

# 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 or 720 one-wire multiplexer channels in one mainframe
- Up to 2,688 one-pole matrix crosspoints in one mainframe
- 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
- LXI Class B with embedded Web browser interface for test setup, maintenance, and basic application control

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 or 2,688 one-pole matrix crosspoints 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

NPLC	DCV/ 2 Wire Ohms		4 Wire Ohms
	DCV/ 2 Wire Ohms	4 Wire Ohms	
1.0	60	29	
0.2	295	120	
0.06	935	285	
0.006	6,200	580	
0.0005	14,100	650	

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# Series 3700

## System Switch/Multimeter and Plug-In Cards

### Ordering Information

#### Mainframes

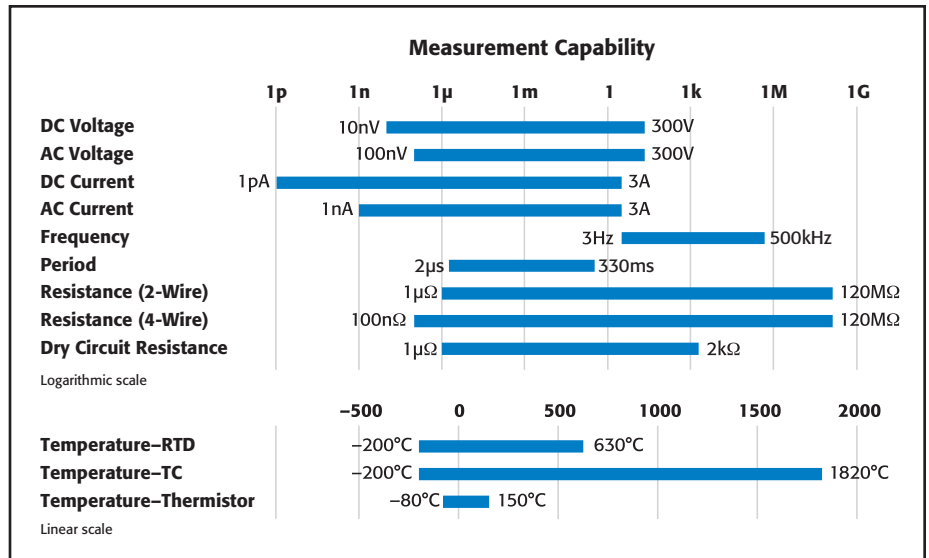
- 3706** Six-slot system switch with high performance DMM
- 3706-NFP** Six-slot system switch with high performance DMM, without front panel display and keypad
- 3706-S** Six-slot system switch
- 3706-SNFP** Six-slot system switch, without front panel display and keypad

#### Plug-in Cards

- 3720** Dual 1×30 multiplexer card (auto CJC when used with 3720-ST)
- 3721** Dual 1×20 multiplexer card (auto CJC when used with 3721-ST)
- 3722** Dual 1×48, high density, multiplexer card
- 3723** Dual 1×30, high speed, reed relay multiplexer card
- 3724** Dual 1×30 FET multiplexer card
- 3730** 6×16, high density, matrix card
- 3731** 6×16 high speed, reed relay matrix card
- 3732** Quad 4×28, ultra-high density, reed relay matrix card
- 3740** 32 channel isolated switch card
- 3750** Multifunction control 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)



Measurement capabilities of the high performance multimeter

### ACCESSORIES AVAILABLE

#### GPIB INTERFACES AND CABLES

7007-1	Shielded GPIB Cable, 1m (3.5ft)
7007-2	Shielded GPIB Cable, 2m (6.6ft)
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus
KUSB-488B	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

#### MULTIMETER CONNECTORS

3706-BAN	DMM Adapter Cable, 15-pin D-sub to banana jacks, 1.4m (4.6 ft)
3706-BKPL	Analog Backplane Extender Board, 15-pin D-sub to terminal block
3706-TLK	Test Lead Kit, includes 3706-BAN and plug-in test lead accessories
8620	Shorting Plug

#### RACK MOUNT KIT

4288-10	Fixed Rear Rack Mount Kit
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#### SERVICES AVAILABLE

##### Mainframe Models 3706 and 3706-NFP

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

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

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

#### SOFTWARE SERVICES

#### SYSTEM DEVELOPMENT OR IMPLEMENTATION

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

\*Not available in all countries.

System switch with high performance multimeter

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## 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.

