Integra Series integrated switching, measurement, and datalogging solutions

DIGITAL MULTIMETERS & SYSTEMS

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

- **Combines functions of DMM, switch system, and datalogger**
- **True 6½-digit (22-bit) resolution**
- **Choice of 12 switch/control plug-in modules**
- **Up to 200 differential input channels (with 300V isolation) for measurement and control**
- **Convenient front panel inputs**
- **Free LabVIEW®, LabWindows/ CVI, Visual Basic, and C/C++ drivers (IVI style)**
- **Ethernet, GPIB, RS-232 communications capabilities**
- **Free ExceLINX™-1A datalogging software**

Integra Series systems (2700, 2701, 2750) combine precision measurement, switching, and control in a single, tightly integrated enclosure for either rack-mounted or benchtop applications. These cost-effective, high performance test platforms offer affordable alternatives to separate DMMs and switch systems, dataloggers/ recorders, plug-in card data acquisition equipment, and VXI/PXI systems. The Integra Series plug-in switching and control modules offer unmatched flexibility and testing efficiency for a wide range of industries and applications. System builders can create test solutions with a combination of channel count, cost per channel, and system performance unmatched by any other single-box measurement system. The input modules provide the flexibility to vary the channel count from 20 to 200 (2-pole), apply a stimulus to the device under test, route signals, control system components, and make precision measurements with up to 14 functions. Robust digital I/O capabilities can be used for triggering, handshaking with other automation equipment, and alarm limit outputs. Scan rates of up to 500 channels/second (up to 3500 readings/second on a single channel) will increase test productivity.

Fast Setup and Operation

The Integra systems are fully integrated, off-the-shelf measurement and control systems. Their DMM-like interfaces make it easy for users to collect data and/or perform troubleshooting within minutes of installation and startup. Once sensor or DUT leads are hooked to the instrument's input, use the front panel controls to select the measurement function, range, filtering, scaling, trigger source, scanning sequence, alarms, and more. The free ExceLINX-1A software makes it easy to configure and use the system in a graphical "point-and-click" environment. This gives developers the basic tools needed to create a simple application without writing program code.

The Advantage of Integrated Design

The Integra systems offer a variety of advantages over existing solutions for ATE and data acquisition applications. For example, their flexible modular architecture and integrated measurement, switching, and control capabilities save rack space by reducing the number of separate instruments needed. This design also simplifies expanding the system as the number of channels grows or re-purposing it as new test requirements evolve. Integrated signal conditioning, scaling, stimulus, filtering and I/O capabilities eliminate the need for external circuitry when designing and building data acquisition systems. The Integra systems offer accuracy and repeatability superior to plug-in data acquisition boards, while providing faster test times than typical DMM/switch systems. This makes it possible to combine higher test yields with higher test throughput.

Ethernet

The Model 2701 offers a 10/100 BaseT Ethernet connection for high speed and long distance communication between a computer and a virtually infinite number of instruments. Any PC with an Ethernet port can connect to a single Model

Built-in measurement functions include:

- **DCV • ACV • DCI • ACI**
- **Resistance (2- or 4-wire, offset compensation selectable)**
- **Dry circuit ohms (20mV clamp) 2750 only**
- **Temperature (with thermocouples, RTDs, or thermistors)**
- **Frequency/Period**
- **Continuity**

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A GREATER MEASURE OF CONFIDENCE

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

Ordering Information

2700	**DMM, Data Acquisition, Datalogging System w/2 Slots**
2701	**DMM, Data Acquisition, Datalogging System w/2 Slots and Ethernet Support**
2750	**DMM, Data Acquisition, Switching, Datalogging System w/5 Slots**

Accessories Supplied

LabVIEW, LabWindows/ CVI, Visual Basic, and C/C++ drivers; manual; and Model 1751 Safety Test Leads.

ACCESSORIES AVAILABLE

2750-321A	Extra slot cover
7007-1	Shielded IEEE-488 Cable, 1m (3.3 ft.) (Models 2700, 2750 only)
7007-2	Shielded IEEE-488 Cable, 2m (6.6 ft.) (Models 2700, 2750 only)
7788	50-Pin D-Shell Connector Kit (2 each)(for Models 7703, 7705 Modules w/D-sub Connectors)
7789	50-Pin/25-Pin D-Shell Kit (1 each)
7790	50-Pin Male, 50-Pin Female, and 25-Pin Male IDC D-Shell Connector Kit (1 each) (Ribbon Cable not Included)
7797	Calibration Extender Board (for Model 2750)
7705-MTC-2	50-Pin Male to Female D-Sub Cable, 2m
7707-MTC-2	25-Pin Male to Female D-Sub Cable, 2m
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus (Models 2700, 2750 only)
KUSB-488B	IEEE-488 USB-to-GPIB Interface Adapter (Models 2700, 2750 only)

SERVICES AVAILABLE

2700-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
2701-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
2750-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
C/2700-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase*
C/2701-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase*
C/2750-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase*

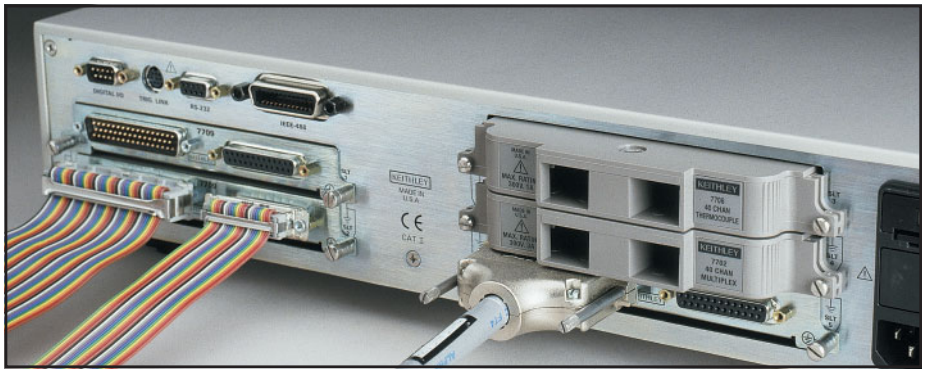
*Not available in all countries

2701 in a point-to-point configuration, to multiple Model 2701s through a hub, or to multiple Model 2701s distributed on a network.

The Model 2701 Ethernet port uses the industry-standard TCP/IP socket interface. This provides data rates up 100Mbits/sec. and allows the instrument to be located up to 100 meters from the nearest computer or network hub in hardwired systems and miles in wireless Ethernet systems. The maximum distances between a control PC and the instruments are limited only by the size of the network. The instrument also provides a built-in diagnostic Web page for easy remote access to the Model 2701. Entering the instrument's IP address in the URL line of Microsoft Internet Explorer will allow communication with and control of the Model 2701. This Web page allows users to read and set network parameters, such as IP address, subnet mask, gateway, MAC address, and calibration dates, and to send commands to and query data from the Model 2701.

Temperature Capabilities

Integra Series mainframes support three major types of temperature sensors with built-in signal conditioning and 300V isolation: thermocouples, RTDs, and thermistors. To begin using a sensor, simply hook it up and the instrument does the rest. If a thermocouple is broken or disconnected, the instrument will alert the operator. The mainframes also support three methods for cold-junction compensation (CJC): automatic (built-in), external (built-in), and simulated.



Install up to five input modules in the 2750 mainframe (or up to two in the 2700 and 2701 mainframes). All switch/control modules are fully enclosed in impact-resistant plastic for exceptional ruggedness. Three connector alternatives simplify connecting the modules to DUTs. Rugged D-sub connectors allow quick, secure connections and are especially convenient when performing routine maintenance or when the system is installed in a rack. IDC ribbon cable adapters are supplied with the Model 7701, 7707, and 7709 modules for fast, uncomplicated hookups in production test and process monitoring applications. Oversize screw-terminal connectors simplify setup in applications that require the greatest connection flexibility. Additional D-sub and IDC ribbon cable connector kits and pre-wired cable assemblies are sold separately.

TYPICAL APPLICATIONS

- **Production test of electronic products and devices**
- **Accelerated stress testing (AST)**
- **Process monitor and control**
- **Device characterization/R&D**
- **Low ohms, multichannel measurements**

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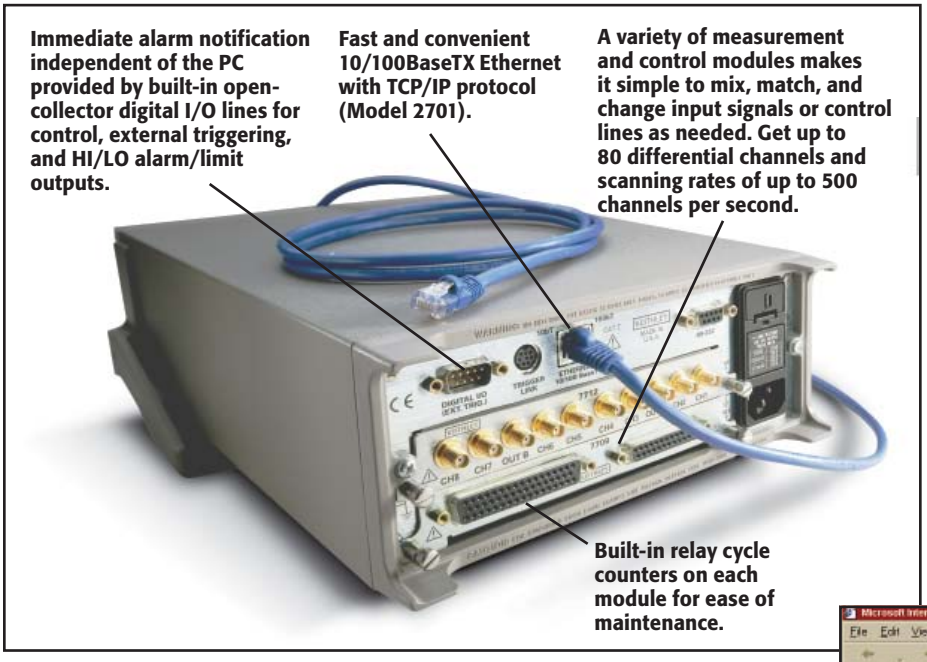
DIGITAL MULTIMETERS & SYSTEMS

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems



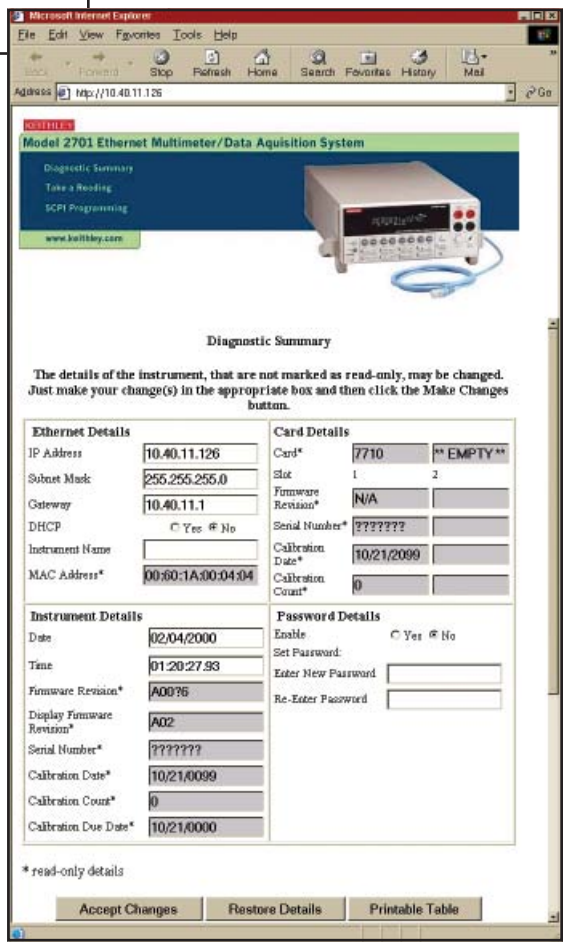
Web-Enabled Data Acquisition and Control via Standard Ethernet

A built-in 10/100BaseTX Ethernet interface makes the Model 2701 the best choice for distributed data acquisition applications that demand stable, high precision measurements. Just connect it directly to an Ethernet port—there's no need for additional interface cards, proprietary cables, or software. The Model 2701 is a cost-effective solution for industrial monitoring and control applications. It combines remote communications with high measurement precision for research and development tasks, such as remote equipment diagnostics and economical monitoring of lab environments.

Free built-In Web diagnostic tool (2701 only)

- **Read and set network parameters**
- **Send command strings and receive data**
- **Debug**

To start communicating with the Integra Series instrument, simply connect the 2701 to a PC Ethernet port using the supplied RJ-45 crossover cable, start Microsoft® Internet Explorer version 5.0 or later, and type the instrument's IP address into the URL line. The built-in web diagnostic interface allows for easy communication and debugging, without the need to install external software. This interface makes it easy to read and set network parameters such as IP address, subnet mask, gateway, MAC address, calibration dates, and other data stored in the Integra Series instrument. It also takes readings from the instrument and allows the user to send command strings and receive data.



2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

Ordering Information

7700 20-channel Differential Multiplexer Module with up to 50MHz Bandwidth, Automatic CJC, and Screw Terminals

7701 32-channel Differential Multiplexer Module with a 25- and 50-Pin Female D-Sub Connector. Supplied with Male IDC Ribbon Cable Connectors

7702 40-channel Differential Multiplexer Module w/ Screw Terminals

7703 32-channel, High Speed, Differential Multiplexer Module with 2 50-Pin Female D-Sub Connectors. Includes 2 Mating Connectors

7705 40-channel, Single-pole Control Module with 2 50-Pin Female D-Sub Connectors. Includes 2 Mating Connectors

7706 All-in-One I/O Module: 20-channel Differential Multiplexer w/Automatic CJC, 16 Digital Outputs, 2 Analog Outputs, a Counter/Totalizer, and Screw Terminals

7707 32-channel Digital I/O w/10-channel Differential Multiplexer Module with a 25-Pin Female and 50-Pin Male D-Sub Connectors. Supplied with Mating IDC Ribbon Cable Connectors

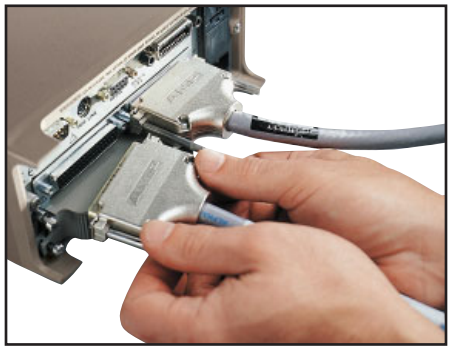
7708 40-channel Differential Multiplexer Module w/Automatic CJC and Screw Terminals

7709 6×8 Matrix Module with 25- and 50-Pin Female D-Sub Connectors. Supplied with Male IDC Ribbon Cable Connectors

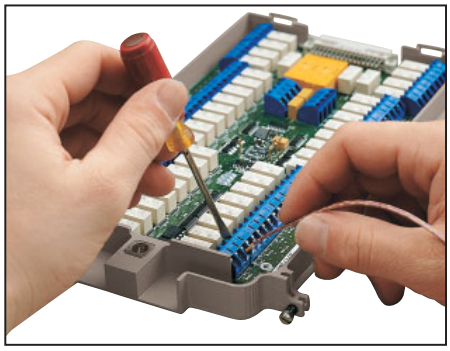
7710 20-channel Solid-state/ Long Life Differential Multiplexer w/Automatic CJC and Screw Terminals

7711 2GHz 50Ω RF Module with Dual 1×4 Configuration and SMA Connections

7712 3.5GHz 50Ω RF Module with Dual 1×4 Configuration and SMA Connections



Rugged 50-pin D-sub connectors ensure dependability and quick setup/teardown in production test racks.

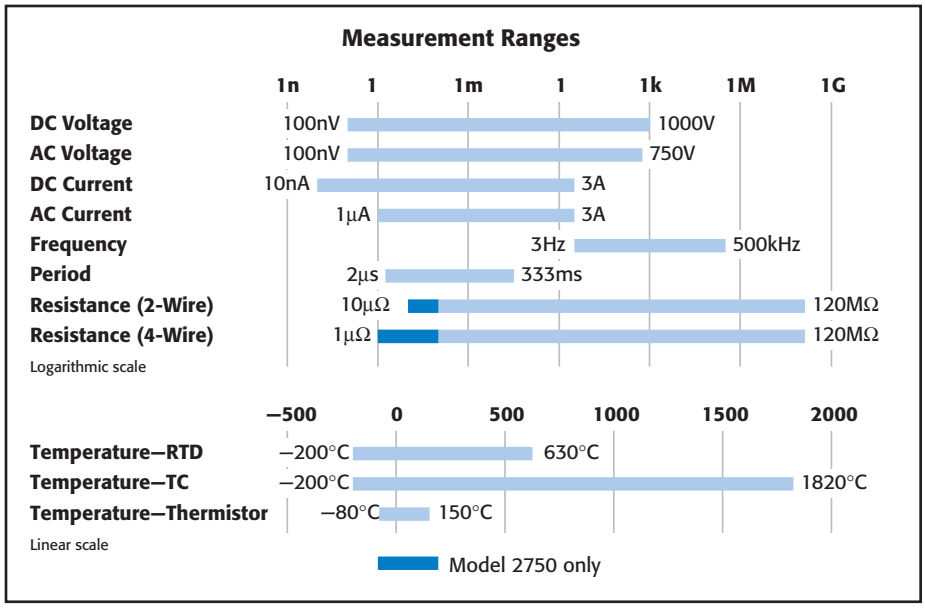


Screw terminals use oversize connectors for easier, mistake-free wiring. Easy-to-use removable terminals are available on some models.

Software Solutions

Whether the task calls for a simple start-up package to acquire several channels of data or the tools to create a fully custom acquisition and analysis solution, Keithley has the software needed to get the most performance from a Model 2700, 2701, or 2750 Multimeter/Switch System. Our broad range of software solutions makes it easy to get applications "Up & Running" quickly and economically.

Measurement Ranges for the Integra Series Systems



2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

Important Features and Benefits

- **Full per-channel configurability**—Each channel can be independently configured for making measurements. The parameters that can be chosen for each channel include speed, range, resolution, number of power line cycles (NPLC), filtering type, offset compensation, math functions to be displayed, CJC type, RTD type, frequency gate time, "m" and "b" values in mX + b format, HI/LO limits, low Ω (Model 2750 only), ratio calculation, and thermistor type.
- **Channel monitor feature**—Monitor any specific input channel on the front panel display during a scan. This feature can also serve as an analog trigger to initiate a scan sequence based on some external factor, such as a temperature rising above a pre-set limit. Only the data of interest is acquired, so there's no need to spend hours searching through reams of normal readings to find anomalous data.
- **Front/rear switch**—Switching between the front and rear panel measurement inputs is as easy as pressing a button. Users can select the front panel inputs for tasks such as system setup and verification, manual probing, troubleshooting, and calibration, while the rear panel inputs through the modules allow fast, automated multiplexing and control.
- **Battery-backed setup memory**—Up to four different setup configurations can be stored in onboard memory. If the line power fails during a scan, the system will resume scanning where it stopped once power is restored.
- **Relay counting**—Provides preventive maintenance of the system and switches.
- **Memory buffer**—The mainframe's non-volatile wrap-around reading memory allows continuous, unattended datalogging over long periods. Data in the buffer can be transferred to a PC controller automatically as new data is acquired. The real-time clock can be used to time- and date-stamp readings for later review and interpretation.
- **2 TTL-level digital inputs**—Use to implement external triggers to initiate a scan sequence.
- **5 "per-channel" HI/LO alarm limit TTL outputs**—Trigger external alarms or perform other control functions without a PC controller.
- **Dry circuit ohms (20mV clamp)**—Protects sensitive devices from damage and prevents self-heating errors during testing (Model 2750 only).
- **Virtual channel**—Stores the results of channel-to channel ratio and average math operations.
- **Onboard statistical analysis**—Mathematical functions available at the push of a button are channel average, mX+b scaling, minimum, maximum, average, and standard deviation.
- **GPIB and RS-232 interfaces** (Models 2700 and 2750)
- **Ethernet and RS-232 interface** (Model 2701 only)

Which Integra Mainframe is the Best Choice for the Application?

Use this selector guide to decide which Integra Series mainframe offers the combination of features and capacity that's right for a specific application. If testing requirements change in the future, switch/control modules and test code can be easily re-used.

	2700	2701	2750
No. of differential input channels	80	80	200
Matrix crosspoints	96	96	240
Ohms resolution	100 μΩ	100 μΩ	1 μΩ
Dry circuit ohms (20mV clamp)	No	No	Yes
No. of slots	2	2	5
Memory buffer	55,000 rdgs	450,000 rdgs	110,000 rdgs
Size (2U height)	Half-rack width	Half-rack width	Full-rack width (19″)
Communications	GPIB, RS-232	Ethernet, RS-232	GPIB, RS-232
Scan-Rate (memory)	180/s	500/s	230/s
Scan-Rate (bus)	145/s	440/s	210/s
Max. Internal Trigger Rate	2000/s	2800/s	2000/s
Max. External Trigger Rate	375/s	2000/s	375/s

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

DC CHARACTERISTICS[1]

Conditions: MED (1 PLC)[2] or 10 PLC or MED (1 PLC) with Digital Filter of 10

Function	Range	Resolution	Test Current ±5% or Burden Voltage	Input Resistance or Open Circuit Voltage[3] 2700/2701	Input Resistance or Open Circuit Voltage[3] 2750	Accuracy: ±(ppm of reading + ppm of range) (ppm = parts per million) (e.g., 10ppm = 0.001%) 24 Hour[4] 23°C ±1°	90 Day 23°C ±5°	1 Year 23°C ±5°	Temperature Coefficient 0°–18°C & 28°–50°C
Voltage[11]	100.0000 mV	0.1 µV		>10 GΩ	>10 GΩ	15 + 30	25 + 35	30 + 35	(1 + 5)/°C
	1.000000 V	1.0 µV		>10 GΩ	>10 GΩ	15 + 6	25 + 7	30 + 7	(1 + 1)/°C
	10.00000 V	10 µV		>10 GΩ	>10 GΩ	10 + 4	20 + 5	30 + 5	(1 + 1)/°C
	100.0000 V	100 µV		10 MΩ ±1%	10 MΩ ±1%	15 + 6	35 + 9	45 + 9	(5 + 1)/°C
	1000.000 V[5]	1 mV		10 MΩ ±1%	10 MΩ ±1%	20 + 6	35 + 9	50 + 9	(5 + 1)/°C
Resistance[6, 8]	1.000000Ω[24]	1 µΩ	10 mA		5.9 V	80 + 40	80 + 40	100 + 40	(8 + 1)/°C
	10.00000Ω[24]	10 µΩ	10 mA		5.9 V	20 + 20	80 + 20	100 + 20	(8 + 1)/°C
	100.0000 Ω	100 µΩ	1 mA	6.9 V	12.2 V	20 + 20	80 + 20	100 + 20	(8 + 1)/°C
	1.000000kΩ	1 mΩ	1 mA	6.9 V	12.2 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	10.00000kΩ	10 mΩ	100 µA	6.9 V	6.8 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	100.0000kΩ	100 mΩ	10 µA	12.8 V	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	1.000000MΩ[23]	1.0 Ω	10 µA	12.8 V	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	10.00000MΩ[7, 23]	10 Ω	0.7 µA//10 MΩ	7.0 V	7.0 V	150 + 6	200 + 10	400 + 10	(70 + 1)/°C
	100.0000MΩ[7, 23]	100 Ω	0.7 µA//10 MΩ	7.0 V	7.0 V	800 + 30	2000 + 30	2000 + 30	(385 + 1)/°C
Dry Circuit Resistance[21, 24]	1.000000 Ω	1 µΩ	10 mA		20 mV	80 + 40	80 + 40	100 + 40	(8 + 1)/°C
	10.00000 Ω	10 µΩ	1 mA		20 mV	25 + 40	80 + 40	100 + 40	(8 + 1)/°C
	100.0000 Ω	100 µΩ	100 µA		20 mV	25 + 40	90 + 40	140 + 40	(8 + 1)/°C
	1.000000kΩ	1 mΩ	10 µA		20 mV	25 + 90	180 + 90	400 + 90	(8 + 1)/°C
Continuity (2W)	1.000kΩ	100 mΩ	1 mA	6.9 V	12.2 V	40 + 100	100 + 100	100 + 100	(8 + 1)/°C
Current	20.00000 mA	10 nA	< 0.2 V			60 + 30	300 + 80	500 + 80	(50 + 5)/°C
	100.0000 mA	100 nA	< 0.1 V			100 + 300	300 + 800	500 + 800	(50 + 50)/°C
	1.000000 A	1.0 µA	< 0.5 V[9]			200 + 30	500 + 80	800 + 80	(50 + 5)/°C
	3.000000 A	10 µA	< 1.5 V[9]			1000 + 15	1200 + 40	1200 + 40	(50 + 5)/°C
Channel (Ratio)[10]	Ratio Accuracy = Accuracy of selected Channel Range + Accuracy of Paired Channel Range								
Channel (Average)[10]	Average Accuracy = Accuracy of selected Channel Range + Accuracy of Paired Channel Range								

TEMPERATURE[19]

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

Thermocouples (Accuracy based on ITS-90)

Type	Range	Resolution	90 Day/1 Year (23°C ± 5°C) Relative to Simulated Reference Junction	Using 77XX Module*	Temperature Coefficient 0°–18°C & 28°–50°C
J	–200 to + 760°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
K	–200 to +1372°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
N	–200 to +1300°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
T	–200 to + 400°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
E	–200 to +1000°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
R	0 to +1768°C	0.1 °C	0.6°C	1.8°C	0.03°C/°C
S	0 to +1768°C	0.1 °C	0.6°C	1.8°C	0.03°C/°C
B	+350 to +1820°C	0.1 °C	0.6°C	1.8°C	0.03°C/°C

* Using 7710 Module: J: 2.5°C; K: 1°C. N, T, E Types: 1.5°C. R, S, B Types: 2.7°C.

4-Wire RTD:

(100Ω platinum [PT100], D100, F100, PT385, PT3916, or user type. Offset compensation On.)

–200° to +630°C	0.01°C	0.06°C	0.003°C/°C

Thermistor: (2.2kΩ, 5kΩ, and 10kΩ)[20]

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

DC SYSTEM SPEEDS[15,18]

	2700/2750	2701
RANGE CHANGES (excludes 4WΩ)[16]:	50/s (42/s)	50/s (42/s)
FUNCTION CHANGES[16]:	50/s (42/s)	50/s (42/s)
AUTORANGE TIME[16]:	<30 ms	<30 ms
ASCII READINGS TO RS-232 (19.2k baud):	55/s	300/s
MAX. EXTERNAL TRIGGER RATE:	375/s	2000/s

DC MEASUREMENT SPEEDS[15]

Single Channel, 60Hz (50Hz) Operation

Function	Digits	Readings/s	PLCs
DCV, DCI, Ω (<10M), Thermocouple, Thermistor	6.5[12,16]	5 (4)	10
	6.5[16]	35 (28)	1
	6.5[12,16]	45 (36)	1
	5.5[12,16]	150 (120)	0.1
	5.5[16, 17]	300 (240)	0.1
	5.5[17]	500 (400)	0.1
2700 and 2750 only	4.5[17]	2500 (2000)	0.01
2701 only	3.5	3500 (2800)	0.002
4WΩ (<10M)	6.5[16]	1.4 (1.1)	10
	6.5[16]	15 (12)	1
	5.5[17]	33 (25)	0.1
4WΩ OComp, RTD[22]	6.5[16]	0.9 (0.7)	10
	6.5[16]	8 (6.4)	1
	5.5[16, 17]	18 (14.4)	0.1
Channel (Ratio), Channel (AVG)	6.5[16]	2.5 (2)	10
	6.5[16]	15 (12)	1
	5.5[17]	25 (20)	0.1

Multiple Channels, Into Memory[18]	Channels/s 2700	2701	2750
7710 Scanning DCV	180/s	500/s	230/s
7710 Scanning DCV with Limits or Time Stamp On	170/s	500/s	230/s
7710 Scanning DCV alternating 2WΩ	45/s	115/s	60/s

Multiple Channels, Into and Out of Memory to GPIB[16, 18] or Ethernet	Channels/s 2700	2701	2750
7702 Scanning DCV	65/s	75/s	65/s
7700 and 7708 Scanning Temperature (T/C)	50/s	50/s	50/s
7710 Scanning DCV	145/s	440/s	210/s
7710 Scanning DCV with Limits or Time Stamp On	145/s	440/s	210/s
7710 Scanning DCV alternating 2WΩ	40/s	115/s	55/s

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

DC SPEED vs. NOISE REJECTION

Rate	Filter	Readings/s[12]	Digits	RMS Noise 10V Range 2700,2750	RMS Noise 10V Range 2701	NMRR	CMRR[14]
10	50	0.1 (0.08)	6.5	<1.2 μV	<2.5 μV	110 dB[13]	140 dB
1	Off	15 (12)	6.5	<4 μV	<6 μV	90 dB[13]	140 dB
0.1	Off	500 (400)	5.5	<22 μV	<40 μV	—	80 dB
0.01	Off	2500 (2000)	4.5	<150 μV	<300 μV	—	80 dB
0.002	Off	3500 (2800)	3.5	—	<1 mV	—	60 dB

DC MEASUREMENT CHARACTERISTICS

DC VOLTS

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

INPUT IMPEDANCE:
100mV–10V Ranges: Selectable >10GΩ // with <400pF or 10MΩ ±1%.
100V, 1000V Ranges: 10MΩ ±1%.
Dry Circuit: 100kΩ ± 1% // <1μF.

