

# Series 3700

## System Switch/Multimeter and Plug-In Cards



- Six slot system switch mainframe with optional high performance multimeter
- Multi-processor architecture optimized for high throughput scanning and pattern switching applications
- Remote PC control via Ethernet, USB, and GPIB interfaces
- Up to 576 two-wire multiplexer channels in one mainframe
- LXI Class B compliance with IEEE 1588 time synchronization
- Embedded Test Script Processor (TSP™) offering unparalleled system automation, throughput, and flexibility
- TSP-Link™ master/slave connection provides easy system expansion and seamless connection to Series 2600 SourceMeter® instruments
- Capable of over 14,000 readings per second to memory with optional high performance multimeter
- Embedded Web browser interface for test setup, maintenance, and basic application control
- Variety of instrument grade switch and control cards

The Series 3700 offers scalable, instrument grade switching and multi-channel measurement solutions that are optimized for automated testing of electronic products and components. The Series 3700 includes four versions of the Model 3706 system switch mainframe along with a growing family of plug-in switch and control cards. When the Model 3706 mainframe is ordered with the high performance multimeter, you receive a tightly integrated switch and measurement system that can meet the demanding application requirements in a functional test system or provide the flexibility needed in stand-alone data acquisition and measurement applications.

### Maximizes system control and flexibility

To provide users with greater versatility when designing test systems, the Series 3700 mainframes are equipped with many standard features. For example, easy connectivity is supported with three remote interfaces: LXI/Ethernet, General Purpose Interface Bus (GPIB), and Universal Serial Bus (USB). Fourteen digital I/O lines are also included, which are programmable and can be

used to control external devices such as component handlers or other instruments. Additionally, system control can be greatly enhanced by using our Test Script Processor (TSP) technology. This technology provides “smart” instruments with the ability to perform distributed processing and control at the instrument level versus a central PC.

### High quality switching at a value price

The Series 3700 builds upon Keithley’s tradition of producing innovative, high quality, precise signal switching. This 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 3700 supports applications as diverse as design validation, accelerated stress testing, data acquisition, and functional testing.

### Model 3706 mainframe

The Series 3700 includes the base Model 3706 system switch/multimeter mainframe with three options for added flexibility. This mainframe contains six slots for plug-in cards in a compact 2U high (3.5 inches/89mm) enclosure that easily accommodates the needs of medium to high channel count applications. When fully loaded, a mainframe can support up to 576 two-wire multiplexer channels for unrivaled density and economical per channel costs.

### High performance, 7½-digit multimeter (DMM)

The high performance multimeter option provides up to 7½-digit measurements, offering 26-bit resolution to support your ever-increasing test accuracy requirements. This flexible resolution supplies a DC reading rate from >14,000 readings/second at 3½ digits to 60 readings/second at 7½ digits to accommodate a greater span of applications.

The multimeter does not use a card slot, so you maintain all six slots in your mainframe.

In addition, the multimeter is wired to the mainframe’s analog backplane, ensuring a high quality signal path from each card channel to the multimeter.

The multimeter supports 13 built-in measurement functions, including: DCV, ACV, DCI, ACI, frequency, period, two-wire ohms, four-wire ohms, three-wire RTD temperature, four-wire RTD temperature, thermocouple temperature, thermistor temperature, and continuity. In addition, the multimeter offers extended low ohms (1Ω) and low current (10μA) ranges. In-rack calibration is supported, which reduces both maintenance and calibration time.

#### Single Channel Reading Rates

| Resolution              | DCV/<br>2 Wire Ohms | 4 Wire<br>Ohms |
|-------------------------|---------------------|----------------|
| 7½ Digits (1 NPLC)      | 60                  | 29             |
| 6½ Digits (0.2 NPLC)    | 295                 | 120            |
| 5½ Digits (0.06 NPLC)   | 935                 | 285            |
| 4½ Digits (0.006 NPLC)  | 6,300               | 580            |
| 3½ Digits (0.0005 NPLC) | 14,000              | 650            |

System switch with high performance multimeter

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## Ordering Information

- 3706** Six-slot system switch with high performance DMM
- 3706-NFP** Six-slot system switch with high performance DMM, without front panel display and keypad
- 3706-S** Six-slot system switch
- 3706-SNFP** Six-slot system switch, without front panel display and keypad
- 3720** Dual 1×30 multiplexer card (auto CJC with 3720-ST)
- 3721** Dual 1×20 multiplexer card (auto CJC with 3721-ST)
- 3722** Dual 1×48, high density, multiplexer card
- 3723** Dual 1×30, high speed, reed relay multiplexer card
- 3730** 6×16, high density, matrix card
- 3740** 32 channel isolated switch card

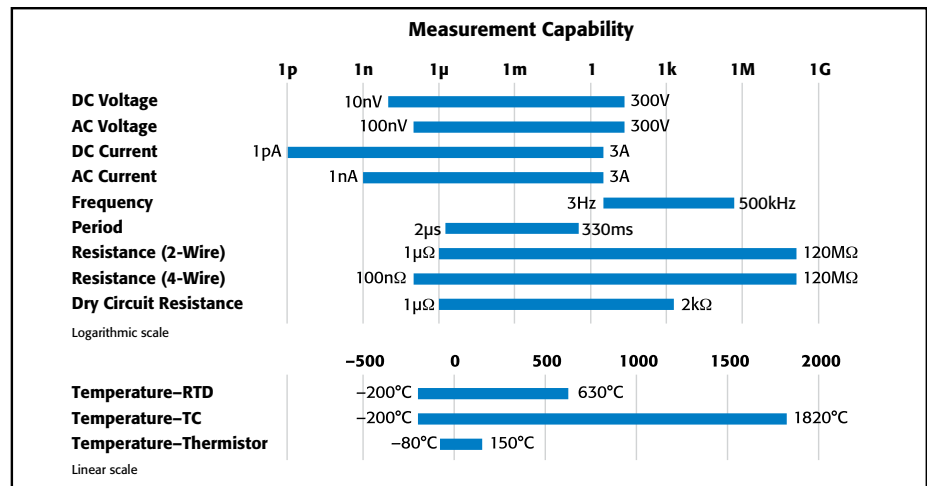
## Accessories Supplied

Test Script Builder  
Software Suite CD

Ethernet Crossover  
Cable (CA-180-3A)

Series 3700 Product CD  
(includes LabVIEW™, IVI C,  
and IVI.COM drivers)

# System Switch/Multimeter and Plug-In Cards



Measurement capabilities of the high performance multimeter

## TSP distributed control increases test speed and lowers test cost

TSP technology enhances instrument control by allowing users the choice of using standard PC control or of creating embedded test scripts that are executed on microprocessors within the instrument. By using TSP test scripts instead of a PC for instrument control, you avoid communication delays between the PC controller and instrument, which results in improved test throughput. Test scripts can contain math and decision-making rules that further reduce the interaction between a host PC and the instrument.

This form of distributed control supports the autonomous operation of individual instruments or groups of instruments and can possibly remove the need for a high level PC controller, which lowers test and ownership costs. This is the same proven TSP technology found in our innovative Series 2600 System SourceMeter instruments.

## TSP-Link for easy and seamless system coordination and expansion

If your channel density requirements grow or if you need to process more signal types, use TSP-Link to expand your system. The TSP-Link master/slave connection offers easy system expansion between Series 3700 mainframes. You can also use TSP-Link to connect to other TSP-Link enabled instruments such as Series 2600 SourceMeter instruments. Everything connected with TSP-Link can be controlled by the master unit, just as if they were all housed in the same chassis.

## ACCESSORIES AVAILABLE

### GPIB INTERFACES AND CABLES

|            |   |
|------------|---|
| 7007-1     | Shielded GPIB Cable, 1m (3.5ft)               |
| 7007-2     | Shielded GPIB Cable, 2m (6.6ft)               |
| KPCI-488LP | IEEE-488 Interface/Controller for the PCI Bus |
| KPXI-488   | IEEE-488 Interface Board for the PXI Bus      |
| KUSB-488A  | IEEE-488 USB-to-GPIB Interface Adapter        |

### DIGITAL I/O, TRIGGER LINK, AND TSP-LINK

|            |  |
|------------|--|
| 2600-TLINK | Trigger I/O to Trigger Link Interface Cable, 1m (3.3 ft) |
| CA-126-1   | Digital I/O and Trigger Cable, 1.5m (4.9 ft)             |
| CA-180-3A  | CAT5 Crossover Cable for TSP-Link                        |

### ANALOG BACKPLANE CONNECTOR

|           |   |
|-----------|---|
| 3706-BKPL | Analog Backplane Extender Board, 15-pin D-sub to terminal block |
|-----------|---|

### RACK MOUNT KIT

|         |                           |
|---------|---------------------------|
| 4288-10 | Fixed Rear Rack Mount Kit |
|---------|---------------------------|

### EXTENDED WARRANTIES AND SERVICES

#### Mainframe Models 3706 and 3706-NFP

|                |   |
|----------------|---|
| 3706-3Y-EW     | 1 Year Factory Warranty Extended to 3 Years               |
| 3706-5Y-EW     | 1 Year Factory Warranty Extended to 5 Years               |
| C/3706-3Y-STD  | Calibration Contract, 3 Years, Standard Calibration       |
| C/3706-3Y-DATA | Calibration Contract, 3 Years, Z540 Calibration with Data |
| C/3706-3Y-ISO  | Calibration Contract, 3 Years, ISO 17025 Calibration      |

#### Mainframe Models 3706-S and 3706-SNFP

|              |   |
|--------------|---|
| 3706-S-3Y-EW | 1 Year Factory Warranty Extended to 3 Years |
| 3706-S-5Y-EW | 1 Year Factory Warranty Extended to 5 Years |

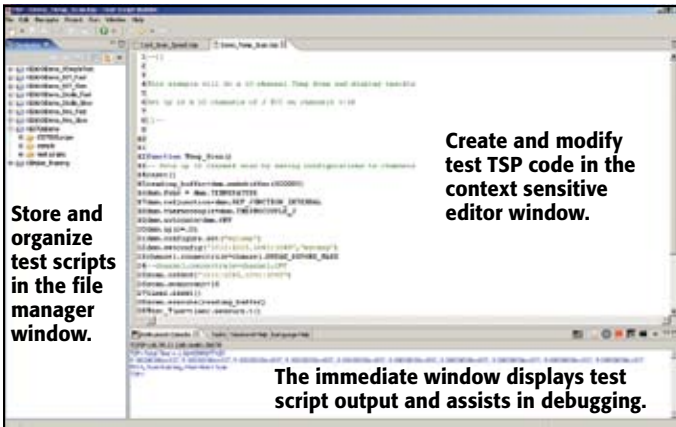
### SOFTWARE SERVICES

#### SYSTEM DEVELOPMENT OR IMPLEMENTATION

Other service contracts are available; please contact us for details.

# Series 3700

# System Switch/Multimeter and Plug-In Cards



### Test Script Builder Software Suite

TSP-Link is a high speed system expansion interface that lets users avoid the complex and time consuming task of expanding their remote interfaces to another mainframe. There is no need to add external triggers and remote communication cables to individual instruments, since all TSP-Link connected devices can be controlled from a single master unit.

### Test Script Builder software suite

Test Script Builder is a software tool that is provided with all Series 3700 instruments to help users easily create, modify, debug, and store TSP test scripts. It supplies a project/file manager window to store and organize test

scripts, a text-sensitive program editor to create and modify test TSP code, and an immediate instrument control window to send Ethernet, GPIB, and USB commands and to receive data from the instrument. The immediate window also allows users to see the output of a given test script and simplifies debugging.

### LXI Class B

Series 3700 mainframes are LXI class B compliant instruments. The features include a 10/100M Base-T Ethernet connection, graphical Web server, LAN based instrument triggering, and IEEE 1588 precision time protocol (PTP) synchronization. PTP time synchronization provides a standard method to synchronize devices on an Ethernet network with microsecond precision for time/event based programming.

### Embedded Web server

The built-in Web interface offers a quick and easy method to control the instrument remotely. Interactive schematics of each card in the mainframe support point-and-click control for opening and closing switches. A scan list builder is provided to guide users through the requirements of a scan list (such as trigger and looping definitions) for more advanced applications. When the mainframe is ordered with the multimeter, additional Web pages are included for measurement configuration and viewing.



### Built-in Web interface

### Transportable memory, USB 2.0 device port

All Model 3706 mainframes contain a USB device port for easy transfer of readings, configurations, and test scripts to memory sticks. This port, which is located on the front panel, provides you with easy access to and portability of measurement results. Simply plug in a memory stick and, with a few simple keystrokes, gain access to virtually unlimited memory storage. Additional capabilities include: saving and recalling system configurations and storage for TSP scripts.



Model 3706 front panel



Model 3706-S front panel



Model 3706 rear panel

System switch with high performance multimeter

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## High Performance Multimeter

### DC Specifications

CONDITIONS: MED (1 PLC) or SLOW (5 PLC).

For <1PLC, add appropriate "ppm of range" adder from "RMS Noise" table.

