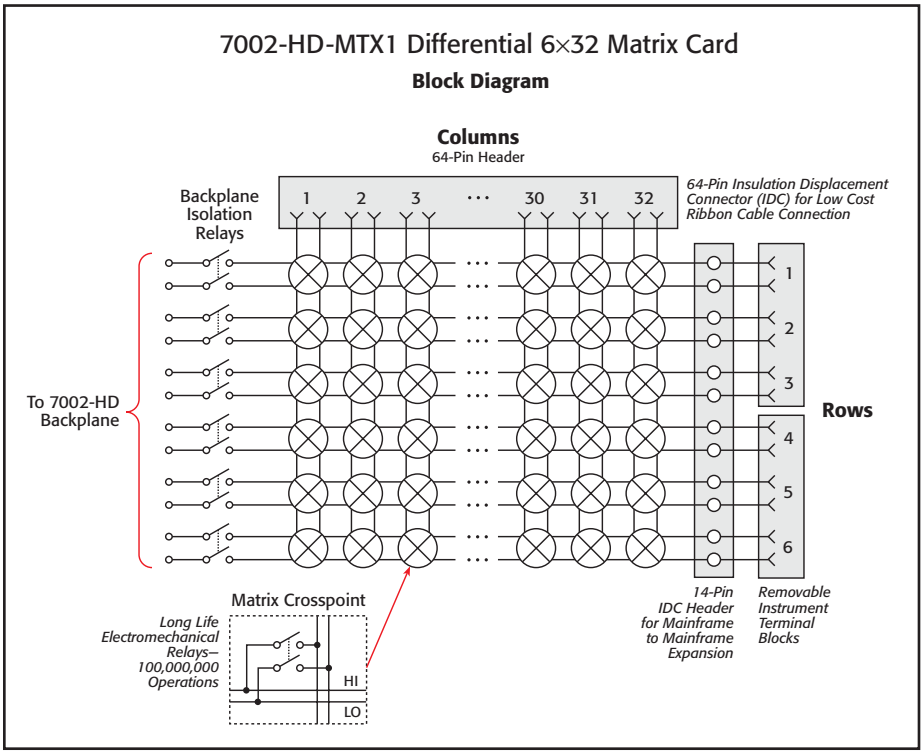


Figure 2. Functional block diagram of Model 7002-HD-MTX1 card

High density solutions for building large switching configurations

SWITCHING AND CONTROL

7002-HD

High Density Switch Mainframe and Cards

7002-HD High Density Switch System Specifications

SYSTEM

EXPANSION: Two plug-in cards per mainframe.

CARD COMPATIBILITY: Compatible with 7002-HD-MTX1 and 7002-HD-MUX1 cards.

MEMORY: Battery backed-up storage for 500 channel patterns.

SWITCH SETTLING TIME: Automatically selected by the mainframe. Additional time from 0 to 99999.999 seconds can be added in 1ms increments.

INPUT TRIGGER SOURCES:
IEEE-488 bus (GET, *TRG).
Trigger Link (external trigger).
Manual (front panel).
Internal Timer, programmable from 1ms to 99999.999 seconds in 1ms increments.

CHANNEL READY OUTPUT: Trigger Link.

SWITCHING SEQUENCE: Break-before-make [On (Default) / Off].

ANALOG BACKPLANE

SIGNALS: 32 single pole paths. These signals provide matrix and multiplexer expansion between cards within one mainframe.

GENERAL

DISPLAY: Dual-line vacuum fluorescent. 1st line: 20-character alphanumeric. 2nd line: 32-character alphanumeric.

REAR PANNEL CONNECTORS: IEEE-488, 8-pin micro DIN connector for Trigger Link, 8-pin micro DIN connector for Trigger Link expansion.

POWER: 100V to 240Vrms, 50/60Hz. 50VA maximum (mainframe only). 150VA maximum (mainframe with two cards at maximum closed channels).

EMC: Complies with European Union Directive 89/336/EEC, EN61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC, EN61010-1.

OPERATING ENVIRONMENT[3]:

7002-HD Cards	Maximum Closed Channels[4]	Temperature	Humidity
MTX1	150	0°C to 50°C	50% RH at 35°C
MUX1	150	0°C to 50°C	50% RH at 35°C

STORAGE ENVIRONMENT: –25°C to 65°C.