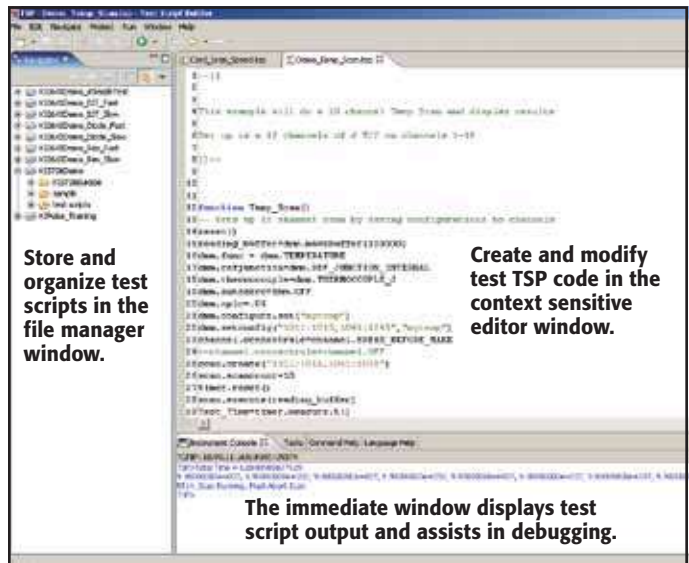
## TSP-Link for easy and seamless system coordination and expansion

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.

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.



Test Script Builder Software Suite

## 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.

## 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.

System switch with high performance multimeter

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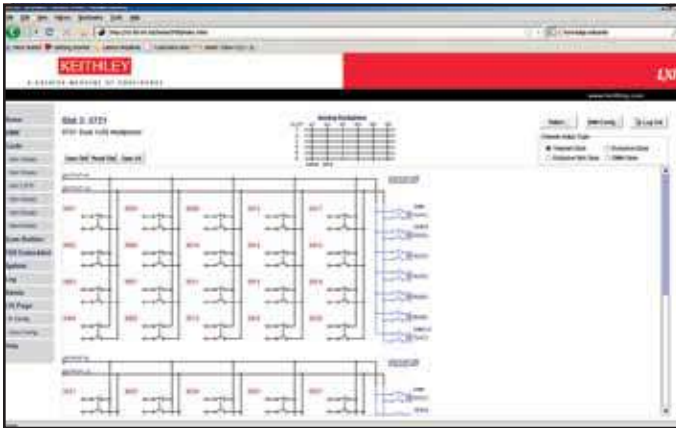
# Series 3700

# System Switch/Multimeter and Plug-In Cards

## Embedded Web server

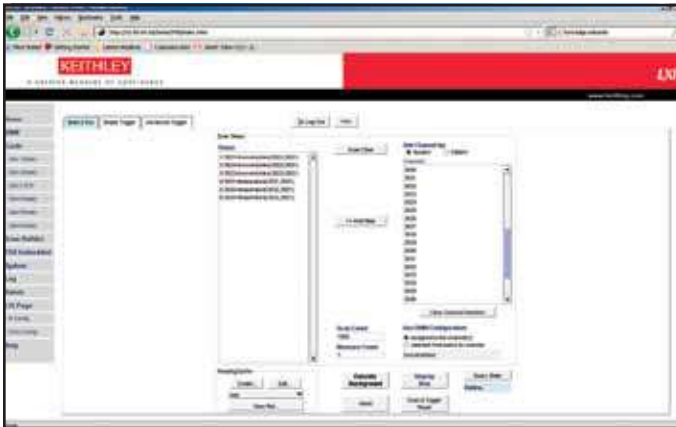
The built-in Web interface offers a quick and easy method to control and analyze measurement results. Interactive schematics of each card in the mainframe support point-and-click control for opening and closing switches. A scan list builder is provided to guide users through the requirements of a scan 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, including a graphing toolkit.

## Built-in Web server interface

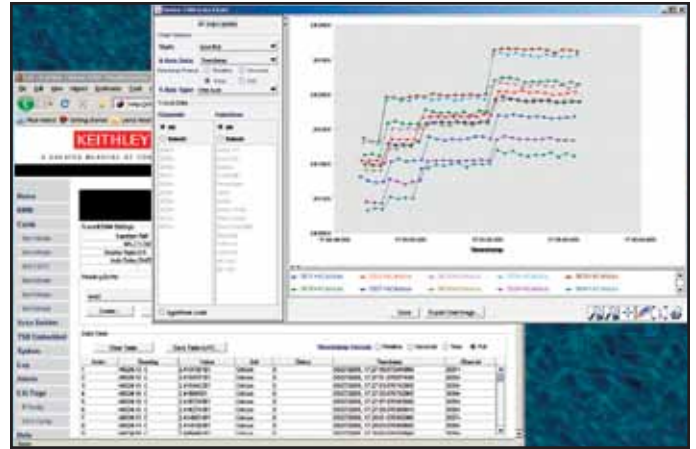


### 1. Configure your switch channels and measurement functions.

Configure the DMM to make your measurements at the desired speed, resolution, etc. and assign them to the desired channels.