Includes rear panel Analog Backplane connector and transducer conversation. Refer to DC Notes for additional card uncertainties.

| Function                               | Range <sup>1</sup>         | Resolution | Test Current or Burden Voltage | Input Resistance or Open Circuit Voltage <sup>2</sup> | Accuracy: ±(ppm of reading + ppm of range)<br>(ppm = parts per million) (e.g., 10ppm = 0.001%) |                      |                      | Temperature Coefficient<br>0°–18°C and 28°–50°C |
|--|----------------------------|------------|--------------------------------|---|--|----------------------|----------------------|---|
|  |                            |            |                                |   | 24 Hour <sup>3</sup><br>23°C ± 1°C   | 90 Day<br>23°C ± 5°C | 1 Year<br>23°C ± 5°C |   |
| Voltage <sup>4</sup>                   | 100.00000 mV <sup>19</sup> | 0.01 μV    |                                | >10 GΩ or 10 MΩ ±1%                                   | 10 + 9   | 25 + 9               | 30 + 9               | (1 + 5)°C                                       |
|  | 1.0000000 V <sup>19</sup>  | 0.1 μV     |                                | >10 GΩ or 10 MΩ ±1%                                   | 7 + 2  | 25 + 2               | 30 + 2               | (1 + 1)°C                                       |
|  | 10.000000 V                | 1 μV       |                                | >10 GΩ or 10 MΩ ±1%                                   | 7 + 2  | 20 + 2               | 25 + 2               | (1 + 1)°C                                       |
|  | 100.00000 V                | 10 μV      |                                | 10 MΩ ±1%   | 15 + 6   | 35 + 6               | 40 + 6               | (5 + 1)°C                                       |
|  | 300.00000 V                | 100 μV     |                                | 10 MΩ ±1%   | 20 + 6   | 35 + 6               | 40 + 6               | (5 + 1)°C                                       |
| Resistance <sup>5, 6, 7</sup>          | 1.0000000 Ω                | 0.1 μΩ     | 10 mA                          | 8.2 V   | 15 + 80  | 40 + 80              | 60 + 80              | (8 + 1)°C                                       |
|  | 10.000000 Ω                | 1 μΩ       | 10 mA                          | 8.2 V   | 15 + 9   | 40 + 9               | 60 + 9               | (8 + 1)°C                                       |
|  | 100.00000 Ω                | 10 μΩ      | 1 mA                           | 13.9 V  | 15 + 9   | 40 + 9               | 60 + 9               | (8 + 1)°C                                       |
|  | 1.0000000 kΩ               | 100 μΩ     | 1 mA                           | 13.9 V  | 20 + 4   | 45 + 4               | 65 + 4               | (8 + 1)°C                                       |
|  | 10.000000 kΩ               | 1 mΩ       | 100 μA                         | 9.1 V   | 15 + 4   | 40 + 4               | 60 + 4               | (8 + 1)°C                                       |
|  | 100.00000 kΩ <sup>4</sup>  | 10 mΩ      | 10 μA                          | 14.7 V  | 20 + 4   | 45 + 4               | 65 + 4               | (8 + 1)°C                                       |
|  | 1.0000000 MΩ <sup>4</sup>  | 100 mΩ     | 10 μA                          | 14.7 V  | 25 + 4   | 50 + 4               | 70 + 4               | (8 + 1)°C                                       |
|  | 10.000000 MΩ               | 1 Ω        | 0.64 μA/10 MΩ                  | 6.4 V   | 150 + 6  | 200 + 10             | 400 + 10             | (70 + 1)°C                                      |
|  | 100.00000 MΩ               | 10 Ω       | 0.64 μA/10 MΩ                  | 6.4 V   | 800 + 30   | 2000 + 30            | 2000 + 30            | (385 + 1)°C                                     |
|  | 1.0000000 Ω                | 1 μΩ       | 10 mA                          | 27 mV   | 25 + 80  | 50 + 80              | 70 + 80              | (8 + 1)°C                                       |
| Dry Circuit Resistance <sup>6, 8</sup> | 10.000000 Ω                | 10 μΩ      | 1 mA                           | 20 mV   | 25 + 80  | 50 + 80              | 70 + 80              | (8 + 1)°C                                       |
|  | 100.00000 Ω                | 100 μΩ     | 100 μA                         | 20 mV   | 25 + 80  | 90 + 80              | 140 + 80             | (8 + 1)°C                                       |
|  | 1.0000000 kΩ               | 1 mΩ       | 10 μA                          | 20 mV   | 25 + 80  | 180 + 80             | 400 + 80             | (8 + 1)°C                                       |
|  | 2.0000000 kΩ               | 10 mΩ      | 5 μA                           | 20 mV   | 25 + 80  | 320 + 80             | 800 + 80             | (8 + 1)°C                                       |
|  | Continuity (2W)            | 1.000 kΩ   | 100 mΩ                         | 1 mA  | 13.9 V   | 40 + 100             | 100 + 100            | 100 + 100                                       |
| Current <sup>9</sup>                   | 10.000000 μA               | 1 pA       | <61 mV                         |   | 40 + 30  | 300 + 30             | 500 + 30             | (35 + 5)°C                                      |
|  | 100.00000 μA               | 10 pA      | <105 mV                        |   | 50 + 9   | 300 + 9              | 500 + 9              | (50 + 5)°C                                      |
|  | 1.0000000 mA               | 100 pA     | <130 mV                        |   | 50 + 9   | 300 + 9              | 500 + 9              | (50 + 5)°C                                      |
|  | 10.000000 mA               | 1 nA       | <150 mV                        |   | 50 + 9   | 300 + 9              | 500 + 9              | (50 + 5)°C                                      |
|  | 100.00000 mA               | 10 nA      | <0.4 V                         |   | 50 + 9   | 300 + 9              | 500 + 9              | (50 + 5)°C                                      |
|  | 1.0000000 A                | 100 nA     | <0.6 V                         |   | 200 + 10   | 500 + 10             | 800 + 10             | (50 + 5)°C                                      |
|  | 3.0000000 A                | 1 μA       | <1.8 V                         |   | 1000 + 15  | 1200 + 15            | 1200 + 15            | (50 + 5)°C                                      |

### TEMPERATURE

(Displayed in °C, °F, or K. Exclusive of probes errors.)

THERMOCOUPLES (Accuracy based on ITS-90):

| Type | Range            | Resolution | 90 Day/1 Year,<br>23°C ± 5°C             |                          | Range           | Temperature Coefficient<br>0°–18°C and 28°–50°C |
|------|------------------|------------|--|--------------------------|-----------------|---|
|      |                  |            | Relative to simulated reference junction | Using 3720 or 3721 Cards |                 |   |
| J    | –150 to + 760°C  | 0.001°C    | 0.2°C                                    | 1.0°C                    | –200 to –150°C  | 0.03°C/°C                                       |
| K    | –150 to +1372°C  | 0.001°C    | 0.2°C                                    | 1.0°C                    | –200 to –150°C  | 0.03°C/°C                                       |
| N    | –100 to +1300°C  | 0.001°C    | 0.2°C                                    | 1.0°C                    | –200 to –100°C  | 0.03°C/°C                                       |
| T    | –100 to +400°C   | 0.001°C    | 0.2°C                                    | 1.0°C                    | –200 to –100°C  | 0.03°C/°C                                       |
| E    | –150 to +1000°C  | 0.001°C    | 0.2°C                                    | 1.0°C                    | –200 to –150°C  | 0.03°C/°C                                       |
| R    | +400 to +1768°C  | 0.1°C      | 0.6°C                                    | 1.8°C                    | 0 to +400°C     | 0.03°C/°C                                       |
| S    | +400 to +1768°C  | 0.1°C      | 0.6°C                                    | 1.8°C                    | 0 to +400°C     | 0.03°C/°C                                       |
| B    | +1100 to +1820°C | 0.1°C      | 0.6°C                                    | 1.8°C                    | +350 to +1100°C | 0.03°C/°C                                       |

4-WIRE RTD OR 3-WIRE RTD (100Ω platinum [PT100], D100, F100, PT385, PT3916, or user 0Ω to 10kΩ) (Selectable Offset compensation On or Off):

For 3-wire RTD, dmm.connect=dmm.CONNECT\_FOUR\_WIRE, ≤0.1Ω lead resistance mismatching in Input HI and LO. Add 0.25°C/0.1Ω of lead resistance mismatch.

|            |                |        |        |            |
|------------|----------------|--------|--------|------------|
| 4-Wire RTD | –200 to +630°C | 0.01°C | 0.06°C | 0.003°C/°C |
| 3-Wire RTD | –200 to +630°C | 0.01°C | 0.75°C | 0.003°C/°C |

THERMISTOR: 2.2kΩ, 5kΩ, and 10kΩ.

|  |               |        |        |            |
|--|---------------|--------|--------|------------|
|  | –80 to +150°C | 0.01°C | 0.08°C | 0.002°C/°C |
|--|---------------|--------|--------|------------|

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## DC SPEEDS VS. RMS NOISE <sup>10, 11</sup>

Single Channel, 60Hz (50Hz) Operation

### RMS Noise<sup>16</sup>, PPM of Range

RMS Noise Calculator:

Add 2.5 × "RMS Noise" to "ppm of range"

(e.g., 10V @ 0.006 PLC)

"ppm of range" = 2.5 × 7.0 ppm + 2 ppm

### Measurements into Buffer (rdgs/s)<sup>13</sup>

### Measurement to PC (ms/rdg) Azero Off<sup>13</sup>

| Function             | NPLC                  | Aperture (ms) | Digits | RMS Noise <sup>16</sup> , PPM of Range |          |          |       |           | Measurements into Buffer (rdgs/s) <sup>13</sup> |               | Measurement to PC (ms/rdg) Azero Off <sup>13</sup> |              |              |
|----------------------|-----------------------|---------------|--------|--|----------|----------|-------|-----------|---|---------------|--|--------------|--------------|
|                      |                       |               |        | 100 mV                                 | 1 V      | 10 V     | 100 V | 300 V     | Azero On  | Azero Off     | Ethernet   | GPIB         | USB          |
| DCV                  | 5 <sup>14</sup>       | 83.3 (100)    | 7½     | 1.0                                    | 0.07     | 0.05     | 0.7   | 0.2       | 9.5 (8)   | 12 (10)       | 86.3 (104)   | 86.1 (102.8) | 86.3 (103.1) |
|                      | 1 <sup>14</sup>       | 16.7 (20)     | 7½     | 0.9                                    | 0.12     | 0.1      | 0.8   | 0.35      | 42 (33)   | 59.8 (49.5)   | 19.4 (22.7)  | 19.5 (22.8)  | 19.9 (23.2)  |
|                      | 0.2 <sup>12, 14</sup> | 3.33 (4.0)    | 6½     | 2.5                                    | 0.32     | 0.3      | 2.5   | 1.0       | 50 (40)   | 60 (50)       | 19.4 (22.7)  | 19.5 (22.8)  | 19.9 (23.2)  |
|                      | 0.2 <sup>14</sup>     | 3.33 (4.0)    | 6½     | 3.5                                    | 6.0      | 0.7      | 3.5   | 1.5       | 120 (100)                                       | 295 (235)     | 7.6 (8.3)  | 6.2 (6.8)    | 6.4 (7.0)    |
|                      | 0.06 <sup>15</sup>    | 1.0 (1.2)     | 5½     | 12                                     | 10       | 1.5      | 4.0   | 3.5       | 205 (165)                                       | 935 (750)     | 1.40 (1.80)  | 1.50 (1.80)  | 1.60 (2.30)  |
|                      | 0.006 <sup>15</sup>   | 0.100 (0.120) | 4½     | 55                                     | 15       | 7.0      | 70    | 35        | 218 (215)                                       | 6,200 (5,500) | 0.55 (0.57)  | 0.65 (0.67)  | 0.75 (0.77)  |
| 0.0005 <sup>15</sup> | 0.0083 (0.001)        | 3½            | 325    | 95                                     | 95       | 900      | 410   | 270 (270) | 14,600 (14,250)                                 | 0.50 (0.5)    | 0.60 (0.60)  | 0.70 (0.70)  |              |
| 2WΩ (≤10kΩ)          |                       |               |        | 10–100 Ω                               | 1 kΩ     | 10 kΩ    |       |           |   |               |  |              |              |
|                      | 5 <sup>14</sup>       | 83.3 (100)    | 7½     | 2.0                                    | 0.5      | 0.4      | —     | —         | 9.5 (8)   | 12 (10)       | 87.0 (105)   | 86.1 (103)   | 86.5 (104)   |
|                      | 1 <sup>14</sup>       | 16.7 (20)     | 7½     | 3.5                                    | 0.8      | 0.6      | —     | —         | 42 (33)   | 59.8 (49.5)   | 21.0 (24.3)  | 19.5 (22.8)  | 19.9 (23.2)  |
|                      | 0.2 <sup>12, 14</sup> | 3.33 (4.0)    | 6½     | 6.5                                    | 1.7      | 1.5      | —     | —         | 50 (40)   | 60 (50)       | 21.0 (24.3)  | 19.5 (22.8)  | 19.9 (23.2)  |
|                      | 0.2 <sup>14</sup>     | 3.33 (4.0)    | 6½     | 8.0                                    | 4.5      | 5.5      | —     | —         | 120 (100)                                       | 295 (235)     | 7.6 (8.3)  | 6.2 (6.8)    | 6.4 (7.0)    |
|                      | 0.06 <sup>15</sup>    | 1.0 (1.2)     | 5½     | 15                                     | 6        | 6.5      | —     | —         | 205 (165)                                       | 935 (750)     | 1.40 (1.80)  | 1.50 (1.80)  | 1.60 (2.30)  |
| 0.006 <sup>15</sup>  | 0.100 (0.120)         | 4½            | 60     | 15                                     | 15       | —        | —     | 218 (215) | 6,200 (5,500)                                   | 0.55 (0.57)   | 0.65 (0.67)  | 0.75 (0.77)  |              |
| 0.0005 <sup>15</sup> | 0.0083 (0.001)        | 3½            | 190    | 190                                    | 190      | —        | —     | 270 (270) | 14,100 (13,700)                                 | 0.50 (0.5)    | 0.60 (0.60)  | 0.70 (0.70)  |              |
| DCI                  |                       |               |        | 10 μA                                  | 100 μA   | 1 mA–1 A | 3A    |           |   |               |  |              |              |
|                      | 5 <sup>14</sup>       | 83.3 (100)    | 7½     | 3.5                                    | 1.3      | 1.2      | 0.4   | —         | 9.5 (8)   | 12 (10)       | 88 (103)   | 86.1 (102.8) | 86.3 (103.1) |
|                      | 1 <sup>14</sup>       | 16.7 (20)     | 6½     | 3.5                                    | 0.9      | 1.4      | 0.9   | —         | 42 (33)   | 59.8 (49.5)   | 21.0 (22.7)  | 19.5 (22.8)  | 19.8 (23.1)  |
|                      | 0.2 <sup>12, 14</sup> | 3.33 (4.0)    | 5½     | 300                                    | 10       | 10       | 4.0   | —         | 50 (40)   | 60 (50)       | 19.4 (22.7)  | 19.5 (22.8)  | 19.8 (23.1)  |
|                      | 0.2 <sup>14</sup>     | 3.33 (4.0)    | 4½     | 300                                    | 35       | 20       | 4.0   | —         | 120 (100)                                       | 295 (235)     | 7.6 (8.3)  | 6.2 (6.8)    | 6.4 (7.0)    |
|                      | 0.06 <sup>15</sup>    | 1.0 (1.2)     | 4½     | 350                                    | 35       | 20       | 4.0   | —         | 205 (165)                                       | 935 (750)     | 1.40 (1.80)  | 1.50 (1.80)  | 1.60 (2.30)  |
| 0.006 <sup>15</sup>  | 0.100 (0.120)         | 4½            | 400    | 45                                     | 25       | 110      | —     | 218 (215) | 6,200 (5,500)                                   | 0.55 (0.57)   | 0.65 (0.67)  | 0.75 (0.77)  |              |
| 0.0005 <sup>15</sup> | 0.0083 (0.001)        | 3½            | 2500   | 450                                    | 250      | 375      | —     | 270 (270) | 14,100 (13,700)                                 | 0.50 (0.5)    | 0.60 (0.60)  | 0.70 (0.70)  |              |
| 4WΩ                  |                       |               |        | 1 Ω                                    | 10–100Ω  | 1 kΩ     | 10 kΩ |           |   |               |  |              |              |
|                      | 5 <sup>14</sup>       | 83.3 (100)    | 7½     | 3.5                                    | 3.0      | 0.5      | 0.5   | —         | 5 (4)   | 5.9 (4.7)     | 173 (206)  | 173 (206)    | 173 (206)    |
|                      | 1 <sup>14</sup>       | 16.7 (20)     | 7½     | 5.0                                    | 0.5      | 0.5      | 0.7   | —         | 23.5 (18.5)                                     | 29 (23)       | 39 (46)  | 39 (46)      | 39 (46)      |
|                      | 0.2 <sup>12, 14</sup> | 3.33 (4.0)    | 5½     | 10                                     | 30       | 10       | 50    | —         | 26.5 (21)                                       | 30 (24)       | 39 (46)  | 39 (46)      | 39 (46)      |
|                      | 0.2 <sup>14</sup>     | 3.33 (4.0)    | 5½     | 300                                    | 50       | 10       | 63    | —         | 80 (60)   | 120 (95)      | 12.3 (14.5)  | 11.3 (13.3)  | 11.7 (13.7)  |
|                      | 0.06 <sup>15</sup>    | 1.0 (1.2)     | 4½     | 500                                    | 50       | 15       | 70    | —         | 140 (110)                                       | 285 (225)     | 6.2 (7.2)  | 6.3 (7.3)    | 6.5 (7.6)    |
| 0.006 <sup>15</sup>  | 0.100 (0.120)         | 4½            | 750    | 75                                     | 30       | 100      | —     | 200 (195) | 580 (565)                                       | 4.2 (4.4)     | 4.3 (4.5)  | 4.6 (4.8)    |              |
| 0.0005 <sup>15</sup> | 0.0083 (0.001)        | 3½            | 3500   | 450                                    | 250      | 250      | —     | 210 (205) | 650 (645)                                       | 4.2 (4.4)     | 4.3 (4.5)  | 4.6 (4.8)    |              |
| 4WΩ OCOMP            |                       |               |        | 1 Ω                                    | 10–100 Ω | 1 kΩ     | 10 kΩ |           |   |               |  |              |              |
|                      | 5 <sup>14</sup>       | 83.3 (100)    | 7½     | 4.0                                    | 3.0      | 0.5      | 0.5   | —         | 2.5 (2.0)                                       | 2.9 (2.3)     | 343 (427)  | 341 (425)    | 342 (426)    |
|                      | 1 <sup>14</sup>       | 16.7 (20)     | 7½     | 11                                     | 1.5      | 0.7      | 1.5   | —         | 12.7 (10)                                       | 14 (11.2)     | 77 (95)  | 74 (92)      | 75 (93)      |
|                      | 0.2 <sup>12, 14</sup> | 3.33 (4.0)    | 6½     | 30                                     | 3.5      | 2.1      | 3.5   | —         | 14 (11.2)                                       | 15 (12)       | 70 (86.5)  | 70 (86.5)    | 70 (86.5)    |
|                      | 0.2 <sup>14</sup>     | 3.33 (4.0)    | 5½     | 500                                    | 50       | 13       | 30    | —         | 46.5 (37)                                       | 56 (44)       | 22.7 (25)  | 20.5 (23)    | 21.1 (24)    |
| 0.0005 <sup>15</sup> | 0.0083 (0.001)        | 3½            | 4500   | 650                                    | 400      | 400      | —     | 129 (125) | 215 (210)                                       | 6.7 (6.7)     | 6.8 (6.8)  | 7 (7)        |              |
| Dry-CktΩ OCOMP       |                       |               |        | 1–10 Ω                                 | 100 Ω    | 1 kΩ     | 2 kΩ  |           |   |               |  |              |              |
|                      | 5 <sup>14</sup>       | 83.3 (100)    | 6½     | 8.0                                    | 10       | 10       | 8.0   | —         | 2.5 (2.0)                                       | 2.9 (2.3)     | 347 (430)  | 345 (428)    | 346 (429)    |
|                      | 1 <sup>14</sup>       | 16.7 (20)     | 5½     | 17                                     | 22       | 25       | 28    | —         | 12 (9.5)  | 13 (10)       | 80 (99)  | 77 (95)      | 78 (97)      |
|                      | 0.2 <sup>12, 14</sup> | 3.33 (4.0)    | 4½     | 50                                     | 50       | 50       | 50    | —         | 14 (11.2)                                       | 15 (12)       | 70 (86.5)  | 70 (86.5)    | 70 (86.5)    |
|                      | 0.2 <sup>14</sup>     | 3.33 (4.0)    | 3½     | 500                                    | 1000     | 1000     | 1500  | —         | 35 (30)   | 45 (36)       | 27 (33)  | 25 (31)      | 26 (32)      |
| 0.0005 <sup>15</sup> | 0.0083 (0.001)        | 2½            | 8500   | 8500                                   | 8500     | 8500     | —     | 84 (84)   | 115 (110)                                       | 10.7 (10.7)   | 10.7 (10.7)  | 11 (11)      |              |