EARTH ISOLATION: 500V peak, >10GΩ and <300pF any terminal to chassis.

INPUT BIAS CURRENT: <75pA at 23°C.

COMMON MODE CURRENT: <500nApp at 50Hz or 60Hz.

AUTOZERO ERROR: Add ±(2ppm of range error + 5μV) for <10 minutes and ±1°C.

INPUT PROTECTION: 1000V, all ranges. 300V with plug in modules.

RESISTANCE

MAXIMUM 4WΩ LEAD RESISTANCE: 80% of range per lead (Dry Ckt mode). 5Ω per lead for 1Ω range; 10% of range per lead for 10Ω, 100Ω, and 1kΩ ranges; 1kΩ per lead for all other ranges.

OFFSET COMPENSATION: Selectable on 4WΩ, 1Ω, 10Ω, 100Ω, 1kΩ, and 10kΩ ranges.

CONTINUITY THRESHOLD: Adjustable 1 to 1000Ω.

INPUT PROTECTION: 1000V, all Source Inputs, 350V Sense Inputs. 300V with plug-in modules.

DC CURRENT

SHUNT RESISTORS: 100mA–3A, 0.1Ω. 20mA, 5Ω.

INPUT PROTECTION: 3A, 250V fuse.

THERMOCOUPLES

CONVERSION: ITS-90.

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

OPEN CIRCUIT CHECK: Selectable per channel. Open >11.4kΩ ±200Ω.

DC NOTES

1. 20% overrange except on 1000V and 3A.
2. Add the following to "ppm of range" uncertainty; 100mV 15ppm; 1V and 100V 2ppm; for Model 2750 1Ω and Dry Circuit Ω 40ppm; 10→1MΩ 2ppm, for Models 2700/2701 100Ω 30ppm, 20mA and 1A 10ppm, 100mA 40ppm.
3. ±2% (measured with 10MΩ input resistance DMM, >10GΩ DMM on 10MΩ and 100MΩ ranges). For Dry Circuit Ω, ±25% with Input HI connected to Sense HI; with Sense HI disconnected add 30mV.
4. Relative to calibration accuracy.
5. For signal levels >500V, add 0.02ppm/V uncertainty for portion exceeding 500V.
6. Specifications are for 4-wire Ω, 1Ω, 10Ω, and 100Ω with offset compensation on. With 77XX plug-in modules, LSYNC on. With offset compensation on, OPEN CKT. VOLTAGE is 12.8V. For 2-wire Ω add 1.5Ω to "ppm of range" uncertainty. 1Ω range is 4-wire only.
7. Must have 10% matching of lead resistance in Input HI and LO.
8. Add the following to "ppm of reading" uncertainty when using plug in modules:

	10 kΩ	100 kΩ	1 MΩ	10 MΩ	100 MΩ
All Modules:				220 ppm	2200 ppm
7701, 7703, 7707, 7709 Modules:	10 ppm	100 ppm	1000 ppm	1%	10%
7706, 7708, 7710 Modules:	5 ppm	50 ppm	500 ppm	5000 ppm	5%
7710 Module 23°C ±5°C:	11 ppm	110 ppm	1100 ppm	1.1%	11%

9. Add 1.5V when used with plug in modules.
10. For RATIO, DCV only. For AVERAGE, DCV, and Thermocouples only. Available with plug in modules only.
11. Add 6μV to "of range" uncertainty when using Models 7701, 7703, and 7707, and 3μV for Models 7706 and 7709.
12. Auto zero off.
13. For LSYNC On, line frequency ±0.1 %. For LSYNC Off, use 60dB for ≥ 1PLC.
14. For 1kΩ unbalance in LO lead. AC CMRR is 70dB.
15. Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay = 0.
16. Speeds include measurements and binary data transfer out the GPIB or ASCII data transfer for Ethernet and RS-232 (reading element only).
17. Sample count = 1000, auto zero off (into memory buffer).
18. Auto zero off, NPLC = 0.01 (Models 2700 and 2750), NPLC = 0.002 (Model 2701).
19. Additional Uncertainty:

		Plug-In Modules				
Type	Range	Front Terminals Simulated Ref. Junction	7709 Simulated Ref. Junction	7701, 7703, 7707 Simulated Ref. Junction	7700, 7708, 7710 Using CJC	7706 Using CJC
J	–200 to 0°C	0.1	0.1	0.3	0.8	1.6
K	–200 to 0°C	0.2	0.2	0.4	0.8	1.6
N	–200 to 0°C	0.3	0.3	0.6	0.8	1.6
T	–200 to 0°C	0.2	0.1	0.4	0.8	1.6
E	–200 to 0°C	–	0.1	0.3	0.8	1.6
R	0 to +400°C	0.4	0.6	1.2	0.5	1.0
S	0 to +400°C	0.4	0.6	1.2	0.5	1.0
B	+350 to +1100°C	0.8	0.3	1.7	0.5	1.0

20. For lead resistance >0Ω, add the following uncertainty/Ω for measurement temperatures of:

	70°–100°C	100°–150°C
2.2 kΩ (44004)	0.22°C	1.11°C
5.0 kΩ (44007)	0.10°C	0.46°C
10 kΩ (44006)	0.04°C	0.19°C

21. For 4-wire Ω only, offset compensation on, LSYNC on.
22. For Dry Circuit 1kΩ range, 2 readings/s max.
23. For 2750 Front Inputs, add the following to Temperature Coefficient "ppm of reading" uncertainty: 1MΩ 25ppm, 10MΩ 250ppm, 100MΩ 2500ppm. Operating environment specified for 0°C to 50°C and 50% RH at 35°C.
24. Model 2750 only.
25. Front panel resolution is limited to 0.1Ω.

AC SPECIFICATIONS[1]

Function	Range	Resolution	Calibration Cycle	Accuracy: ±(% of reading + % of range), 23°C ± 5°C 3 Hz–10 Hz	10 Hz–20 kHz	20 kHz–50 kHz	50 kHz–100 kHz	100 kHz–300 kHz
Voltage[2]	100.0000 mV	0.1 μV	90 Days (all ranges)	0.35 + 0.03	0.05 + 0.03	0.11 + 0.05	0.6 + 0.08	4.0 + 0.5
	1.000000 V	1.0 μV						
	10.00000 V	10 μV	1 Year (all ranges)	0.35 + 0.03	0.06 + 0.03	0.12 + 0.05	0.6 + 0.08	4.0 + 0.5
	100.0000 V	100 μV						
	750.000 V	1.0 μV						
			(Temp. Coeff.)/°C[3]	0.035 + 0.003	0.005 + 0.003	0.006 + 0.005	0.01 + 0.006	0.03 + 0.01
				3 Hz–10 Hz	**10 Hz–3 kHz**	**3 kHz–5 kHz**		
Current[2]	1.000000 A	1.0 μA	90 Day/1 Year	0.30 + 0.04	0.10 + 0.04	0.14 + 0.04		
	3.00000 A[14]	10 μA		0.35 + 0.06	0.16 + 0.06	0.18 + 0.06		
			(Temp. Coeff.)/°C[3]	0.035 + 0.006	0.015 + 0.006			
				(3 Hz–500 kHz) (333 ms–2 μs)				
Frequency[4] and Period	100 mV to 750 V	0.333 ppm	90 Day/1 Year	100 ppm + 0.333 ppm (SLOW, 1s gate)				
		3.33 ppm		100 ppm + 3.33 ppm (MED, 100ms gate)				
		33.3 ppm		100 ppm + 33.3 ppm (FAST, 10ms gate)				

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

ADDITIONAL UNCERTAINTY ±(% of reading)

Low Frequency Uncertainty	Med	Fast
20 Hz – 30 Hz	0.3	—
30 Hz – 50 Hz	0	—
50 Hz – 100 Hz	0	1.0
100 Hz – 200 Hz	0	0.18
200 Hz – 300 Hz	0	0.10
>300 Hz	0	0

CREST FACTOR: [5]	1–2	2–3	3–4	4–5
Additional Uncertainty:	0.05	0.15	0.30	0.40
Max. Fundamental Freq.:	50kHz	50kHz	3kHz	1kHz

Maximum Crest Factor: 5 at full-scale.

AC MEASUREMENT CHARACTERISTICS

AC VOLTS

MEASUREMENT METHOD: AC-coupled, True RMS.

INPUT IMPEDANCE: 1MΩ ±2% // by <100pF.

INPUT PROTECTION: 1000Vp or 400VDC. 300Vrms with plug in modules.

AC CURRENT

MEASUREMENT METHOD: AC-coupled, True RMS.

SHUNT RESISTANCE: 0.1Ω.

BURDEN VOLTAGE: 1A <0.5Vrms, 3A <1.5Vrms. Add 1.5Vrms when used with plug in modules.

INPUT PROTECTION: 3A, 250V fuse.

FREQUENCY AND PERIOD

MEASUREMENT METHOD: Reciprocal counting technique.

GATE TIME: SLOW 1s, MED 100ms, and FAST 10ms.

AC GENERAL

AC CMRR[6]: 70dB.

VOLT HERTZ PRODUCT: ≤8 × 10^7.

AC MEASUREMENT SPEEDS [7, 13]

Single Channel, 60Hz (50Hz) Operation

Function	Digits	Readings/s	Rate	Bandwidth
ACV, ACI	6.5	2s/Reading	SLOW	3 Hz–300 kHz
	6.5	4.8 (4)	MED	30 Hz–300 kHz
	6.5 [9]	40 (32)	FAST	300 Hz–300 kHz
Frequency, Period	6.5	1 (1)	SLOW	3 Hz–300 kHz
	5.5	9 (9)	MED	30 Hz–300 kHz
	4.5	35 (35)	FAST	300 Hz–300 kHz
	4.5 [10]	65 (65)	FAST	300 Hz–300 kHz

Multiple Channel

7710 SCANNING ACV [10, 11]: 500/s.

7710 SCANNING ACV WITH AUTO DELAY ON : 2s/reading.

AC SYSTEM SPEEDS [7, 9, 11]

	2700/2750	2701
AC System Speed:	(19.2K)	(115.2K)
Range Changes:[12]	4/s (3/s)	4/s (3/s)
Function Changes:[12]	4/s (3/s)	4/s (3/s)
Autorange Time:	< 3s	< 3s
ASCII Readings to RS-232 (19.2k baud):	50/s	300/s
Max. External Trigger Rate:	250/s	2000/s

AC NOTES

1. 20% overrange except on 750V and 3A.
2. Specification are for SLOW mode and sine wave inputs >5% of range. SLOW and MED are multi-sample A/D conversions. FAST is DETector:BANDwidth 300 with nPLC = 1.0.
3. Applies to 0°–18°C and 28°–50°C.
4. For square wave inputs >10% of ACV range, except 100mV range. 100mV range frequency must be >10Hz if input is <20mV.
5. Applies to non-sine waves >5Hz.
6. For 1kΩ unbalance in LO lead.
7. Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay=0.
8. For ACV inputs at frequencies of 50 or 60Hz (±10%), add the following to "% of Range" uncertainty: 100mV 0.25%, 1V 0.05%, 10V 0.13%, 100V 0.03%, 750V 0.015 (Model 2701 only).
9. Auto Zero off.
10. Sample count = 1024.
11. DETector:BANDwidth 300 with nPLC = 0.006 (2701 only).
12. Maximum useful limit with trigger delay = 175ms.
13. Includes measurement and binary data transfer out GPIB or ASCII data transfer for Ethernet and RS-232 (Reading Element only).

GENERAL

EXPANSION SLOTS: 2 (2700, 2701), 5 (2750).

POWER SUPPLY: 100V / 120V / 220V / 240V ±10%.

LINE FREQUENCY: 45Hz to 66Hz and 360Hz to 440Hz, automatically sensed at power-up.

POWER CONSUMPTION: 28VA (2700), 80VA (2701, 2750).

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 80% RH at 35°C.

STORAGE ENVIRONMENT: –40°C to 70°C.

BATTERY: Lithium battery-backed memory, 3 years @ 23°C (Models 2700, 2750) Lithium Ion battery-backed memory, 30 days of buffer storage @ 23°C and >4 hours charge time. Battery lifetime: >3 years @ 23°C, >1.5 years @ 50°C (Model 2701)

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

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

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

WARM-UP: 2 hours to rated accuracy.

DIMENSIONS:

Rack Mounting: 89mm high × 213mm wide (2700, 2701) or 485mm wide (2750) × 370mm deep (3.5 in × 8.375 in or 19 in × 14.563 in).

Bench Configuration (with handle and feet): 104mm high × 238mm wide (2700, 2701) or 485mm wide (2750) × 370mm deep (4.125 in × 9.375 in (2700, 2701) or 19 in (2750) × 14.563 in).

SHIPPING WEIGHT: 6.5kg (14 lbs.) (2700, 2701) or 13kg (28 lbs.) (2750).

DIGITAL I/O: 2 inputs, 1 for triggering and 1 for hardware interlock.
5 outputs, 4 for Reading Limits and 1 for Master Limit. Outputs are TTL compatible or can sink 250mA, diode clamped to 40V.

TRIGGERING AND MEMORY:

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

Reading Hold Sensitivity: 0.01%, 0.1%, 1%, or 10% of reading.

Trigger Delay: 0 to 99 hrs (1ms step size).

External Trigger Delay: <2ms (2700), <1ms (2701, 2750).

External Trigger Jitter: <1ms (2700), <500μs (2701), <500μs (2750).

Memory Size: 55,000 readings (2700), 450,000 readings (2701), 110,000 readings (2750).

MATH FUNCTIONS: Rel, Min/Max/Average/Std Dev/Peak-to-Peak (of stored reading), Limit Test, %, 1/x, and mX+b with user defined units displayed.

REMOTE INTERFACE:
GPIB (IEEE-488.2) (2700, 2750), RS-232C (2700, 2701, and 2750).
Ethernet TCP/IP (10bT and 100bT) (2701)
SCPI (Standard Commands for Programmable Instruments)
LabVIEW Drivers

FOR MODEL 2701:

Ethernet: RJ-45 connector, TCP/IP, 10bT and 100bTx autosensed.

IP Configuration: Static or DHCP.

Password Protection: 11 Characters.

Software: Windows 98, NT, 2000, ME, and XP compatible. Internet Explorer 5.0 or higher required. Web page server by 2701.

2700, 2701, 2750

Multimeter/Data Acquisition/ Switch Systems

Switch/Control Module Capabilities

All plug-in modules are compatible with the two-slot Model 2700 and Model 2701 Multimeter/Data Acquisition Systems and the five-slot Model 2750 Multimeter/Switch System. When the application's needs change, simply change modules. Integra systems reconfigure themselves automatically.

Module Capabilities Overview

	7700	7701	7702	7703	7705	7706	7707	7708	7709	7710	7711	7712
DC Volts	✓	✓	✓	✓		✓	✓	✓	✓	✓		
DC Current	✓		✓									
Temperature												
T/C w/Automatic CJC	✓					✓		✓		✓		
T/C w/External CJC	✓	✓	✓	✓		✓	✓	✓	✓	✓		
RTD	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Thermistor	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Resistance (2- or 4-wire)	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Continuity	✓	✓	✓	✓		✓	✓	✓	✓	✓		
AC Volts	✓	✓	✓	✓		✓	✓	✓	✓	✓		
AC Current	✓		✓									
Frequency	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Event Counter/Totalizer						✓						
Signal Routing/Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Digital Input							✓					
Digital Output						✓	✓					
Analog Output						✓						
RF Switching											✓	✓

Integra Plug-In Modules

KEITHLEY

Integra Series
Model 2700 Multimeter/ Data Acquisition System

HIGH PERFORMANCE DATA ACQUISITION AND CONTROL SYSTEM

A complete solution for PC-based multi-point measurement and control

Get a DMM, a switch mainframe, and a data acquisition/control system for the price of a PC plug-in board

The **Model 2700 Multimeter/Data Acquisition System** combines the functionality and high channel count of a switch mainframe with the accuracy, convenience, and traceability of a true 6½-digit (22-bit) DMM. It packs all these capabilities into a compact half-rack unit at a price that's comparable to a high performance data acquisition board. Keithley's growing family of Integra Series plug-in modules gives the Model 2700 the industry's lowest per-channel installed cost in a high performance data acquisition and control package. Mix or match any two modules to get up to 80 differential channels of multiplexed measurement and control. That means significantly more channels in less space than competing solutions.

An astonishing range of functions and built-in signal conditioning

Each channel of the Model 2700 can be configured separately for any of 14 measurement functions and provides built-in signal conditioning. The Model 2700's high noise isolation up to 1000V allows it to measure virtually any electrical or physical parameter with high accuracy:

- DC volts
- Temperature measurements with thermocouples, RTDs, or thermistors
- 2-wire Ω
- 4-wire Ω
- Continuity
- DC current
- AC volts
- Frequency
- Period
- AC current
- Event counter/totalizer
- Digital I/O

Perform system level control functions

Optional plug-in modules allow the Model 2700 to manage a variety of system control tasks:

- Actuate indicator lights and/or relays to provide alarm limit status, and directly interface with mechanical systems through open-collector digital I/O.
- Control power to the DUT, switch in or change loads, and perform general signal routing through isolated switching.
- Bias the DUT or perform analog control through dual ±12V analog output ports.
- Route DC, AC, or RF signals from the DUT to other test equipment in the rack.

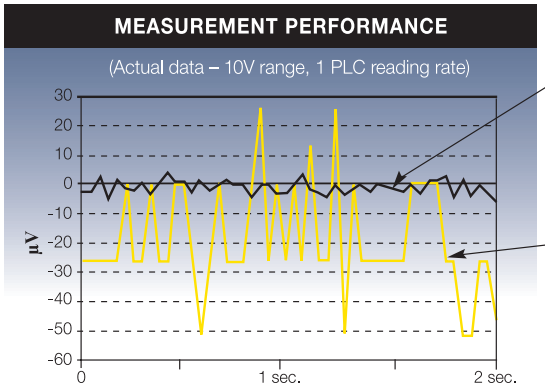
Wide testing flexibility

This economical, easy-to-configure solution is widely used in applications like temperature logging, precision measurement and control, and mixed signal data acquisition for product development, ATE, component testing, and process monitoring. The plug-in approach eliminates the triggering, timing, and processing issues that often complicate building systems from separate instruments and switches. The tight switching-and-measurement integration also helps reduce test time significantly. That means higher throughput and a better return on equipment investment.

Powerful software options

The Model 2700 is compatible with a variety of software options to match a variety of test programming needs. For example, the free TestPoint runtime offers basic datalogging capabilities. This start-up utility can be modified with the powerful TestPoint application development package. Optional ExceLINX-1A software makes it easy to acquire data directly into an Excel spreadsheet. Free IVI (VISA-based) drivers simplify developing fully custom programs in Visual Basic, C/C++, LabVIEW, LabWindows/CVI, or TestPoint.

TIGHT SWITCHING-AND-MEASUREMENT INTEGRATION



Keithley's patented measurement engine provides true 6½- digit (22-bit) performance at higher reading rates.

Typical 6½-digit meters only deliver 5½-digit (<18-bit) performance under similar conditions.

Engineers trust Keithley to provide best-in-class measurement performance. In many cases, our products provide up to 10X better performance at equivalent reading rates or up to 10X greater speed at equivalent measurement performance. Our patented A/D converter and high performance signal conditioning circuitry make this possible.

High ease of use meets high measurement accuracy

If there's a power failure, the battery-backed set-up memory and non-volatile RAM data storage means scans can automatically be resumed right where they stopped when power returns.

Front panel input jacks simplify manual probing, troubleshooting, and calibration. Includes 1000V protection in case of accidental overload.

On-board statistical analysis is available at the push of a button, including channel average and ratio, mX+b scaling, min, max, average, and standard deviation.

Its familiar DMM-like front panel scheme makes the Model 2700 easy to use on the bench or in the rack. Select or change functions with the press of a button.

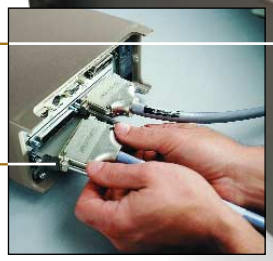
Non-volatile memory stores up to 55,000 time-stamped readings.

NON-VOLATILE MEMORY

GPIB and RS-232 communications are standard.

Screw terminals use oversize connectors for easier, mistake-free wiring.

Built-in open-collector digital I/O lines provide for control, external triggering, and HI/LO alarm/limit ouputs.



A variety of measurement and control modules makes it simple to mix, match, and change input signals or control lines as needed. Install up to two modules at a time to create a "mini-ATE" system with up to 80 channels.

Rugged 50-pin D-sub connectors ensure dependability and quick setup/teardown in production test racks.

Built-in relay cycle counters on each module for ease of maintenance.

Versatile plug-in options for any application

We're continuing to expand our line of Integra plug-in switch/control modules:

	7700	20-channel differential multiplexer with automatic CJC and screw terminals for general purpose or thermocouple measurements.
NEW!	**7701**	32-channel differential multiplexer with D-sub connectors, IDC ribbon cable compatible
	7702	40-channel differential multiplexer with screw terminals
	7703	32-channel high speed differential multiplexer with reed relays and D-sub connectors
	7705	40-channel switch/control module, SPST independent switch with D-sub connectors (Form C configurable)
	7706	All-in-one I/O module, 20-channel differential multiplexer, 2 analog outputs, 16 digital outputs and event counter/totalizer with screw terminals
NEW!	**7707**	32 open-collector digital I/O and 10-channel differential multiplexer with D-sub connectors, IDC ribbon cable compatible
NEW!	**7708**	40-channel differential multiplexer with automatic CJC and screw terminals for general purpose or thermocouple measurements
NEW!	**7709**	6×8 matrix switch module, with D-sub connectors, IDC ribbon cable compatible
NEW!	**7711**	2GHz RF switch module with dual 1×4 configuration
NEW!	**7712**	3.5GHz RF switch module with dual 1×4 configuration

Additional hardware accessories:

KPCI-488	IEEE-488/GPIB interface for PCI bus
7007-2	2-meter double shielded premium GPIB/IEEE-488 cable
7705-MTC-2	2-meter male to female 50-pin D-sub cable for 7703, 7705, 7707, and 7709
7707-MTC-2	2-meter male to female 25-pin D-sub cable for 7707 and 7709
7788	50-pin D-shell connector kit (2 each)
7789	50-pin/25-pin D-shell connector kit (1 each)
7790	50-pin male, 50-pin female and 25-pin male IDC D-shell kit (1 each)

Visit www.keithley.com for more information on modules and accessories

Ideal for production testing

Use the Model 2700 for high throughput production testing of multiple points on a DUT and/or testing multiple DUTs in batch mode. D-sub and SMA rear panel connectors make it fast and easy to disconnect the Model 2700 from the test fixture. Free instrument drivers designed for use in a variety of popular Application Development Environments simplify creating custom systems for production test.

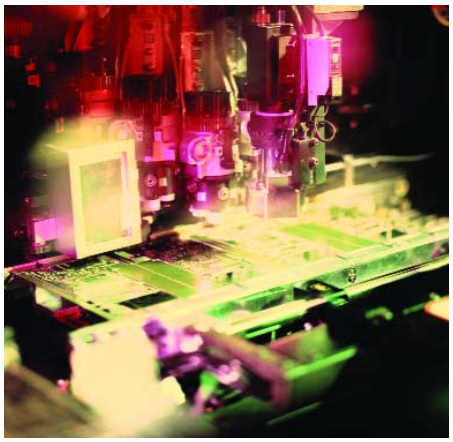
Versatile enough for environmental stress, burn-in, and QA testing

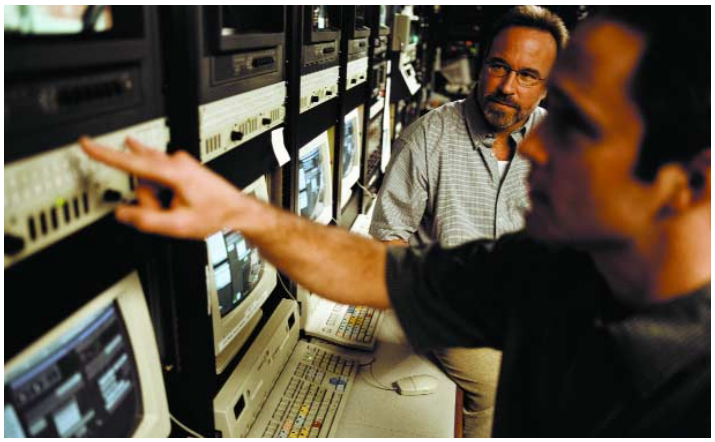
The Model 2700 is ideal for both short- and long-term monitoring and characterization tasks. It's immune to power failures, resuming scanning where it left off when power is restored–all set-up information is battery backed and data is stored in non-volatile RAM. Input channels can handle virtually any input while its digital output lines can trigger external alarms or perform other controls independent of a PC.

Perfect for research and product development

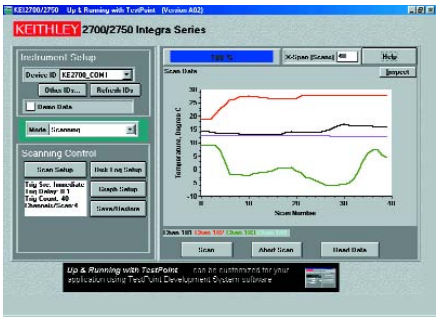
A DMM-like front panel, half-rack footprint, 80-channel capacity, outstanding measurement performance, and low cost make the Model 2700 ideal for R&D applications. The free TestPoint™ runtime start-up software included with the Model 2700 and the economical ExceLINX-1A add-in utility provide basic datalogging capabilities, so it's easy to get new applications "Up & Running" quickly and inexpensively.

IDEAL FOR PROBING AND TROUBLESHOOTING TASKS

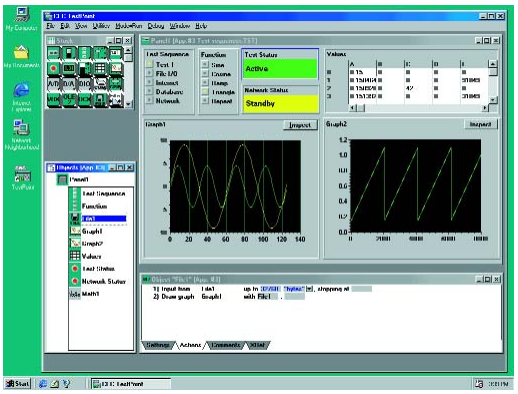




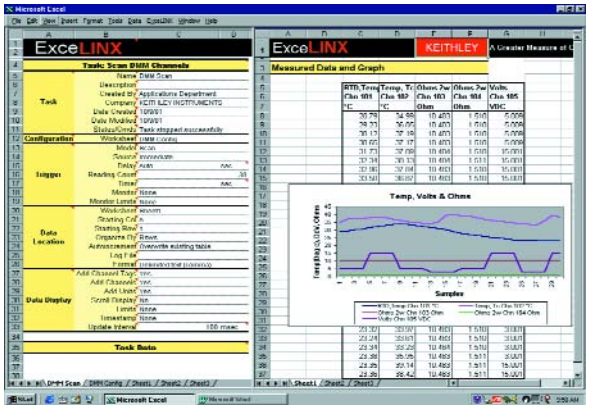
Powerful, easy-to-use software options



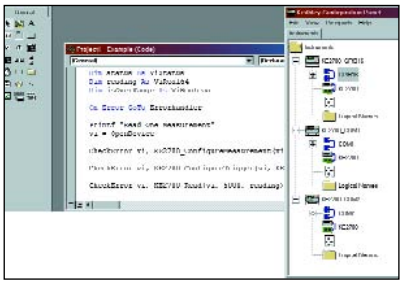
Free Customizable Start-up Software. This free TestPoint runtime offers basic datalogging capabilities that can get a system up and running almost immediately. With just a few clicks of the mouse, this software can confirm that the system's hardware, wiring, communications, and software drivers are installed and operating correctly. It can also be used to configure instrument functions and perform simple data acquisition tasks. Data from multiple channels can be saved to disk and up to eight channels of data can be graphed automatically. If the application demands greater functionality, this runtime can be modified with the TestPoint package.



TestPoint Application Development Package. If the free start-up software doesn't provide a feature the job demands, there's no problem—just use the economical TestPoint application development package to modify it. TestPoint's object oriented, drag-and-drop technology offers the flexibility needed to build basic systems quickly, without in-depth programming. Expanding TestPoint applications is easy, too, with optional Internet, database, and statistical process control toolkits.



ExceLINX-1A. This powerful and economical add-in utility for Microsoft® Excel makes it simple to acquire data from the Model 2700 directly into Excel, then employ Excel's graphics, charting, and analysis capabilities to turn that data into useful information. No programming is required to use ExceLINX —a few mouse clicks are all it takes to configure channels, set parameters, triggers, and scan lists.