**2. Build and run your automated scan list.** The toolkit makes it easy to build and execute an automated sequence of channel-open and channel-close commands and triggered multimeter measurements.



**3. Analyze your data.** View your results in real-time or historical mode with point-and-click simplicity. Data can be exported directly to your PC in either numerical or graphical formats for presentation or other applications.



Model 3706 front panel



Model 3706-S front panel



Model 3706-NFP and Model 3706-SNFP front panel



Model 3706 rear panel

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## High Performance Multimeter Specifications (Rev. D)

### DC Specifications

CONDITIONS: 1 PLC or 5 PLC.

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

Includes rear panel Analog Backplane connector and transducer conversion. 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) (ppm = parts per million) (e.g., 10ppm = 0.001%)			Temperature Coefficient 0°–18°C and 28°–50°C
					24 Hour <sup>3</sup> 23°C ± 1°C	90 Day 23°C ± 5°C	1 Year 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>4, 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	45 + 9	65 + 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	10 mΩ	10 μA	14.7 V	20 + 4	45 + 5	65 + 5	(8 + 1)°C
	1.0000000 MΩ	100 mΩ	10 μA	14.7 V	25 + 4	50 + 5	70 + 5	(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 + 50	300 + 50	500 + 50	(35 + 9)°C
	100.00000 μA	10 pA	<105 mV		50 + 9	300 + 30	500 + 30	(50 + 5)°C
	1.0000000 mA	100 pA	<130 mV		50 + 9	300 + 30	500 + 30	(50 + 5)°C
	10.000000 mA	1 nA	<150 mV		50 + 9	300 + 30	500 + 30	(50 + 5)°C
	100.00000 mA	10 nA	<0.4 V		50 + 9	300 + 30	500 + 30	(50 + 5)°C
	1.0000000 A	100 nA	<0.6 V		200 + 60	500 + 60	800 + 60	(50 + 10)°C
	3.0000000 A	1 μA	<1.8 V		1000 + 75	1200 + 75	1200 + 75	(50 + 10)°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, 23°C ± 5°C Simulated reference junction	90 Day/1 Year, 23°C ± 5°C Using 3720, 3721, or 3724 Cards	Range	90 Day/1 Year, 23°C ± 5°C Using 3720, 3721, or 3724 Cards	Temperature Coefficient 0°–18°C and 28°–50°C
J	–150 to + 760°C	0.001°C	0.2°C	1.0°C	–200 to –150°C	1.5°C	0.03°C/°C
K	–150 to +1372°C	0.001°C	0.2°C	1.0°C	–200 to –150°C	1.5°C	0.03°C/°C
N	–100 to +1300°C	0.001°C	0.2°C	1.0°C	–200 to –100°C	1.5°C	0.03°C/°C
T	–100 to +400°C	0.001°C	0.2°C	1.0°C	–200 to –100°C	1.5°C	0.03°C/°C
E	–150 to +1000°C	0.001°C	0.2°C	1.0°C	–200 to –150°C	1.5°C	0.03°C/°C
R	+400 to +1768°C	0.1°C	0.6°C	1.8°C	0 to +400°C	2.3°C	0.03°C/°C
S	+400 to +1768°C	0.1°C	0.6°C	1.8°C	0 to +400°C	2.3°C	0.03°C/°C
B	+1100 to +1820°C	0.1°C	0.6°C	1.8°C	+350 to +1100°C	2.8°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. Not recommended with Model 3724 card. See Model 3724 manual for "Measurement Considerations."

	–80 to +150°C	0.01°C	0.08°C		0.002°C/°C
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## DC SPEEDS vs. RMS NOISE

Single Channel, 60Hz (50Hz) Operation.  
1PLC and 5PLC RMS noise are included in DC specifications.