Series 3700 specifications

SWITCHING AND CONTROL

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

## SYSTEM PERFORMANCE <sup>13, 14</sup>

3½-Digit Mode, Azero off, nPLC = 0.0005

| Function                 | Function Change (ms) | Range Change (ms) | Auto-range (ms) |
|--------------------------|----------------------|-------------------|-----------------|
| DCV or 2WΩ (<10kΩ)       | 10                   | 10                | 10              |
| 4WΩ (<10kΩ)              | 20                   | 20                | 20              |
| DCI                      | 10                   | 10                | 10              |
| Frequency or Period      | 22                   | 10                | —               |
| ACV or ACI <sup>17</sup> | 85                   | 85                | 300             |

| Buffer Transfer Speed                    | Ethernet | GPIB   | USB    |
|--|----------|--------|--------|
| Average for 1000 readings                | 2450/s   | 2000/s | 1800/s |
| Average for 1000 readings with timestamp | 2300/s   | 1800/s | 1600/s |

| Card                   | Command   | Single Command Execution Time (ms) |      |      |
|------------------------|---|------------------------------------|------|------|
|                        |   | Ethernet                           | GPIB | USB  |
| 3720, 3721, 3722, 3730 | channel.close (ch_list) or channel.open (ch_list)             | 5.7                                | 5.8  | 6.1  |
| 3723 <sup>18</sup>     | channel.close (ch_list) or channel.open (ch_list)             | 2.3                                | 2.4  | 2.7  |
| 3740                   | channel.close (ch_list 1-28) or channel.open (ch_list 1-28)   | 10.7                               | 10.8 | 11.1 |
|                        | channel.close (ch_list 29-32) or channel.open (ch_list 29-32) | 22.7                               | 22.8 | 23.1 |

## DC MEASUREMENT CHARACTERISTICS

### DC VOLTS

A-D LINEARITY: 1.0ppm of reading + 2.0 of range.

INPUT IMPEDANCE: 100mV–10V Ranges: Selectable >10GΩ // <400pF or 10MΩ ±1%.  
100V–300V Ranges: 10MΩ ±1%.

INPUT BIAS CURRENT: <50pA at 23°C with dmm.autozero=dmm.OFF or dmm.inputdivider=dmm.ON.

COMMON MODE CURRENT: <500nA p-p for ≤1MHz.

AUTOZERO OFF ERROR: For DCV ±1°C and <10 minutes, add ±(8ppm of reading + 5μV).

INPUT PROTECTION: 300V all ranges.

COMMON MODE VOLTAGE: 300V DC or 300Vrms (425V peak for AC waveforms) between any terminal and chassis.

### RESISTANCE

MAX. 4WΩ LEAD RESISTANCE: 5Ω per lead for 1Ω range; 10% of range for 10Ω → 1kΩ ranges; 1kΩ per lead for all other ranges.

MAX. 4WΩ LEAD RESISTANCE (DRY CKT): 0.5Ω per lead for 1Ω range; 10% of range per lead for 10Ω → 100Ω ranges; 50Ω per lead for 1kΩ → 2kΩ ranges.

INPUT IMPEDANCE: 1Ω–100Ω Ranges: 99kΩ ±1% // <1μF.  
1kΩ–2kΩ Ranges: 10MΩ ±1% // <0.015μF.

OFFSET COMPENSATION: Selectable on 4WΩ 1Ω → 10kΩ ranges.

OPEN LEAD DETECTOR: Selectable per channel. 1.5μA, ±20% sink current per DMM SHI and SLO lead. Default on.

CONTINUITY THRESHOLD: Adjustable 1 to 1000Ω.

AUTOZERO OFF ERROR: For 2WΩ ±1°C and <10 minutes, add ±(8ppm of reading + 0.5mΩ) for 10Ω and 5mΩ for all other ranges.

INPUT PROTECTION: 300V all ranges.

### DC CURRENT

AUTOZERO OFF ERROR: For ±1°C and <10 minutes, add ±(8ppm of reading + range error). Refer to table below.

| Range                                | 3 A    | 1 A    | 100 mA | 10 mA   | 1 mA    | 100 μA  | 10 μA   |
|--------------------------------------|--------|--------|--------|---------|---------|---------|---------|
| Shunt Resistance guarantee by design | 0.1 Ω  | 0.1 Ω  | 1 Ω    | 10 Ω    | 100 Ω   | 1 kΩ    | 6 kΩ    |
| Burden Voltage                       | <1.8 V | <0.6 V | <0.4 V | <150 mV | <130 mV | <105 mV | <61 mV  |
| Burden Voltage with 3721 card        | <2.4 V | <1.2 V | <0.4 V | <150 mV | <130 mV | <105 mV | <61 mV  |
| Autozero OFF "of range" Error        | 50 μA  | 50 μA  | 5 μA   | 0.5 μA  | 50 nA   | 5 nA    | 0.85 nA |

INPUT PROTECTION: 3A, 250V fuse.

### THERMOCOUPLES

CONVERSION: ITS-90.

REFERENCE JUNCTION: Internal, External, or Simulated (Fixed).

OPEN LEAD DETECTOR: Selectable per channel. Open >1.15kΩ ±50Ω. Default on.

COMMON MODE ISOLATION: 300V DC or 300Vrms (425V peak for AC waveforms), >10GΩ and <350pF any terminal to chassis.

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# System Switch/Multimeter and Plug-In Cards

## DC NOTES

- 20% overrange except 1% on 300V range and 3.33% on 3A range.
- ±5% (measured with 10MΩ input resistance DMM, >10GΩ DMM on 10MΩ and 100MΩ ranges). Refer to table for other 2W/4W configurations. For Dry Circuit, +20%, <1mV with dmm.offsetcompensation=ON for 100Ω → 2kΩ ranges.

| Range      | 2W     | 4W     | 4W-Kelvin | Ocomp 4W | Ocomp 4W-Kelvin |
|------------|--------|--------|-----------|----------|-----------------|
| 1, 10Ω     | 8.2 V  | 8.2 V  | 8.2 V     | 12.1 V   | 12.1 V          |
| 100, 1kΩ   | 13.9 V | 14.1 V | 13.9 V    | 15.0 V   | 12.7 V          |
| 10kΩ       | 9.1 V  | 9.1 V  | 9.1 V     | 0.0 V    | 0.0 V           |
| 100k, 1MΩ  | 12.7 V | 14.7 V | 12.7 V    | —        | —               |
| 10M, 100MΩ | 6.4 V  | 6.4 V  | 6.4 V     | —        | —               |

- Relative to calibration accuracy.
- Add the following additional uncertainty:

| Card             | DCV "of range" | 100 kΩ "of reading + of range" | 1 MΩ "of reading" |
|------------------|----------------|--------------------------------|-------------------|
| 3720, 3721, 3730 | 4.5 μV         | 8 ppm + 7 ppm                  | 8 ppm             |
| 3722             | 4.5 μV         | 8 ppm + 7 ppm                  | 8 ppm             |
| 3723             | 6 μV           | 8 ppm + 7 ppm                  | 8 ppm             |

- Specifications are for 4-wire Ω, 1 → 100Ω with offset compensation on. Series 3700 plug-in cards with I<sub>SYNC</sub> and offset compensation on. 2-wire Ω specifications are for dmm.connect=dmm.CONNECT\_ALL.

For 2-wire Ω, add the following to "ppm of range" uncertainty:  
700mΩ with dmm.connect=dmm.CONNECT\_TWO\_WIRE, 100mΩ with REL, and 1.5Ω without REL.  
1Ω range is 4-wire only.

- Test current with dmm.offsetcompensation=OFF, ±5%.
- Add the following to "ppm of reading" uncertainty when using Series 3700 Plug-in Cards in Operating Environment ≥50%RH.

| Card   | 10 kΩ  | 100 kΩ  | 1 MΩ  | 10 MΩ | 100 MΩ |
|--|--------|---------|-------|-------|--------|
| 3720, 3721, 3730 with MTC D-Shell connector                    | 1 ppm  | 10 ppm  | 0.01% | 0.1%  | 1%     |
| 3722, 3723 and 3720, 3721, 3730 with -ST screw terminal module | 10 ppm | 100 ppm | 0.1%  | 1%    | 10%    |

Series 3700 Plug-in Cards Operating Environment: Specified for 0°C to 50°C, ≤70%RH at 35°C.