Free IVI (VISA-based) Instrument drivers. Experienced programmers who prefer to build fully custom systems from scratch can take advantage of our instrument driver, which is designed for use with Application Development Environments such as Visual Basic, C/C++, LabVIEW™, LabWindows™/CVI, and TestPoint. This IVI-style driver (VISA based) supports all of the instrument's functionality, and comes with numerous programming examples to help programmers get started quickly.

Three new system bundles make it easy to get applications off to a quick, economical start:

- The **2700/7700** value pack provides a basic 20-channel system.
- The **2700-DAQ-40** includes the Models 2700 and 7708 plus ExceLINX-1A for a 40-channel system.
- The **2700-DAQ-80** provides one Model 2700, two Model 7708 modules, and ExceLINX-1A for an 80-channel system.

Condensed specifications*

DC VOLTAGE

1000V protection all ranges; A/D Linearity of 1ppm rdg + 1ppm rng; 1200000 max counts

Range	Reso-lution	Accuracy (90 day rdg + rng)	Accuracy (1 year rdg + rng)	Input Resistance
100.0000mV	100nV	0.0025% + 0.0035%	0.0030% + 0.0035%	10MΩ or >10GΩ
1.000000V	1.0μV	0.0025% + 0.0007%	0.0030% + 0.0007%	10MΩ or >10GΩ
10.00000V	10μV	0.0020% + 0.0005%	0.0030% + 0.0007%	10MΩ or >10GΩ
100.0000V	100μV	0.0035% + 0.0006%	0.0045% + 0.0007%	10MΩ
1000.000V	1.mV	0.0035% + 0.0006%	0.0050% + 0.0007%	10MΩ

THERMOCOUPLE

Conversion to ITS-90; Automatic, External, or Simulated CJC; Open T/C check.

Type	Range	Accuracy (1 year with simulated CJC)	Accuracy (1 year with automatic CJC)
J	-200 to +760°C	±0.2°C for all ranges	±1.0°C
K	-200 to +1372°C	±0.2°C for all ranges	±1.0°C
N	-200 to +1300°C	±0.2°C for all ranges	±1.0°C
T	-200 to +400°C	±0.2°C for all ranges	±1.0°C
E	-200 to +1000°C	±0.2°C for all ranges	±1.0°C
R	0 to +1768°C	±0.6°C for all ranges	±1.8°C
S	0 to +1768°C	±0.6°C for all ranges	±1.8°C
B	+350 to +1820°C	±0.6°C for all ranges	±1.8°C

RESISTANCE

2- or 4-wire; Offset Compensation selectable; 1000V / 350V protection on source / sense inputs

Range	Reso-lution	Accuracy (90 day rdg + rng)	Accuracy (1 year rdg + rng)	Test Current
100.0000Ω	100μΩ	0.0080% + 0.0006%	0.0100% + 0.0006%	1mA
1.000000kΩ	1.0mΩ	0.0080% + 0.0006%	0.0100% + 0.0006%	1mA
10.00000kΩ	10mΩ	0.0080% + 0.0006%	0.0100% + 0.0006%	100μA
100.0000kΩ	100mΩ	0.0080% + 0.0010%	0.0100% + 0.0010%	10μA
1.000000MΩ	1.0Ω	0.0080% + 0.0010%	0.0100% + 0.0010%	10μA
10.00000MΩ	10Ω	0.0200% + 0.0010%	0.0400% + 0.0010%	0.7μA
100.0000MΩ	100Ω	0.2000% + 0.0030%	0.1500% + 0.0030%	0.7μA

RTD

D100, F100, PT385, PT3916, or user type; plus probe error

Range	Resolution	Accuracy (1 year)
-200 to +600°C	0.001°C	±0.06°C

THERMISTOR

2.2kΩ, 5kΩ, and 10kΩ; plus sensor error

Range	Resolution	Accuracy (1 year)
-200 to +600°C	0.001°C	±0.08°C

DC CURRENT

250V, 3A fused inputs; Built-in shunt resistors

Range	Reso-lution	Accuracy (90 day rdg + rng)	Accuracy (1 year rdg + rng)	Input Resistance
20.00000mA	10nA	0.03% + 0.004%	0.05% + 0.004%	<0.2V
100.0000mA	100nA	0.03% + 0.040%	0.05% + 0.040%	<0.05V
1.000000A	1μA	0.05% + 0.004%	0.06% + 0.004%	<0.3V
3.000000A	10μA	0.11% + 0.004%	0.12% + 0.004%	<1.0V

AC VOLTAGE

True RMS; 5:1 max Crest Factor

Range	Resolution	Frequency Range	Accuracy (1 year rdg + rng)
100mV to 750V	0.1μV to 1mV	3Hz – 10Hz	0.35% + 0.03%
		10Hz – 20kHz	0.06% + 0.03%
		20kHz – 50kHz	0.12% + 0.05%
		50kHz – 100kHz	0.6% + 0.08%
		100kHz – 300kHz	4.0% + 0.5%

FREQUENCY and PERIOD

Selectable Gate Times of 10msec, 100msec, 1sec

Range	Frequency Range	Period Range	Accuracy (1 year rdg + rng)
100mV to 750V	3Hz to 500kHz	333msec to 2μsec	0.01% + 0.333ppm (1.0 sec)
			0.01% + 0.3.33ppm (0.1 sec)
			0.01% + 0.**33.3ppm (0**.01 sec)

AC CURRENT

True RMS; 5:1 Crest Factor

Range	Resolution	Frequency Range	Accuracy (1 year rdg + rng)
1A	1μA	10Hz – 5kHz	0.35% + 0.06%
3A	10μA	10Hz – 5kHz	0.15% + 0.06%

DC READING RATES

Function	Digits	Readings/sec	NPLC
DCV, DCI,	6.5	5	10
2W Ohms	6.5	50	1
	5.5	250	0.1
	4.5	2000	0.01
4W Ohms, RTD	6.5	2.5	10
Thermistor,	6.5	25	1
Thermocouple	5.5	125	0.1
	4.5	250	0.01

DC READING SPEED VS. NOISE REJECTION

NPLC	Digits	Filter	NMRR	CMRR	RMS Noise (10V range)
10	6.5	50	110dB	140dB	<1.2μV
1	6.5	Off	90dB	140dB	<4.0μV
0.1	5.5	Off	–	80dB	<22μV
0.01	4.5	Off	–	80dB	<150μV

SCANNING RATE, INTO AND OUT OF MEMORY TO GPIB

	Channels/s
7703 scanning DCV	185/s
7703 scanning DCV with limits or timestamp on	150/s
7703 scanning DCV alternating 2W	60/s
7702 scanning DCV	60/s
7700, 7706, and 7708 scanning temperature (T/C)	50/s

SYSTEM FEATURES

Scanning Channels	Up to 80 differential
Trigger Source	External digital input, front panel keypad, channel monitor, interval timer, GPIB/RS-232, Trigger Link, immediate
Scan Count	1 to 55,000 or continuous
Scan Interval	0 to 99 hours; 1msec step size
Channel Delay	0 to 9999999sec per channel; 1msec step size
Configuration	Per channel for measurement setups, math, and limits
Power Fail Recovery	Resume scanning sequence; configuration and stored data are preserved
Power up Memory	4 user configurations with labels
Real Time Clock	Included; use to timestamp readings
Data Storage	Non-volatile 55,000 reading buffer with timestamp; continuous fill; query while filling; min/max/avg/std dev
Alarm Limits	2 HI and 2 LO limits per channel; selectable polarity
Digital Inputs	2 TTL level – external trigger plus interlock
Digital Outputs	4 TTL level – selectable polarity; HI/LO limit configurable
Master Alarm	1 TTL level output toggles when any HI/LO limit is exceeded
Front Panel Lock	Software enabled
Communication	IEEE-488.2, RS-232
Per-channel Math	mΞ+b, %
Multi-channel Math	Ratio, Average
Resolution	$6\frac{1}{2}$-digit with 20% overrange; 28-bit readings available over IEEE-488
Software	TestPoint-based start-up applications; LabVIEW, TestPoint, LabWindows/CVI, Visual Basic, C/C++ driver

GENERAL INFORMATION

Power Supply	100V / 120V / 220V / 240V / ±10%
Line Frequency	45Hz to 66Hz; 360Hz to 400Hz
Operating Environment	0°C to 50°C
Size	89mm H x 213mm W x 370mm D
Warranty	3 years on mainframe, 1 year on Measurement & Control Modules
Safety	UL-3111-1, IEC 1919-1, CSA
EMC	CE mark, FCC Class A

BEST-IN-CLASS MEASUREMENT PERFORMANCE

* Visit www.keithley.com for detailed specifications.

High channel count measurement and control solutions

While the **Model 2700** offers the capacity needed to handle applications with up to 80 channels, many applications require hundreds of switch/control channels. For these cases, the five-slot, 200-channel **Model 2750** Multimeter/Switch System is often the perfect size. Built on the same measurement platform, the Model 2700 and Model 2750 share many of the same capabilities and programming commands. The Model 2750 also offers low-ohms measurement capabilities with 1$\mu\Omega$ sensitivity. All the switch/control modules and software work in both mainframes. This high compatibility also makes it easy to migrate applications from the Model 2700 to the Model 2750 as new test needs emerge or the number of test points grows.

Register for a free online interactive demo

Keithley's engineering experts offer free online demonstrations of the Model 2700 hardware and software. All it takes to participate is an Internet connection and a telephone to watch the demo and communicate with the instructor. Call us or contact us via our website to register for a session.

Request more technical information on the Model 2700

Detailed information on the Model 2700 is free for the asking, including a technical data book, which includes detailed specifications and application examples that can help you choose the most appropriate modules and accessories. A brochure on software for the Model 2700 and 2750 is also available. Request your copies by calling 1-888-KEITHLEY (534-8453) or contacting us at **www.keithley.com**.

Service you can depend on

When you need help, contact us at www.keithley.com or call us at **1-888-KEITHLEY (534-8453)**. Whatever your application is, Keithley's appplication engineers are ready to help you meet its challenges, before and after the sale. You can rely on us to suggest the most effective system configurations and to provide prompt, reliable applications support once your system is set up.

The next time you're faced with a challenging application, give us a call. We'll offer you a cost-effective solution that will help you improve your product quality, throughput, and yield.

FREE reference handbooks

*To request your free copy of the first edition of Keithley's Data Acquisition and Control Handbook or the fourth edition of our Switching Handbook, contact us at **1-888-KEITHLEY** (534-8453) or on the web at www.keithley.com.*

KEITHLEY

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Technical Data

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Integra Series Multimeter/Switch Systems

Introduction

The Integra Series of 6½-digit Multimeter/Switch systems blends Keithley's high performance DMM technology, switching expertise, and data acquisition knowledge into compact, affordable, easy-to-use packages. This technical data booklet provides a comprehensive overview of the systems and includes detailed specifications.

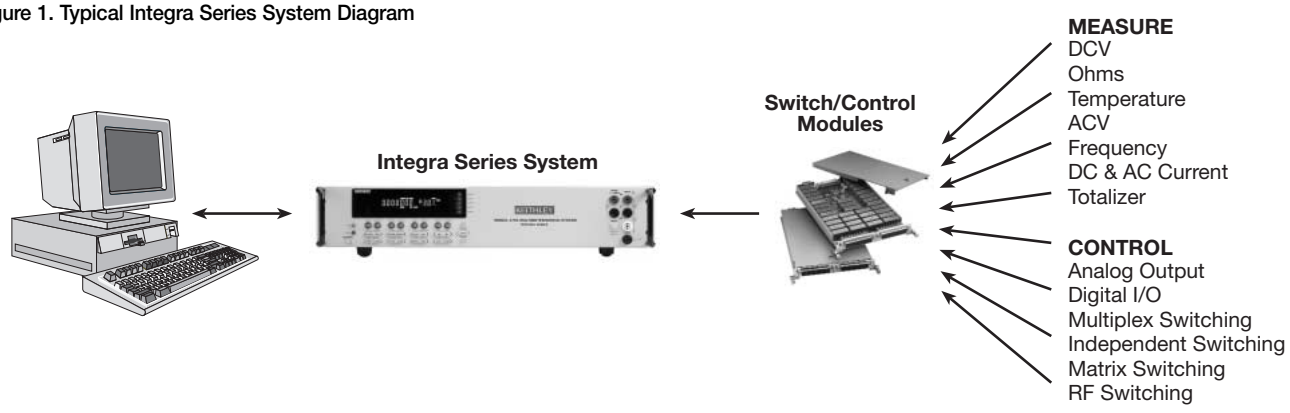
There are three Integra systems: the Model 2700, 2701, and 2750. Each consists of a mainframe and a growing line of plug-in switch/control modules. The Model 2700 and 2701 each include two slots for the plug-in modules; the Model 2750 has five slots. Each slot can support a series of multiplexer, matrix, or control modules, and all the modules in a system operate simultaneously. Input modules can be mixed or matched to provide a broad range of measurement, acquisition, and control capabilities.

While the core functionality and programming of all Integra Series systems are identical, each mainframe has unique capabilities. For example, the Model 2701 is the only system to provide a 10/100BaseTX Ethernet interface, and the Model 2750 provides extended low ohms measurement capability.

Setting up an Integra system is simple and straightforward. When a plug-in module is inserted into a slot, it is ready to be used immediately. Settings can be configured from the front panel of the system or via the computer controller (over GPIB, RS-232, or Ethernet). Also, each channel can be configured independently.

If you have any questions after reviewing this information, please contact your local Keithley representative or call one of our Application Engineers at 1-800-552-1115 (U.S. only). Check Keithley's website, www.keithley.com, for the names and numbers of our representatives around the world.

Figure 1. Typical Integra Series System Diagram



Quick Comparison of Integra Systems

	Communication Bus	No. of Slots	Max. No. of Channels or Crosspoints	Battery-Backed Memory Buffer	Maximum Measurement Speed (readings/second on one channel)	Maximum Scanning Rate (channels/second)	Other
Model 2701	Ethernet, RS-232	2	80 channels or 96 crosspoints	450,000 readings	3500	500	Hardwired Ethernet interface good to 100m from computer or network hub. Wireless Ethernet good for miles.
Model 2700	GPIB, RS-232	2	80 channels or 96 crosspoints	55,000 readings	2000	180	
Model 2750	GPIB, RS-232	5	200 channels or 240 crosspoints	110,000 readings	2500	230	Low ohms capabilities, 1μΩ sensitivity

Integra Series Multimeter/Switch Systems

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Integra Series Multimeter/Switch Systems

Model 2700

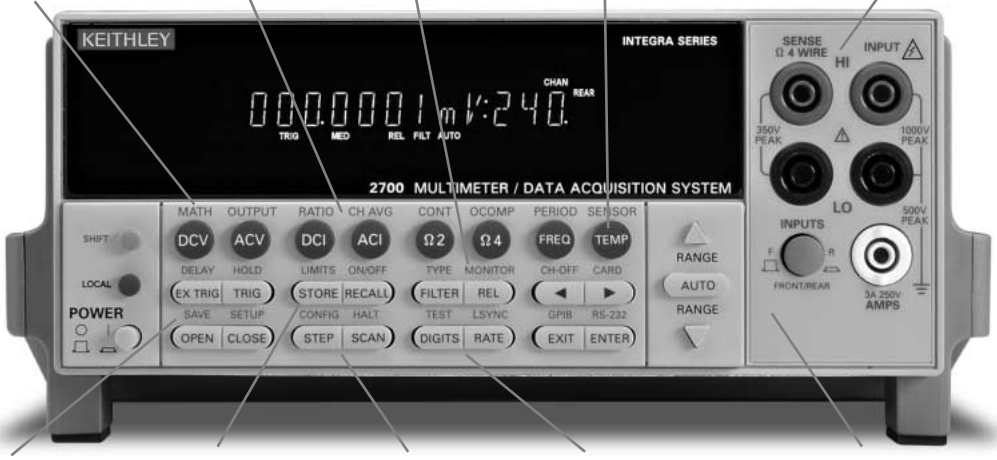
Use mX+b or % scaling to convert sensor/transducer outputs directly into engineering units.

Measure the ratio or average of two input channels.

View a channel of interest without interrupting a scan by using the Channel Monitor feature.

Built-in linearization for thermocouples, RTDs, and thermistors.

Front panel input jacks simplify manual probing, troubleshooting, and calibration. Built-in signal conditioning with 1000V isolation simplifies system configuration and ensures good measurements.



Initialize the system with one of four fully programmable set-up conditions. System configuration is stored in non-volatile memory.

Non-volatile memory allows time-stamped storage of 55k readings.

Manually step through channels or scan automatically. Configure each channel independently.

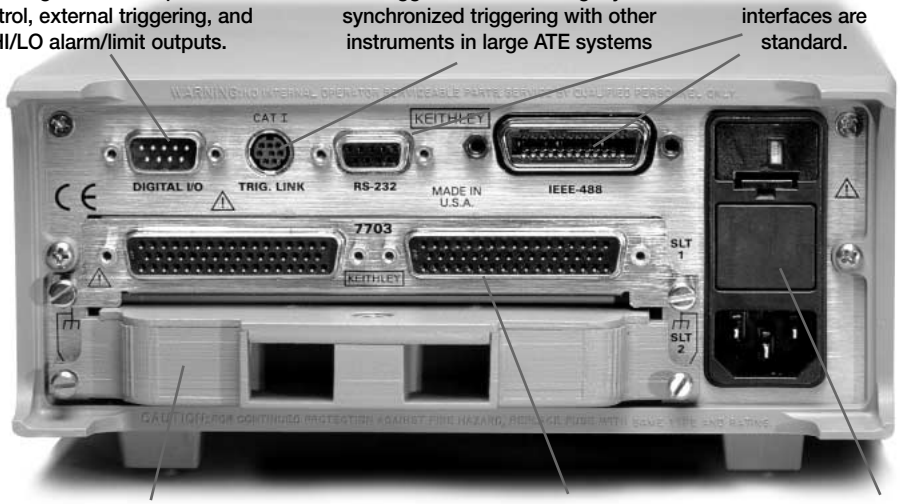
Set the number of digits to be displayed as well as the reading rate.

Familiar DMM-like front panel scheme makes it easier to use on bench or rack. Select or change functions with the simple push of a button.

Built-in digital I/O lines provide for control, external triggering, and HI/LO alarm/limit outputs.

Trigger Link enables tightly synchronized triggering with other instruments in large ATE systems

GPIB and RS-232 interfaces are standard.



A variety of measurement and control modules let you mix, match, and change input signals or control lines any time you like. Install up to two modules at a time to create up to an 80-channel “mini-ATE” system.

Rugged 50-pin D-sub connectors ensure dependability and quick setup/teardown in production test racks.

Built-in noise rejection circuitry ensures stable, predictable measurements.

Integra Series Multimeter/Switch Systems

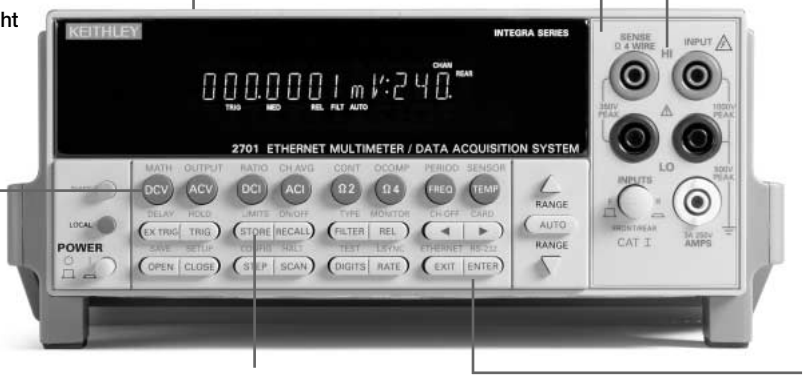
Model 2701

If there's a power failure, valuable data is protected with the battery-backed non-volatile memory and scans can automatically be resumed right where they stopped when power returns.

Built-in signal conditioning and statistical analysis is configurable per channel for maximum flexibility.

Open lead detection protects against false readings due to lead disconnections.

Front panel input jacks simplify manual probing, troubleshooting, and calibration. Includes 1000V protection in case of accidental overload.



Large memory buffer (450,000 readings) for storing data without tying up the network.

Its familiar DMM-like front panel scheme makes the Model 2701 easy to use on the bench or in the rack. Select or change functions with the press of a button.

Fast and convenient 10/100BaseTX Ethernet with TCP/IP protocol.

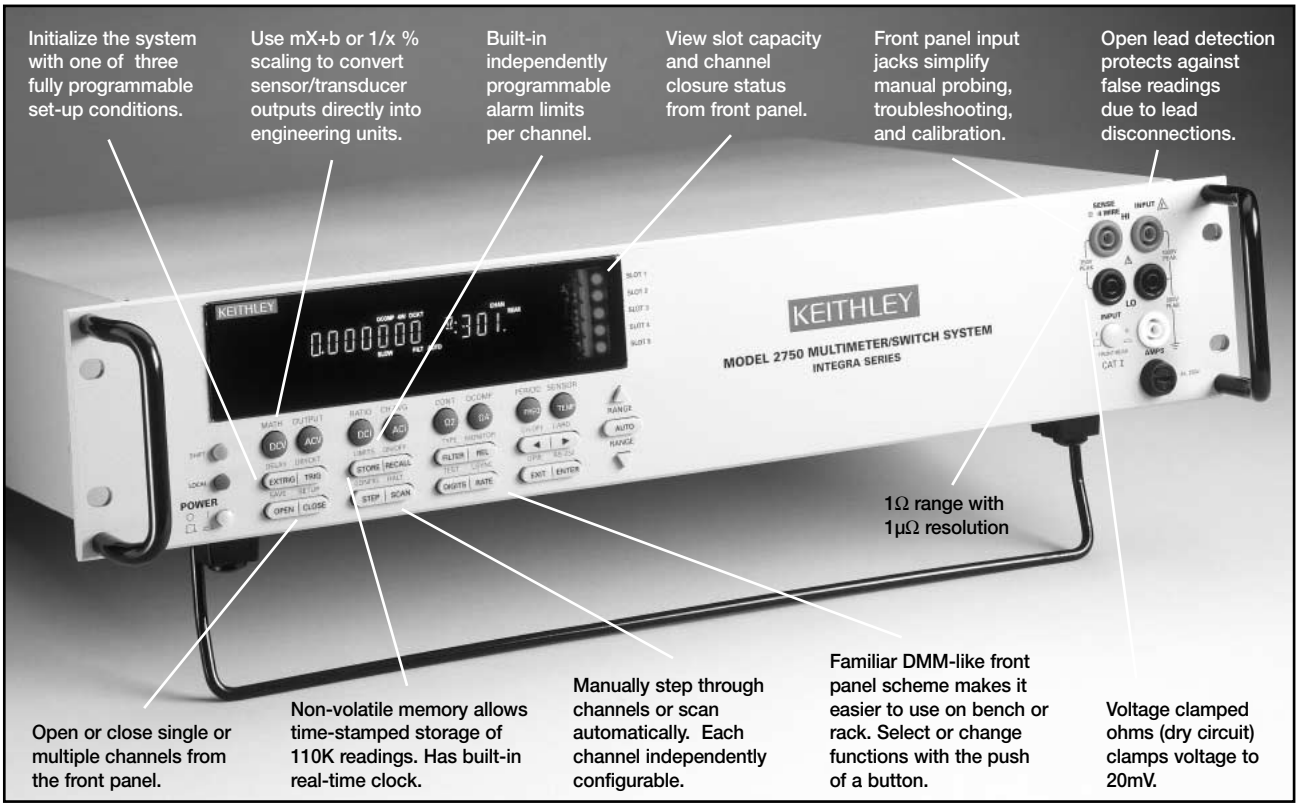
Immediate alarm notification independent of the PC provided by built-in open-collector digital I/O lines for control, external triggering, and HI/LO alarm/limit outputs.

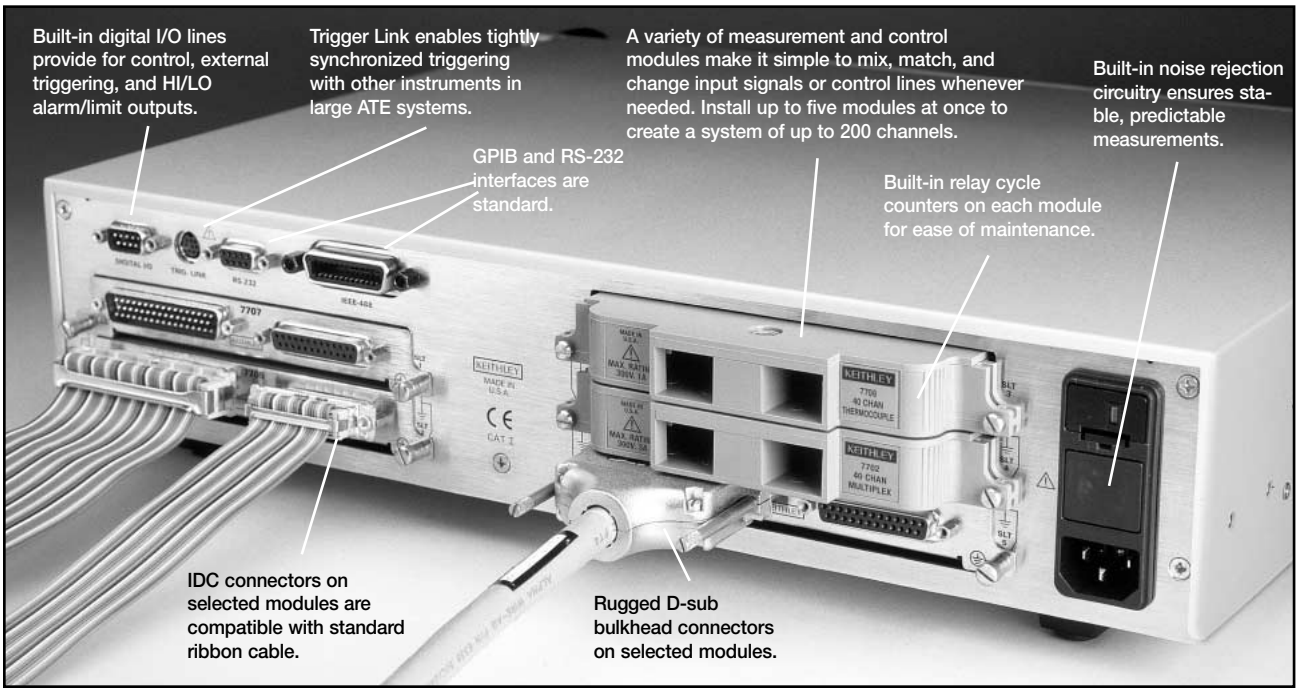
A variety of measurement and control modules makes it simple to mix, match, and change input signals or control lines as needed. Get up to 80 differential channels and up to 500 channels per second scanning rate.

Built-in relay cycle counters on each module for ease of maintenance.

Integra Series Multimeter/Switch Systems

Model 2750





Measurement Ranges for the Integra Series Systems

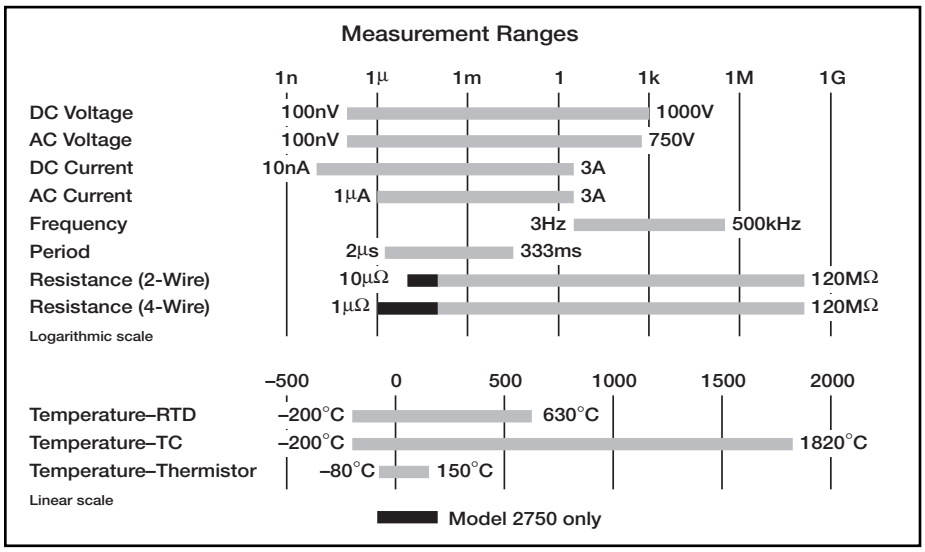


Figure 2. Measurement Ranges

Switch/Control Module Capabilities

The flexibility to mix and match switch/control modules in a single mainframe simplifies configuring Integra Series-based systems for a wide range of applications. Each module offers a different combination of capabilities, such as number of channels, speed, etc. Before selecting a module, it is critical to analyze the needs of the application carefully and consider future requirements for expansion.