ALTITUDE: Maximum 2000m above sea level.

RACK MOUNT DIMENSIONS:

Configuration	Height	Width	Depth
7002-HD	89mm (3.5 in.)	213mm (8.375 in.)	537mm (21.125 in.)
Installed MTX1	89mm (3.5 in.)	213mm (8.375 in.)	562mm (22.125 in.)
Installed MUX1	89mm (3.5 in.)	213mm (8.375 in.)	562mm (22.125 in.)

WEIGHT: <5.7 kg (12.6 lbs.).

7002-HD NOTES

1 Display off.
2 Time from the output of a Channel Ready pulse until a new External Trigger will be accepted on the 8-pin micro DIN connector.
3 For indoor use only.
4 Refer to card user's guide for measurement considerations.
5 External Trigger speed includes the time to output a Channel Ready pulse and the re-trigger hold-off time.

7002-HD Front panel

7002-HD rear panel shown with 7002-HD-MTX1 and 7002-HD-MUX1 cards installed.

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7002-HD

High Density Switch Mainframe and Cards

7002-HD-MUX1 Differential Quad 1×40 Multiplexer Card Specifications

GENERAL

RELAY SWITCH CONFIGURATION: Differential Quad 1×40 multiplexers with programmable multiplex expansion and matrix input switching.

RELAY TYPE: Double pole form A (DPST) electromechanical relays.

RELAY DRIVE CURRENT: <35mA per channel.

RELAY ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 7002-HD.

EMC: Conforms to European Union Directive 89/336/EEC, EN61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC, EN61010-1.

INPUTS

MAXIMUM SIGNAL LEVEL: 200VDC or 200Vrms (283V peak for AC waveforms), 1A switched, 60W, 125VA maximum.

COMMON MODE VOLTAGE: 200VDC or 200Vrms (283V peak for AC waveforms) between any terminal and chassis.

CONNECTOR TYPE:

Matrix Inputs: 5mm removable screw terminals (supports 18–22AWG wire). Supplied with removable screw terminals.

	Individual Channels		Channel Patterns		
7002-HD Cards	External Trigger Rate	External Trigger Speed[5]	External Trigger Rate	External Trigger Speed[5]	Re-Trigger Hold-off[2]
MTX1	<128/s	>7.9 ms	<100/s	>10.0 ms	>0.5 ms
MUX1	<128/s	>7.9 ms	<100/s	>10.0 ms	>0.5 ms

Multiplexer Outputs: 5mm removable screw terminals (supports 18–22AWG wire). Supplied with removable screw terminals.

Multiplexer Inputs: 40-pin male IDC compatible headers.

CONTACT LIFE: $>10^8$ operations at no load.
$>10^5$ operations at rated load (resistive load).

	Multiplexer Configuration		
	Quad 1×40	Single 1×160[5]	Single 1×320[6]
CHANNEL RESISTANCE[4]	<1 Ω	<1 Ω	<2 Ω
CONTACT POTENTIAL[7]	<4.5 μV per contact pair	<9 μV per contact pair	<9 μV per contact pair
OFFSET CURRENT	<100 pA	<100 pA	<200 pA
ISOLATION			
Between any two terminals	$>10^9$Ω <150 pF	$>10^9$Ω <550 pF	$>10^9$Ω <1100 pF
Between any terminal and earth	$>10^9$Ω <250 pF	$>10^9$Ω <700 pF	$>10^9$Ω <1450 pF
CROSSTALK (50Ω Load)[1]	<–50 dB below 1 MHz <–30 dB below 10 MHz	<–50 dB below 1 MHz <–25 dB below 10 MHz	<–50 dB below 1 MHz <–25 dB below 10 MHz
INSERTION LOSS (50Ω Source, 50Ω Load)[1]	<0.35 dB below 1 MHz <3 dB below 25 MHz	<0.5 dB below 1 MHz <3 dB below 10 MHz	<0.7 dB below 1 MHz <3 dB below 2 MHz

ENVIRONMENTAL[2]

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 50% RH at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: <1.9kg (4.2 lbs).

ALTITUDE: Maximum 2000m above sea level.