### 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>		
				100mV	1V	10V	100V	300V	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	1.7	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	3.0	1.5	8.0	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)				<b>10-100Ω</b>	<b>1kΩ</b>	<b>10kΩ</b>							
	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				<b>10μA</b>	<b>100μA</b>	<b>1mA-100mA</b>	<b>1A</b>	<b>3A</b>					
	5 <sup>14</sup>	83.3 (100)	7½	3.5	1.6	1.6	2.9	2.0	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	1.1	1.1	2.2	1.8	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	50	5.0	3.0	4.0	8.0	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	100	35	12	4.0	8.0	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	8.0	20	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	200	40	50	100	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	325	750	270 (270)	14,100 (13,700)	0.50 (0.5)	0.60 (0.60)	0.70 (0.70)	
4WΩ				<b>1Ω</b>	<b>10-100Ω</b>	<b>1kΩ</b>	<b>10kΩ</b>						
	5 <sup>14</sup>	83.3 (100)	7½	5.5	0.8	0.5	0.5	—	5 (4)	5.9 (4.7)	173 (206)	173 (206)	173 (206)
	1 <sup>14</sup>	16.7 (20)	7½	15	1.4	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	100	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				<b>1Ω</b>	<b>10-100Ω</b>	<b>1kΩ</b>	<b>10kΩ</b>						
	5 <sup>14</sup>	83.3 (100)	7½	5.5	0.8	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	16	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	45	4.5	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				<b>1-10Ω</b>	<b>100Ω</b>	<b>1kΩ</b>	<b>2kΩ</b>						
	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)	

## RTD SPEEDS vs. NOISE

1 PLC and 5 PLC Noise are included in RTD Specifications.

Function	Single Channel, 60Hz (50Hz) Operation			Add °C to Reading <sup>16</sup>		Measurements into Buffer <sup>13</sup> (rdg/s)		Measurement to PC (ms/rdg) Azero Off		
	NPLC	Aperture (ms)	Digits	4-Wire	3-Wire	Azero On	Azero Off	Ethernet	GPIB	USB
OCOMP OFF	5 <sup>14</sup>	83.3 (100)	7½	0	0	5 (4)	5.9 (4.7)	173 (206)	173 (206)	173 (206)
	1 <sup>14</sup>	16.7 (20)	7½	0	0	23.5 (18.5)	29 (23)	39 (46)	39 (46)	39 (46)
	0.2 <sup>12,14</sup>	3.33 (4.0)	5½	0.01	0.01	26.5 (21)	30 (24)	39 (46)	39 (46)	39 (46)
	0.2 <sup>14</sup>	3.33 (4.0)	5½	0.18	0.18	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	0.24	0.24	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	0.37	0.37	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	3.10	3.10	209 (205)	650 (645)	4.2 (4.4)	4.3 (4.5)	4.6 (4.8)	
OCOMP ON	5 <sup>14</sup>	83.3 (100)	7½	0	0	2.5 (2.0)	2.9 (2.3)	343 (427)	341 (425)	342 (426)
	1 <sup>14</sup>	16.7 (20)	7½	0	0	12.7 (10)	14 (11.2)	77 (95)	74 (92)	75 (93)
	0.2 <sup>12,14</sup>	3.33 (4.0)	6½	0.02	0.02	14 (11.2)	15 (12)	70 (86.5)	70 (86.5)	70 (86.5)
	0.2 <sup>14</sup>	3.33 (4.0)	5½	0.38	0.38	46.0 (37)	56 (44)	22.7 (25)	20.5 (23)	21.1 (24)
	0.0005 <sup>15</sup>	0.0083 (0.001)	3½	4.67	4.67	128 (125)	215 (210)	6.7 (6.7)	6.8 (6.8)	7 (7)

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

## SYSTEM PERFORMANCE 13, 14

3½-Digit Mode, Azero off, nPLC = 0.0005. Time includes function change from either DCV or 2WΩ to listed function.

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 17	110	10	—
ACV or ACI 17	20	85	300

Buffer Transfer Speed	Ethernet	GPIO	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	GPIO	USB
3720, 3721, 3722, 3730	channel.close (ch_list) or channel.open (ch_list)	5.7	5.8	6.1
3723, 3724 3731, 3732 18	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 ppm 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 per lead 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–10Ω Ranges: 99kΩ ±1% // <1μF.  
100Ω–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 MEASUREMENT CHARACTERISTICS (continued)

### 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 guaranteed by design	0.05 Ω	0.05 Ω	1 Ω	10 Ω	100 Ω	1 kΩ	6 kΩ
Burden Voltage	<1.75 V	<0.55 V	<0.4 V	<150 mV	<130 mV	<105 mV	<61 mV
Burden Voltage with 3721 card	<2.35 V	<1.15 V	<0.4 V	<150 mV	<130 mV	<105 mV	<61 mV
Autozero OFF "of range" Error	100 μA	100 μA	5 μA	0.5 μA	50 nA	5 nA	0.85 nA

For each additional amp after ±1.5A input, add the following to ppm of range:

—	120	60	60	60	60	60	95
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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.