Module Capabilities Overview

	7700	7701	7702	7703	7705	7706	7707	7708	7709	7710	7711	7712
DC Volts	✓	✓	✓	✓		✓	✓	✓	✓	✓		
DC Current	✓		✓									
Temperature												
T/C w/Automatic CJC	✓					✓		✓		✓		
T/C w/External CJC	✓	✓	✓	✓		✓	✓	✓	✓	✓		
RTD	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Thermistor	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Resistance (2- or 4-wire)	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Continuity	✓	✓	✓	✓		✓	✓	✓	✓	✓		
AC Volts	✓	✓	✓	✓		✓	✓	✓	✓	✓		
AC Current	✓		✓									
Frequency	✓	✓	✓	✓		✓	✓	✓	✓	✓		
Event Counter/Totalizer						✓						
Signal Routing/Control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Digital Input							✓					
Digital Output						✓	✓					
Analog Output						✓						
RF Performance											✓	✓

Integra Series Multimeter/Switch Systems

Module Selector Guide

This selector guide may prove helpful in identifying the best module for a specific application. Install up to five modules at a time in the Model 2750 mainframe or two modules in the Model 2700 or 2701 mainframe.

Module	# Analog Inputs	Configuration		Type of Connector	Max. Voltage	Max. Switched Current	Bandwidth	Contact Life	Switch Speed	Other
7700	20	Multiplexer w/CJC	1×20 or two 1×10	Screw terminals	300 V	1	50 MHz	10^8	3 ms	Maximum power = 125VA. 2 current measure channels.
7701	32	Multiplexer	1×32 or two 1×16	D-sub	150 V	1 A	2 MHz	10^8	3 ms	Maximum power = 125VA.
7702	40	Multiplexer	1×40 or two 1×20	Screw terminals	300 V	1 A	2 MHz	10^8	3 ms	Maximum power = 125VA. 2 current measure channels.
7703	32	Multiplexer	1×32 or two 1×16	D-sub	300 V	500 mA	2 MHz	10^8	1 ms	Reed relays.
7705	40	Independent SPST	N/A	D-sub	300 V	2A	10 MHz	10^8	3 ms	Maximum power = 125VA.
7706	20	Multiplexer w/CJC	1×20 or two 1×10	Screw terminals	300 V	1 A	2 MHz	10^8	3 ms	2 analog outputs. 16 digital outputs. Maximum power = 125VA.
7707	10	Multiplexer/ Digital I/O	1×10 or two 1×5	D-sub	300 V	1 A	2 MHz	10^8	3 ms	32 digital I/O. Maximum power = 125VA.
7708	40	Multiplexer w/CJC	1×40 or two 1×20	Screw terminals	300 V	1 A	2 MHz	10^8	3 ms	Maximum power = 125VA.
7709	48	Matrix	6×8	D-sub	300 V	1 A	2 MHz	10^8	3 ms	Connects to internal DMM. Daisy chain multiple cards for up to a 6×40 matrix. Maximum power = 125VA.
7710	20	Multiplexer w/CJC	1×20 or two 1×10	Removable screw terminals	60 V	0.1 A	2 MHz	10^{10}	0.5 ms	Solid state relays, 60V max. 500 channels/second scan rate.
7711	8	Multiplexer	Dual 1×4	SMA	60 V	0.5 A	2 GHz	10^6	10 ms	Insertion loss <1.0dB @ 1GHz. VSWR <1.2 @ 1GHz.
7712	8	Multiplexer	Dual 1×4	SMA	42 V	0.5 A	3.5 GHz	10^6	10 ms	Insertion loss <1.1dB @ 2.4GHz.

* Can be disconnected from internal DMM for routing external signals

Connector Guide for Keithley Integra Series Modules

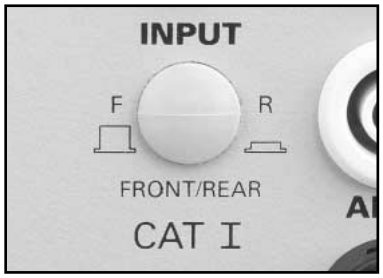
Module	Connector Type	Supplied Accessories	Available Accessories
7700	Oversized Screw Terminal	Strain Relief	7401 TC wire
7701	50-pin female D-sub & 25-pin female D-sub	7789 connector kit	7790 connector kit, 7705-MTC-2 & 7707-MTC-2 cables
7702	Oversized Screw Terminal	Strain Relief	—
7703	Two 50-pin female D-sub	7788 connector kit	7705-MTC-2 cable
7705	Two 50-pin female D-sub	7788 connector kit	7705-MTC-2 cable
7706	Screw Terminal	Strain Relief	7401 TC wire
7707	50-pin male D-sub & 25-pin female D-sub	7790 connector kit	7789 connector kit, 7705-MTC-2 & 7707-MTC-2 cables
7708	Oversized Screw Terminal	Strain Relief	7401 TC wire kit
7709	50-pin female D-sub & 25-pin female D-sub	7790 connector kit	7789 connector kit, 7705-MTC-2 & 7707-MTC-2 cables
7710	Quick Disconnect Screw Terminal	Strain Relief	7401 TC wire kit
7711	SMA	—	7711-BNC-SMA & 7712-SMA-N adapters, 7712-SMA-1 & S46-SMA-0.5,-1 SMA cables, 7051-2,-5,-10 BNC cables
7712	SMA	—	7712-SMA-N adapter, 7712-SMA-1 & S46-SMA-0.5,-1 SMA cables

Channel Configuration Capabilities

- ***Measurement functions:*** An Integra system can measure many different parameters: DC voltage, DC current, AC voltage, AC current, 2-wire Ω, 4-wire Ω, voltage clamped Ω (2750 only), temperature (using thermocouples, RTDs, and thermistors), frequency, period, and continuity.
- ***Math functions:*** A variety of math functions are available at the push of a button, including channel average and ratio, mX+b scaling, min, max, average and standard deviation. All are available on a per-channel basis.
- ***Measurement setup:*** Each channel can be configured independently for making measurements. Selectable channel parameters include:

- Speed
- Range
- Resolution
- Number of power line cycles (NPLC)
- Math functions
- Ratio calculation
- Individual "m" and "b" values in mX+b format
- Channel averaging
- Hi-Low limits
- Resistance measurement method (2- or 4-wire)
- Offset compensation
- CJC type
- Thermistor type
- Thermocouple type
- RTD type
- Voltage clamped ohms (Dry Circuit, 2750 only)

- ***DUT-to-modules connections:*** It is easy to connect the device under test to the switch/control modules. The 7703 and 7705 modules use dual 50-pin "D-sub" input connectors for secure, quick connections. The 7701, 7707, and 7709 modules use "D-sub" connectors that are compatible with off-the-shelf standard ribbon cable. These connectors are especially convenient for rapid system setup. When greater connection flexibility is required, the 7700, 7702, and 7708 modules provide oversize screw terminal connectors that simplify setup by eliminating the need to handle small connectors. The standard wires used are 20AWG. Model 7710 uses removable terminal blocks to provide the simplicity of screw terminal connections with the speed of mass terminated cables. The 7711 and 7712 RF modules use industry standard SMA connectors.
- ***Mainframe-to-modules connection:*** Secure screws connect the modules to the mainframe. At power-up, the mainframe detects any attached modules automatically, which minimizes set-up time. All signals are routed internally from module to mainframe.
- ***Front/rear switch:*** The front inputs are used for manual probing, troubleshooting, and calibration. A switch on the front panel makes it easy to shift between the front and rear inputs. This eases setting up the equipment and speeds verifying proper setup and connections prior to automating the measurement.



Scanning Capabilities

- ***Relay Closure Counts:*** Relay closure counts are logged every time a channel is closed. These counts are permanently written to the EEPROM on the module at a user-settable time interval (factory default of 10 minutes) or whenever the counts are queried. Valid intervals (set in integer number of minutes) are between 1 and 1440 minutes (24 hours). Relay closures are counted when a relay cycles from open to closed state.
- ***Open Sense Lead Indication.*** The system can alert the user if there is a sense lead disconnection on any channel. In this case, the front panel display will show "OVERFLOW." Therefore, the system does not need other equipment or calibration to inspect the broken connection or failed relay on the scanner card. In addition, the system will protect against erroneously passed conditions.
- ***Scan count:*** An Integra Series system can be programmed to run a given number of scans (up to 450,000) automatically and to record readings into the internal memory buffer. The instrument also allows programming the trigger source used to initiate each scan. (Refer to page 11 for more information on triggering.)

Integra Series Multimeter/Switch Systems

- ***Scan interval:*** The user can set the interval after which each succeeding scan will begin. Scan intervals can be set anywhere from 0 to 99 hours in increments of 1ms.
- ***Scan sequence/omitting channels:*** In addition to scanning in numerical sequence, the system can be programmed to skip any channels that are not required for a particular test. This avoids recording irrelevant data and speeds the data acquisition process. This makes scanning both faster and more flexible.
- ***Ratio (DCV only):*** The instrument can calculate and display the ratio of measurements of paired channels. Ratios can only be determined for specific channel pairs, depending upon the input module used. For example, channel pairs on the Model 7702 include Channels 1 and 21, Channels 2 and 22, etc. Hi/Lo limits are fully supported.
- ***Channel average (DCV and thermocouple only):*** The instrument can calculate and display the average of two channel measurements. As with ratio calculations, only paired channels can be averaged. Hi/Lo limits are fully supported.

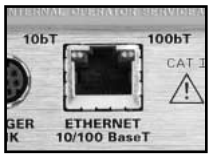
Choice of Communication Interfaces

RS-232

All the Integra Series mainframes include RS-232 ports for computer control. RS-232 is a low cost point-to-point interface, allowing a computer to interface with a one mainframe per port at distances up to several hundred meters, depending on the baud rate setting. Slow baud rates can be run long distances, while the fastest baud rate settings are limited to several meters maximum distance. The Model 2700 and 2750 can receive commands and transfer data via RS-232 at various baud rates up to 19.2kBaud. The Model 2701 offers data rates up to 115.2kBaud with hardware handshaking.

GPIB

The Model 2700 and 2750 both offer a GPIB port. GPIB provides higher speed data transfers (up to 1Mbyte/sec.) than RS-232, and allows up to 32 devices to addressed from a single GPIB controller card in a host computer. The maximum cabling distance for the GPIB interface is 2 meters between each GPIB connection. Up to 20 total meters of cable may be connected to a single controller card.



Ethernet

The Model 2701 offers a 10/100 BaseT Ethernet connection for high speed and long distance communication between a computer and a virtually infinite number of instruments. Any PC with an Ethernet port can connect to a single Model 2701 in a point-to-point configuration, to multiple 2701s through a hub, or to multiple 2701s distributed on a network. See the system configuration section on page 35 for more details on Ethernet connections.

The Model 2701 Ethernet port uses the industry-standard TCP/IP socket interface. This provides data rates up 100Mbits/sec. and allows the instrument to be located up to 100 meters from the nearest computer or network hub in hardwired systems and miles in wireless Ethernet systems. The maximum distances between a control PC and the instruments are limited only by the size of the network. The instrument also provides a built-in diagnostic web page for easy remote access to the 2701. Entering the instrument's IP address in the URL line of Microsoft® Internet Explorer® will allow communication with and control of the 2701. This Web page allows users to read and set network parameters, such as IP address, subnet mask, gateway, MAC address, and calibration dates, and to send commands to and query data from the 2701.

Triggering and I/O Capabilities

Trigger sources

Any of the following sources can be used for triggering a reading or scan sequence:

A. ***Immediate:*** An Integra Series system self-triggers automatically. This default method is the simplest way to take a measurement on a single channel.

B. An ***external trigger*** is received via the Trigger Link connector. Triggering through Trigger Link is very precise (<0.5ms trigger latency) and provides tight timing control for synchronization in larger systems. Therefore, measurements can be taken at a precise time with very little uncertainty. This capability can be valuable when optimizing coordination with other system instruments, such as the Model 2400 SourceMeter® instrument in larger rack & stack applications.

C. A ***bus trigger*** is received (GET or *TRG) on GPIB or *TRG on RS-232 and Ethernet.

D. ***Manual:*** Use of front panel TRIG key.

E. ***Analog trigger:*** A display reading on a particular channel can be programmed as an analog trigger. A scan sequence is started whenever such a reading is reached [programmed for either a greater than (>) or less than (<) condition as a trigger]. In other words, this feature can be used to initiate a scan sequence based on some external factor, such as a temperature rising above a pre-set limit. After scanning all the configured channels on the instrument, the instrument then returns to the channel that acted as the analog trigger, and checks for the reading to be in conditional limits. Depending on the limits and current reading, the instrument decides whether to start the next scan. Only the data of interest are acquired, eliminating the need to spend hours searching through reams of normal readings to find anomalous data.

F. ***Digital trigger:*** Two digital inputs (TTL-level) are standard on each mainframe—one to serve as a trigger input and one to serve as a hardware interlock. The digital trigger is logical "and"-ed with the interlock. The interlock is default true. Therefore, the digital trigger input would be recognized for triggering only when the digital trigger and the interlock are both true. Thus, the interlock provides the user with a controlling mechanism for recognizing the digital trigger if necessary (see ***Figure 3***).

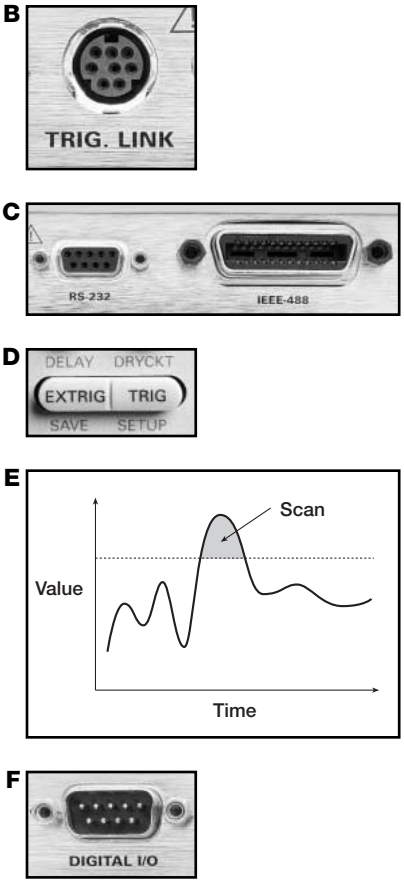
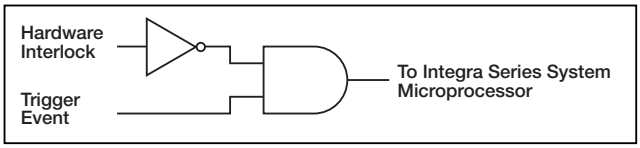


Figure 3



Alarm Limits/Digital Outputs

The digital output lines can trigger external alarms without the need for a PC connection. The instrument can be programmed to provide alarms when any pre-set limits are breached. Limits can be applied to all measurement functions except continuity, which has its own alarm beeper. The limit test is performed after "mX + b" and math operations.

Limit types: Each channel has four independently programmable limits, each of which can be assigned a value. These are:

1. Limit1 High (for example, 1% higher than the expected reading)
2. Limit1 Low (for example, 1% less than the expected reading)
3. Limit2 High (for example, 5% higher than the expected reading)
4. Limit2 Low (for example, 5% less than the expected reading)

The outputs can be positive or negative true, pulse, or fixed level. Pulse widths are programmable.

Master Limit: In addition to these limit alarms, a master limit is provided. It is logically "or"-ed with the four limits and is active every time any of the other limits are breached.

Each of the alarm limits and the master alarm is mapped to a specific output pin on the 9-pin male connector that handles the output of that alarm limit.

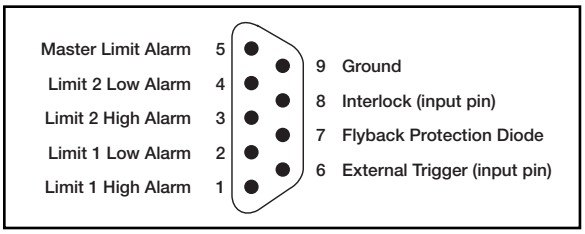


Figure 4. Structure of the 9-Pin Male Digital I/O Connector

Electrical Capabilities:

- 250mA sink (output).
- TTL level outputs (no external supply is needed).
- Open collector output up to 33V with external supply.
- Ability to trigger or start a scan by connecting to one of the digital input lines.

On-board Data Storage

Buffer: There are non-volatile "read and transmit" memory buffers (in other words, the buffer can be emptied while it is being filled) in each system. The buffer can be configured in "wrap around" mode for recording readings continuously for long periods. There is no need to stop taking data, reset the instrument, or change memory cards. The wrap around memory can be configured to issue a Service Request (SRQ) at predetermined points in the scan. An SRQ can be issued when the buffer is one-quarter full, one-half full, three-quarters full, or completely full. The instrument can be commanded to download the readings without interfering with the current acquisition; therefore, data acquisition and retrieval can occur simultaneously. When the buffer is full, the instrument returns to the beginning of the buffer and starts writing in the locations emptied by the previous download.

Timestamp: The readings in the memory can be timestamped to trace the progress of a test. The time can be configured as either:

- Real time: The actual calendar day and time.
- Relative Time: Time is relative to the first reading stored in the buffer.

Saving/Recalling a Setup

All current set-up information for individual channels and the mainframe is battery backed and the measurement data is stored in the non-volatile memory. Therefore, while the instrument is switched off, the configuration for each channel is saved in the memory, then automatically recalled when the product is switched on again. Up to five (four for Model 2700 and three for Model 2750) different sets of setups can be recorded for each channel, so it's unnecessary to set up each channel before a different test.

Power Failure Recovery

All set-up information is battery backed and data is stored in non-volatile RAM, so the system is immune to power failures and can resume scanning where it stopped once power is restored. There is no need to restart interrupted tests from the beginning. The scan resumption feature is user-selectable.

Channel Monitor

The channel monitor feature allows monitoring any specific input channel on the front panel display at any time during a scan. The system can scan across channels very rapidly, so the channel monitor offers a convenient way to view only the channel of interest without interrupting a scan.

Measurement Performance

Each Integra series system is a true 6½-digit (22-bit) instrument designed for high measurement precision. Its high precision enhances measurement repeatability and stability.

Measurement performance is a key advantage of all of Keithley's products. The Integra Series is based on a number of advanced technologies that improve its overall performance dramatically, including:

- Patented A/D converter IC circuitry design to increase the resolution, precision, and speed of measurement.
- Advanced signal conditioning hardware to filter out unwanted noise and provide necessary isolation.
- A unique "servo" front end design (***Figure 6***). While conventional DMMs typically measure and correct for the zero drift of front-end circuitry, these systems' servo front end eliminates zero drift, which also eliminates the wasted measurement time usually required to check zero, further increasing measurement speed.

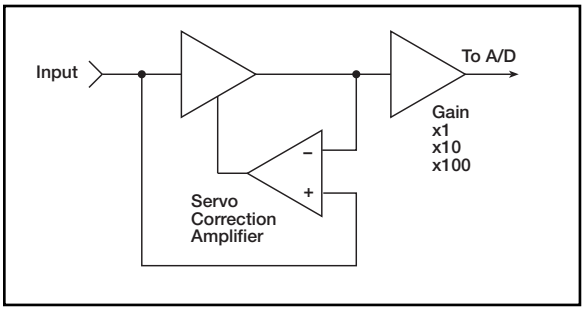


Figure 6.

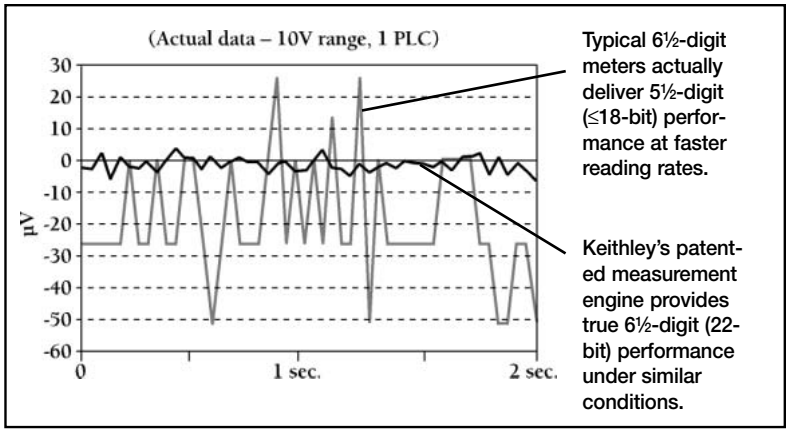


Figure 5. When the measurements matter, Keithley provides up to 10x better performance at equivalent reading rates or up to 10x faster speeds at equivalent measurement performance. Our patented A/D converter and high performance signal conditioning circuitry make this possible.

Specification Conversion Factors

Percent	PPM	Digits	Bits	dB	Portion of 10V
10%	100000	1	3.3	–20	1 V
1%	10000	2	6.6	–40	100 mV
0.1%	1000	3	10	–60	10 mV
0.01%	100	4	13.3	–80	1 mV
0.001%	10	5	16.6	–100	100 µV
0.0001%	1	6	19.9	–120	10 µV
0.00001%	0.1	7	23.3	–140	1 µV
0.000001%	0.01	8	26.6	–160	100 nV
0.0000001%	0.001	9	29.9	–180	10 nV

Integra Series Performance (6½-digit, 22-bit)

Integra Series Multimeter/Switch Systems

Digital Filtering

For each major measurement function, users can employ either averaging or advanced digital filtering to reduce noise and increase the effective resolution.

Averaging Filter

The averaging filter operates over a range of from two to 100 readings. All readings included in the filter range are weighted equally. A step input of any size will ramp up linearly to the final value after obtaining the number of readings specified by the user. The averaging filter may be configured as either a moving averaging or as a repeat filter. Operation over the GPIB bus is often done in "repeat" mode to ensure that all readings are fully filtered. Also, taking filtered measurements in repeat mode requires only one trigger, simplifying programming. Only the repeat filter can be used while scanning.

Advanced Filter

When a DMM is used in bench mode, it's often desirable for it to respond immediately upon connection to a test point, without the slow response associated with an averaging filter. The advanced filter addresses this need by providing a filter reset level. If the measured value deviates significantly from previous values, the filter is reset to the new value, and filtering is restarted. In this way, the user can set the filter reset level just above the maximum noise level anticipated and the multimeter will respond to new values immediately.

NPLC

Selectable power line cycle integration allows the user to specify the number of power line cycles (NPLC) over which to integrate (1, 5, 10, etc.). Use of line cycle integration provides rejection of noise from line cycle interference, the most common source of noisy readings. In general, the longer the integration time chosen, the greater the noise rejection will be. The system can also be set to less than 1 NPLC integration time, as fast as 0.002 NPLC (~33μs at 60Hz) in the Model 2701 and 0.01 NPLC (~167μs at 60Hz) in the Model 2700 and 2750 for faster data measurement (but without power line noise rejection).

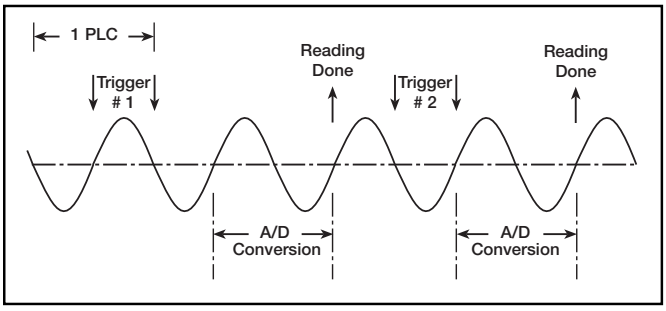


Figure 7

Line Cycle Synchronization

To attain the highest possible line cycle noise rejection, it is important to trigger the reading at the beginning of a power line cycle. The system can be set to start a measurement precisely when the power line signal crosses zero (see ***Figure 7***). This function increases the normal mode noise rejection 30dB, providing an additional ×30 reduction in noise due to line cycle interference.

Autozero

Internal autozeroing is used to maintain the best measurement performance. The advanced firmware design does the required calculation, such as CJC compensation for thermocouple measurements with the 7700, 7706, 7708, and 7710, automatically in the background. This enables the Integra system to provide faster reading rates (competitive products spend half their measurement time validating their own zero). Autozero can be disabled to increase measurement speed, but this may result in greater measurement uncertainty.

Low Ohms Measurement (Model 2750 only)

The Model 2750 can measure low ohms on all of its switch/control modules that have multiplexers or matrix configurations. The four-wire ohms measurement supports low ohms measurements down to the 1Ω range, with micro-ohm resolution. Measurements can be accommodated through ribbon cable or discrete wiring. On four-wire ohms measurements, up to five additional ohms of cable/switch card resistance can be tolerated per cable lead. This allows the use of ribbon cable without overloading the range.

Offset Compensation

For more accurate low resistance measurements, all Integra systems provide the offset compensation mode to eliminate errors from the thermoelectric EMF effects (V_{EMF}). During the measurement cycle, the built-in ohms current source is turned off, then turned on again, and the resulting EMF error is automatically subtracted. This technique is typically used when measuring values less than 100Ω using the four-wire ohms method.

Voltage Limit/Dry Circuit Ohms (Model 2750 only)

The use of dry circuit mode, when selected, limits the open-circuit voltage to 20mV. This allows resistance measurements to be made with low power. When measuring contact and connector resistances, it is important not to puncture oxides and films that may have formed. Standard resistance measurements have open-circuit voltage levels from 5.4V to 12.8V, depending on the selected range.

Dry circuit ohms can be used on the 1Ω, 10Ω, 100Ω, and 1kΩ ranges for the four-wire ohms (Ω4) function. Also, offset compensated ohms (OCOMP) can be used with dry circuit ohms to cancel the effect of thermoelectric EMFs.

Dry circuit ohms should be used for any device that could be damaged by high open-circuit voltage. If not sure, and the slightly degraded accuracy is not a consideration, it is good practice to use dry circuit ohms to measure low resistance.

The accuracy specifications for all dry circuit ohms ranges are with offset compensated ohms and line synchronization enabled.

Temperature Measurements

The Integra systems support three major types of temperature sensors with built-in signal conditioning and linearization: thermocouples, RTDs, and thermistors.

	Thermocouples	RTDs	Thermistors
Temperature Range	–200 ~ 1820°C	–200 ~ 630°C	–80 ~ 150°C
Advantage	• Self-powered • Wide temperature range	• High stability • High accuracy • No CJC required	• Interchangeability • No CJC required • High accuracy over limited temperature range
Cost	Low	High	Medium

The Integra systems provide built-in algorithms for a variety of thermocouples, RTDs, and thermistors. To begin using a sensor, simply hook it up and the system does the rest.

- Thermocouples: Type J, K, N, T, E, R, S, B
- RTDs: D100, F100, PT100, PT385, PT3916, or user type
- Thermistors: 2250Ω, 5kΩ, and 10kΩ

Cold Junction Compensation Methods

Thermocouple measurements always require that the temperature be known at the point where the thermocouple is connected to the instrument. This connection point is known as the "cold junction." The Integra systems support three different methods for including this "cold-junction" temperature in the temperature measurements.

Automatic CJC

The CJC sensors are mounted on the multiplexer module's PC board (7700, 7706, 7708, and 7710). They sense the actual temperature across the module's connector, then compensate all temperature measurements accordingly. The CJC scaling is done automatically when autozero is turned on, so the user does not have to acquire it separately. When autozero is turned off, the instrument is optimized for speed and does not refresh the CJC compensation. This allows the user to obtain faster scan rates for short periods of time while ambient temperature remains stable.

External CJC

A thermistor or RTD is attached to Channel 1 by the end user. This thermistor or RTD is then used to measure the temperature of the point(s) where the thermocouples are connected to the instrument or to copper wires leading to the instrument. The precision of the actual temperature measurement depends on the accuracy of the cold junction reading and how close the sensor is to the actual temperature of the connection.

Simulated CJC

When the "change" in temperature is of interest rather than the absolute temperature value, the user can enter a parameter as a cold junction reference point (for example, 23°C for room temperature). This parameter will be used to adjust the actual temperature measurement for each channel. This simulated temperature must be updated manually if ambient conditions change. This is also the method used when an actual ice bath is used to establish a cold junction of 0°C. The simulated parameter is then set to 0°C or 32°F.

Open Thermocouple Detect

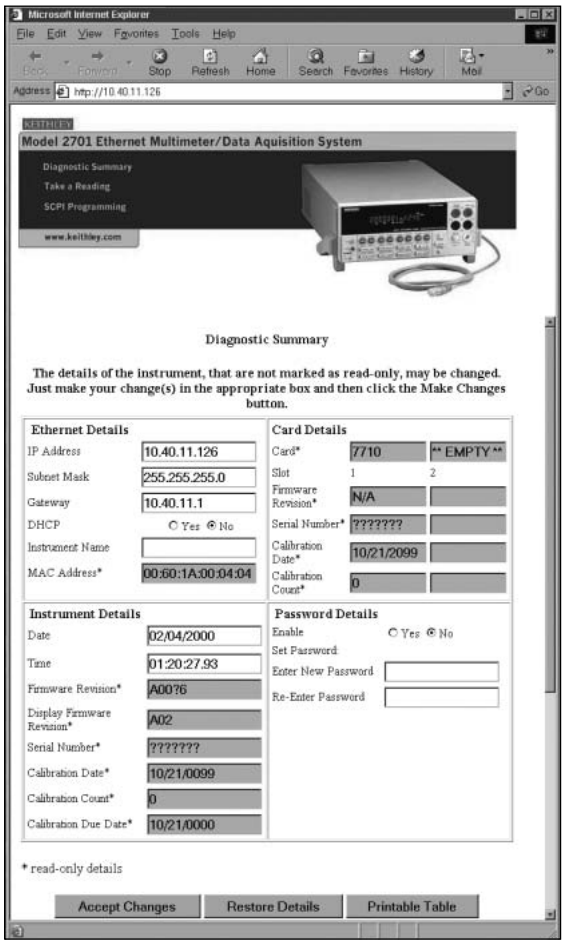
A system can alert the user if any thermocouple becomes broken or otherwise disconnected from the input terminal blocks. When the Open T/C Detect feature is enabled, the system will perform (in the background) a two-wire resistance measurement across each thermocouple input channel. If an open connection is detected, the front panel display will show "OVERFLOW" for that channel.