- For 4-wire Ω only, offset compensation and I<sub>SYNC</sub> on. For Models 3722 and 3723, 10Ω → 2kΩ ranges only.
- Includes Analog Backplane 15-pin rear panel connector. For 3721, refer to DC Current table for additional uncertainties.
- For I<sub>SYNC</sub> On, line frequency ±0.1%.

|                       | nPLC | 5            | 1            | 0.2   | <0.2 |
|-----------------------|------|--------------|--------------|-------|------|
| I <sub>SYNC</sub> On  | NMRR | 110 dB       | 90 dB        | 70 dB | —    |
| I <sub>SYNC</sub> Off | NMRR | 60 dB, ±2 dB | 60 dB, ±2 dB | —     | —    |

- For 1kΩ unbalance in LO lead. AC CMRR is 70dB.

|      | nPLC | 5      | 1      | 0.2 <sup>12</sup> | ≤0.2  |
|------|------|--------|--------|-------------------|-------|
| CMRR |      | 140 dB | 140 dB | 120 dB            | 80 dB |

- For I<sub>SYNC</sub> On.
- Reading rates are for 60Hz (50Hz) operation using factory defaults operating conditions dmm.reset("all"), Autorange off, Limits off, dmm.autodelay=dmm.OFF, dmm.opendetector=dmm.OFF, format.data=format.SREAL, DCV = 10V, 2W/4W = 1kΩ, DCI = 1mA, Dry-Ckt = 10Ω, ACI = 1mA, and ACV = 1V. For Dry-Ckt 100Ω and 2kΩ, 60 rdg/s max. with offset compensation OFF and 29.5 rdg/s max. with offset compensation ON. For temperature reading rates use DCV for T/C, 2WΩ for Thermistor, and 4WΩ for RTD. Speeds are typical and include measurements and binary data transfer out the Ethernet, GPIB, or USB.
- DMM configured for single reading, dmm.measurecount=1, and print(dmm.measure()). May require additional settling delays for full accuracy, depending on measurement configuration.
- DMM configured for multisample readings and single buffer transfer, dmm.measurecount=1000, buf=dmm.makebuffer(1000), dmm.measure(buf), and printbuffer(1,1000,buf).
- dmm.autozero=dmm.ON. RMS noise using low thermal short for DCV, 2WΩ, 4WΩ, and Dry-Ckt Off. For DCI, dmm.connect=dmm.CONNECT\_NONE or 0. Includes Model 3721 card accuracies. RMS noise values are typical.
- For DC, dmm.nplc=0.0005. For AC, dmm.detectorbandwidth=300, dmm.nplc=0.0005. For ACI, dmm.autodelay=dmm.ON (50ms), max rate is 50ms and ACV dmm.autodelay=dmm.ON (50ms), max rate is 50ms. 18. Speeds are within same multiplexer bank. Add an additional 8ms when changing banks or slots.
- When properly zeroed using REL function.

## AC Specifications

| Function                          | Range <sup>1</sup>        | Resolution            | Calibration Cycle             | Accuracy: ± (% of reading + % of range) 23°C ± 5°C |                   |                    |               |                |                 |
|-----------------------------------|---------------------------|-----------------------|-------------------------------|--|-------------------|--------------------|---------------|----------------|-----------------|
|                                   |                           |                       |                               | 3 Hz–5 Hz  | 5 Hz–10 Hz        | 10 Hz –20 kHz      | 20 kHz–50 kHz | 50 kHz–100 kHz | 100 kHz–300 kHz |
| Voltage <sup>2</sup>              | 100.0000 mV               | 0.1 μV                | 90 Day (all ranges)           | 1.0 + 0.03   | 0.30 + 0.03       | 0.05 + 0.03        | 0.11 + 0.05   | 0.6 + 0.08     | 4.0 + 0.5       |
|                                   | 1.000000 V                | 1 μV                  |                               | 1.0 + 0.03   | 0.30 + 0.03       | 0.06 + 0.03        | 0.12 + 0.05   | 0.6 + 0.08     | 4.0 + 0.5       |
|                                   | 10.00000 V                | 10 μV                 | 1 Year (all ranges)           | 1.0 + 0.03   | 0.30 + 0.03       | 0.06 + 0.03        | 0.12 + 0.05   | 0.6 + 0.08     | 4.0 + 0.5       |
|                                   | 100.0000 V                | 100 μV                |                               | 1.0 + 0.03   | 0.30 + 0.03       | 0.06 + 0.03        | 0.12 + 0.05   | 0.6 + 0.08     | 4.0 + 0.5       |
|                                   | 300.0000 V                | 1 mV                  |                               | 1.0 + 0.03   | 0.30 + 0.03       | 0.06 + 0.03        | 0.12 + 0.05   | 0.6 + 0.08     | 4.0 + 0.5       |
|                                   |                           |                       | Temp. Coeff. /°C <sup>3</sup> | 0.010 + 0.003                                      | 0.030 + 0.003     | 0.005 + 0.003      | 0.006 + 0.005 | 0.01 + 0.006   | 0.03 + 0.01     |
| Current <sup>2</sup>              | 1.000000 mA <sup>8</sup>  | 1 nA                  | 90 Day/1 Year (all ranges)    | 1.0 + 0.04   | 0.30 + 0.04       | 0.08 + 0.03        | 0.09 + 0.03   | 0.09 + 0.03    | 0.09 + 0.03     |
|                                   | 10.00000 mA               | 10 nA                 |                               | 1.0 + 0.04   | 0.30 + 0.04       | 0.08 + 0.03        | 0.09 + 0.03   | 0.09 + 0.03    | 0.09 + 0.03     |
|                                   | 100.0000 mA               | 100 nA                | 1.0 + 0.04                    | 0.30 + 0.04  | 0.08 + 0.03       | 0.09 + 0.03        | 0.09 + 0.03   | 0.09 + 0.03    |                 |
|                                   | 1.000000 A                | 1 μA                  | 1.0 + 0.04                    | 0.30 + 0.04  | 0.20 + 0.03       | 0.88 + 0.04        | 2.0 + 0.04    | 2.0 + 0.04     |                 |
|                                   | 3.000000 A                | 10 μA                 | 1.0 + 0.04                    | 0.30 + 0.04  | 0.20 + 0.03       | 0.88 + 0.04        | 2.0 + 0.04    | 2.0 + 0.04     |                 |
|                                   |                           |                       | Temp. Coeff. /°C <sup>3</sup> | 0.10 + 0.004                                       | 0.030 + 0.004     | 0.005 + 0.003      | 0.006 + 0.005 | 0.006 + 0.005  | 0.006 + 0.005   |
| Frequency <sup>4</sup> and Period |                           |                       |                               | Accuracy: ±(ppm of reading + offset ppm)           |                   |                    |               |                |                 |
|                                   |                           |                       |                               | 3 Hz–500 kHz                                       | 3 Hz–500 kHz      | 333 ms–2 μs        |               |                |                 |
|                                   | 100.0000 mV to 300.0000 V | 0.333 ppm to 33.3 ppm | 90 Day/1 Year (all ranges)    | 80 + 0.333   | 80 + 0.333        | (SLOW, 0.25s gate) |               |                |                 |
|                                   |                           |                       |                               | 80 + 3.33  | 80 + 3.33         | (MED, 100ms gate)  |               |                |                 |
|                                   |                           |                       | 80 + 33.3                     | 80 + 33.3  | (FAST, 10ms gate) |                    |               |                |                 |

## ADDITIONAL UNCERTAINTY ±(% of reading)

| Low Frequency Uncertainty | Detectorbandwidth     |                        |                           |
|---------------------------|-----------------------|------------------------|---------------------------|
|                           | 3 (SLOW) 3 Hz–300 kHz | 30 (MED) 30 Hz–300 kHz | 300 (FAST) 300 Hz–300 kHz |
| 20 Hz–30 Hz               | 0                     | 0.3                    | —                         |
| 30 Hz–50 Hz               | 0                     | 0                      | —                         |
| 50 Hz–100 Hz              | 0                     | 0                      | 4.0                       |
| 100 Hz–200 Hz             | 0                     | 0                      | 0.72                      |
| 200 Hz–300 Hz             | 0                     | 0                      | 0.18                      |
| 300 Hz–500 Hz             | 0                     | 0                      | 0.07                      |
| >500 Hz                   | 0                     | 0                      | 0                         |

| Additional Uncertainty ±(% of reading) | Detectorbandwidth | Crest Factor <sup>5</sup> Maximum Crest Factor: 5 at full-scale |      |      |      |
|--|-------------------|---|------|------|------|
|  |                   | 1–2   | 2–3  | 3–4  | 4–5  |
| 5 Hz–10 Hz                             | 3                 | 0.50  | 1.20 | 1.30 | 1.40 |
| 10 Hz–30 Hz                            | 3                 | 0.20  | 0.30 | 0.60 | 0.90 |
| 30 Hz–100 Hz                           | 3 or 30           | 0.20  | 0.30 | 0.60 | 0.90 |
| >100 Hz                                | 3 or 30           | 0.05  | 0.15 | 0.30 | 0.40 |
| 300 Hz–500 Hz                          | 300 only          | 0.50  | 1.20 | 1.30 | 1.40 |
| ≥500 Hz                                | 300 only          | 0.05  | 0.15 | 0.30 | 0.40 |

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## AC SPEEDS

Single Channel, 60Hz (50Hz) Operation

| Function          | NPLC                 | Aperture (ms)   | Measurements into Buffer <sup>13</sup> (rdg/s) |                             |                 | Measurement to PC <sup>13</sup> (ms/rdg) |                                     |                                     |
|-------------------|----------------------|-----------------|--|-----------------------------|-----------------|--|-------------------------------------|-------------------------------------|
|                   |                      |                 | Digits   | Azero On                    | Azero Off       | Ethernet                                 | GPIB                                | USB                                 |
| ACI / ACV         | SLOW                 | N/A             | 6½   | 0.45 (0.45)                 | N/A             | 2150 (2150)                              | 2150 (2150)                         | 2150 (2150)                         |
|                   | MED                  | N/A             | 6½   | 2.5 (2.5)                   | N/A             | 400 (400)                                | 400 (400)                           | 400 (400)                           |
|                   | 1.0 <sup>14</sup>    | 16.67 (20)      | 6½   | 42 (33)                     | 59.5 (50)       | 19.4 (22.7)                              | 19.5 (22.8)                         | 19.8 (23.1)                         |
|                   | 0.2 <sup>14</sup>    | 3.33 (4.0)      | 6½   | 120 (100)                   | 295 (235)       | 7.6 (8.3)                                | 6.2 (6.8)                           | 6.4 (7.0)                           |
|                   | 0.06 <sup>15</sup>   | 1.0 (1.2)       | 5½   | 170 (165)                   | 935 (750)       | 1.40 (1.80)                              | 1.50 (1.80)                         | 1.60 (2.30)                         |
|                   | 0.006 <sup>15</sup>  | 0.100 (0.120)   | 4½   | 218 (215)                   | 6,200 (5,500)   | 0.55 (0.57)                              | 0.65 (0.67)                         | 0.75 (0.77)                         |
|                   | 0.0005 <sup>15</sup> | 0.0083 (0.001)  | 3½   | 218 (215)                   | 14,600 (14,250) | 0.50 (0.5)                               | 0.60 (0.60)                         | 0.70 (0.70)                         |
| Frequency/ Period | N/A                  | SLOW, MED, FAST | N/A  | 2× input period + gate time | N/A             | 2× input period + gate time + 2.7ms      | 2× input period + gate time + 2.8ms | 2× input period + gate time + 3.1ms |

## AC MEASUREMENT CHARACTERISTICS

### AC VOLTS

MEASUREMENT METHOD: AC-coupled, True RMS.

INPUT IMPEDANCE: 1MΩ ±2% // by <150pF.

INPUT PROTECTION: 300VDC or 300Vrms rear inputs or 37xx cards.

### AC CURRENT

MEASUREMENT METHOD: AC-coupled, True RMS.

| Range                         | 3 A        | 1 A        | 100 mA     | 10 mA       | 1 mA        |
|-------------------------------|------------|------------|------------|-------------|-------------|
| Shunt Resistance <sup>7</sup> | 0.1 Ω      | 0.1 Ω      | 1.0 Ω      | 10 Ω        | 100 Ω       |
| Burden Voltage Rear Panel     | <1.8 V rms | <0.6 V rms | <0.4 V rms | <150 mV rms | <125 mV rms |
| Burden Voltage 3721 Card      | <2.4 V rms | <1.0 V rms | <0.6 V rms | <200 mV rms | <130 mV rms |

INPUT PROTECTION: 3A, 250V fuse.

### FREQUENCY AND PERIOD

MEASUREMENT METHOD: Reciprocal Counting technique.

GATE TIME: SLOW 0.25s, MED 100ms, and FAST 10ms (dmm.aperture=0.25, 0.1, or 0.01).

### AC GENERAL

AC CMRR<sup>6</sup>: 70dB.

VOLT HERTZ PRODUCT: ≤8×10<sup>7</sup> Volt-Hz (guaranteed by design), ≤2.1×10<sup>7</sup> Volt-Hz verified. Input frequency verified for ≤3×10<sup>5</sup> Hz.

## AC NOTES

- 20% overrange except 1% on 300V and 3.33% on 3A. Default resolution is 5½ digits, maximum useable resolution is 6½ with 7½ digits programmable.
- Specification are for SLOW mode and sinewave inputs >5% of range. SLOW and MED are multi-sample A/D conversions. FAST is dmm.detectorbandwidth=300 with dmm.nplc=1.0.
- Applies to 0°–18°C and 28°–50°C.
- Specified for square wave inputs. Input signal must be >10% of ACV range. If input is <20mV on the 100mV range then the frequency must be >10Hz. For sinewave inputs, frequency must be >100Hz.
- Applies to non-sinewave inputs ≥5Hz.
- For 1kΩ unbalance in LO lead.
- Shunt resistance guaranteed by design.
- For Model 3721, 1mA ACI, add 0.05% to "of reading" uncertainty from 250Hz → 10kHz.

- Reading rates are for 60Hz (50Hz) operation using factory defaults operating conditions dmm.reset("all"), Autorange off, Limits off, dmm.autodelay=dmm.OFF, dmm.opendetector=dmm.OFF, format.data=format.SREAL, DCV = 10V, 2W/4W = 1kΩ, DCI = 1mA, Dry-Ckt = 10Ω, ACI = 1mA, and ACV = 1V. For Dry-Ckt 100Ω and 2kΩ, 60 rdg/s max. with offset compensation OFF and 29.5 rdg/s max. with offset compensation ON. For temperature reading rates use DCV for T/C, 2WΩ for Thermistor, and 4WΩ for RTD. Speeds are typical and include measurements and binary data transfer out the Ethernet, GPIB, or USB.
- DMM configured for single reading, dmm.measurecount=1, and print(dmm.measure()). May require additional settling delays for full accuracy, depending on measurement configuration.
- DMM configured for multisample readings and single buffer transfer, dmm.measurecount=1000, buf=dmm.

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

makebuffer(1000), dmm.measure(buf), and printbuffer(1,1000,buf).

## GENERAL SPECIFICATIONS

**EXPANSION SLOTS:** 6.

**POWER LINE:** Universal, 100V to 240V.

**LINE FREQUENCY:** 50Hz and 60Hz, automatically sensed at power-up.

**POWER CONSUMPTION:** 28VA with DMM and display, up to 140VA with six 37xx cards.

**REAL TIME CLOCK:** Battery backed, 10 years typical life.

**WARRANTY:** 1 year.

**EMC:** Conforms to European Union Directive 2004/108/EC EN61326-1.

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

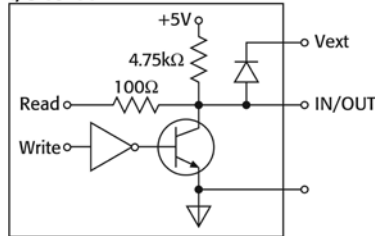
**VIBRATION:** MIL-PRF-28800F Class 3, Random.