### DC NOTES

- 20% overrange on DC functions 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 with -ST accessory:

Card	±(ppm of range)			±(ppm of reading + ppm of range)			
	100mV	1V	10V	100kΩ	1MΩ	10MΩ	100MΩ
3720, 3721, 3722, and 3730	45	4.5	—	8 + 5	8 + 0.5	—	—
3723	60	6.0	—	8 + 6	8 + 0.5	—	—
3724	45	4.5	—	8 + 5	80 + 0.5	250 + 1	5000 + 1
3731	800	80	8	8 + 80	40 + 8	0 + 25	0 + 15
3732 (Quad 4×28)	200	20	2	8 + 20	40 + 2	0 + 7	0 + 4

- Specifications are for 4-wire Ω, 1Ω–1kΩ with offset compensation on. For Series 3700 plug-in cards, I<sub>SYNC</sub> and offset compensation on. 1Ω range is 4-wire only. Model 3724 card: 1kΩ–100MΩ ranges only. Model 3731 card: 100Ω–100MΩ ranges only.

For 2-wire Ω specifications, add the following to "ppm of range" uncertainty:

DMM Connect Relays	Rel Enable	Rear Panel Connector			
		or 3700 Card	3724 Card	3731 Card	
CONNECT_ALL	ON	100 mΩ	500 mΩ	900 mΩ	
CONNECT_ALL	OFF	1.5 Ω	64 Ω	2.3 Ω	
CONNECT_TWO_WIRE	ON	700 mΩ	1.2 Ω	1.5 Ω	
CONNECT_TWO_WIRE	OFF	1.5 Ω	64 Ω	2.3 Ω	

- 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	10kΩ	100kΩ	1MΩ	10MΩ	100MΩ
3720, 3721, 3724, 3730, 3731, 3732 (Quad 4×28) with MTC D-Shell connector	1 ppm	10 ppm	0.01%	0.1%	1%
3720, 3721, 3724, 3730, 3731, 3732 (Quad 4×28) with -ST screw terminal module	10 ppm	100 ppm	0.1%	1%	10%
3722 and 3723	10 ppm	100 ppm	0.1%	1%	10%

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

- Dry-Ckt Ω is 4-wire only. Specifications with offset compensation and I<sub>SYNC</sub> on.

Card	Ranges
3720, 3721, and 3730	1 Ω – 2 kΩ
3722, 3723, and 3732	10 Ω – 2 kΩ
3724	1 kΩ – 2 kΩ
3731	100 Ω – 2 kΩ

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

## DC NOTES (continued)

9. Includes Analog Backplane 15-pin rear panel connector. For 3721, refer to DC Current table for additional uncertainties.

10. For  $I_{\text{SYNC}}$  On, line frequency  $\pm 0.1\%$ .

	nPLC	5	1	<0.2	<0.01
$I_{\text{SYNC}}$ On	NMRR	110 dB	90 dB	45 dB	—
$I_{\text{SYNC}}$ Off	NMRR	60 dB, $\pm 2$ dB	60 dB, $\pm 2$ dB	—	—

11. For 1k $\Omega$  unbalance in LO lead. AC CMRR is 70dB.

	nPLC	5	1	0.2 <sup>12</sup>	$\leq 0.2$
CMRR		140 dB	140 dB	120 dB	80 dB

12. For  $I_{\text{SYNC}}$  On.

13. Reading rates are for 60Hz (50Hz) operation using factory defaults operating conditions `dmm.reset("all")`. Autorange off. `dmm.autodelay=dmm.OFF`, `dmm.opendetector=dmm.OFF`, `format.data=format.SREAL`. Ranges as follows: DCV = 10V, 2W $\Omega$ /4W $\Omega$  = 1k $\Omega$ , DCI = 1mA, Dry-Ckt  $\Omega$  = 10 $\Omega$ , ACI = 1mA, and ACV = 1V. For

Dry-Ckt  $\Omega$  with Offset Comp OFF 2k $\Omega$ , 60 rdg/s max. Dry-Ckt  $\Omega$  with Offset Comp ON 2k $\Omega$ , 29.5 rdg/s max. For temperature reading rates use DCV for T/C and 2W $\Omega$  for Thermistor. Speeds are typical and include measurements and data transfer out the Ethernet, GPIB, or USB.

14. DMM configured for single reading, `dmm.measurecount=1`, and `print(dmm.measure())`. May require additional settling delays for full accuracy, depending on measurement configuration.

15. DMM configured for multisample readings and single buffer transfer, `dmm.measurecount=1000`, `buf=dmm.makebuffer(1000)`, `dmm.measure(buf)`, and `printbuffer(1,1000,buf)`.