Calibration

The design of the Integra Series and their calibration procedure were developed to address a variety of critical calibration issues. For example, the systems have front panel input jacks, so there's no need to disassemble the system for periodic recalibrations. There's also no need to buy, stock, and track spare "cal only" modules. The systems are connected to the calibrator through the front panel input jacks. The systems' calibration procedure covers both verification and adjustment and can be performed through either the front panel or any of the remote interfaces. The calibration interval is user-selectable.

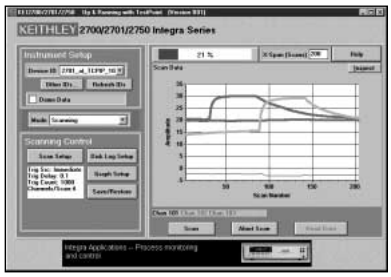
Start-Up Software

Free built-In Web diagnostic tool (2701 only)

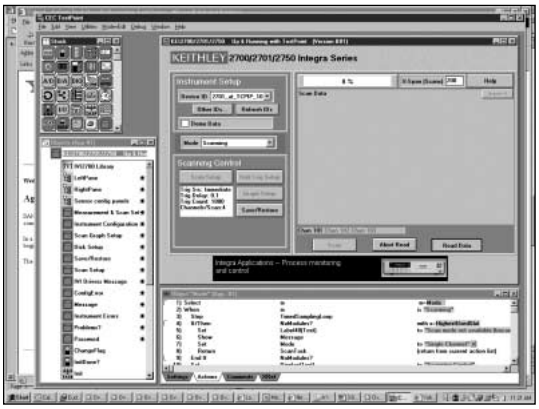


To start communicating with the Integra Series instrument, simply connect the 2701 to a PC Ethernet port using the supplied RJ-45 crossover cable, start Microsoft® Internet Explorer® version 5.0 or later, and type the instrument's IP address into the URL line. The built-in web diagnostic interface allows for easy communication and debugging, without the need to install external software. This interface makes it easy to read and set network parameters such as IP address, subnet mask, gateway, MAC address, calibration dates, and other data stored in the Integra Series instrument. It also takes readings from the instrument and allows the user to send command strings and receive data.

Free customizable start-up software



This free TestPoint runtime offers basic datalogging capabilities that can get a system "up & running" almost immediately. With just a few clicks of the mouse, this software can confirm the system's hardware, wiring, communications, and software drivers are installed and operating correctly. It can also configure instrument functions and perform simple data acquisition tasks. Data from multiple channels can be saved to disk and up to eight channels of data can be graphed automatically. If the application demands greater functionality, this runtime can be modified with the TestPoint application development package.



TestPoint™ Application Development Package

If Keithley's free start-up software doesn't provide a feature needed to support a specific application, the economical TestPoint application development package makes it simple to create a semi-custom solution by modifying the runtime application. By using the start-up runtime as a foundation, TestPoint offers the flexibility needed to build basic systems quickly, without in-depth programming. TestPoint uses object-oriented, drag-and-drop technology to bring both power and simplicity to data acquisition and test and measurement applications. TestWizards and pre-written application templates in a choice of graphical styles make it simple to create a complete application with a few mouse clicks. Additional objects can be modified and added to create custom enhancements.

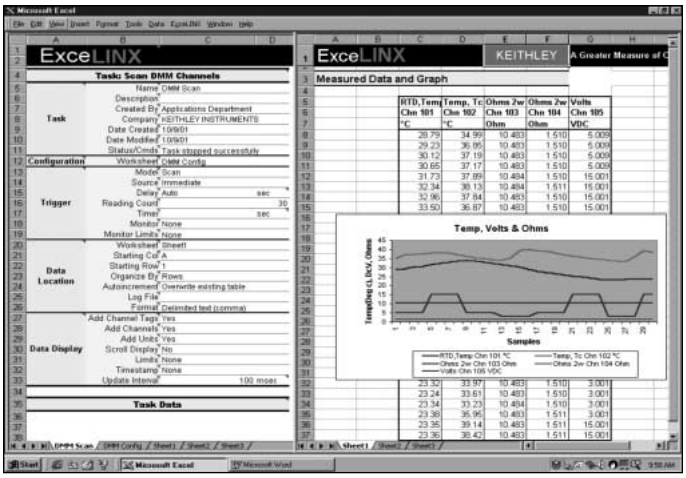
Three optional toolkits make it easy to expand applications:

- Internet toolkit provides Web-based remote measurements and control.
- Database toolkit provides access to popular database packages like Access, SQL, Oracle, and others.
- Statistical process control (SPC) toolkit adds charts, statistics, and analysis capabilities.

Integra Series Multimeter/Switch Systems

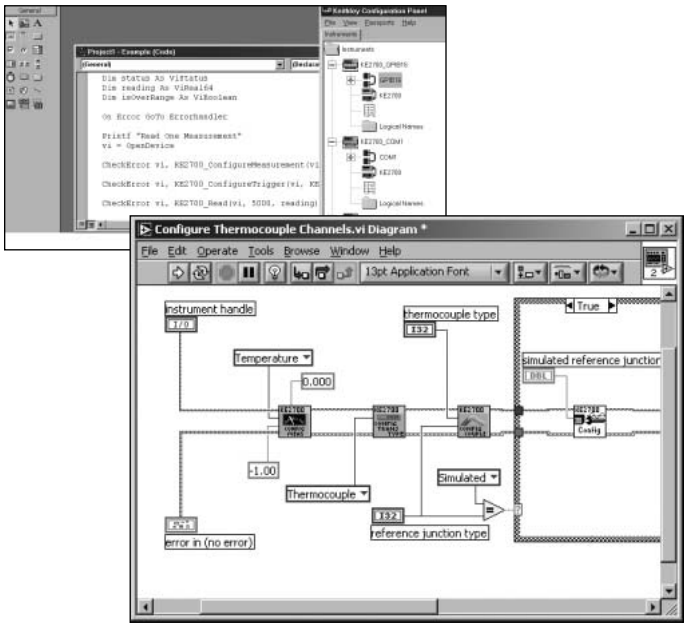
Datalogging/Data Acquisition Software

ExceLINX-1A



For advanced datalogging tasks, this powerful and economical add-in utility for Microsoft® Excel makes it simple to acquire data from the Integra Series instrument directly into Excel, then employ Excel's graphic, charting, and analysis capabilities to turn that data into useful information. No programming is required—a few mouse clicks are all it takes to configure channels, set parameters, configure triggers, and scan lists. ExceLINX-1A can control up to three Integra Series instruments for up to 600 channels of data acquisition. Sold separately.

Custom Application Development with VISA Based IVI Driver



For building custom applications, programmers can take advantage of the VISA based Integra series IVI driver designed for use with software development environments like Visual Basic, Visual C/C++, LabVIEW, LabWindows/CVI, and TestPoint. The VISA (Virtual Instrument Software Architecture) layer of the driver allows the programmer to quickly reconfigure the communication bus between the PC and the instruments without changing a single line of source code. This means that changing GPIB control board vendors or switching the communication bus between GPIB, RS-232, and Ethernet requires no rework of a custom application program. The IVI (Interchangeable Virtual Instrument) layer of the driver provides a simplified command interface that is common to the entire Integra Series product family. The driver also includes a large set of examples for reference during software design.

Integra Series Multimeter/Switch Systems

Specifications are subject to change without notice.

Download the latest specs from **www.keithley.com**.

Integra Series Multimeter/Switch Systems

Mainframes

DC CHARACTERISTICS[1]

CONDITIONS: MED (1 PLC)[2] or 10 PLC or MED (1 PLC) with Digital Filter of 10

FUNCTION	RANGE	RESOLUTION	TEST CURRENT ±5% OR BURDEN VOLTAGE	INPUT RESISTANCE OR OPEN CKT. VOLTAGE[3] 2700/2701	2750	ACCURACY: ±(ppm of reading + ppm of range) (ppm = parts per million) (e.g., 10ppm = 0. 24 Hour[4] 23°C±1°	90 Day 23°C±5°	1 Year 23°C±5°	TEMPERATURE COEFFICIENT 0°–18°C & 28°–50°C
Voltage[11]	100.0000 mV	0.1 µV		>10 GΩ	>10 GΩ	15 + 30	25 + 35	30 + 35	(1 + 5)/°C
	1.000000 V	1.0 µV		>10 GΩ	>10 GΩ	15 + 6	25 + 7	30 + 7	(1 + 1)/°C
	10.00000 V	10 µV		>10 GΩ	>10 GΩ	10 + 4	20 + 5	30 + 5	(1 + 1)/°C
	100.0000 V	100 µV		10 MΩ ± 1%	10 MΩ ± 1%	15 + 6	35 + 9	45 + 9	(5 + 1)/°C
	1000.000 V[5]	1 mV		10 MΩ ± 1%	10 MΩ ± 1%	20 + 6	35 + 9	50 + 9	(5 + 1)/°C
Resistance[6, 8]	1.000000 Ω[24]	1 µΩ	10 mA		5.9 V	80 + 40	80 + 40	100 + 40	(8 + 1)/°C
	10.00000 Ω[24]	10 µΩ	10 mA		5.9 V	20 + 20	80 + 20	100 + 20	(8 + 1)/°C
	100.0000 Ω	100 µΩ	1 mA	6.9 V	12.2 V	20 + 20	80 + 20	100 + 20	(8 + 1)/°C
	1.000000 kΩ	1 mΩ	1 mA	6.9 V	12.2 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	10.00000 kΩ	10 mΩ	100 µA	6.9 V	6.8 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	100.0000 kΩ	100 mΩ	10 µA	12.8 V	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	1.000000 MΩ[23]	1.0 Ω	10 µA	12.8 V	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	10.00000 MΩ[7, 23]	10 Ω	0.7 µA // 10M Ω	7.0 V	7.0 V	150 + 6	200 + 10	400 + 10	(70 + 1)/°C
	100.0000 MΩ[7, 23]	100 Ω	0.7 µA // 10M Ω	7.0 V	7.0 V	800 + 30	2000 + 30	2000 + 30	(385 + 1)/°C
Dry Circuit Resistance[21, 24]	1.000000 Ω	1 µΩ	10 mA		20 mV	80 + 40	80 + 40	100 + 40	(8 + 1)/°C
	10.00000 Ω	10 µΩ	1 mA		20 mV	25 + 40	80 + 40	100 + 40	(8 + 1)/°C
	100.0000 Ω	100 µΩ	100 µA		20 mV	25 + 40	90 + 40	140 + 40	(8 + 1)/°C
	1.000000 kΩ	1 mΩ	10 µA		20 mV	25 + 90	180 + 90	400 + 90	(8 + 1)/°C
Continuity (2W)	1.000 kΩ	100 mΩ	1 mA	6.9 V	12.2 V	40 + 100	100 + 100	100 + 100	(8 + 1)/°C
Current	20.00000 mA	10 nA	< 0.2 V			60 + 30	300 + 80	500 + 80	(50 + 5)/°C
	100.0000 mA	100 nA	< 0.1 V			100 + 300	300 + 800	500 + 800	(50 + 50)/°C
	1.000000 A	1.0 µA	< 0.5 V[9]			200 + 30	500 + 80	800 + 80	(50 + 5)/°C
	3.000000 A	10 µA	< 1.5 V[9]			1000 + 15	1200 + 40	1200 + 40	(50 + 5)/°C
Channel (Ratio)[10]	Ratio Accuracy = Accuracy of selected Channel Range + Accuracy of Paired Channel Range								
Channel (Average)[10]	Average Accuracy = Accuracy of selected Channel Range + Accuracy of Paired Channel Range								

TEMPERATURE[19]

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

Thermocouples (Accuracy based on ITS-90.)

Type	Range	Resolution	90 Day/1 Year (23°C ± 5°C) Relative to Simulated Reference Junction	Using 77XX Module	Temperature Coefficient 0°–18°C & 28°–50°C
J	–200 to +760 °C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
K	–200 to +1372°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
N	–200 to +1300°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
T	–200 to +400°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
E	–200 to +1000°C	0.001 °C	0.2°C	1.0°C	0.03°C/°C
R	0 to +1768°C	0.1 °C	0.6°C	1.8°C	0.03°C/°C
S	0 to +1768°C	0.1 °C	0.6°C	1.8°C	0.03°C/°C
B	+350 to +1820°C	0.1 °C	0.6°C	1.8°C	0.03°C/°C

4-Wire RTD:
(100Ω platinum [PT100], D100, F100, PT385, PT3916, or user type. Offset compensation On)

–200° to 630°C	0.01 °C	0.06°C		0.003°C/°C

Thermistor: (2.2kΩ, 5kΩ, and 10kΩ)[20]

–80° to 150°C	0.01 °C	0.08°C		0.002°C/°C

DC SYSTEM SPEEDS[15,18]

	2700/2750	2701
RANGE CHANGES (excludes 4WΩ)[16]:	50/s (42/s)	50/s (42/s)
FUNCTION CHANGES[16]:	50/s (42/s)	50/s (42/s)
AUTORANGE TIME[16]:	<30 ms	<30 ms
ASCII READINGS TO RS-232 (19.2k BAUD):	55/s	300/s
MAX. EXTERNAL TRIGGER RATE:	375/s	2000/s

DC MEASUREMENT SPEEDS[15]

Single Channel, 60Hz (50Hz) Operation

FUNCTION	DIGITS	READINGS/s		PLCs
DCV, DCI, Ω (<10M), Thermocouple, Thermistor	6.5[12,16]	5	(4)	10
	6.5[16]	35	(28)	1
	6.5[12,16]	45	(36)	1
	5.5[12,16]	150	(120)	0.1
	5.5[16, 17]	300	(240)	0.1
	5.5[17]	500	(400)	0.1
2701 and 2750 only	4.5[17]	2500	(2000)	0.01
2701 only	3.5	3500	(2800)	0.002
4WΩ (<10M)	6.5[16]	1.4	(1.1)	10
	6.5[16]	15	(12)	1
	5.5[17]	33	(25)	0.1
4WΩ OComp, RTD[22]	6.5[16]	0.9	(0.7)	10
	6.5[16]	8	(6.4)	1
	5.5[16, 17]	18	(14.4)	0.1
Channel (Ratio), Channel (AVG)	6.5[16]	2.5	(2)	10
	6.5[16]	15	(12)	1
	5.5[17]	25	(20)	0.1

Multiple Channels, Into Memory[18]

	Channels/s 2700	2701	2750
7710 Scanning DCV	180/s	500/s	230/s
7710 Scanning DCV with Limits or Time Stamp On	170/s	500/s	230/s
7710 Scanning DCV alternating 2WΩ	45/s	115/s	60/s

Multiple Channels, Into and Out of Memory to GPIB[16, 18] or Ethernet

	Channels/s 2700	2701	2750
7702 Scanning DCV	65/s	75/s	65/s
7700 and 7708 Scanning Temperature (T/C)	50/s	50/s	50/s
7710 Scanning DCV	145/s	440/s	210/s
7710 Scanning DCV with Limits or Time Stamp On	145/s	440/s	210/s
7710 Scanning DCV alternating 2WΩ	40/s	115/s	55/s

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DC SPEED vs. NOISE REJECTION

Rate	Filter	Readings/s[12]	Digits	RMS Noise 10V Range 2700,2750	2701	NMRR	CMRR[14]
10	50	0.1 (0.08)	6.5	< 1.2 μV	< 2.5 μV	110 dB[13]	140 dB
1	Off	15 (12)	6.5	< 4 μV	< 6 μV	90 dB[13]	140 dB
0.1	Off	500 (400)	5.5	< 22 μV	< 40 μV	—	80 dB
0.01	Off	2500 (2000)	4.5	< 150 μV	< 300 μV	—	80 dB
0.002	Off	3500 (2800)	3.5	—	< 1 mV	—	60 dB

DC MEASUREMENT CHARACTERISTICS

DC VOLTS

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

INPUT IMPEDANCE:
100mV–10V Ranges: Selectable >10GΩ // with <400pF or 10MΩ ±1%.
100V, 1000V Ranges: 10MΩ ±1%.
Dry Circuit: 100kΩ ± 1% // <1μF.

EARTH ISOLATION: 500V peak, >10GΩ and <300pF any terminal to chassis.

INPUT BIAS CURRENT: <75pA at 23°C.

COMMON MODE CURRENT: <500nApp at 50Hz or 60Hz.

AUTOZERO ERROR: Add ±(2ppm of range error + 5μV) for < 10 minutes and ±1°C.

INPUT PROTECTION: 1000V, all ranges. 300V with plug in modules.

RESISTANCE

MAXIMUM 4WΩ LEAD RESISTANCE: 80% of range per lead (Dry Ckt mode). 5Ω per lead for 1Ω range; 10% of range per lead for 10Ω, 100Ω, and 1kΩ ranges; 1kΩ per lead for all other ranges.

OFFSET COMPENSATION: Selectable on 4WΩ, 1Ω, 10Ω, 100Ω, 1kΩ, and 10kΩ ranges.

CONTINUITY THRESHOLD: Adjustable 1 to 1000 Ω

INPUT PROTECTION: 1000V, all Source Inputs, 350V Sense Inputs. 300V with plug-in modules.

DC CURRENT

SHUNT RESISTORS: 100mA–3A, 0.1Ω. 20mA, 5Ω.

INPUT PROTECTION: 3A, 250V fuse.

THERMOCOUPLES

CONVERSION: ITS-90.

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

OPEN CIRCUIT CHECK: Selectable per channel. Open >11.4kΩ ±200Ω.

DC NOTES

1. 20% overrange except on 1000V and 3A.
2. Add the following to "ppm of range" uncertainty; 100mV 15ppm; 1V and 100V 2ppm; for Model 2750 1Ω and Dry Circuit Ω 40ppm; 10→1MΩ 2ppm, for Models 2700/2701 100Ω 30ppm, 20mA and 1A 10ppm, 100mA 40ppm.
3. ±2% (measured with 10MΩ input resistance DMM, >10GΩ DMM on 10MΩ and 100MΩ ranges). For Dry Circuit Ω, ±25% with Input HI connected to Sense HI; with Sense HI disconnected add 30mV
4. Relative to calibration accuracy.
5. For signal levels >500V, add 0.02ppm/V uncertainty for portion exceeding 500V.
6. Specifications are for 4-wire Ω, 1Ω, 10Ω, and 100Ω with offset compensation on. With 77XX plug-in modules, LSYNC on. With offset compensation on, OPEN CKT. VOLTAGE is 12.8V. For 2-wire Ω add 1.5Ω to "ppm of range" uncertainty. 1Ω range is 4-wire only.
7. Must have 10% matching of lead resistance in Input HI and LO.
8. Add the following to "ppm of reading" uncertainty when using plug in modules:

	10 kΩ	100 kΩ	1 MΩ	10 MΩ	100 MΩ
All Modules:				220 ppm	2200 ppm
7701, 7703, 7707, 7709 Modules:	10 ppm	100 ppm	1000 ppm	1%	10%
7706, 7708, 7710 Modules:	5 ppm	50 ppm	500 ppm	5000 ppm	5%
7710 Module 23°C ±5°C:	11 ppm	110 ppm	1100 ppm	1.1%	11%

9. Add 1.5V when used with plug in modules.
10. For RATIO, DCV only. For AVERAGE, DCV and Thermocouples only. Available with plug in modules only.
11. Add 6μV to "of range" uncertainty when using Models 7701, 7703, and 7707, and 3μV for Models 7706 and 7709.
12. Auto zero off.
13. For LSYNC On, line frequency ±0.1 %. For LSYNC Off, use 60dB for ≥ 1PLC.
14. For 1kΩ unbalance in LO lead. AC CMRR is 70dB.
15. Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay = 0.
16. Speeds include measurements and binary data transfer out the GPIB or ASCII data transfer for Ethernet and RS-232 (reading element only).
17. Sample count = 1000, auto zero off (into memory buffer).
18. Auto zero off, NPLC = 0.01 (Models 2700 and 2750), NPLC = 0.002 (Model 2701).
19. Additional Uncertainty:

Type	Range	Front Terminals Sim. Ref. Junction	Plug-In Modules 7709 Sim. Ref. Junction	7701/03/07 Sim. Ref. Junction	7700/08 Using CJC	7706 Using CJC	7710 Using CJC
J	–200° to 0°C	0.1	0.1	0.3	0.8	1.6	4.5
K	–200° to 0°C	0.2	0.2	0.4	0.8	1.6	1.0
N	–200° to 0°C	0.3	0.3	0.6	0.8	1.6	2.5
T	–200° to 0°C	0.2	0.1	0.4	0.8	1.6	2.5
E	–200° to 0°C	–	0.1	0.3	0.8	1.6	2.5
R	0° to +400°C	0.4	0.6	1.2	0.5	1.0	2.2
S	0° to +400°C	0.4	0.6	1.2	0.5	1.0	2.2
B	+350° to +1100°C	0.8	0.3	1.7	0.5	1.0	2.2

Type	Range	7710 Using CJC
J	0° to +760°C	1.5
K	0° to +1372°C	–
N	0° to +1300°C	0.5
T	0° to +400°C	0.5
E	0° to +1000°C	0.5
R	+400° to +1768°C	0.9
S	+400° to +1768°C	0.9
B	+1100° to +1820°C	0.9

20. For lead resistance >0Ω, add the following uncertainty/Ω for measurement temperatures of:

		70°–100°C	100°–150°C
2.2 kΩ	(44004)	0.22°C	1.11°C
5.0 kΩ	(44007)	0.10°C	0.46°C
10 kΩ	(44006)	0.04°C	0.19°C

21. For 4-wire Ω only, offset compensation on, LSYNC on.
22. For Dry Circuit 1kΩ range, 2 readings/s max.
23. For 2750 Front Inputs, add the following to Temperature Coefficient "ppm of reading" uncertainty: 1MΩ 25ppm, 10MΩ 250ppm, 100MΩ 2500ppm. Operating environment specified for 0°C to 50°C and 50% RH at 35°C.
24. Model 2750 only.
25. Front panel resolution is limited to 0.1Ω.

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AC SPECIFICATIONS[1]

Function	Range	Resolution	Calibration Cycle	Accuracy: ±(% of reading + % of range), 23°C ± 5°C				
				3 Hz–10 Hz	10 Hz–20 kHz	20 kHz–50 kHz	50 kHz–100 kHz	100 kHz–300 kHz
Voltage[2]	100.0000 mV	0.1 µV	90 Days	0.35 + 0.03	0.05 + 0.03	0.11 + 0.05	0.6 + 0.08	4.0 + 0.5
	1.000000 V	1.0 µV	(all ranges)					
	10.00000 V	10 µV	1 Year	0.35 + 0.03	0.06 + 0.03	0.12 + 0.05	0.6 + 0.08	4.0 + 0.5
	100.0000 V	100 µV	(all ranges)					
	750.000 V	1.0 µV						
			(Temp. Coeff.)/°C[3]	0.035 + .003	0.005 + .003	0.006 + .005	0.01 + .006	0.03 + .01

Function	Range	Resolution	Calibration Cycle	3 Hz–10 Hz	10 Hz–3 kHz	3 kHz–5 kHz
Current[2]	1.000000 A	1.0 µA	90 Day/1 Year	0.30 + 0.04	0.10 + 0.04	0.14 + 0.04
	3.00000 A[14]	10 µA		0.35 + 0.06	0.16 + 0.06	0.18 + 0.06
			(Temp. Coeff.)/°C[3]	0.035 + 0.006	0.015 + 0.006	

Function	Range	Resolution	Calibration Cycle	(3 Hz–500 kHz) (333 ms–2 µs)
Frequency[4] **and Period**	100 mV to 750 V	0.333 ppm to 33.3 ppm	90 Day/1 Year	100 ppm + 0.333 ppm (SLOW, 1s gate) 100 ppm + 3.33 ppm (MED, 100ms gate) 100 ppm + 33.3 ppm (FAST, 10ms gate)

ADDITIONAL UNCERTAINTY ±(% OF READING)

Low Frequency Uncertainty	MED	FAST
20 Hz – 30 Hz	0.3	—
30 Hz – 50 Hz	0	—
50 Hz – 100 Hz	0	1.0
100 Hz – 200 Hz	0	0.18
200 Hz – 300 Hz	0	0.10
>300 Hz	0	0

CREST FACTOR:[5]	1–2	2–3	3–4	4–5
Additional Uncertainty:	0.05	0.15	0.30	0.40
Max. Fundamental Freq.:	50kHz	50kHz	3kHz	1kHz

Maximum Crest Factor: 5 at full-scale.

AC MEASUREMENT CHARACTERISTICS

AC VOLTS

MEASUREMENT METHOD: AC-coupled, True RMS.

INPUT IMPEDANCE: 1MΩ ±2% // by <100pF.

INPUT PROTECTION: 1000Vp or 400VDC. 300Vrms with plug in modules.

AC CURRENT

MEASUREMENT METHOD: AC-coupled, True RMS.

SHUNT RESISTANCE: 0.1Ω.

BURDEN VOLTAGE: 1A <0.5Vrms, 3A <1.5Vrms. Add 1.5Vrms when used with plug in modules.

INPUT PROTECTION: 3A, 250V fuse.

FREQUENCY AND PERIOD

MEASUREMENT METHOD: Reciprocal counting technique.

GATE TIME: SLOW 1s, MED 100ms, and FAST 10ms.

AC GENERAL

AC CMRR[6]: 70dB.

VOLT HERTZ PRODUCT: <= 8×10^7.

AC MEASUREMENT SPEEDS[7, 13]

Single Channel, 60Hz (50Hz) Operation

Function	Digits	Readings/s	Rate	Bandwidth
ACV, ACI	6.5	2s/Reading	SLOW	3 Hz–300 kHz
	6.5	4.8 (4)	MED	30 Hz–300 kHz
	6.5[9]	40 (32)	FAST	300 Hz–300 kHz
Frequency, Period	6.5	1 (1)	SLOW	3 Hz–300 kHz
	5.5	9 (9)	MED	30 Hz–300 kHz
	4.5	35 (35)	FAST	300 Hz–300 kHz
	4.5[10]	65 (65)	FAST	300 Hz–300 kHz

Multiple Channel

7710 SCANNING ACV[10, 11]: 500/s.

7710 SCANNING ACV WITH AUTO DELAY ON: 2s/reading.

AC SYSTEM SPEEDS[7, 9, 11]

	2700/2750	2701
AC System Speed:	(19.2k)	(115.2K)
Range Changes:[12]	4/s (3/s)	4/s (3/s)
Function Changes:[12]	4/s (3/s)	4/s (3/s)
Autorange Time:	< 3s	< 3s
ASCII Readings to RS-232 (19.2k baud):	50/s	300/s
Max. External Trigger Rate:	250/s	2000/s

AC NOTES

1. 20 % overrange except on 750V and 3A.
2. Specification are for SLOW mode and sine wave inputs >5% of range. SLOW and MED are multi-sample A/D conversions. FAST is DETector:BANDwidth 300 with nPLC = 1.0.
3. Applies to 0°–18°C and 28°–50°C.
4. For square wave inputs >10% of ACV range, except 100mV range. 100mV range frequency must be >10Hz if input is <20mV.
5. Applies to non-sine waves >5Hz.
6. For 1kΩ unbalance in LO lead.
7. Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay=0..
8. For ACV inputs at frequencies of 50 or 60Hz (±10%), add the following to "% of Range" uncertainty: 100mV 0.25%, 1V 0.05%, 10V 0.13%, 100V 0.03%, 750V 0.015 (Model 2701 only)..
9. Auto Zero off.
10. Sample count = 1024.
11. DETector:BANDwidth 300 with nPLC = 0.006 (2701 only).
12. Maximum useful limit with trigger delay = 175ms.
13. Includes measurement and binary data transfer out GPIB or ASCII data transfer for Ethernet and RS-232 (Reading Element only).