**WARM-UP:** 2 hours to rated accuracy.

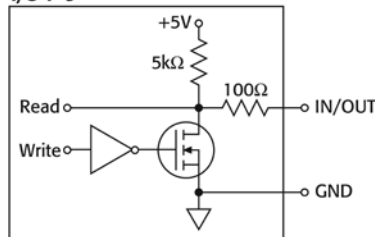
**DIGITAL I/O:** 25-pin female D-shell.

|  | I/O 1-9           | I/O 10-14         | Vext        |
|--|-------------------|-------------------|-------------|
| $I_{\text{SINK, max}}$                       | 5 mA              | 250 mA            | —           |
| Absolute $V_{\text{IN}}$                     | 5.25 V to -0.25 V | 5.25 V to -0.25 V | 5 V to 33 V |
| $V_{\text{IH min}}$                          | 2.2 V             | 2.2 V             | —           |
| $V_{\text{IL max}}$                          | 0.7 V             | 0.7 V             | —           |
| $V_{\text{OL max}}$ at $I_{\text{sink max}}$ | 0.7 V             | 0.7 V             | —           |
| $V_{\text{OH min}}$ , 0.4mA source           | 2.7 V             | 2.4 V             | —           |
| Min $V_{\text{IN}}$ pulse                    | 2 $\mu\text{s}$   | 10 $\mu\text{s}$  | —           |
| Min $V_{\text{O}}$ pulse                     | 1 $\mu\text{s}$   | 50 $\mu\text{s}$  | —           |

I/O 10-14



I/O 1-9



### TRIGGERING AND MEMORY:

**Window Filter Sensitivity:** 0.01%, 0.1%, 1%, 10%, or full-scale of range (none).

**Trigger Delay:** 0 to 99 hrs. (10 $\mu\text{s}$  step size).

**External Trigger Delay:** <10 $\mu\text{s}$ .

**Memory:** Up to 650,000 time-stamped readings with Web page disabled. Additional memory available with external "thumb drive."

**Non-volatile Memory:** Single user save setup, with up to 75 DMM configurations and  $\geq 600$  channel patterns (dependent on name length, DMM function and configuration, and pattern image size). Additional memory available with external "thumb drive."

**MATH FUNCTIONS:** Rel, dB, Limit Test, %, 1/x, and mX+b with user defined displayed.

### REMOTE INTERFACE:

**Ethernet:** RJ-45 connector, LXI Class C, 10/100BT, no auto MDIX.

**GPIO:** IEEE-488.1 compliant. Supports IEEE-488.2 common commands and status model topology.

**USB Device (rear panel, type B):** Full speed, USBTMC compliant.

**USB Host (front panel, type A):** USB 2.0, support for thumb drives.

**LXI COMPLIANCE:** LXI Class B with IEEE 1588 precision time protocol.

### LXI TIMING (applies to scanning) and SPECIFICATION:

**Receive LAN[0-7] Event Delay:** 600 $\mu\text{s}$  min, 800 $\mu\text{s}$  typ., n/s max.

**Alarm to Trigger Delay:** 25 $\mu\text{s}$  min., 50 $\mu\text{s}$  typ., n/s max.

**Generate LAN[0-7] Event:** 750 $\mu\text{s}$  min., 1000 $\mu\text{s}$  typ., n/s max. (minimums are probabilistic and represent a 95% confidence factor).

**Clock Accuracy:** 25ppm.

**Synchronization Accuracy:** <150ns (probabilistic and represents a 95% confidence factor).

**Timestamp Accuracy:** 100 $\mu\text{s}$ .

**Timestamp Resolution:** 20ns.

**LANGUAGE:** Embedded Test Script Processor (TSP) accessible from any host interface. Responds to individual Instrument Control Library (ICL) commands. Responds to high-speed test scripts comprised of ICL commands and Test Script Language (TSL) statements (e.g., branching, looping, math, etc.). Able to execute high-speed test scripts stored in memory without host intervention.

**IP CONFIGURATION:** Static or DHCP.

**PASSWORD PROTECTION:** 11 characters

**MINIMUM PC HARDWARE:** Intel Pentium 3, 800MHz, 512Mbyte RAM, 210Mbyte disk space or better.

**OPERATING SYSTEMS/SOFTWARE:** Windows 2000 and XP compatible, supports Web browsers with Java plug-in (requires Java plug-in 1.6 or higher). Web pages served by 3706.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C,  $\leq 80\%RH$  at 35°C, altitude up to 2000 meters.

**STORAGE ENVIRONMENT:** -40° to 70°C.

### DIMENSIONS:

**Rack Mounted:** 89mm high  $\times$  483mm wide  $\times$  457mm deep (3.5 in.  $\times$  19 in.  $\times$  18 in.).

**Bench Configuration (includes handle and feet):** 104mm high  $\times$  483mm wide  $\times$  457mm deep (4.125 in.  $\times$  19 in.  $\times$  18 in.).

**SHIPPING WEIGHT:** 13kg (28 lbs).

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

## Specifications for Plug-In Cards

|                       | 3720   | 3721   | 3722                               | 3723   | 3730  | 3740  |
|-----------------------|--|--|------------------------------------|--|---|---|
| No. of Channels       | 60 (Dual 1×30)   | 40 (dual 1×20)   | 96 (dual 1×48)                     | 60 (dual 1×30) or<br>120 single pole (dual 1×60) | 6×16  | 32  |
| Card Config.          | Multiplexer  | Multiplexer  | Multiplexer                        | Multiplexer                                      | Matrix  | Independent                                 |
| Type of Relay         | Latching<br>electromechanical  | Latching<br>electromechanical  | Latching<br>electromechanical      | Dry reed   | Latching<br>electromechanical   | Latching<br>electromechanical               |
| Contact Configuration | 2 Form A   | 2 Form A   | 2 Form A                           | 1 Form A   | 2 Form A  | 28 Form C, 4 Form A                         |
| Max. Voltage          | 300 V  | 300 V (ch 1–40),<br>60 V (ch 41–42)  | 300 V                              | 200 V  | 300 V   | 300 VDC/250 VAC (Form A)                    |
| Max. Current Switched | 1 A  | 2 A (ch 1–40),<br>3 A (ch 41–42)   | 1 A                                | 1 A  | 1 A   | 2 A (Form C), 7 A (Form A)                  |
| Comments              | 2 independent 1×30<br>multiplexers. Automatic<br>temperature reference with<br>screw terminal accessory<br>(Model 3720-ST) | 2 independent 1×20<br>multiplexers. Automatic<br>temperature reference with<br>screw terminal accessory<br>(Model 3721-ST) | 2 independent 1×48<br>multiplexers | 2 independent 1×30<br>multiplexers               | Columns can be expanded<br>through the backplane or<br>isolated by relays | 32 general purpose<br>independent channels. |

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# 3720

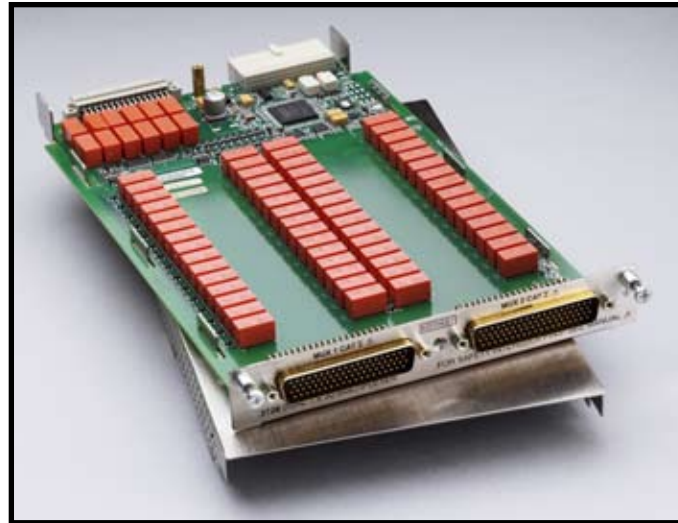
- 60 two-pole channels or 30 four-pole channels for general purpose switching
- Automatic CJC for temperature measurements with 3720-ST accessory
- Analog backplane connection relays provide easy bank and card interconnections
- 300V, 1A switched or 2A carry signal capacity; 60W, 125VA
- Screw terminal connections provided with removable 3720-ST accessory
- Relay closures stored in onboard memory
- Latching electromechanical relays

## Ordering Information

**3720**      **Dual 1×30**  
                 **Multiplexer Card**

## Dual 1×30 Multiplexer Card

60 differential channels, automatic CJC w/3720-ST accessory



The Model 3720 offers two independent banks of 1×30 two-pole multiplexers. It is ideal for general purpose switching, including temperature measurements. The two banks can automatically be connected to the Series 3700 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.

### ACCESSORIES AVAILABLE

|              |  |
|--------------|--|
| 3720-MTC-1.5 | 78 Pin D-sub Female to Male Cable, 1.5m (5 ft.)  |
| 3720-MTC-3   | 78 Pin D-sub Female to Male Cable, 3m (10 ft.)   |
| 3720-ST      | Screw Terminal Block (required for auto CJC thermocouple measurements)                             |
| 3791-CIT     | Contact Insertion and Extraction Tool  |
| 3791-KIT78-R | 78 Pin Female D-sub Connector Kit (contains 2 female D-sub connectors and 156 solder-cup contacts) |
| 7401         | Type K Thermocouple Wire (100 ft.)   |

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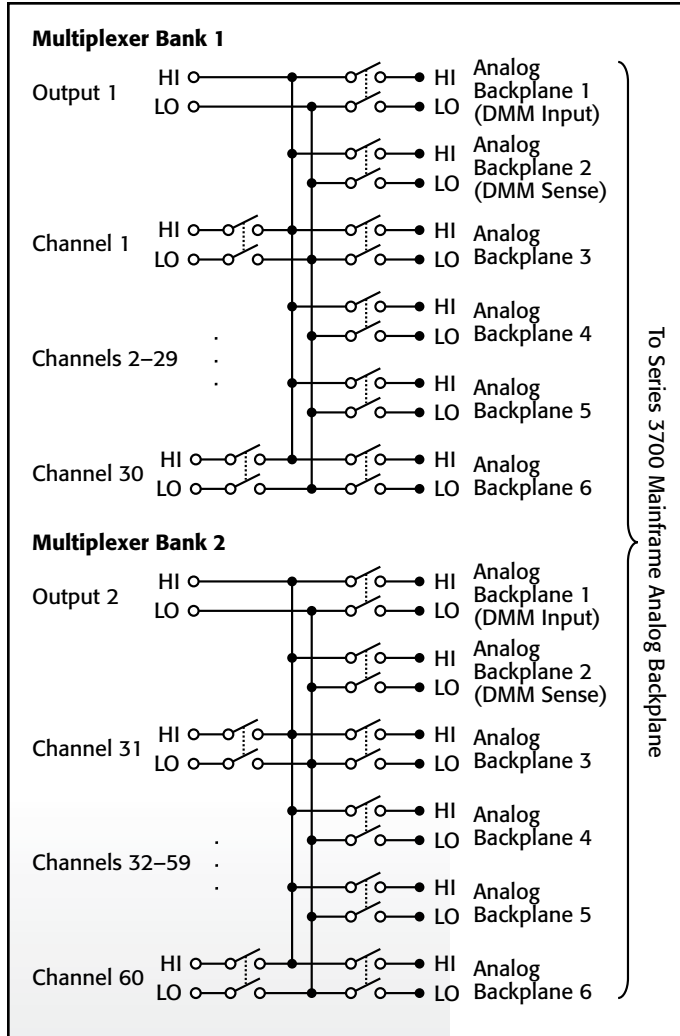
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**3720**

# Dual 1×30 Multiplexer Card

60 differential channels, automatic CJC w/3720-ST accessory

Model 3720 specifications



**MULTIPLEXER CONFIGURATION:** Two independent 1×30 2-pole multiplexers. Banks can be isolated from the backplane by relays. Card can be configured for 2 and 4 wire.

**CONTACT CONFIGURATION:** 2 pole form A.

**CONNECTOR TYPE:** Two 78 pin male D-shells.

**MODEL 3720-ST SCREW TERMINAL OPTION:** #22 AWG typical wire size with 0.062 inch O.D. 124 conductors maximum. #16 AWG maximum wire size with 0.092 inch O.D. 36 conductors per card maximum.

**MAXIMUM SIGNAL LEVEL:** Channels 1–60: 300V DC or RMS, 1A switched (2A carry), 60W, 125VA.

**COMMON MODE VOLTAGE:** 300V DC or RMS between any terminal and chassis.

**VOLT-HERTZ LIMIT:**  $8 \times 10^7$ .

**CONTACT LIFE:**  $>10^8$  operations at maximum signal level.  $>10^8$  operations no load.<sup>1</sup>

|  | Dual 1×30 <sup>3</sup>    | Single 1×60 <sup>2,3</sup> |
|--|---------------------------|----------------------------|
| Channel Resistance (end of contact life) | <1.0 Ω                    | <1.5 Ω                     |
| Contact Potential (differential)         | <±1 μV                    | <±3 μV                     |
| Offset Current                           | <±250 pA                  | <±250 pA                   |
| <b>Isolation</b>                         |                           |                            |
| Differential                             | 10 <sup>9</sup> Ω, 250 pF | 10 <sup>9</sup> Ω, 450 pF  |
| Bank-Bank                                | 10 <sup>10</sup> Ω, 75 pF | —                          |
| Channel-Channel                          | 10 <sup>9</sup> Ω, 75 pF  | 10 <sup>9</sup> Ω, 75 pF   |
| Common Mode                              | 10 <sup>9</sup> Ω, 200 pF | 10 <sup>9</sup> Ω, 400 pF  |
| <b>Crosstalk Channel-Channel</b>         |                           |                            |
| 300kHz                                   | <–60 dB                   | <–55 dB                    |
| 1MHz                                     | <–50 dB                   | <–50 dB                    |
| 20MHz:                                   | <–25 dB                   | <–20 dB                    |
| <b>Bandwidth</b>                         | 30 MHz                    | 10 MHz                     |

**TYPICAL SCANNING SPEEDS:**

**Switch Only<sup>4</sup>:** Sequential scanning, single channel, immediate trigger advance:  $>120$  ch/s.

**With Measurements Into Memory<sup>5</sup>:**

DCV (10V range) or 2W Ohms (1kΩ range):  $>110$  ch/s.