16. `dmm.autozero=dmm.ON`. RMS noise using low thermal short for DCV, 2W $\Omega$ , 4W $\Omega$ , and Dry-Ckt  $\Omega$ . For DCI, `dmm.connect=dmm.CONNECT_NONE` or 0. For RTD, noise using low thermal 190 $\Omega$  precision resistor. Includes Model 3721 card accuracies. RMS noise values are typical.

17. For DCV or 2W $\Omega$  to Frequency or Period, `dmm.nplc=0.2` and `dmm.aperture=0.01` sec. For ACI or ACV, `dmm.detectorbandwidth=300`. For ACI or ACV with `dmm.autodelay=dmm.ON`, best speed is 65ms.

18. Speeds are within same multiplexer bank. Add an additional 8ms when changing banks or slots.

19. When properly zeroed using REL function.

## AC Specifications

			Accuracy: $\pm(\%$ of reading + $\%$ of range) 23°C $\pm$ 5°C						
Function	Range <sup>1</sup>	Resolution	Calibration Cycle	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 $\mu$ V	90 Day (100mV–100V)	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 $\mu$ V		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 $\mu$ V	90 Day	1.0 + 0.05	0.30 + 0.05	0.05 + 0.05	0.11 + 0.08	0.6 + 0.11	4.0 + 0.8
	100.0000 V	100 $\mu$ V		1.0 + 0.05	0.30 + 0.05	0.06 + 0.05	0.12 + 0.08	0.6 + 0.11	4.0 + 0.8
	300.0000 V	1 mV	Temp. Coeff. /°C <sup>3</sup> (all ranges)	0.010 + 0.003	0.030 + 0.003	0.005 + 0.003	0.006 + 0.005	0.01 + 0.006	0.03 + 0.01
	300.0000 V	1 mV		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>7</sup>	1 nA	90 Day/1 Year	1.0 + 0.04	0.30 + 0.04	0.08 + 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	
	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		
	1.000000 A	1 $\mu$ A	1.0 + 0.04	0.30 + 0.04	0.20 + 0.04	0.88 + 0.04	2.0 + 0.04		
	3.000000 A	10 $\mu$ A	1.0 + 0.05	0.30 + 0.05	0.20 + 0.05	0.88 + 0.05	2.0 + 0.05		
			Temp. Coeff. /°C <sup>3</sup> (all ranges)	0.10 + 0.004	0.030 + 0.004	0.005 + 0.003	0.006 + 0.005	0.006 + 0.005	
			Accuracy: $\pm(\text{ppm of reading} + \text{offset ppm})$						
Frequency <sup>4</sup> and Period				3 Hz–500 kHz	3 Hz–500 kHz	333 ms–2 $\mu$ s			
	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	(0.25 s gate)			
				80 + 3.33	80 + 3.33	(100 ms gate)			
				80 + 33.3	80 + 33.3	(10 ms gate)			

## ADDITIONAL UNCERTAINTY $\pm(\%$ of reading)

Low Frequency Uncertainty	Detector Bandwidth			Additional Uncertainty $\pm(\%$ of reading)	Detector Bandwidth	Crest Factor <sup>5</sup> Maximum Crest Factor: 5 at full-scale			
	3 (3 Hz–300 kHz)	30 (30 Hz–300 kHz)	300 (300 Hz–300 kHz)			1–2	2–3	3–4	4–5
20 Hz–30 Hz	0	0.3	—	5 Hz–10 Hz	3	0.50	1.20	1.30	1.40
30 Hz–50 Hz	0	0	—	10 Hz–30 Hz	3	0.20	0.30	0.60	0.90
50 Hz–100 Hz	0	0	4.0	30 Hz–100 Hz	3 or 30	0.20	0.30	0.60	0.90
100 Hz–200 Hz	0	0	0.72	>100 Hz	3 or 30	0.05	0.15	0.30	0.40
200 Hz–300 Hz	0	0	0.18	300 Hz–500 Hz	300 only	0.50	1.20	1.30	1.40
300 Hz–500 Hz	0	0	0.07	$\geq 500$ Hz	300 only	0.05	0.15	0.30	0.40
>500 Hz	0	0	0						