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GENERAL SPECIFICATIONS:

EXPANSION SLOTS: 2 (2700, 2701), 5 (2750).
POWER SUPPLY: 100V / 120V / 220V / 240V ±10%.
LINE FREQUENCY: 45Hz to 66Hz and 360Hz to 440Hz, automatically sensed at power-up.
POWER CONSUMPTION: 28VA (2700), 80VA (2701, 2750).
OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 80% RH at 35°C.
STORAGE ENVIRONMENT: –40°C to 70°C.
BATTERY: Lithium battery-backed memory, 3 years @ 23°C (Models 2700, 2750) Lithium Ion battery-backed memory, 30 days of buffer storage @ 23°C and >4 hours charge time. Battery lifetime: >3 years @ 23°C, >1.5 years @ 50°C (Model 2701)
WARRANTY: 3 years excludes battery.
EMC: Conforms to European Union Directive 89/336/EEC EN61326-1.
SAFETY: Conforms to European Union Directive 73/23/EEC EN61010-1, CAT I.
VIBRATION: MIL-PRF-28800F Class 3, Random.
WARM-UP: 2 hours to rated accuracy.
DIMENSIONS:
Rack Mounting: 89mm high × 213mm wide (2700, 2701) or 485mm wide (2750) × 370mm deep (3.5 in × 8.375 in or 19 in × 14.563 in).
Bench Configuration (with handle and feet): 104mm high × 238mm wide (2700, 2701) or 485mm wide (2750) × 370mm deep (4.125 in × 9.375 in (2700, 2701) or 19 in (2750) × 14.563 in).
SHIPPING WEIGHT: 6.5kg (14 lbs.) (2700, 2701) or 13kg (28 lbs.) (2750).
DIGITAL I/O: 2 inputs, 1 for triggering and 1 for hardware interlock.
5 outputs, 4 for Reading Limits and 1 for Master Limit. Outputs are TTL compatible or can sink 250mA, diode clamped to 40V.

TRIGGERING AND MEMORY:
Window Filter Sensitivity: 0.01%, 0.1 %, 1%, 10%, or Full-scale of range (none).
Reading Hold Sensitivity: 0.01%, 0.1 %, 1%, or 10% of reading.
Trigger Delay: 0 to 99 hrs (1ms step size).
External Trigger Delay: <2ms (2700), <1ms (2701, 2750).
External Trigger Jitter: <1ms (2700), <500µs (2701), <500µs (2750).
Memory Size: 55,000 readings (2700), 450,000 readings (2701), 110,000 readings (2750).
MATH FUNCTIONS: Rel, Min/Max/Average/Std Dev/Peak-to-Peak (of stored reading), Limit Test, %, 1/x, and mX+b with user defined units displayed.
REMOTE INTERFACE:
GPIB (IEEE-488.2) (2700, 2750) and RS-232C.
Ethernet TCP/IP (10bT and 100bT) (2701)
SCPI (Standard Commands for Programmable Instruments)
LabVIEW Drivers
ACCESSORIES SUPPLIED: Model 1751 Safety Test Leads, Product Information CD-ROM. (Model 2701 only: Getting Started Foldout, 3m Ethernet crossover cable, software CD-ROM with IVI/VISA drivers for VB, VC/C++, LabVIEW, TestPoint, and LabWindows/CVI, plus free runtime start-up software.)
ACCESSORIES AVAILABLE:
4288-7Rack Mount Rear Support Kit (2750)
77XX-904A Module Manual
77XXModules
Extended Warranty
ExceLINX-1A (Excel add-in datalogger software)
TestPoint™ Software Development Package
FOR MODEL 2701:
Ethernet: RJ-45 connector, TCP/IP, 10bT and 100bTx autosensed.
IP Configuration: Static or DHCP.
Password Protection: 11 Characters.
Software: Windows 98, NT, 2000, ME, and XP compatible. Internet Explorer 5.0 or higher required. Web page server by 2701.

Integra Series
Modules

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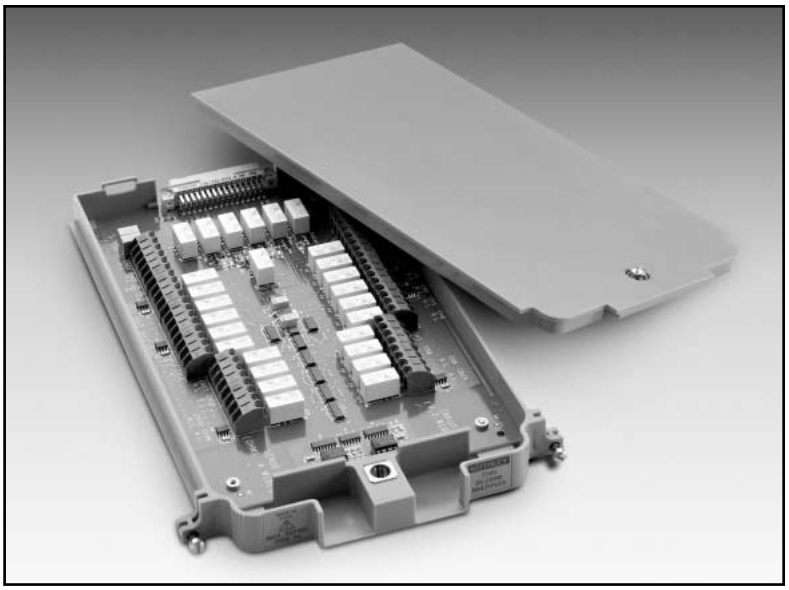
7700 20-CHANNEL DIFFERENTIAL MULTIPLEXER W/AUTOMATIC CJC



FEATURES

- 20 channels for general-purpose measurements, plus two channels to measure current.
- 2- or 4-wire measurement.
- Oversize screw terminal connection blocks are standard for easier connections.
- Automatic CJC sensors on the scanner card mean there are no other accessories are required to make thermocouple temperature measurements.
- Configurable as two independent banks of multiplexers.
- 300V, 1A capacity for voltage channels; 60W, 125VA.
- 3A capacity for current channels.
- Relay closures stored in on-board memory.

GENERAL

20 CHANNELS: 20 channels of 2-pole relay input. All channels configurable to 4-pole.

2 CHANNELS: 2 channels of current only input.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 2700 rev. A01, 2701 rev. A01, and 2750 rev. A01 or higher.

CAPABILITIES

CHANNELS 1-20: Multiplex one of 20 2-pole or one of 10 4-pole signals into DMM.

CHANNELS 21-22: Multiplex one of 2 2-pole current signals into DMM.

INPUTS

MAXIMUM SIGNAL LEVEL:

Channels (1-20): 300V DC or 300V rms (425V peak) for AC waveforms, 1A switched, 60W, 125VA maximum.

Channels (21-22): 60V DC or 30V rms, 3A switched, 60W, 125VA maximum.

CONTACT LIFE (typ.): $>10^5$ operations at max signal level.
$>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω at end of contact life.

CONTACT POTENTIAL: <±500nV typical per contact, 1μV max.
<±500nV typical per contact pair, 1μV max.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: Screw terminal, #20 AWG wire size.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^{10}$Ω, <100pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <200pF.

INSERTION LOSS (50Ω Source, 50Ω Load):

	w/Internal DMM	w/o Internal DMM*
<0.1 dB:	1 MHz	1 MHz
<3 dB:	2 MHz	50 MHz

CROSSTALK (50Ω Load):

	w/Internal DMM	w/o Internal DMM*
10 MHz:	<–40 dB	<–40 dB
25 MHz:	**	<–25 dB

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

TEMPERATURE ACCURACY USING INTERNAL CJC: 1.0°C (see mainframe specification for details).

* Channels 24 and 25 are open. Refer to ROUTe:MULTiple command in 27XX User Manual.

** Not valid.

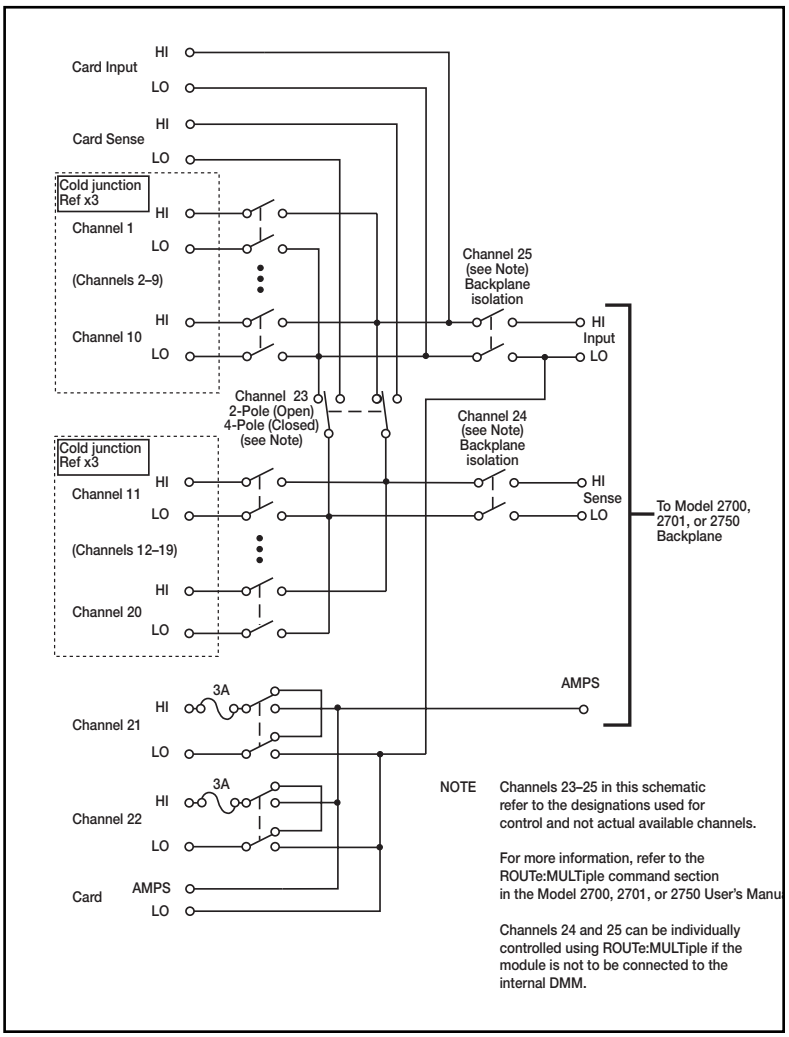
ENVIRONMENTAL:

OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: 0.45kg (1 lb).

ACCESSORY AVAILABLE: Model 7401 Type K Thermocouple Wire, 30.5m (100 ft).



Integra Series
Modules

Multimeter/Switch Systems

7701 LOW-VOLTAGE 32-CHANNEL DIFFERENTIAL MULTIPLEXER

FEATURES

- Configurable for 32 channels of differential measurements, with up to 16 channels of 4-pole measurements.
- Configurable for 32 channels of common-side 4-wire ohms.
- Configurable as two independent banks of multiplexers.
- Two female D-shell connectors are standard for secure hook-up and quick teardown.
- 150V, 1A capacity for voltage channels; 60W, 125VA.
- Two mating IDC connectors for ribbon cable are supplied.
- Relay closures stored in on-board memory.
- Screw terminal jumpers allow user-configurable DMM connections.

GENERAL

32 CHANNELS: 32 channels of 2-pole relay input. All channels configurable to 4-pole.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 2700 rev. B03, Model 2701 rev. A01, and Model 2750 rev. A01 or higher.

DMM CONNECTIONS: Screw terminals provide internal DMM connections to channels 34 and 35 and connections to external wiring access.

CAPABILITIES

CHANNELS 1–32: Multiplex one of 32 2-pole or one of 16 4-pole signals into DMM. Configuration supports dual 1×16 independent multiplexers.

INPUTS

MAXIMUM SIGNAL LEVEL: Any channel to Any Channel (1–32): 150V DC or 150Vrms (212V peak) for AC waveforms, 1A switched, 60W, 125VA maximum.

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

CONTACT LIFE (typ): $>10^5$ operations at max signal level.
$>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω any path and additional 1Ω at end of contact life.

CONTACT POTENTIAL: <6μV per contact pair.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: 50-pin female D-shell, Channels 1–24.
25-pin female D-shell, Channels 25–32.
Supplied with male IDC ribbon cable connectors.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^9$Ω, <200pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <400pF.

CROSS TALK (1MHz, 50Ω Load): <–35dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.35dB below 1MHz.
<3dB below 2MHz.

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

ENVIRONMENTAL:

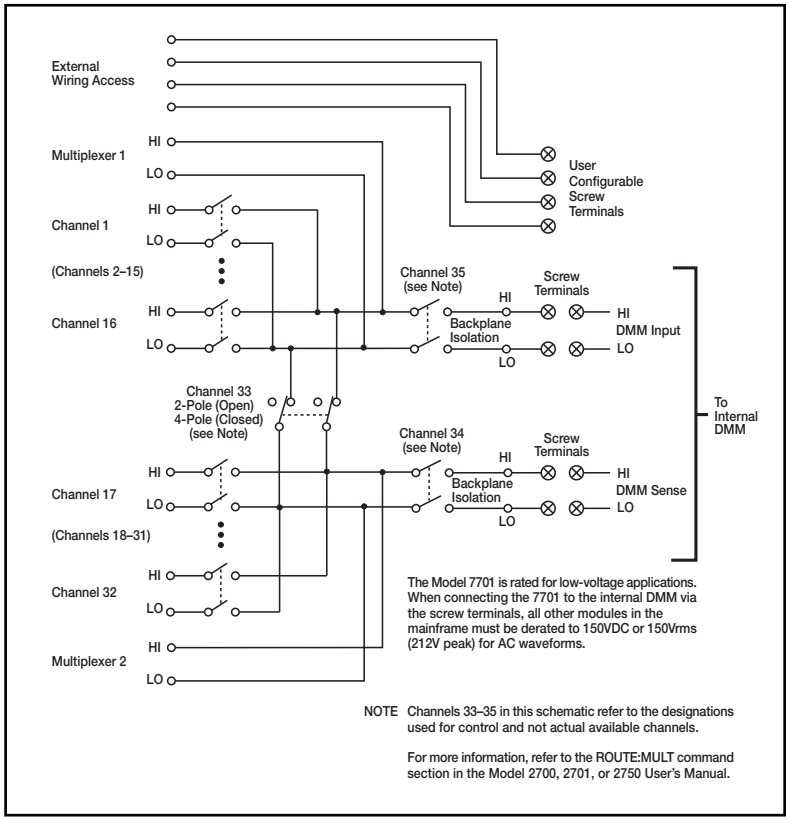
OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 50% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: <0.52kg (1.16 lb).

ACCESSORIES AVAILABLE:

Model 7789	50/25 Pin Male D-Shell Solder Cup Connectors
Model 7790	50/50/25 Pin Female/Male D-Shell IDC Connectors
Model 7705-MTC-2	50 Pin Male to Female DSUB Cable, 2m (6.6 ft).
Model 7707-MTC-2	25 Pin Male to Female DSUB Cable, 2m (6.6 ft).



See page 43 for common-side 4-wire ohms configuration example.

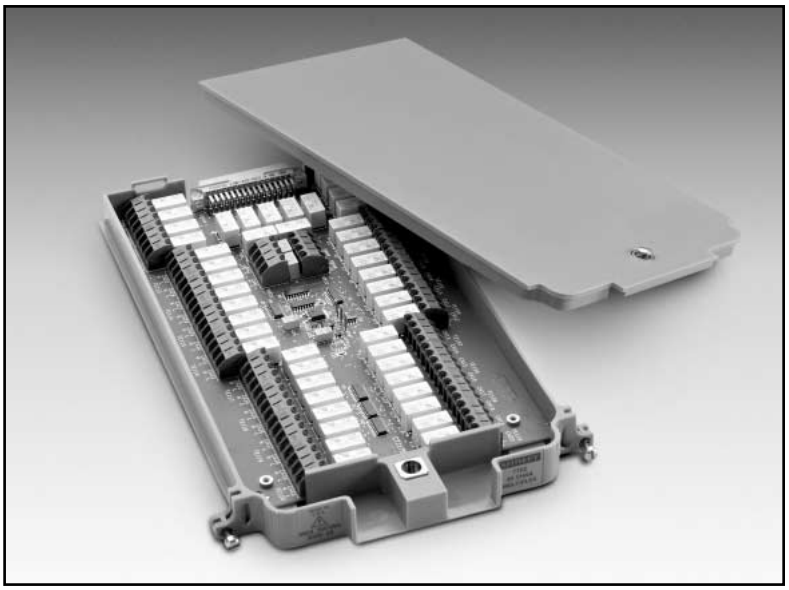
Integra Series
Modules

Multimeter/Switch Systems

7702 40-CHANNEL DIFFERENTIAL MULTIPLEXER

FEATURES

- There are 40 channels for general-purpose measurement, plus 2 channels to measure current.
- 2- or 4-wire measurement.
- Oversize screw terminal connection blocks are standard for easier connection.
- Configurable as two independent banks of multiplexers.
- 300V, 1A capacity for voltage channels; 60W, 125VA.
- 3A capacity for current channels.
- Relay closures stored in on-board memory.



GENERAL

40 CHANNELS: 40 channels of 2-pole relay input.
All channels configurable to 4-pole.

2 CHANNELS: 2 channels of current only input.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 2700 rev. A01, 2701 rev. A01, and 2750 rev. A01 or higher.

CAPABILITIES

CHANNELS 1-40: Multiplex one of 40 2-pole or one of 20 4-pole signals into DMM.

CHANNELS 41-42: Multiplex one of 2 2-pole current signals into DMM.

INPUTS

MAXIMUM SIGNAL LEVEL:

Channels (1-40): 300V DC or rms, 1A switched, 60W, 125VA maximum.

Channels (41-42): 60V DC or 30V rms, 3A switched, 60W, 125VA maximum.

CONTACT LIFE (typ): $>10^5$ operations at max signal level.
$>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω at end of contact life.

CONTACT POTENTIAL: <±500nV typical per contact, 1μV max.
<±500nV typical per contact pair, 1μV max.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: Screw terminal, #20 AWG wire size.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^{10}$Ω, <100pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <200pF.

CROSS TALK (10MHz, 50Ω Load): <–40dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.1dB below 1MHz.
<3dB below 2MHz.

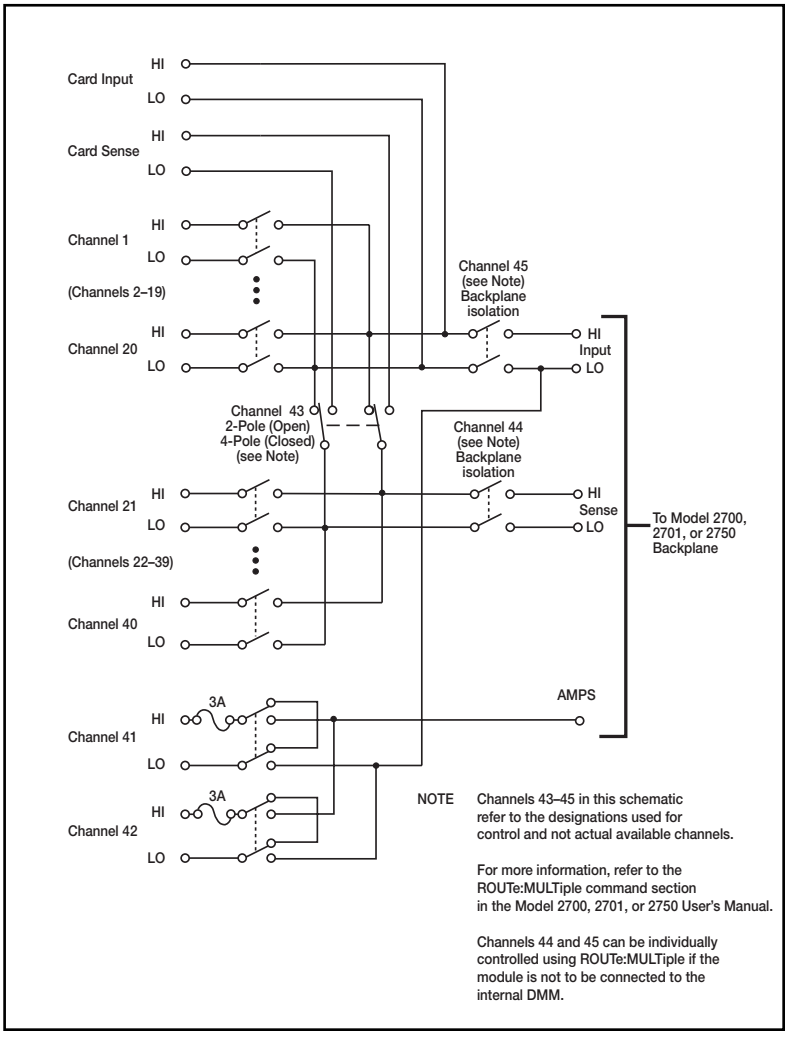
COMMON MODE VOLTAGE: 300V between any terminal and chassis.

ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: 0.5kg (1.1 lb).



7703 32-CHANNEL HIGH SPEED DIFFERENTIAL MULTIPLEXER

FEATURES

- There are 32 channels for general purpose measurement.
- Relay actuation time of less than 1ms for high-speed scanning.
- 2 or 4 wire measurement.
- Two 50-pin female "D-sub" connectors are standard for secure hook-up and quick teardown.
- Configurable as two independent banks of multiplexers.
- Reed relay based design with 300 volt, 500mA; 10VA.
- Two mating connector with solder cup (Model 7788) are supplied.
- Relay closures stored in on-board memory.

GENERAL

32 CHANNELS: 32 channels of 2-pole relay input.
All channels configurable to 4-pole.

RELAY TYPE: Reed.

ACTUATION TIME: <1ms.

FIRMWARE: Specified for Model 2700 rev. A01, 2701 rev. A01, and 2750 rev. A01 or higher.

CAPABILITIES

CHANNELS 1-32: Multiplex one of 32 2-pole or one of 16 4-pole signals into DMM.

INPUTS

MAXIMUM SIGNAL LEVEL:

Channels (1-32): 300V DC or rms, 0.5A switched, 10W maximum.

Contact Life (typ): $>5\times10^4$ operations at max signal level.
$>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω at end of contact life.

CONTACT POTENTIAL: <±3μV typical per contact, 6μV max.
<±3μV typical per contact pair, 6μV max.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: 50 pin D-sub×2.

RELAY DRIVE CURRENT: 20mA per channel.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^9\Omega$, <200pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9\Omega$, <400pF.

CROSS TALK (1 MHz, 50Ω Load): <–40dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.35dB below 1MHz.
<3dB below 2MHz.

COMMON MODE VOLTAGE: 300V between any terminal and chassis.

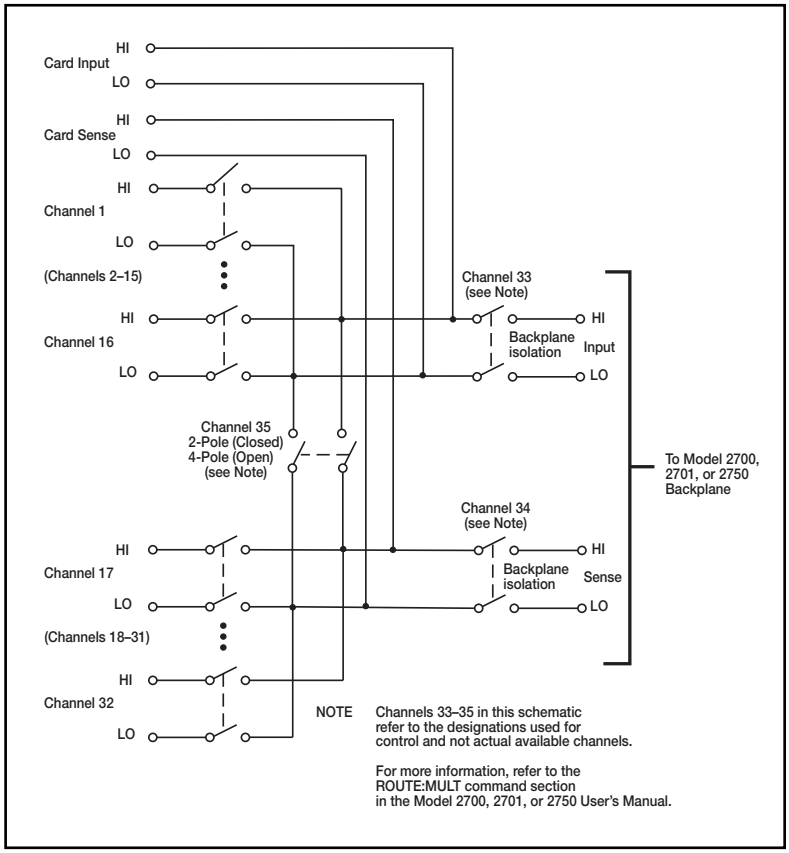
ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: 0.8kg (1.75 lbs).

ACCESSORIES AVAILABLE:
Model 7705-MTC-2 50 Pin Male to Female DSUB Cable, 2m (6.6 ft).



Integra Series
Modules

Multimeter/Switch Systems

7705 40-CHANNEL CONTROL MODULE

FEATURES

- 40 channels designed for controlling power to the DUT, switching loads, controlling light indicators and relays, etc.
- Two 50-pin female "D-sub" connectors are standard for secure hook-up and quick teardown.
- 300V, 2A capacity.
- Two mating connectors with solder cup pins (Model 7788) are supplied.
- Relay closures stored in on-board memory.

GENERAL

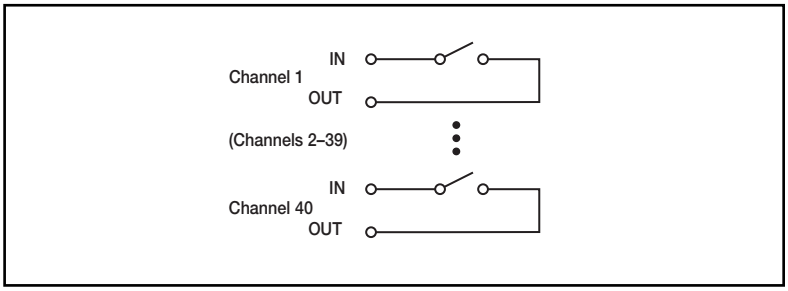
RELAY SWITCH CONFIGURATION: 40 independent channels of 1-pole switching. Isolated from internal DMM.

CONTACT CONFIGURATION: 1 pole Form A.

RELAY TYPE: Latching electromechanical.

CONNECTOR TYPE: Two 50-pin female D-sub connectors.

FIRMWARE: Specified for Model 2700 rev. A01, 2701 rev. A01, and 2750 rev. A01 or higher.



INPUTS

MAXIMUM SIGNAL LEVEL: 300VDC or rms, 2A switched, 60W (DC, resistive), 125VA (AC, resistive).

CONTACT LIFE: **Cold Switching:** 10^8 closures.
At Maximum Signal Levels: 10^5 closures.

CHANNEL RESISTANCE (per conductor): <1Ω.

CONTACT POTENTIAL: ≤4μV per contact.

OFFSET CURRENT: <100pA.

ACTUATION TIME: 3ms.

ISOLATION: **Channel to Channel:** $>10^9\Omega$, <50pF.
Common Mode: $>10^9\Omega$, <100pF.

CROSSTALK (1MHz, 50Ω load): <–35dB.

INSERTION LOSS (50Ω source, 50Ω load): <0.3dB below 1MHz, <3dB below 10MHz.

COMMON MODE VOLTAGE: 300V between any terminal and chassis.

ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: 0.45kg (1 lb).

ACCESSORIES AVAILABLE:
Model 7705-MTC-2 50 Pin Male to Female DSUB Cable, 2m (6.6 ft).

7706 ALL-IN-ONE I/O MODULE

FEATURES

- 20 channels of analog input (w/automatic CJC) for general-purpose measurement.
- 16 channels of digital output.
- Event counter/totalizer can monitor and control system components, such as fixturing, limit switches, pass/fail indicators, external voltage sources, loads, door closures, revolutions, etc., while performing mixed signal measurement.
- 300V, 1A capacity; 60W, 125VA maximum.
- Configurable as two independent banks of multiplexers.
- Two analog outputs (±12V, 5mA).
- Relay closures stored in on-board memory.

GENERAL

20 CHANNELS: 20 channels of 2-pole relay input.
All channels configurable to 4-pole.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 2700 rev. A02 or B01, 2701 rev. A01, and 2750 rev. A01 or higher.

CAPABILITIES

CHANNELS 1–20: Multiplex one of 20 2-pole or one of 10 4-pole signals into DMM.

Channels 21–25 are referenced to chassis ground.

CHANNELS 21–22: 16 Digital Outputs.

CHANNELS 23–24: Analog Voltage Output (2).

CHANNELS 25: Totalize Input.

INPUTS

MAXIMUM SIGNAL LEVEL (Channels 1–20): 300V DC or rms, 1A switched, 60W, 125VA maximum.

CONTACT LIFE (typ.): $>10^5$ operations at max. signal level: $>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω at end of contact life.

CONTACT POTENTIAL: <±2μV typical per contact, 3μV max.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: Screw terminal, #20 AWG wire size.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^9$Ω, <100pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <200pF.

CROSS TALK (10MHz, 50Ω Load): <–35dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.1dB below 1MHz.
<3dB below 2Mhz.

COMMON MODE VOLTAGE: 300V between any terminal and chassis.

TEMPERATURE ACCURACY USING INTERNAL CJC: 1.0°C (see mainframe specification for details).

TOTALIZE INPUT

MAXIMUM COUNT: 2^{32}–1.

TOTALIZE INPUT: 100kHz (max), rising or falling edge, programmable.