RECOMMENDED CONNECTOR/CABLE[3]

4-pin 5mm nylon removable screw terminal: RIA Part # 31007104 or equivalent.

5-pin 5mm nylon removable screw terminal: RIA Part # 31007105 or equivalent.

6-pin 5mm nylon removable screw terminal: RIA Part # 31007106 or equivalent.

40-pin 0.100″ × 0.100″ PBT female IDC socket without strain relief (for MUX 1-3): 3M Part # 89140-0101 or equivalent.

40-pin 0.100″ × 0.100″ PBT female IDC socket with strain relief (for MUX 4): 3M Part # 89140-0103 or equivalent.

Long snap in nylon latch arms (for MUX 4): 3M Part # 3505-33 or equivalent.

40-conductor 300V PVC shielded/jacketed ribbon cable: 3M Part # 3517/40 or equivalent.

7002-HD-MUX1 NOTES

1. Includes end of life.
2. For indoor use only.
3. Refer to User's Guide for measurement considerations.
4. At end of life, add an additional 1Ω for a single card and 2Ω for two cards.
5. For signals routed through a multiplexer and the interconnect matrix.
6. Two cards installed in mainframe using analog backplane for expansion.
7. For configurations using MUX 4, add 8μV to specification.

7002-HD

High Density Switch Mainframe and Cards

7002-HD-MTX1 6×32 Matrix Card Specifications

GENERAL

MATRIX CONFIGURATION: Differential 6 rows × 32 columns.

RELAY TYPE: Double pole form A (DPST) electromechanical relays.

RELAY DRIVE CURRENT: <35mA per channel.

RELAY ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 7002-HD.

EMC: Conforms to Union Directive 89/336/EEC; EN61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC EN61010-1.

INPUTS

MAXIMUM SIGNAL LEVEL: 200VDC or 200Vrms (283V peak for AC waveforms), 1A switched, 60W, 125VA maximum.

COMMON MODE VOLTAGE: 200VDC or 200Vrms (283V peak for AC waveforms) between any terminal and chassis.

CONNECTOR TYPE:

Columns: 64-pin IDC compatible header with latch/eject arms.

Rows: 5mm removable screw terminals (supports 18–22AWG wire). Supplied with removable screw terminals. 14-pin IDC compatible header.

CONTACT LIFE: $>10^8$ operations at no load. $>10^5$ operations at rated load (resistive load).

ENVIRONMENTAL[2]

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 50% RH at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: <2.1kg (4.6 lbs).

ALTITUDE: Maximum 2000m above sea level.

	Matrix Configuration	
	6×32	**6×64[3]**
CHANNEL RESISTANCE[4]	<1Ω	<2Ω
CONTACT POTENTIAL	<4.5 μV per contact pair	<9 μV per contact pair
OFFSET CURRENT	<100 pA	<200 pA
ISOLATION		
Between any two terminals	$>10^9$Ω <150 pF	$>10^9$Ω <300 pF
Between any terminal and earth	$>10^9$Ω <500 pF	$>10^9$Ω <700 pF
CROSSTALK (1MHz, 50Ω Load)[5]	<–35 dB	<–35 dB
INSERTION LOSS (50Ω Source, 50Ω Load)[5]	<0.35 dB below 1MHz <3 dB below 2MHz	<0.7 dB below 1MHz <3 dB below 1.5MHz

RECOMMENDED CONNECTOR/CABLE[1]

6-pin 5mm nylon removable screw terminal: RIA Part # 31007106 or equivalent.

14-pin 0.100″ × 0.100″ PBT female IDC socket: 3M Part # 89114-0101 or equivalent.

14-conductor 300V PVC jacketed ribbon cable: 3M Part # 3603/14 or equivalent.

64-pin 0.100″ × 0.100″ PBT female IDC socket: 3M Part # 7964-6500EC or equivalent.

64-conductor 300V PVC jacketed ribbon cable: 3M Part # 3603/64 or equivalent.

7002-HD-MTX1 NOTES

1. Refer to user guide for measurement considerations.
2. For indoor use only.
3. Two cards installed in mainframe using analog backplane for expansion.
4. Add an additional 1Ω at end of life for single card and 2Ω for two cards.
5. Includes end of life.

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