Series 3700 specifications

SWITCHING AND CONTROL

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

## AC SPEEDS Single Channel, 60Hz (50Hz) Operation

Function	Detector Bandwidth	NPLC	Aperture (ms)	Measurements into Buffer <sup>a</sup> (rdg/s)			Measurement to PC <sup>a</sup> (ms/rdg)		
				Digits	Azero On	Azero Off	Ethernet	GPIO	USB
ACI / ACV	3	N/A	N/A	6½	0.45 (0.45)	N/A	2150 (2150)	2150 (2150)	2150 (2150)
	30	N/A	N/A	6½	2.5 (2.5)	N/A	400 (400)	400 (400)	400 (400)
	300	1.0 <sup>10</sup>	16.67 (20)	6½	42 (33)	59.5 (50)	19.4 (22.7)	19.5 (22.8)	19.8 (23.1)
	300	0.2 <sup>10</sup>	3.33 (4.0)	6½	120 (100)	295 (235)	7.6 (8.3)	6.2 (6.8)	6.4 (7.0)
	300	0.06 <sup>11</sup>	1.0 (1.2)	5½	170 (165)	935 (750)	1.40 (1.80)	1.50 (1.80)	1.60 (2.30)
	300	0.006 <sup>11</sup>	0.100 (0.120)	4½	218 (215)	6,200 (5,500)	0.55 (0.57)	0.65 (0.67)	0.75 (0.77)
300	0.0005 <sup>11</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	N/A	10–273	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 guaranteed by design	0.05 Ω	0.05 Ω	1.0 Ω	10 Ω	100 Ω
Burden Voltage Rear Panel	<1.75 V rms	<0.55 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: dmm.aperture=0.273→0.01. Default 0.01s.

### 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 on AC functions 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 Detector Bandwidth 3 and sinewave inputs >5% of range. Detector Bandwidth 3 and 30 are multi-sample A/D conversions. Detector bandwidth 300 is a single A/D conversion, programmable from 0.0005PLC to 15PLC. Default condition set to 1PLC.
- 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→10kHz, and DC content ≤3% of range.
- For 1kΩ unbalance in LO lead.
- For Model 3721, 1mA ACI, add 0.05% to “of reading” uncertainty from 250Hz → 10kHz.
- Shunt resistance guaranteed by design.
- Reading rates are for 60Hz (50Hz) operation using factory defaults operating conditions dmm.reset(“all”), Autorange off, dmm.autodelay=dmm.OFF, dmm.opendetector=dmm.OFF, format.data=format.SREAL. Ranges as follows: DCV = 10V, 2WΩ/4WΩ = 1kΩ, DCI = 1mA, Dry-Ckt Ω = 10Ω, ACI = 1mA, and ACV = 1V. For Dry-Ckt Ω with Offset Comp OFF 2kΩ, 60 rdg/s max. Dry-Ckt Ω with Offset Comp ON 2kΩ, 29.5 rdg/s max. For temperature reading rates use DCV for T/C and 2WΩ for Thermistor. Speeds are typical and include measurements and data transfer out the Ethernet, GPIO, 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).

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# Series 3700

# System Switch/Multimeter and Plug-In Cards

## GENERAL

**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.

**EMC:** Conforms to European Union EMC Directive.

**SAFETY:** Conforms to European Union Low Voltage Directive.

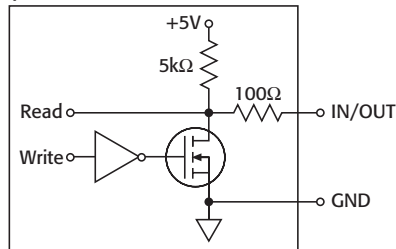
**VIBRATION:** MIL-PRF-28800F Class 3, Random.

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

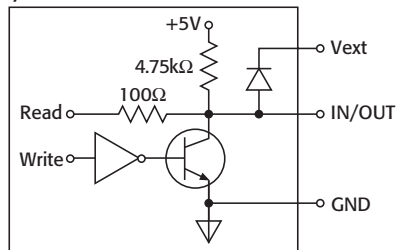
**DIGITAL I/O:** 25-pin female D-shell.

	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 1-9



### I/O 10-14



### 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 B, 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 (not specified) max.

**Alarm to Trigger Delay:** 25 $\mu\text{s}$  min., 50 $\mu\text{s}$  typ., n/s (not specified) max.

**Generate LAN[0-7] Event:** 750 $\mu\text{s}$  min., 1000 $\mu\text{s}$  typ., n/s (not specified) 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

- Multiplexer, matrix, and I/O cards
- Relay closures automatically counted and stored in each card's onboard memory
- Unlimited contact life with solid-state relay (Model 3724)
- Automatic CJC for temperature measurements when used with screw terminal accessory (Models 3720, 3721, 3724)

## Ordering Information

3720	Dual 1×30 Multiplexer Card . . . . .	132
3721	Dual 1×20 Multiplexer Card . . . . .	134
3722	Dual 1×48, High Density, Multiplexer Card . . . . .	136
3723	Dual 1×30, High Speed, Reed Relay, Multiplexer Card . . . . .	138
3724	Dual 1×30 FET Multiplexer Card . . . . .	140
3730	6×16, High Density, Matrix Card . . . . .	143
3731	6×16, High Speed, Reed Relay, Matrix Card . . . . .	145
3732	Quad 4×28, Ultra-High Density, Reed Relay, Matrix Card . . . . .	147
3740	General Purpose Card with 32 Independent Channels . . . . .	151
3750	Multifunction Control Card . . . . .	153

# Plug-in Cards for Series 3700 Mainframes

## Specifications for Plug-In Cards

Additional Series 3700 cards are currently in development. For a current list of cards and specifications, visit [www.keithley.com](http://www.keithley.com).