Thermocouple:  $>110$  ch/s.

3- or 4-Wire RTD:  $>100$  ch/s.

4-Wire Ohms (1kΩ range):  $>100$  ch/s.

ACV (10V range):  $>110$  ch/s.

**GENERAL**

**ACTUATION TIME:** 4ms.

**TEMPERATURE ACCURACY using Automatic CJC with 3720-ST accessory:** 1°C for J, K, T and E types (see mainframe specification for details).

**RELAY TYPE:** Latching electromechanical.

**RELAY DRIVE SCHEME:** Matrix.

**INTERLOCK:** Backplane relays disabled when interlock connection is removed.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C. Specified to 70% R.H. at 35°C.

**STORAGE ENVIRONMENT:** –25° to 65°C.

**WEIGHT:** 2.5 lbs.

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

**EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.

- Open detector enabled during thermocouple measurements. Minimum signal level 10mV, 10μA.
- 3706 mainframe with all DMM backplane relays disconnected. Maximum two card backplane relays closed.
- Connections made using 3720-ST accessory.
- Scanning script local to 3706 mainframe, within same bank, and break before make switching.
- 3706 mainframe with autorange off, limits off, dmm.autozero=0, dmm.autodelay=0, 4½ digits (NPLC=0.006), for ACV dmm.detectorbandwidth=300, for OHMs dmm.offsetcompensation=off, dmm.opendetector=off. Scanning script local to mainframe, sequential scan within same bank (2 pole) or card (4 pole), and break before make switching.

SWITCHING AND CONTROL

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# 3721

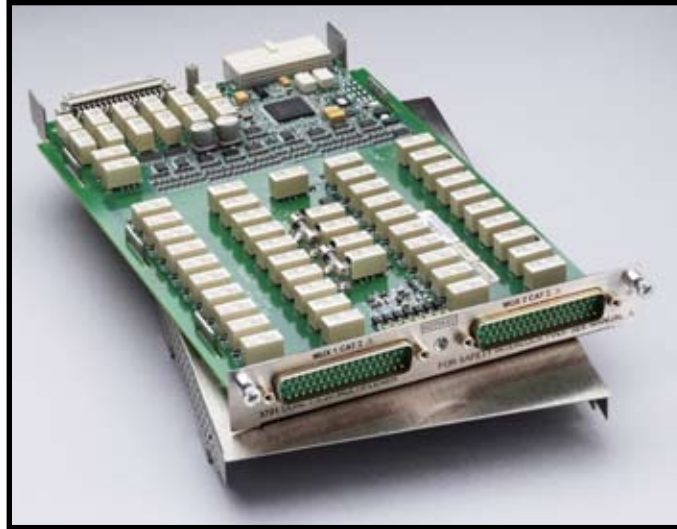
- 40 two-pole or 20 four-pole channels for general purpose switching
- 2 dedicated channels for current measurements, 3A capacity
- Automatic CJC for temperature measurements with 3721-ST accessory
- 4-wire common side ohms input supports 40 channels of 4-wire ohms measurements
- Analog backplane connection relays provide easy bank and card interconnections
- 300V, 2A switched or 3A carry signal capacity; 60W, 125VA
- Latching electromechanical relays

## Ordering Information

**3721 Dual 1×20 Multiplexer Card**

# Dual 1×20 Multiplexer Card

40 differential channels, automatic CJC w/3721-ST accessory



The Model 3721 offers two independent banks of 1×20 two-pole multiplexers that are ideal for general purpose switching, including temperature measurements. The two banks can automatically be connected to the Series 3700 mainframe backplane and optional DMM through the analog backplane connection relays. This connection allows the mainframe to reconfigure the Model 3721 as a single 1×40 two-pole multiplexer or to enable card-to-card expansion for even larger configurations.

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 four-wire common side ohms measurements. For thermocouple type measurements, automatic cold junction compensation (CJC) is supported with the Model 3721-ST (screw terminal) accessory.

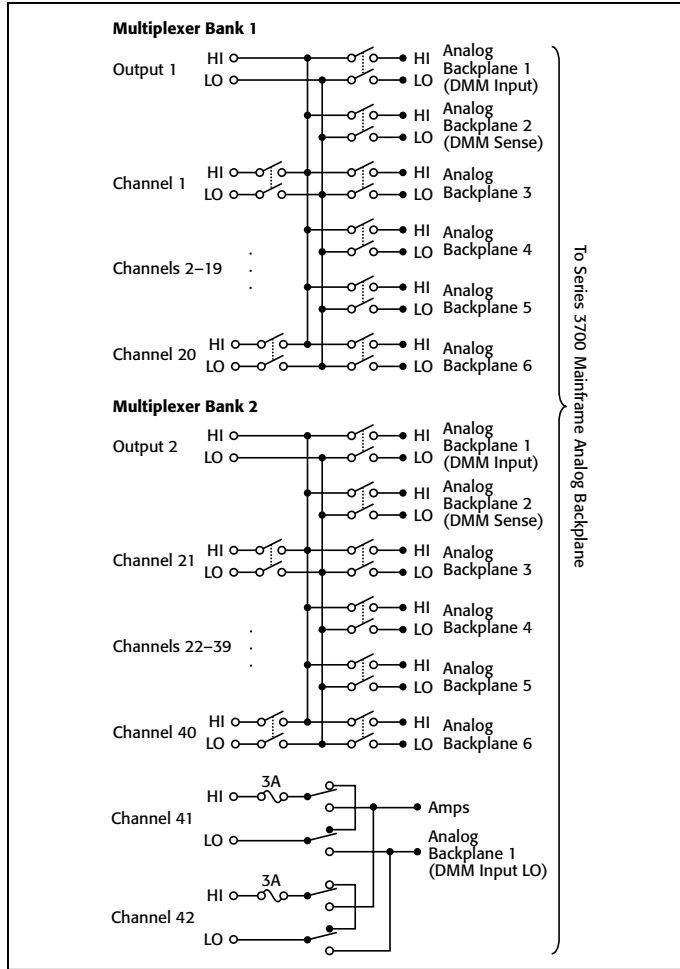
The Model 3721 uses two 50-pin male D-sub connectors for signal connections. For screw terminal or automatic CJC, use the detachable Model 3721-ST accessory.

## ACCESSORIES AVAILABLE

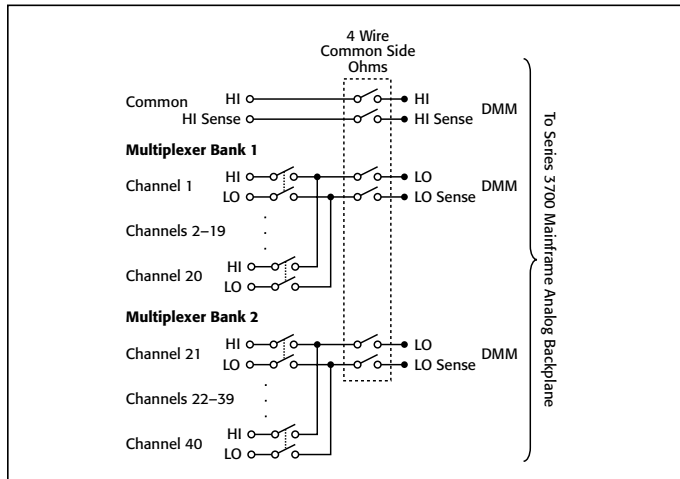
|              |  |
|--------------|--|
| 3721-MTC-1.5 | 50 Pin D-sub Female to Male Cable, 1.5m (5 ft.)  |
| 3721-MTC-3   | 50 Pin D-sub Female to Male Cable, 3m (10 ft.)   |
| 3721-ST      | Screw Terminal Block (required for auto CJC thermocouple measurements)                             |
| 3790-KIT50-R | 50 Pin Female D-sub Connector Kit (contains 2 female D-sub connectors and 100 solder-cup contacts) |
| 7401         | Type K Thermocouple Wire (100 ft.)   |

# Dual 1×20 Multiplexer Card

40 differential channels, automatic CJC w/3721-ST accessory



**Two pole mode**



**Four-wire common side ohm mode**

**MULTIPLEXER CONFIGURATION:** Two independent 1×20 2-pole multiplexers. Banks can be connected together via relay creating a single 1×40 multiplexer. Banks can be isolated from the backplane by relays. Card can be configured for common side Ohms measurement via backplane relays. **Channel 41–42:** Multiplex one of two 2-pole current signals into DMM.

**CONTACT CONFIGURATION:** 2 pole form A.

**CONNECTOR TYPE:** Two 50 pin male D-shells. Removable screw terminal option.

**MAXIMUM SIGNAL LEVEL:** **Channels 1–40:** 300V DC or RMS, 2A switched (3A carry), 60W, 125VA maximum. **Channels 41–42:** 60V DC or 30V RMS, 3A switched, 60W, 125VA maximum. Fused 3A, 250V RMS.

**COMMON MODE VOLTAGE:** **Channels 1–40:** 300V DC or RMS between any terminal and chassis.

**VOLT-HERTZ LIMIT:** 8×10<sup>7</sup>.

**CONTACT LIFE:** >10<sup>5</sup> operations at maximum signal level. >10<sup>8</sup> operations no load.<sup>1</sup>

|  | Dual 1×20 <sup>3</sup>    | Single 1×40 <sup>2,3</sup> |
|--|---------------------------|----------------------------|
| Channel Resistance (end of contact life) | <1.0 Ω                    | <1.5 Ω                     |
| Contact Potential (differential)         | <±1 μV                    | <±3 μV                     |
| Offset Current                           | <±250 pA                  | <±250 pA                   |
| <b>Isolation</b>                         |                           |                            |
| Differential                             | 10 <sup>9</sup> Ω, 280 pF | 10 <sup>9</sup> Ω, 530 pF  |
| Bank-Bank                                | 10 <sup>11</sup> Ω, 60 pF | —                          |
| Channel-Channel                          | 10 <sup>9</sup> Ω, 50 pF  | 10 <sup>9</sup> Ω, 50 pF   |
| Common Mode                              | 10 <sup>9</sup> Ω, 180 pF | 10 <sup>9</sup> Ω, 480 pF  |
| <b>Crosstalk Channel-Channel</b>         |                           |                            |
| 300kHz                                   | <-60 dB                   | <-60 dB                    |
| 1MHz                                     | <-50 dB                   | <-50 dB                    |
| 20MHz:                                   | <-25 dB                   | <-15 dB                    |
| <b>Bandwidth</b>                         | 28 MHz                    | 9 MHz                      |

**TYPICAL SCANNING SPEEDS:**

**Switch Only<sup>4</sup>:** Sequential scanning, single channel, immediate trigger advance: >120 ch/s.

**With Measurements Into Memory<sup>5</sup>:**

DCV (10V range) or 2W Ohms (1kΩ range): >110 ch/s.

Thermocouple: >110 ch/s.

3- or 4-Wire RTD: >100 ch/s.

4-Wire Ohms (1kΩ range): >100 ch/s.

ACV (10V, 400Hz range) or ACI (1A, 400Hz range): >110 ch/s.

**GENERAL**

**ACTUATION TIME:** 4ms.

**TEMPERATURE ACCURACY using Automatic CJC with 3721-ST accessory:** 1°C for J, K, T and E types (see mainframe specification for details).

**RELAY TYPE:** Latching electromechanical.

**RELAY DRIVE SCHEME:** Direct.

**INTERLOCK:** Backplane relays disabled when interlock connection is removed.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C. Specified to 70% R.H. at 35°C.

**STORAGE ENVIRONMENT:** -25° to 65°C.

**WEIGHT:** 2.25 lbs.

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

**EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.

1. Open detector enabled during thermocouple measurements. Minimum signal level 10mV, 10μA.
2. 3706 mainframe with all DMM backplane relays disconnected. Maximum two card backplane relays closed.
3. Connections made using 3721-ST accessory.
4. Scanning script local to 3706 mainframe, within same bank, and break before make switching.
5. 3706 mainframe with autorange off, limits off, dmm.autozero=0, dmm.autodelay=0, 4½ digits (NPLC=0.006), for ACV dmm.detectorbandwidth=300, for OHMs dmm.offsetcompensation=off, dmm.opendetector=off. Scanning script local to mainframe, sequential scan within same bank (2 pole) or card (4 pole), and break before make switching.

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# 3722

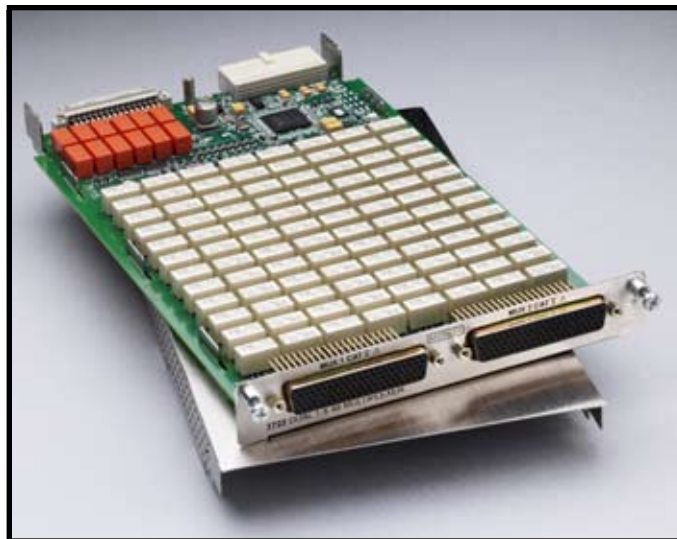
- 96 two-pole or 48 four-pole channels for general purpose measurements
- Analog backplane connection relays provide easy bank and card interconnections
- 300V, 1A switched or 2A carry signal capacity; 60W, 125VA
- 1 $\mu$ V and 100pA offsets
- 25MHz bandwidth
- Relay closures stored in onboard memory
- Latching electromechanical relays
- Scan and measure over 110 channels/second

## Ordering Information

**3722** Dual 1 $\times$ 48, High Density, Multiplexer Card

## Dual 1 $\times$ 48, High Density, Multiplexer Card

96 differential channels, 300 Volts/1 Amp



The Model 3722 offers two independent banks of 1 $\times$ 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 3700 mainframe backplane and optional DMM through the analog backplane connection relays. This connection allows the mainframe to reconfigure the card as a single 1 $\times$ 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. They can accommodate 300V, 1A switched signal levels.