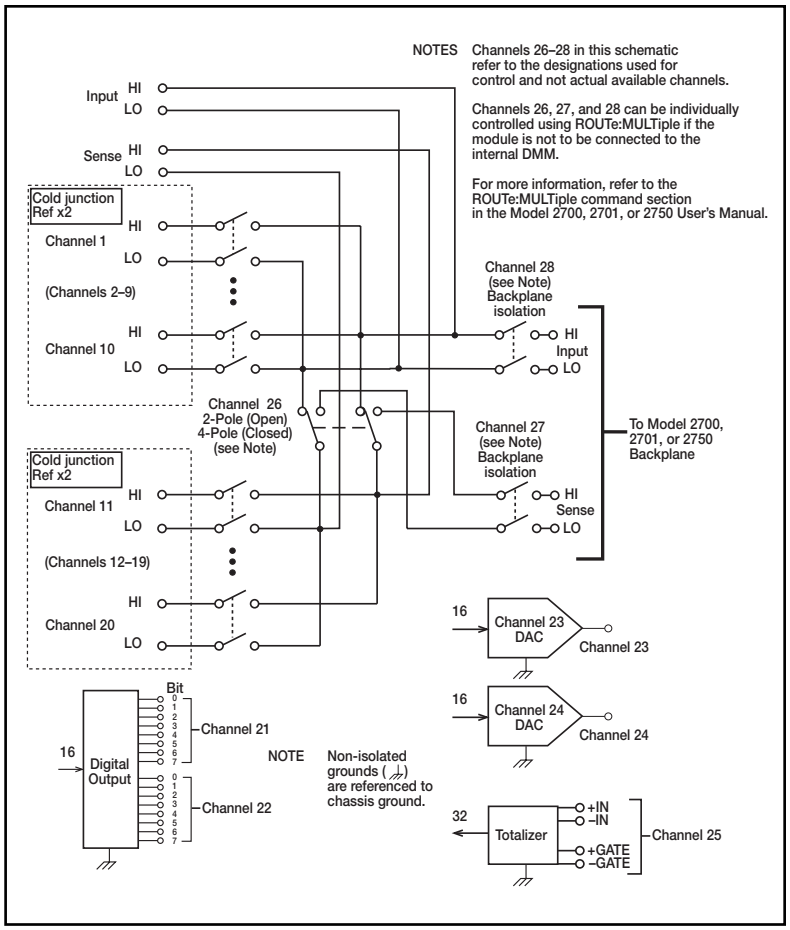
SIGNAL LEVEL: 1Vp-p (min), 42Vpk (max).

THRESHOLD: 0V or TTL, jumper selectable.

DATE INPUT: TTL-Hi, TTL-Lo, or none.

COUNT RESET: manual or Read+Reset.

READ SPEED: 50/s.



ANALOG VOLTAGE OUTPUT

DAC 1, 2: ±12V in 1mV increments, non-isolated.

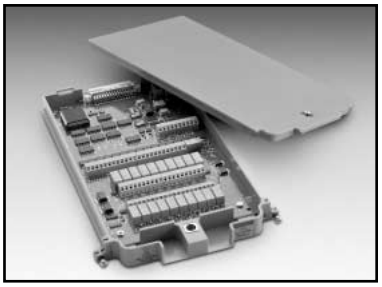
RESOLUTION: 1mV.

I_{OUT}: 5mA max.

SETTLING TIME: 1ms to 0.01% of output.

ACCURACY ±(% of output + mV):
1 year ±5°C: 0.15% + 19mV;
90 day ±5°C: 0.1% + 19mV;
24 hour ±1°C: 0.04% + 19mV.

TEMPERATURE COEFFICIENT:
±(0.015% + 1mV)/°C.



DIGITAL OUTPUT

V_{OUT}(L): <0.8V @ Iout = 400mA.

V_{OUT}(H): >2.4V @ Iout = 1mA.

V_{OUT}(H)MAX.: <42V with external open drain pull-up.

WRITE SPEED: 50/s.

ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: 0.5kg (1.1 lbs).

Integra Series
Modules

Multimeter/Switch Systems

7707 MULTIPLEXER-DIGITAL I/O MODULE

GENERAL

10 CHANNELS: 10 channels of 2-pole relay input.
All channels configurable to 4-pole.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 2700 rev. B03, 2701 rev. A01, and 2750 rev. A01 or higher.

CAPACITY: **Model 2700:** (1) 7707 and (1) 77XX, except 7706.
Model 2701: Any combination of 77XX modules.
Model 2750: (4) 7707 and (1) 77XX, except 7706. A 7706 module may be substituted for a 7707 module.

CAPABILITIES

CHANNELS 1–10: Multiplex one of 10 2-pole or one of 5 4-pole signals into DMM.

CHANNELS 11–14: 32 Digital Inputs/Outputs referenced to chassis ground.

THERMAL PROTECTION: Channels 11–14 are thermally protected to 1A.

INPUTS (CHANNELS 1–10)

MAXIMUM SIGNAL LEVEL: Any Channel to Any Channel (1–10): 300VDC or 300Vrms (425V peak) for AC waveforms, 1A switched, 60W, 125VA maximum.

SAFETY CATEGORY: Conforms to European Union Directive 73/23/EEC EN 61010-1, CAT I.

CONTACT LIFE (typ.): $>10^5$ operations at max. signal level: $>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω any path and additional 1Ω at end of contact life.

CONTACT POTENTIAL: <6μV typical per contact pair and additional 5μV with Channels 11–14 at rate V_{OUT}(L).

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: 50-pin male D-shell, Channels 11–14.
25-pin female D-shell, Channels 1–10.
Supplied with female and male IDC ribbon cable connectors.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^9$Ω, <100pF with isolation channels 16 and 17 open.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <200pF.

CROSS TALK (10MHz, 50Ω Load): <–35dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.1dB below 1MHz.
<3dB below 2MHz.

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

DIGITAL INPUT/OUTPUT (CHANNELS 11–14)

V_{IN}(L): <0.8V (TTL).

V_{IN}(H): >2V (TTL).

V_{OUT}(L): <1.0V @ I_{OUT} = 100mA.

V_{OUT}(H): >2.4V @ I_{OUT} = 1mA.

V_{OUT}(H)MAX.: <40V with external open drain pull-up.

READ/WRITE SPEED: 50/s.

ENVIRONMENTAL

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

STORAGE ENVIRONMENT: –25°C to 65°C.

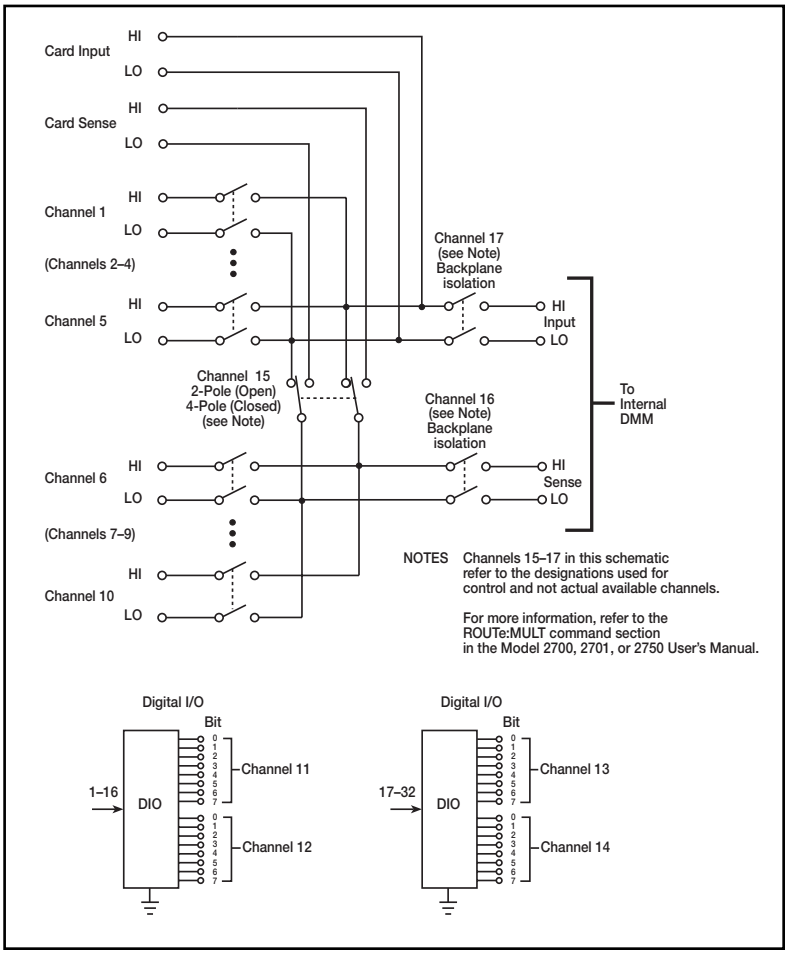
WEIGHT: <0.5kg (1.1 lbs).

ACCESSORIES AVAILABLE:

Model 7790	50/50/25 Pin Female/Male D-Shell IDC Connectors
Model 7705-MTC-2	50 Pin Male to Female DSUB Cable, 2m (6.6 ft).
Model 7707-MTC-2	25 Pin Male to Female DSUB Cable, 2m (6.6 ft).

FEATURES

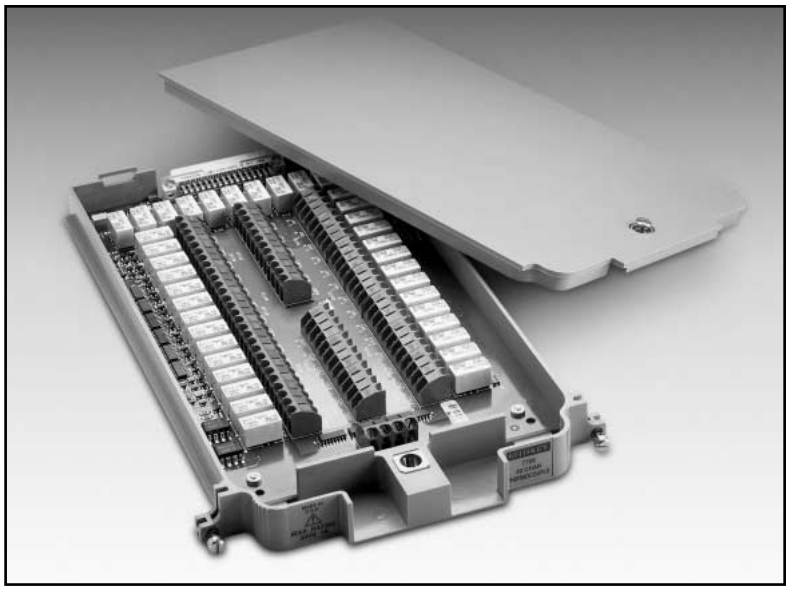
- 10 channels of analog input for general-purpose measurement.
- 32 channels of digital input and output (four 8-bit ports) for I/O control.
- 300V, 1A capacity; 60W, 125VA maximum (analog).
- Configurable as two independent banks of multiplexers.
- 33V, 100mA capacity (digital).
- Two mating IDC connectors supplied.
- Digital outputs are short circuit protected.
- Relay closures stored in on-board memory.



7708 40-CHANNEL DIFFERENTIAL MULTIPLEXER MODULE

FEATURES

- 40 differential channels for general-purpose measurements.
- 2- or 4-wire measurements.
- Oversize screw terminal connection blocks are standard for easier connection.
- 300V, 1A capacity for voltage channels; 60W, 125VA.
- Configurable as two independent banks of multiplexers.
- Built-in CJC sensors automatically linearize thermocouples.
- Relay closures stored in on-board memory.



GENERAL

40 CHANNELS: 40 channels of 2-pole relay input. All channels configurable to 4-pole.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

FIRMWARE: Specified for Model 2700 rev. B02, 2701 rev. A01, and 2750 rev. A01 or higher.

CAPABILITIES

CHANNELS 1–40: Multiplex one of 40 2-pole or one of 20 4-pole signals into DMM.

INPUTS

MAXIMUM SIGNAL LEVEL:

Channels (1–40): 300V DC or rms, 1A switched, 60W, 125VA maximum.

CONTACT LIFE (typ): $>10^5$ operations at max. signal level.
$>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω at end of contact life.

CONTACT POTENTIAL: <±500nV typical per contact, 1μV max.
<±500nV typical per contact pair, 1μV max.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: Screw terminal, #20 AWG wire size.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^{10}$Ω, <100pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <200pF.

CROSS TALK (10MHz, 50Ω Load): <–40dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.1dB below 1MHz.
<3dB below 2MHz.

COMMON MODE VOLTAGE: 300V between any terminal and chassis.

TEMPERATURE ACCURACY USING INTERNAL CJC: 1.0°C (see mainframe specification for details).

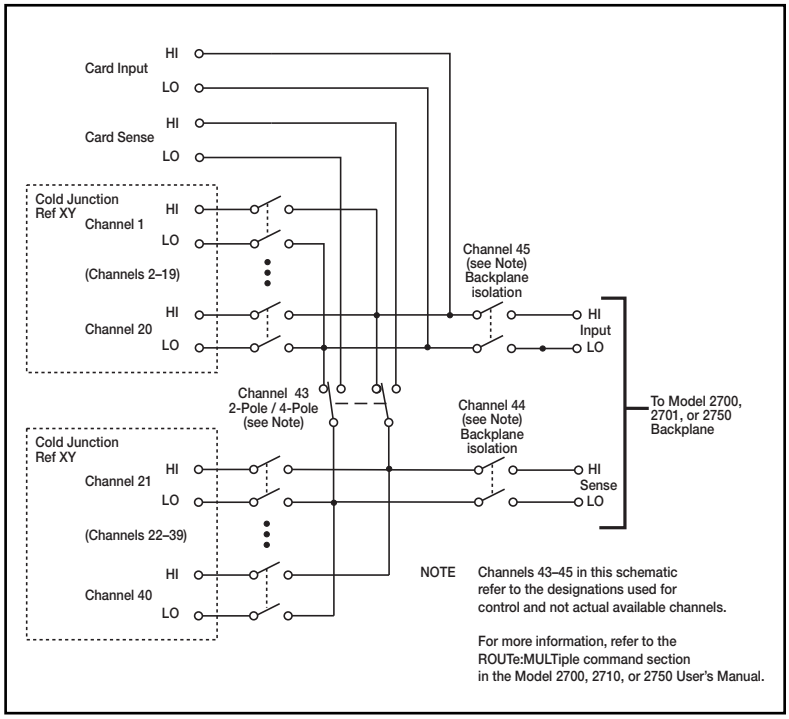
ENVIRONMENTAL:

OPERATING ENVIRONMENT: Specified for 0°C to 50°C.
Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: 0.52kg (1.16 lb).

ACCESSORIES AVAILABLE:
Model 7401 Type K Thermocouple Wire, 30.5m (100 ft).



Integra Series
Modules

Multimeter/Switch Systems

7709 6×8 MATRIX MODULE

FEATURES

- Automatic 2- or 4-wire connection to DMM
- 6 row×8 column matrix
- Two female "D-sub" connectors are standard for secure hook-up and quick teardown.
- 300V, 1A capacity.
- Two mating IDC connectors for ribbon cable are supplied.
- Relay closures stored in on-board memory.

GENERAL

MATRIX CONFIGURATION: 6 rows × 8 columns.

CONTACT CONFIGURATION: 2 pole Form A.

FIRMWARE: Specified for Model 2700 rev. B03, Model 2701 rev. A01, and Model 2750 rev. A01 or higher.

RELAY TYPE: Latching electromechanical.

ACTUATION TIME: <3ms.

CAPABILITIES

DMM CONNECTION:

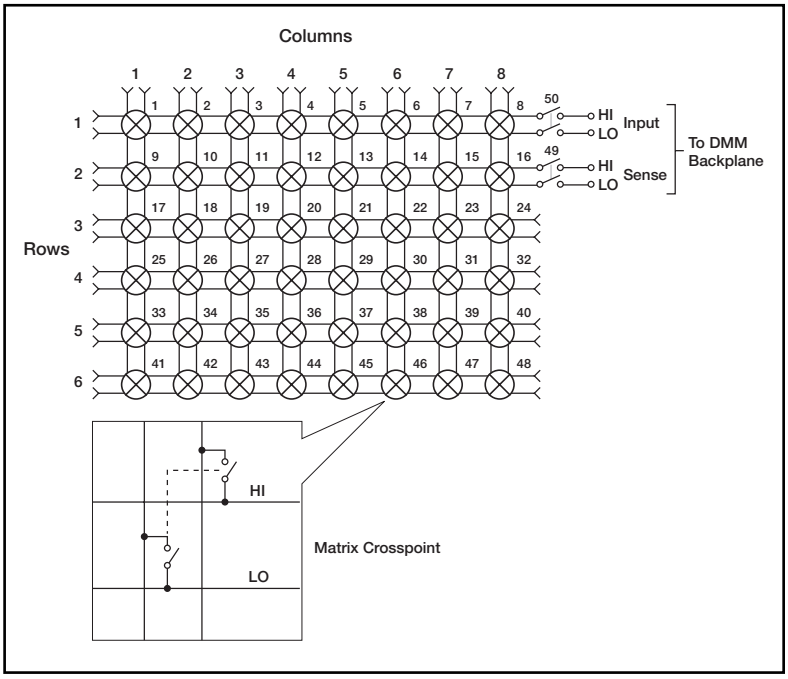
2-Wire Functions

Row 1, channels 1–8, through channel 50.

4-Wire Functions

Row 1, channels 1–4 (Source) through channel 50 and Row 2, channels 13–16 (Sense), through channel 49.

CLOSE CHANNEL: CLOSE command connects channels 1–8 to DMM. For 4-wire, channels 1–4 are automatically paired with channels 13–16. ROUTe:MULTiple allows any combination of rows and columns to be connected at the same time.



INPUTS

MAXIMUM SIGNAL LEVEL: Any Channel to Any Channel (1–48): 300VDC or 300Vrms (425V peak) for AC waveforms, 1A switched, 60W, 125VA maximum.

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

CONTACT LIFE (typ): $>10^5$ operations at max signal level.
$>10^8$ operations cold switching.

CONTACT RESISTANCE: <1Ω any path and additional 1Ω at end of contact life.

CONTACT POTENTIAL: <3μV per contact pair.

OFFSET CURRENT: <100pA.

CONNECTOR TYPE: 50-pin female D-shell for rows and columns.
25-pin female D-shell for "daisy-chain" rows.
Supplied with male IDC ribbon cable connectors.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^9$Ω, <200pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <400pF.

CROSS TALK (1MHz, 50Ω Load): <–35dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.35dB below 1MHz.
<3dB below 2MHz.

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

ENVIRONMENTAL:

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

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: <0.52kg (1.16 lb).

ACCESSORIES AVAILABLE:

Model 7789	50/25 Pin Male D-Shell Solder Cup Connectors
Model 7790	50/50/25 Pin Female/Male D-Shell IDC Connectors
Model 7705-MTC-2	50 Pin Male to Female DSUB Cable, 2m (6.6 ft).
Model 7707-MTC-2	25 Pin Male to Female DSUB Cable, 2m (6.6 ft).

7710 20-CHANNEL SOLID STATE/LONG-LIFE DIFFERENTIAL MULTIPLEXER W/AUTOMATIC CJC

FEATURES

- Solid-state relays for long life and low maintenance (100 times longer life than mechanical relays)
- Higher scanning speeds of up to 500 channels per second
- Automatic CJC with no extra accessories required for thermocouple measurements
- Removable screw terminals offer simple, quick connections
- 20 channels for general purpose measurements
- Configurable as two independent banks of multiplexers

GENERAL

CHANNELS: 20 channels of 2-pole relay input. All channels configurable to 4-pole.

RELAY TYPE: Solid State Opto-Coupled FET.

ACTUATION TIME: <0.5ms (100mA load).

FIRMWARE: Specified for Model 2700 Rev. B05, Model 2750 Rev. A04, and Model 2701 Rev. A01.

CAPABILITIES

CHANNELS 1–20: Multiplex one of 20 2-pole or one of 10 4-pole signals into DMM.

INPUTS

MAXIMUM SIGNAL LEVEL: Any channel to any channel (1–20): 60VDC or 42V rms, 100mA switched, 6W, 4.2VA maximum.

COMMON MODE VOLTAGE: 300VDC or 300Vrms (425V peak) maximum between any terminal and chassis.

RELAY LIFE (TYP): $>10^5$ operational hours max. signal level or 10^{10} operations (guaranteed by design).

RELAY DRIVE CURRENT: 6mA per channel continuous, 25mA during initial pulse.

CHANNEL RESISTANCE (per conductor): <5Ω.

CONTACT POTENTIAL: <1μV per pair.

OFFSET CURRENT: <3nA @ 23°C (per channel); additional 0.13nA/°C >23°C.

CONNECTOR TYPE: 3.5mm removable screw terminals, #20 AWG wire size.

ISOLATION BETWEEN ANY TWO TERMINALS: $>10^9$Ω, <100pF.

ISOLATION BETWEEN ANY TERMINAL AND EARTH: $>10^9$Ω, <100pF.

CROSSTALK (CH-CH, 300kHz, 50Ω Load) : <–40dB.

INSERTION LOSS (50Ω Source, 50Ω Load): <0.5dB below 100kHz, <3dB below 2MHz.

TEMPERATURE ACCURACY USING INTERNAL CJC: 1°C (Type K) (see mainframe specifications for details).

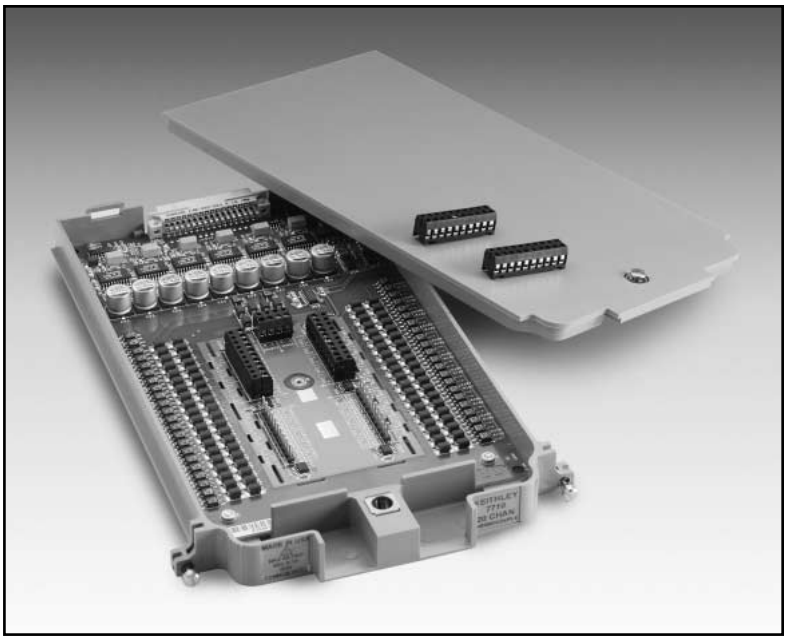
SCANNING SPEEDS (see mainframe specifications for details)

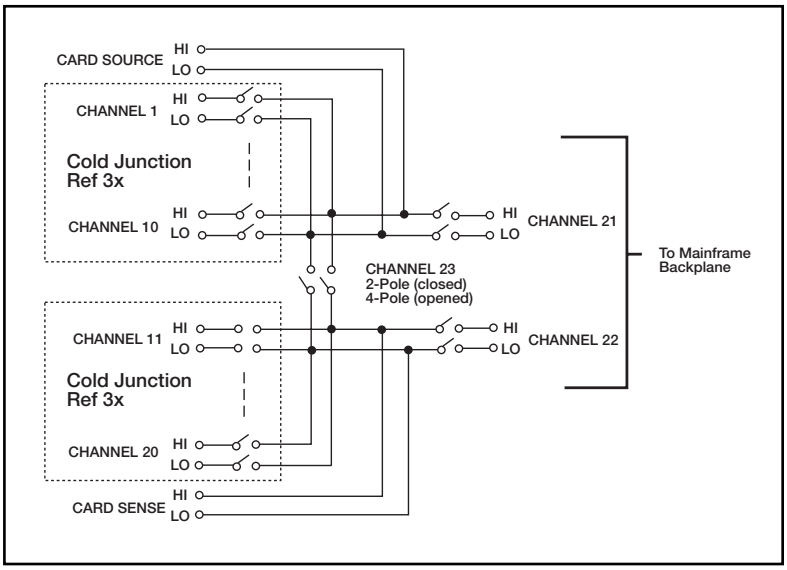
Multiple Channels, Into Memory

	Channels/s		
	2700	2701	2750
7710 Scanning DCV	180/s	500/s	230/s
7710 Scanning DCV with Limits or Time Stamp On	170/s	500/s	230/s
7710 Scanning DCV alternating 2WΩ	45/s	130/s	60/s

Multiple Channels, Into and Out of Memory to GPIB or Ethernet

	Channels/s		
	2700	2701	2750
7710 Scanning DCV	145/s	440/s	210/s
7710 Scanning DCV with Limits or Time Stamp On	145/s	440/s	210/s
7710 Scanning DCV alternating 2WΩ	40/s	130/s	55/s





ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified for 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –25° to 65°C.

WEIGHT: 0.45kg (1 lb).

ACCESSORIES AVAILABLE: Model 7401 Type K Thermocouple Wire, 30.5m (100 ft).

Integra Series
Modules

Multimeter/Switch Systems

7711 2GHz 50Ω RF MODULE

FEATURES

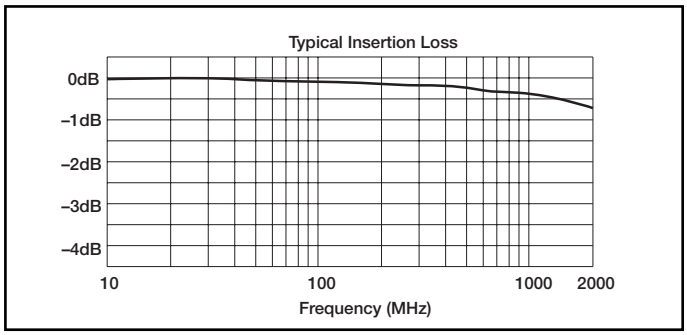
- Outstanding signal routing performance to 2GHz
- Dual 1×4 configuration
- Rear panel connections
- On-board switch closure counter
- On-board S-parameter storage
- Switch up to 60VDC

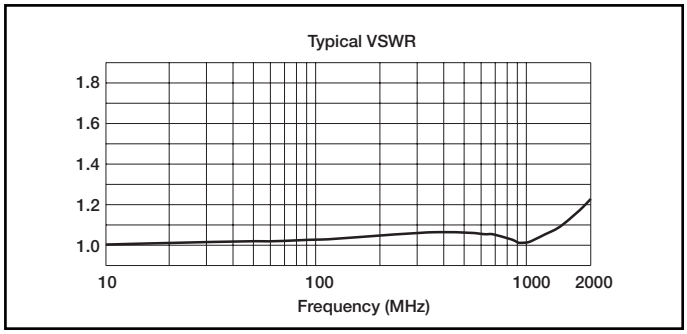
AC PERFORMANCE (End of Life)

For $Z_{load} = Z_{source} = 50\Omega$

	<100 MHz	500 MHz	1 GHz	1.5 GHz	2 GHz
Insertion Loss Max.	<0.4 dB	<0.6 dB	<1.0 dB	<1.2 dB	<2.0 dB
VSWR Max.	<1.1	<1.2	<1.2	<1.3	<1.7 [2]
Ch-Ch Crosstalk[1] Max.	–85 dB	–65 dB	–55 dB	–45 dB	–35 dB

[1] Specification assumes 50Ω termination.
[2] Add 0.1VSWR after 5×10^5 closures (no load).





INPUTS (CHANNELS 1-8)

MAXIMUM SIGNAL LEVEL: Any channel to any channel or chassis (1–8): 30Vrms (42V peak for AC waveforms) or 60VDC, 0.5A.

MAXIMUM POWER: 20W per module, 10W per channel (refer to 7711/7712 Manual PA-818 for measurement considerations).

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

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

ISOLATION: **Multiplexer to Multiplexer:** >1GΩ.
Center to Shield: >1GΩ, <25pF.
Channel to Channel: >100MΩ.

CONTACT LIFE: 1×10^6 no load, 1×10^5 rated load (resistive load).

CONTACT POTENTIAL: <6μV

CONTACT RESISTANCE: <0.5Ω (initial), <1Ω (end of life).

RISE TIME: <300ps (guaranteed by design).

SIGNAL DELAY: <3ns.

GENERAL

RELAY TYPE: High frequency electromechanical.

CONTACT CONFIGURATION: Dual 1×4 multiplexer, single pole four throw, Channels 1 and 5 are normally closed.

NOTES: One channel in each multiplex bank is always closed to the corresponding OUT connector.

CLOSE CHANNEL: ROUTe:CLOSe allows a single channel in a multiplex bank to be closed. ROUTe:MULTiple:CLOSe allows two channels (one in each bank) to be closed at one time.

OPEN CHANNEL: ROUTe:OPEN:ALL closes CH1 and CH5 to OUT A and OUT B respectively.

ACTUATION TIME: <10ms.

FIRMWARE: Specified for Model 2700 rev. B04, 2701 rev. A01, and 2750 rev. A03 or higher.

CONNECTOR TYPE: Ten external rear panel SMA connectors.

MATING TORQUE: 0.9 N·m (8 in-lb).

ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified for 80% RH at 35°C.

STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: <0.5kg (1.1 lb).