	3720	3721	3722
Page	132	134	136
No. of Channels	60 (Dual 1×30)	40 (dual 1×20)	96 (dual 1×48)
Card Config.	Multiplexer	Multiplexer	Multiplexer
Type of Relay	Latching electromechanical	Latching electromechanical	Latching electromechanical
Contact Configuration	2 Form A	2 Form A	2 Form A
Max. Voltage	300 V	300 V (ch 1–40), 60 V (ch 41–42)	300 V
Max. Current Switched	1 A	2 A (ch 1–40), 3 A (ch 41–42)	1 A
Comments	2 independent 1×30 multiplexers. Automatic temperature reference when used with screw terminal accessory (Model 3720-ST)	2 independent 1×20 multiplexers. Automatic temperature reference when used with screw terminal accessory (Model 3721-ST)	2 independent 1×48 multiplexers

## Plug-in Card Accessories

	3720	3721	3722
Cables	3720-MTC-1.5, 3720-MTC-3	3721-MTC-1.5, 3721-MTC-3	3722-MTC-1.5, 3722-MTC-1.5/MM, 3722-MTC-3, 3722-MTC-3/MM
Screw Terminal Block	3720-ST	3721-ST	
Connector Kits	3791-KIT78-R	3790-KIT50-R	3792-KIT104-R, 3792-KIT104-R/F
Tools	3791-CIT		3791-CIT

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# Series 3700

# Plug-in Cards for Series 3700 Mainframes

3723	3724	3730	3731	3732	3740	3750
138	140	143	145	147	151	153
60 (dual 1×30) or 120 single pole (dual 1×60)	60 (dual 1×30)	6×16	6×16	448 crosspoints (Quad 4×28)	32	40 digital I/O, 4 counter/totalizers, and 2 isolated analog outputs
Multiplexer	Multiplexer	Matrix	Matrix	Matrix	Independent	Independent
Dry reed	FET solid-state	Latching electromechanical	Dry reed	Dry reed	Latching electromechanical	N/A
1 Form A	2 Form A	2 Form A	2 Form A	1 Form A	28 Form C, 4 Form A	N/A
200 V	200 V	300 V	200 V	200 V	300 VDC/250 VAC (Form A)	N/A
1 A	0.1 A	1 A	1 A	0.75 A	2 A (Form C), 7 A (Form A)	N/A
2 independent 1×30 multiplexers	2 independent 1×30 multiplexers. Automatic temperature reference when used with screw terminal accessory (Model 3724-ST)	Columns can be expanded through the backplane or isolated by relays	Relay actuation time of 0.5ms. Columns can be expanded through the backplane or isolated by relays	Banks can be connected together via bank configuration relays to create a single 4×112 or dual 4×56 matrix. Analog backplane relays also included for card to card expansion. Row expansion with 3732-ST-R accessory to create a dual 8×28 or single 16×28 matrix.	32 general purpose independent channels.	All-in-one card design. 40 bidirectional I/O. Four 32-bit counter/totalizers. 2 programmable analog (V or I) outputs.

3723	3724	3730	3731	3732	3740	3750
3720-MTC-1.5, 3720-MTC-3	3720-MTC-1.5, 3720-MTC-3	3721-MTC-1.5, 3721-MTC-3	3721-MTC-1.5, 3721-MTC-3	3720-MTC-1.5, 3720-MTC-3	3721-MTC-1.5, 3721-MTC-3	3721-MTC-1.5, 3721-MTC-3
3723-ST, 3723-ST-1	3724-ST	3730-ST	3731-ST	3732-ST-C, 3732-ST-R	3740-ST	3750-ST
3791-KIT78-R	3791-KIT78-R	3790-KIT50-R	3790-KIT50-R	3791-KIT78-R	3790-KIT50-R	3790-KIT50-R
3791-CIT	3791-CIT			3791-CIT		

Plug-in cards for Series 3700 mainframes

SWITCHING AND CONTROL