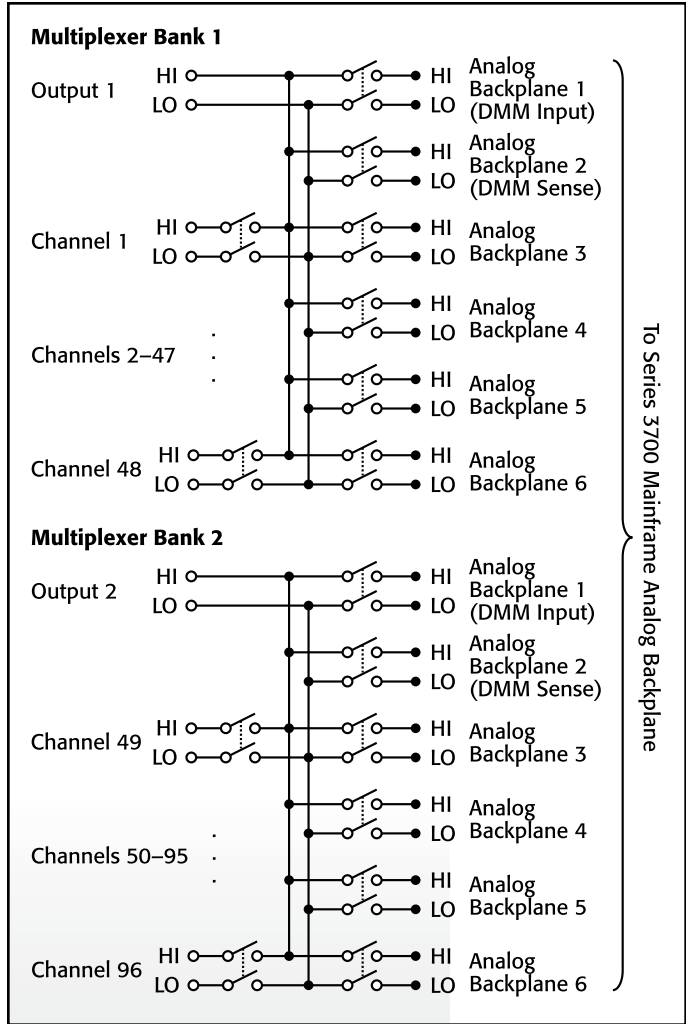
The Model 3722 uses two 104-pin D-sub connectors for signal connections. A solder style connector kit (Model 3791-KIT104-R) and pre-assembled cables (Model 3722-MTC-1.5 and 3722-MTC-3) are available for card connections.

### ACCESSORIES AVAILABLE

|               |   |
|---------------|---|
| 3722-MTC-1.5  | 104 Pin D-sub Male to Male Cable, 1.5m (5 ft.)  |
| 3722-MTC-3    | 104 Pin D-sub Male to Male Cable, 3m (10 ft.)   |
| 3791-CIT      | Contact Insertion and Extraction Tool   |
| 3791-KIT104-R | 104 Pin Male D-sub Connector kit (contains 2 male D-sub connectors with housings and 208 solder-cup contacts) |

# Dual 1×48, High Density, Multiplexer Card

96 differential channels, 300 Volts/1 Amp



**MULTIPLEXER CONFIGURATION:** Two independent 1×48 2-pole multiplexers. Banks can be connected together via relays creating a single 1×96 multiplexer. Banks can be isolated from the backplane by relays. Card can be configured for 2- and 4-wire mode.

**CONTACT CONFIGURATION:** 2 pole form A.  
**CONNECTOR TYPE:** Two 104 pin female D-shells.  
**MAXIMUM SIGNAL LEVEL:** 300V DC or RMS, 1A switched (2A carry), 60W, 125VA.  
**COMMON MODE VOLTAGE:** 300V DC or RMS between any terminal and chassis.  
**VOLT-HERTZ LIMIT:** 8×10<sup>7</sup>.  
**CONTACT LIFE:** >10<sup>5</sup> operations at maximum signal level. >10<sup>8</sup> operations no load.<sup>1</sup>

|  | Dual 1×48 <sup>2</sup>      | Single 1×96                 |
|--|-----------------------------|-----------------------------|
| Channel Resistance (end of contact life) | <1.5 Ω                      | <2.5 Ω                      |
| Contact Potential (differential)         | <±1 μV                      | <±2 μV                      |
| Offset Current                           | <100 pA                     | <100 pA                     |
| <b>Isolation</b>                         |                             |                             |
| Differential                             | 5×10 <sup>9</sup> Ω, 200 pF | 5×10 <sup>9</sup> Ω, 400 pF |
| Bank-Bank                                | 10 <sup>9</sup> Ω, 50 pF    | —                           |
| Channel-Channel                          | 10 <sup>9</sup> Ω, 50 pF    | 10 <sup>9</sup> Ω, 50 pF    |
| Common Mode                              | 10 <sup>10</sup> Ω, 200 pF  | 10 <sup>10</sup> Ω, 400 pF  |
| <b>Crosstalk Channel-Channel</b>         |                             |                             |
| 300kHz                                   | <-65 dB                     | <-65 dB                     |
| 1MHz                                     | <-55 dB                     | <-55 dB                     |
| 20MHz:                                   | <-30 dB                     | <-30 dB                     |
| <b>Bandwidth</b>                         | 25 MHz                      | 15 MHz                      |

**TYPICAL SCANNING SPEEDS:**

**Switch Only<sup>3</sup>:** Sequential scanning, single channel, immediate trigger advance: >120 ch/s.

**With Measurements Into Memory<sup>4</sup>:**

- DCV (10V range) or 2W Ohms (1kΩ range): >110 ch/s.
- 3- or 4-Wire RTD: >100 ch/s.
- 4-Wire Ohms (1kΩ range): >100 ch/s.
- ACV (10V, 400Hz range): >110 ch/s.

**GENERAL**

**ACTUATION TIME:** 4ms.

**RELAY TYPE:** Latching electromechanical.

**RELAY DRIVE SCHEME:** Matrix.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C. Specified to 70% R.H. at 35°C.

**STORAGE ENVIRONMENT:** -25° to 65°C.

**WEIGHT:** 2.5 lbs.

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

**EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.

1. Minimum signal level 10mV, 10μA.  
 2. 3706 mainframe with all DMM backplane relays disconnected. Maximum two card backplane relays closed.  
 3. Scanning script local to 3706 mainframe, within same bank, and break before make switching.  
 4. 3706 mainframe with autorange off, limits off, dmm.autozero=0, dmm.autodelay=0, 4½ digits (NPLC=006), for ACV dmm.detectorbandwidth=300, for OHMs dmm.offsetcompensation=off. Scanning script local to mainframe, sequential scan within same bank (2 pole) or card (4 pole), and break before make switching.

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# 3723

- 60 two-pole or 30 four-pole channels for high speed scanning
- 120 channel single-pole mode for one-wire (common side) measurements
- Analog backplane connection relays provide easy bank and card interconnections
- 200V, 1A switched or 1.25A carry signal capacity; 15W
- Relay actuation time <0.5ms
- 20MHz bandwidth
- Ideal for multi-channel I-V testing with Model 2600 SourceMeter® instruments
- Long life dry reed relays (>10<sup>9</sup> operations)

## Ordering Information

**3723** Dual 1×30, High Speed, Reed Relay, Multiplexer Card

## Dual 1×30, High Speed, Multiplexer Card

60 differential channels, long life reed relays



The Model 3723 offers two independent banks of high speed 1×30 two-pole multiplexers that are ideal for high speed scanning applications. The two banks can automatically be connected to the Series 3700 mainframe backplane and optional 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 1×120 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 0.5ms, this card can meet 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.

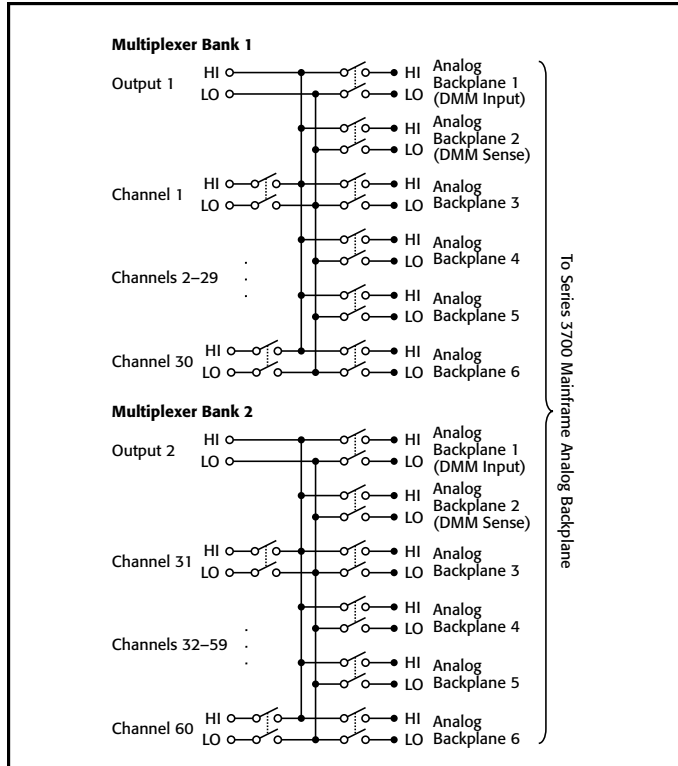
The Model 3723 uses two 78-pin D-sub connectors for signal connections. For screw terminal connections, use the Model 3723-ST for two- and four-pole configurations or the Model 3723-ST-1 for single-wire applications.

### ACCESSORIES AVAILABLE

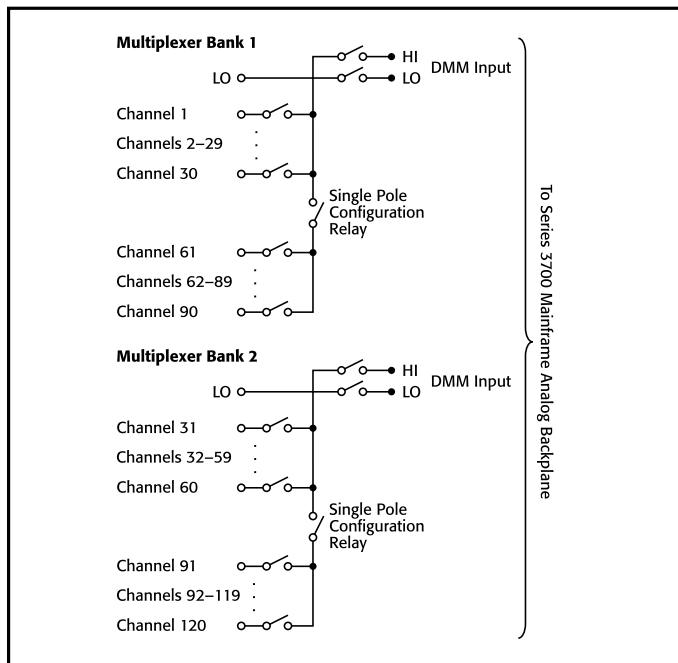
|              |  |
|--------------|--|
| 3720-MTC-1.5 | 78 Pin D-sub Female to Male Cable, 1.5m (5 ft.)  |
| 3720-MTC-3   | 78 Pin D-sub Female to Male Cable, 3m (10 ft.)   |
| 3723-ST      | Screw Terminal Block   |
| 3723-ST-1    | Screw Terminal Block for single-pole applications  |
| 3791-CIT     | Contact Insertion and Extraction Tool  |
| 3791-KIT78-R | 78 Pin Female D-sub Connector Kit (contains 2 female D-sub connectors and 156 solder cup contacts) |

# Dual 1×30, High Speed, Multiplexer Card

60 differential channels, long life reed relays



Two-pole mode



Single-pole mode

**MULTIPLEXER CONFIGURATION:** Two independent 1×30 2-pole multiplexers. Banks can be connected together via relay creating a single 1×60 multiplexer. Banks can be isolated from the backplane by relays. Card can be configured for 1-, 2-, and 4-wire.

**CONTACT CONFIGURATION:** 2 pole form A.

**CONNECTOR TYPE:** Two 78 pin male D-shells.

**MODEL 3723-ST SCREW TERMINAL OPTION:** #22 AWG typical wire size with 0.062 inch O.D. 124 conductors maximum. #16 AWG maximum wire size with 0.092 inch O.D. 36 conductor per card maximum.

**MAXIMUM SIGNAL LEVEL:** 200V DC or RMS, 1A switched (1.25A carry), 15W.

**COMMON MODE VOLTAGE:** 300V DC or RMS between any terminal and chassis.

**VOLT-HERTZ LIMIT:** 8×10<sup>7</sup>.

**CONTACT LIFE: Reed:** >10<sup>9</sup> operations, no load. 10<sup>7</sup> operations @ 100V, 10mA.

**EMR:** >10<sup>9</sup> operations @ 5V, 10mA. 10<sup>5</sup> operations @ maximum signal level.

|  | Dual 1×30 <sup>1</sup>     | Single 1×60 <sup>1,2</sup> |
|--|----------------------------|----------------------------|
| Channel Resistance (end of contact life) | <1.5 Ω                     | <2.0 Ω                     |
| Contact Potential: Differential          | <±6 μV                     | <±6 μV                     |
| Single-Ended                             | <±12 μV                    | <±12 μV                    |
| Offset Current                           | <250 pA                    | <250 pA                    |
| Isolation                                |                            |                            |
| Differential Bank-Bank                   | 10 <sup>10</sup> Ω, 260 pF | 10 <sup>10</sup> Ω, 500 pF |
| Bank-Bank                                | 10 <sup>10</sup> Ω, 75 pF  | —                          |
| Channel-Channel                          | 10 <sup>10</sup> Ω, 75 pF  | 10 <sup>10</sup> Ω, 75 pF  |
| Common Mode                              | 10 <sup>10</sup> Ω, 280 pF | 10 <sup>9</sup> Ω, 625 pF  |
| Crosstalk Channel-Channel                |                            |                            |
| 300kHz                                   | <-55 dB                    | <-55 dB                    |
| 1MHz                                     | <-50 dB                    | <-45 dB                    |
| 20MHz:                                   | <-20 dB                    | <-20 dB                    |
| Bandwidth                                | 20 MHz                     | 10 MHz                     |

**TYPICAL SCANNING SPEEDS:**

**Switch Only<sup>3</sup>:** Sequential scanning, single channel, immediate trigger advance: >1000 ch/s.

**With Measurements Into Memory<sup>4</sup>:**

DCV (10V range) or 2W Ohms (1kΩ range): >800 ch/s.

3- or 4-Wire RTD: >450 ch/s.

4-Wire Ohms (1kΩ range): >450 ch/s.

ACV (10V, 400Hz range): >800 ch/s.

**GENERAL**

**ACTUATION TIME:** <0.5ms.

**RELAY TYPE:** Dry reed.

**RELAY DRIVE SCHEME:** Direct.

**RELAY DRIVE CURRENT:** 10mA.

**INTERLOCK:** Backplane relays disabled when interlock connection is removed.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C. Specified to 70% R.H. at 35°C.

**STORAGE ENVIRONMENT:** -25° to 65°C.

**WEIGHT:** 3.0 lbs.

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

**EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.

- Connections made using 3723-ST accessory.
- 3706 mainframe with all DMM backplane relays disconnected. Maximum two card backplane relays closed.
- Scanning script local to 3706 mainframe, within same bank, and break before make switching.
- 3706 mainframe with autorange off, limits off, dmm.autozero=0, dmm.autodelay=0, 4½ digits (NPLC=0.006), for ACV dmm.detectorbandwidth=300, for OHMS dmm.offsetcompensation=off. Scanning script local to mainframe, sequential scan within same bank (2 pole) or card (4 pole), and break before make switching.

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# 3730

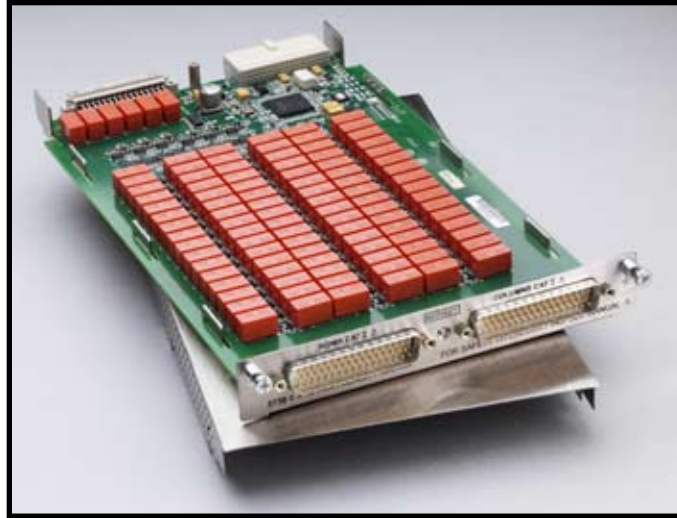
- 6 row by 16 column matrix (2-pole)
- Analog backplane connection relays provide easy column expansion
- 300V, 1A switched or 2A carry signal capacity; 60W, 125VA
- Screw terminal connections provided with removable 3730-ST accessory
- 2 $\mu$ V and 100pA offsets
- Relay closures stored in onboard memory
- Latching electromechanical relays

## Ordering Information

**3730**      **6 $\times$ 16, High Density, Matrix Card**

## 6 $\times$ 16, High Density, Matrix Card

96 two-pole crosspoints with column expansion relays



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

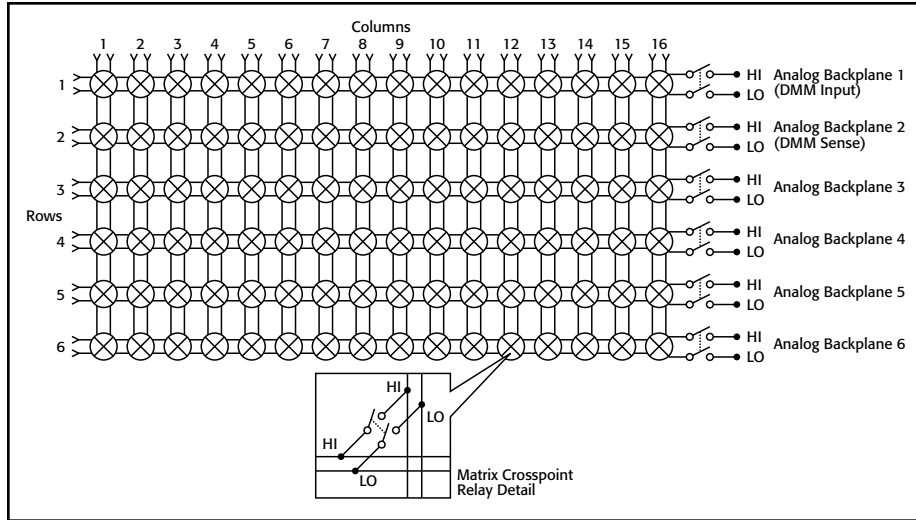
### ACCESSORIES AVAILABLE

|              |  |
|--------------|--|
| 3721-MTC-1.5 | 50 Pin D-sub Female to Male Cable, 1.5m (5 ft.)  |
| 3721-MTC-3   | 50 Pin D-sub Female to Male Cable, 3m (10 ft.)   |
| 3730-ST      | Screw Terminal Block   |
| 3790-KIT-R   | 50 Pin Female D-sub Connector Kit (contains 2 female D-sub connectors and 100 solder-cup contacts) |

# 3730

## 6×16, High Density, Matrix Card

96 two-pole crosspoints with column expansion relays



**MULTIPLEXER CONFIGURATION:** 6 row by 16 column matrix. Columns can be expanded using the backplane or isolated by relays.

**CONTACT CONFIGURATION:** 2 pole form A.  
**CONNECTOR TYPE:** Two 50 pin male D-shells.

**MODEL 3730-ST SCREW TERMINAL OPTION:** #22 AWG typical wire size with 0.062 inch O.D. 88 conductors maximum. #16 AWG maximum wire size with 0.092 inch O.D. 44 conductor per card maximum.

**MAXIMUM SIGNAL LEVEL:** 300V DC or RMS, 1A switched (2A carry), 60W, 125VA.

**COMMON MODE VOLTAGE:** 300V DC or RMS between any terminal and chassis.

**VOLT-HERTZ LIMIT:**  $8 \times 10^7$ .

**CONTACT LIFE:**  $>10^5$  operations @ maximum signal level.  $>10^8$  operations no load.<sup>1</sup>

|  | 6×16 <sup>2, 3</sup>       |
|--|----------------------------|
| Channel Resistance (end of contact life) | <1.0 Ω                     |
| Contact Potential (differential)         | <±2 μV                     |
| Offset Current                           | <±100 pA                   |
| <b>Isolation</b>                         |                            |
| Differential                             | 10 <sup>10</sup> Ω, 250 pF |
| Channel-Channel                          | 10 <sup>10</sup> Ω, 75 pF  |
| Common Mode                              | 10 <sup>10</sup> Ω, 150 pF |
| <b>Crosstalk Channel-Channel</b>         |                            |
| 300kHz                                   | <-65 dB                    |
| 1MHz                                     | <-55 dB                    |
| 20MHz:                                   | <-30 dB                    |
| Bandwidth                                | 27 MHz                     |

### GENERAL

**ACTUATION TIME:** 4ms.

**RELAY TYPE:** Latching electromechanical.

**RELAY DRIVE SCHEME:** Hybrid Matrix.

**INTERLOCK:** Backplane relays disabled when terminal assembly is removed.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C. Specified to 70% R.H. at 35°C.

**STORAGE ENVIRONMENT:** -25° to 65°C.

**WEIGHT:** 2.5 lbs.

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

**EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.

1. Minimum signal level 10mV, 10μA.

2. Connections made using 3730-ST accessory.

3. 3706 mainframe with all DMM backplane relays disconnected.

# 3740

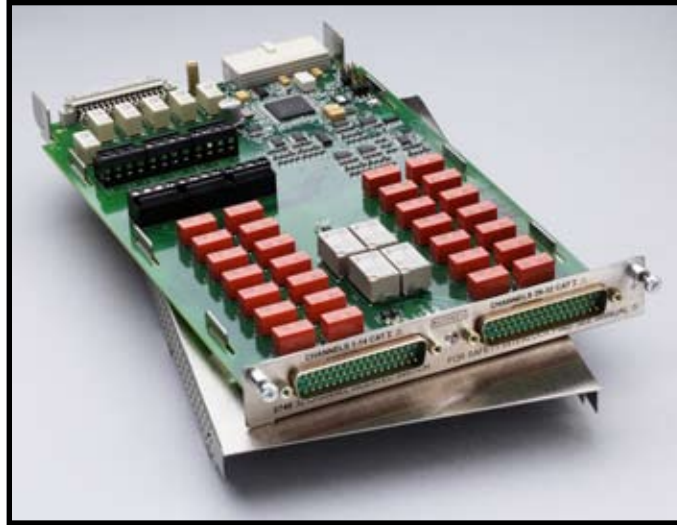
- 28 general purpose Form C relays rated for 300V, 2A switched or 3A carry signal capacity; 60W, 125VA
- 4 high current Form A relays rated for 250VAC, 7A or 30VDC, 7A switched capacity; 210W
- Analog backplane connection relays provided for user interconnections
- Screw terminal connections provided with removable 3740-ST accessory
- Relay closures stored in onboard memory
- Latching electromechanical relays

## Ordering Information

**3740** General Purpose Card with 32 Independent Channels

## 32 Channel Isolated Switch Card

28 Form C relays and 4 high power Form A relays



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

If any general purpose signal requires routing to the Series 3700 mainframe backplane, terminal blocks are located on the card, which are enabled with jumpers. Custom configurations can be created with the user accessible terminal blocks. For additional protection, an onboard temperature sensor will notify 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.

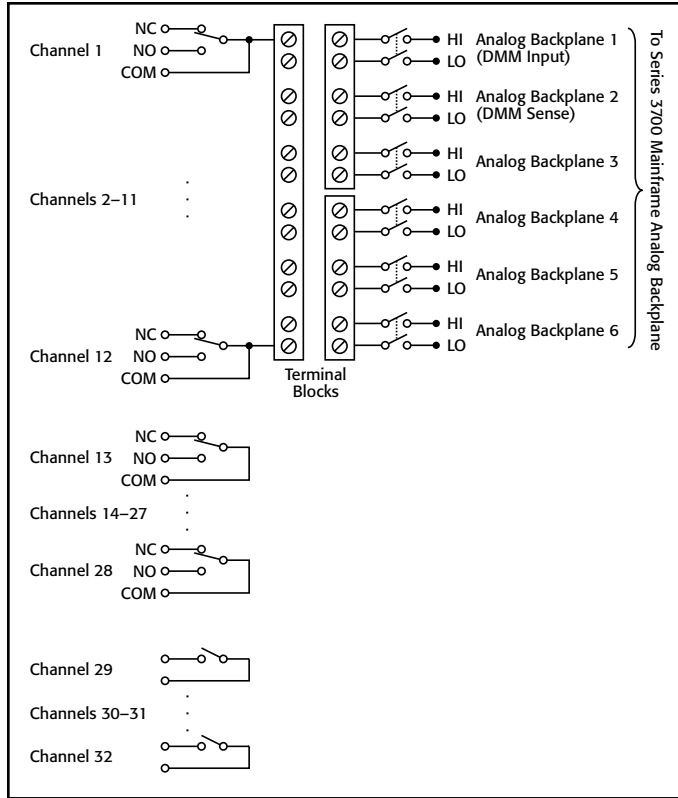
### ACCESSORIES AVAILABLE

|              |  |
|--------------|--|
| 3721-MTC-1.5 | 50 Pin D-sub Female to Male Cable, 1.5m (5 ft.)  |
| 3721-MTC-3   | 50 Pin D-sub Female to Male Cable, 3m (10 ft.)   |
| 3740-ST      | Screw Terminal Block   |
| 3790-KIT50-R | 50 Pin Female D-sub Connector Kit (contains 2 female D-sub connectors and 100 solder cup contacts) |

# 3740

## 32 Channel Isolated Switch Card 28 Form C relays and 4 high power Form A relays

Model 3740 specifications



**RELAY SWITCH CONFIGURATION:** 32 general purpose independent channels. 28 channels of Form C switching at 2A and 4 channels of Form A switching at 7A. Relays can be connected to each other and backplane via removable terminal blocks.

**CONTACT CONFIGURATION:** **General Purpose:** 1 pole Form C. **High Current:** 1 pole Form A. **CONNECTOR TYPE:** Two 50 pin male D-shells.

**MODEL 3740-ST SCREW TERMINAL OPTION:** #22 AWG typical wire size with 0.062 inch O.D. 84 conductors maximum. #16 AWG maximum wire size with 0.092 inch O.D. 44 conductors per card maximum.

**MAXIMUM SIGNAL LEVEL:** **Form C:** 300V DC or RMS, 2A switched (3A carry), 60W, 125VA. **Form A:** 250VAC 7A, 30VDC 7A, 210W.

**COMMON MODE VOLTAGE:** 300V DC or RMS between any terminal and chassis.

**VOLT-HERTZ LIMIT:**  $8 \times 10^7$ .

**CONTACT LIFE:** **Form C:**  $>10^5$  operations at maximum signal level.  $>10^8$  operations no load.<sup>1</sup> **Form A:**  $>10^5$  operations at maximum signal level,  $>5 \times 10^7$  operations no load.<sup>1</sup>

**CHANNEL RESISTANCE (end of contact life):**  $<0.5 \Omega$ .

**CONTACT POTENTIAL:**  $<\pm 3 \mu V$  typical per contact.

**ISOLATION:** **Channel-Channel:**  $10^9 \Omega$ ,  $<200 pF$ . **Common Mode:**  $>10^{10} \Omega$ ,  $<150 pF$ .

**Crosstalk (Channel-Channel, 50 $\Omega$  load- 50 $\Omega$  source):**

100kHz:  $<-50 dB$ .

1MHz:  $<-35 dB$ .

10MHz:  $<-15 dB$ .

**BANDWIDTH:** 30MHz.

### GENERAL

**OVER-TEMPERATURE:** Temperature sensor indicates over temperature.

**ACTUATION TIME:** **Form C:** 4ms. **Form A:** 10ms.

**RELAY TYPE:** **Form C:** Latching electromechanical. **Form A:** Nonlatching electromechanical.

**RELAY DRIVE SCHEME:** Direct.

**INTERLOCK:** Backplane relays disabled when interlock connection is removed.

**OPERATING ENVIRONMENT:** Specified for 0° to 50°C. Specified to 70% R.H. at 35°C.

**STORAGE ENVIRONMENT:** -25° to 65°C.

**WEIGHT:** 2.5 lbs.

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

**EMC:** Conforms to European Union Directive 2004/108/EC, EN61326-1.

1. Minimum signal level 10mV, 10 $\mu A$ .

SWITCHING AND CONTROL

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

System switch with high performance multimeter

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