ACCESSORIES AVAILABLE

7051-2	BNC Cable, male to male, 0.6m (2 ft.)
7051-5	BNC Cable, male to male, 1.5m (5 ft.)
7051-10	BNC Cable, male to male, 3.0m (10 ft.)
7711-BNC-SMA	Male SMA to female BNC Cables (5), 0.15m (0.5 ft)
7712-SMA-1	SMA Cable, male to male, 1m (3.3 ft)
7712-SMA-N	Female SMA to Male N-Type Adapter
S46-SMA-0.5	SMA Cable, male to male, 0.15m (0.5 ft.)
S46-SMA-1	SMA Cable, male to male, 0.3m (1 ft.)

7712 3.5GHz 50Ω RF MODULE

FEATURES

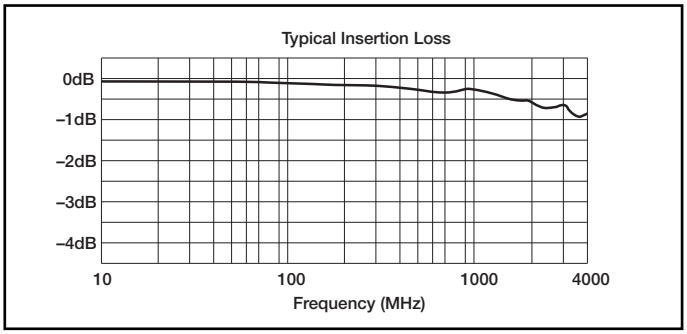
- 3.5GHz bandwidth
- Dual 1×4 configuration
- Rear panel SMA connections
- On-board switch closure counter
- On-board S-parameter storage

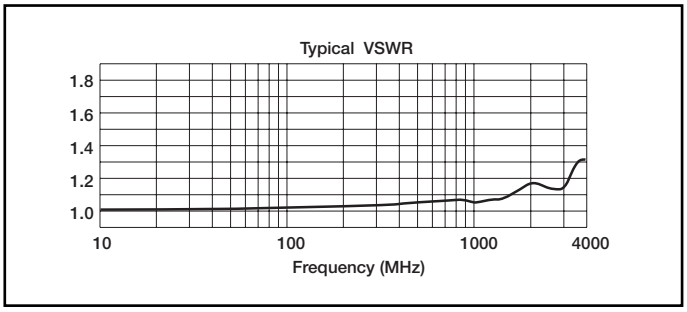
AC PERFORMANCE (End of Life)

For $Z_{load} = Z_{source} = 50\Omega$

	<500 MHz	1 GHz	2.4 GHz	3.5 GHz
Insertion Loss MAX	<0.5 dB	<0.65 dB	<1.1 dB	<1.3 dB
VSWR MAX	<1.15	<1.2	<1.45[2]	<1.45
Ch-Ch Crosstalk[1] MAX	–75 dB	–70 dB	–50 dB	–45 dB

[1] Specification assumes 50Ω termination.
[2] Add 0.1VSWR after 5×10^5 closures (no load).





INPUTS (CHANNELS 1-8)

MAXIMUM SIGNAL LEVEL: Any channel to any channel or chassis (1–8): 30Vrms (42V peak for AC waveforms) or 42VDC, 0.5A.

MAXIMUM POWER: 20W per module, 10W per channel (refer to 7711/7712 Manual PA-818 for measurement considerations).

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

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

ISOLATION: **Multiplexer to Multiplexer:** >1GΩ.
Center to Shield: >1GΩ, <20pF.
Channel to Channel: >100MΩ.

CONTACT LIFE: 5×10^6 no load, 1×10^5 rated load (resistive load).

CONTACT POTENTIAL: <12μV.

CONTACT RESISTANCE: <0.5Ω (initial), <1Ω (end of life).

RISE TIME: <200ps (guaranteed by design).

SIGNAL DELAY: <1.5ns.

GENERAL

RELAY TYPE: High frequency electromechanical.

CONTACT CONFIGURATION: Dual 1×4 multiplexer, single pole four throw, Channels 1 and 5 are normally closed.

NOTES: One channel in each multiplex bank is always closed to the corresponding OUT connector.

CLOSE CHANNEL: ROUTe:CLOSe allows a single channel in a multiplex bank to be closed. ROUTe:MULTiple:CLOSe allows two channels (one in each bank) to be closed at one time.

OPEN CHANNEL: ROUTe:OPEN:ALL closes CH1 and CH5 to OUT A and OUT B respectively.

ACTUATION TIME: <10ms.

FIRMWARE: Specified for Model 2700 rev. B04, 2701 rev. A01, and 2750 rev. A03 or higher.

CONNECTOR TYPE: Ten external rear panel SMA connectors.

MATING TORQUE: 0.9 N·m (8 in-lb).

ENVIRONMENTAL

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified for 80% RH at 35°C.

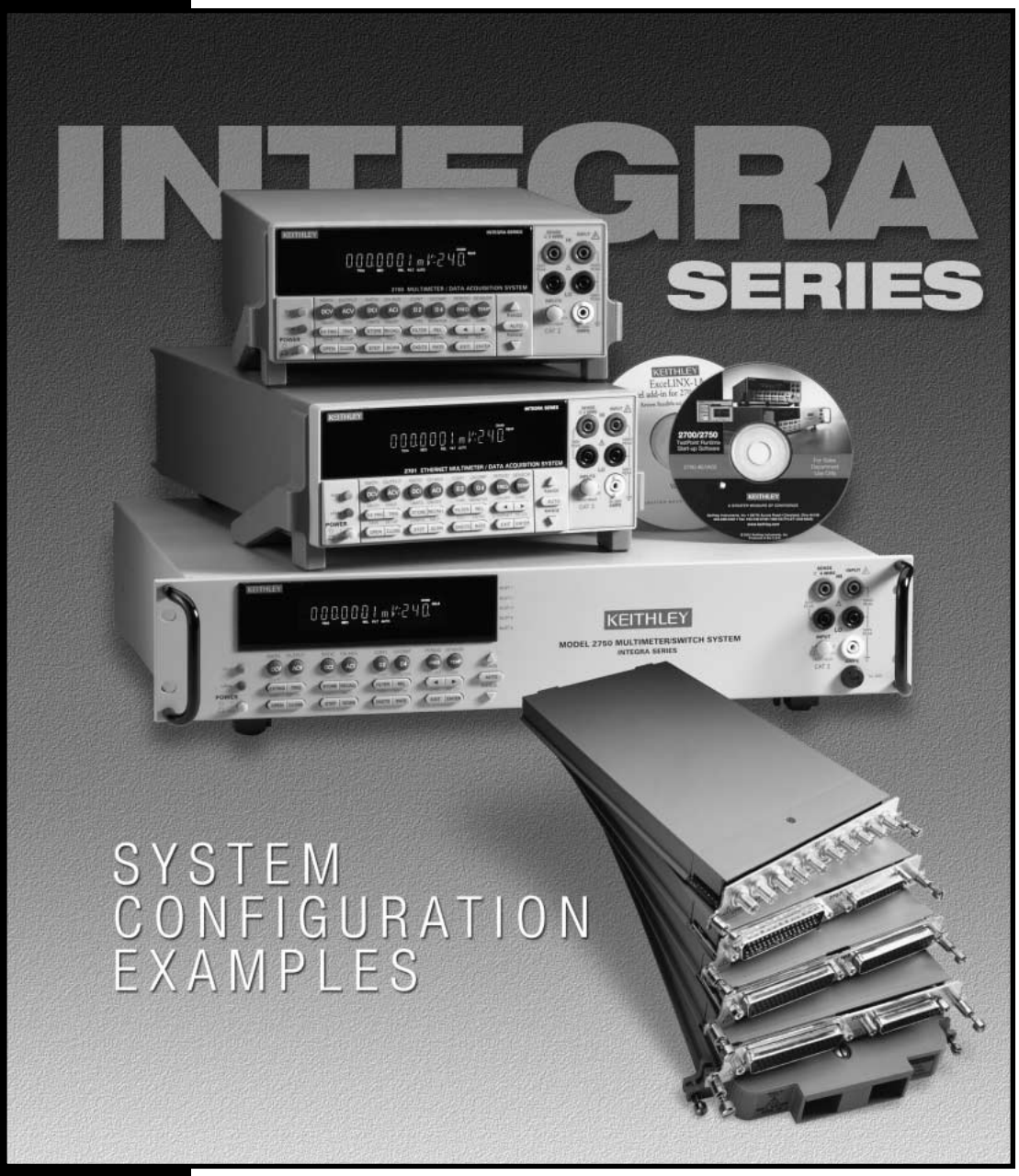
STORAGE ENVIRONMENT: –25°C to 65°C.

WEIGHT: <0.5kg (1.1 lb).

ACCESSORIES AVAILABLE

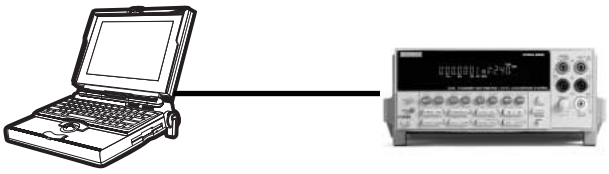
7712-SMA-1	SMA Cable, male to male, 1m (3.3 ft)
7712-SMA-N	Female SMA to Male N-Type Adapter
S46-SMA-0.5	SMA Cable, male to male, 0.15m (0.5 ft.)
S46-SMA-1	SMA Cable, male to male, 0.3m (1 ft.)

Integra Series Multimeter/Switch Systems



Integra Series Multimeter/Switch Systems

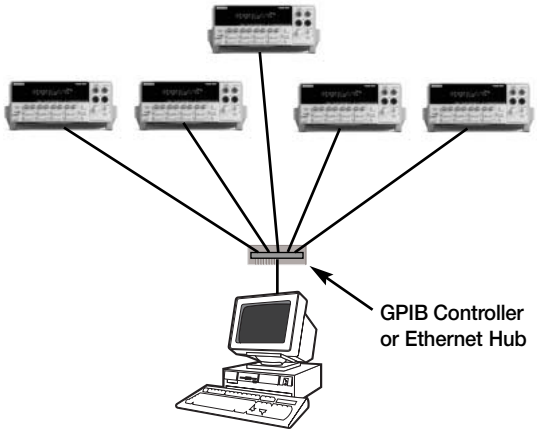
Simple Computer to Single Instrument Control



Interface	Maximum Distance	Maximum Speed	Cable Type
RS-232	~15 m†	115.2 kb/s (2701) 19.2 kb/s (2700, 2750)	Null modem cable Keithley Model 7009-5
GPIB	2 m	1 MB/s	Standard GPIB cable Keithley Model 7007-*
Ethernet	Hardwired: 100 m Wireless: >16 km	100 Mb/s	RJ-45 crossover cable

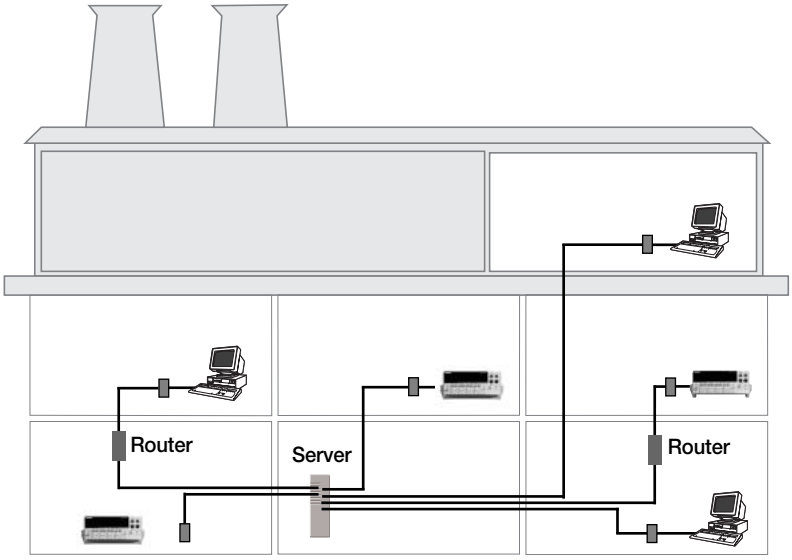
† RS-232 maximum distance is heavily dependent on the baud rate setting. Very slow baud rates can be operated at distances longer than 15m, while faster baud rates may require cables shorter than 15m.

Single Computer to Multiple Instruments



Interface	Maximum No. of Instruments	Maximum Distance	Maximum Speed	Cable Type
GPIB	14 per controller	2m per cable 20m per controller	1 MB/s	Standard GPIB cable Keithley Model 7007-*
Ethernet	∞	Hardwired: 100m per cable Wireless: >16 km	100 Mb/s	Standard RJ-45 straight-through cable

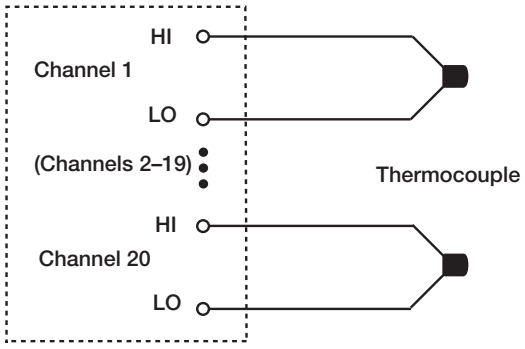
Multiple Computers to Multiple Instruments–Ethernet Only



Call or visit www.keithley.com for Technical Note #2393, "Network Primer and Programming Tutorial for the Model 2701 Ethernet-Based DMM/Data Acquisition System." This document explains the basic principles for using instruments over a network and programming methods for Ethernet.

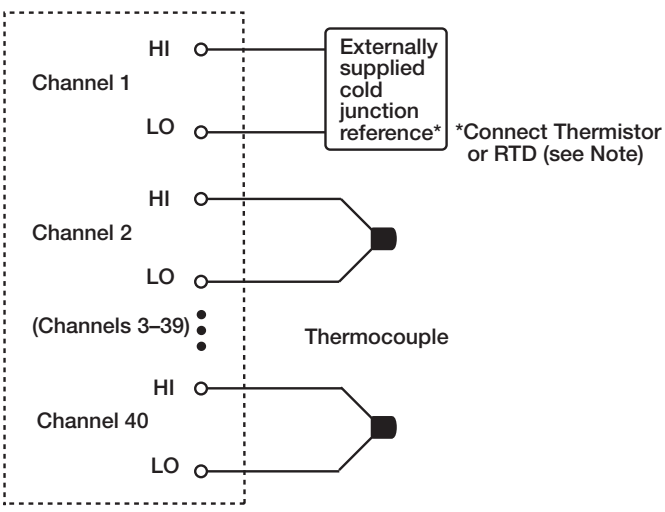
Integra Series Multimeter/Switch Systems

Thermocouple Configuration Example Using Internal CJC



NOTE: The red lead is the LO signal on all thermocouples. This applies to U.S. standards.

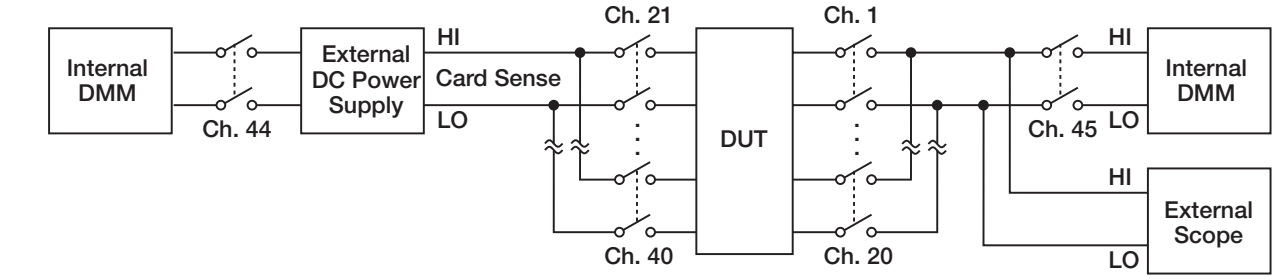
Thermocouple Configuration Example Using External CJC



NOTE: If an RTD is connected as the cold junction reference, Channel 21 will be used for the sense leads of the RTD and is not available for connection of a thermocouple.

NOTE: The red lead is the LO signal on all thermocouples.

7708 Configuration Examples



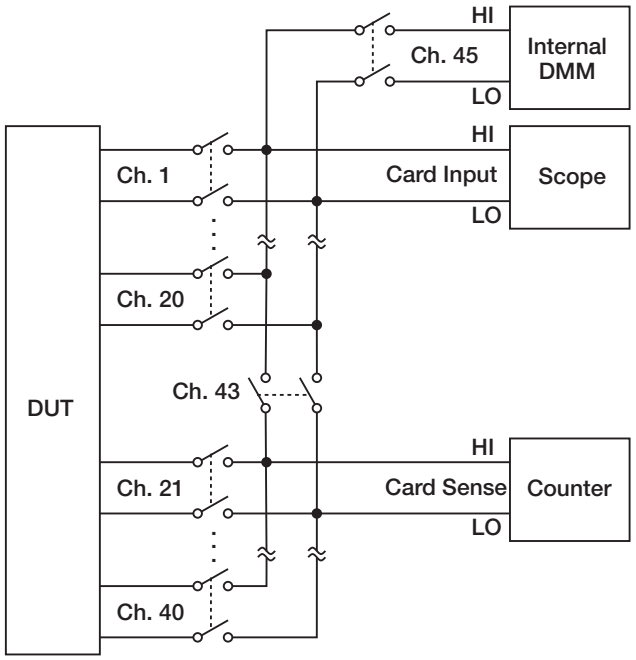
See Model 7708 specifications.

Channel 43 .....Closed
Channel 44 .....Open
Channel 45 .....Closed for DMM measure

NOTE: This configuration example can be duplicated with the 7700, 7701, 7702, 7703, 7706, 7707, and 7708 modules. See module specifications for their channel configurations.

7708 Configuration Examples (continued)

Using internal DMM and external instruments



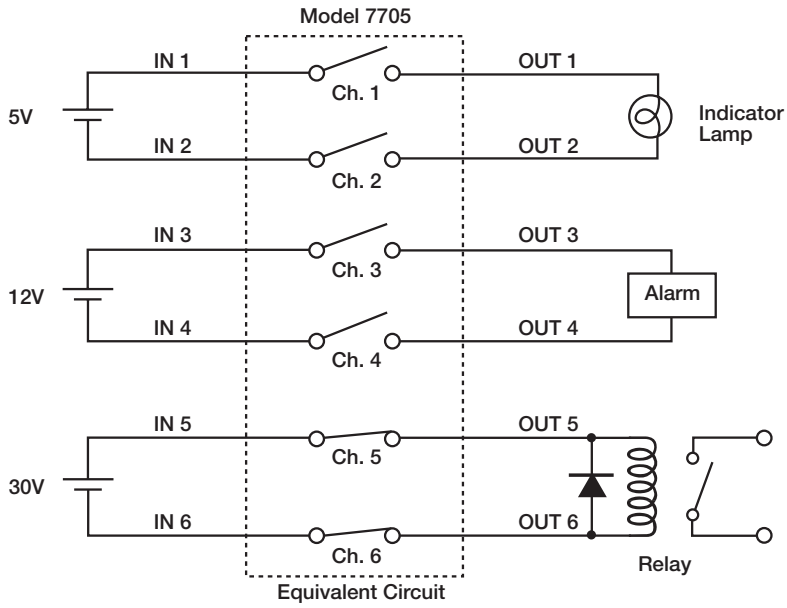
See Model 7708 specifications.

Channel 43 .....Open
Channel 44 .....Open
Channel 45 .....Closed

NOTE: This configuration example can be duplicated with the 7700, 7701, 7702, 7703, 7706, 7707, and 7708 modules. See module specifications for their channel configurations.

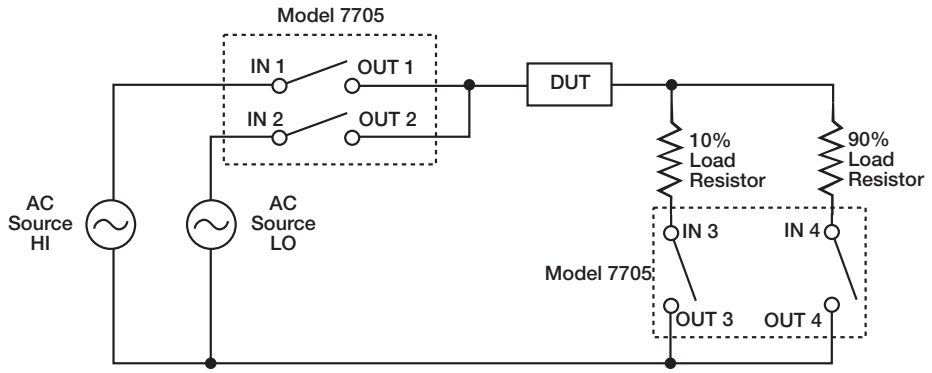
7705 Configuration Examples

Typical connections—indicator lamps, alarm, and relay



7705 Configuration Examples (continued)

Variable AC line/load test connections

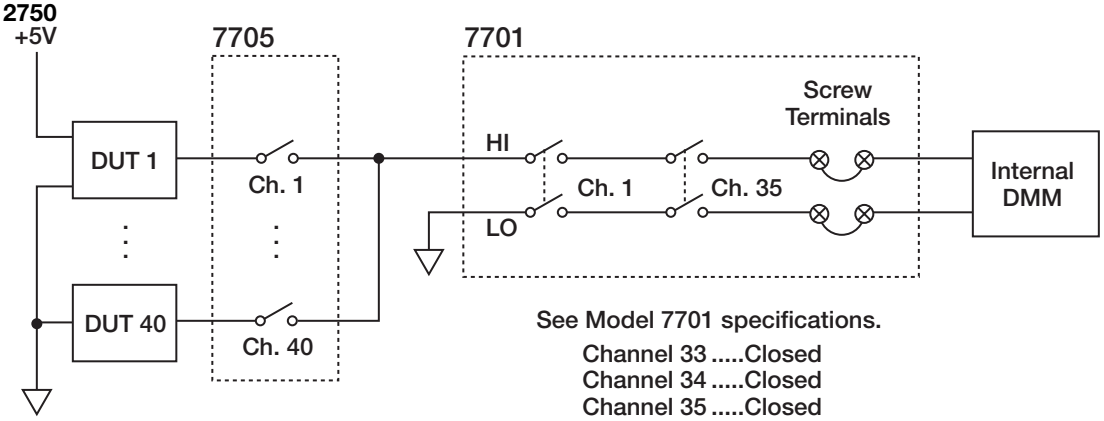


CAUTION: Maximum switch current is 2A.

Source is impedance limited from mains (Safety Category I signals).

Single Pole (Single Point Ground) Switching Example

Using the 7705 for independent switching and the 7701 to bring measurement of DUT to internal DMM of 2750

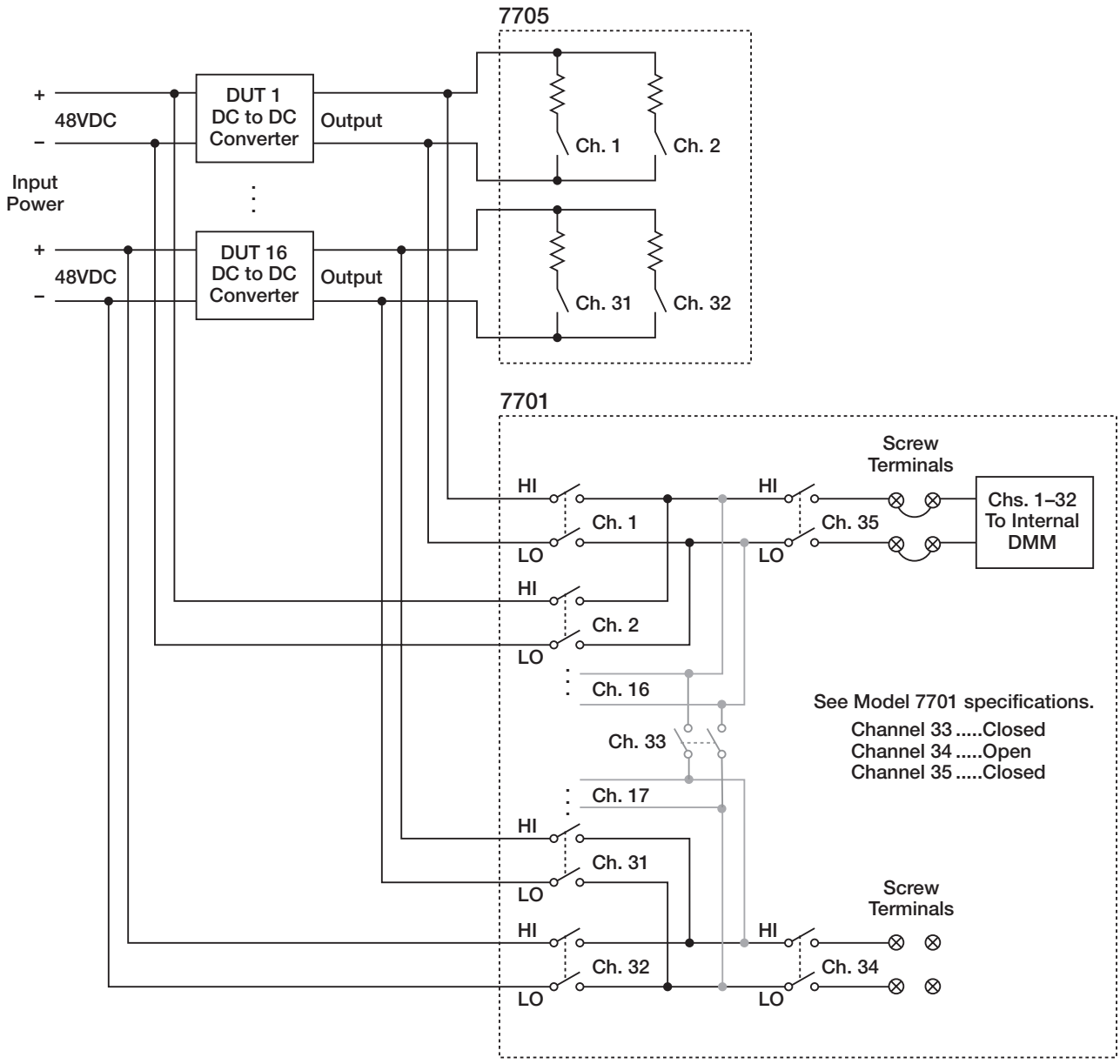


See Model 7701 specifications.

Channel 33 .....Closed
Channel 34 .....Closed
Channel 35 .....Closed

7705 Configuration Examples (continued)

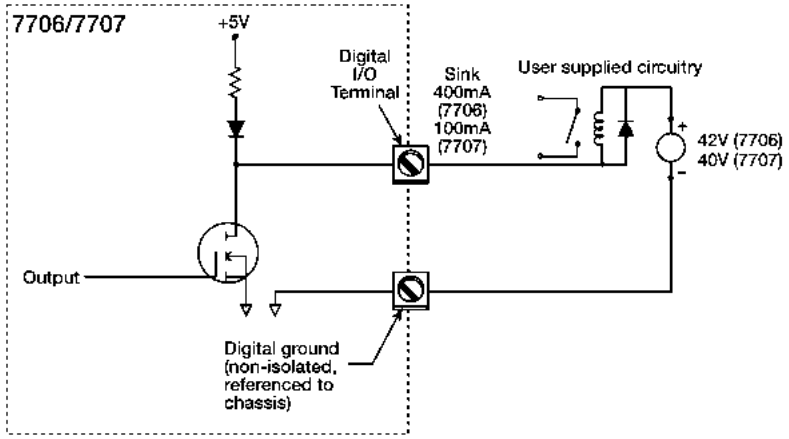
7705 independent switch and 7701 multiplexer example



Integra Series Multimeter/Switch Systems

Analog Output and Digital I/O Examples

Typical digital output w/external power supply



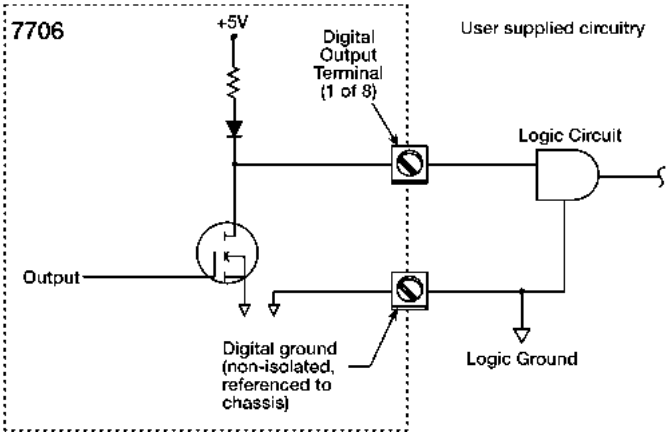
Digital Output

The 7706 module has two non-isolated 8-bit output ports that can be used for outputting digital patterns. The two ports can be combined to output a single 16-bit word or a dual 8-bit byte. A simplified diagram of a single output bit is shown here.

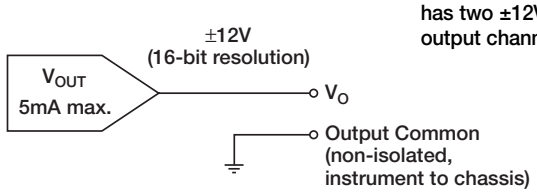
The 7707 module has four non-isolated 8-bit input/output ports that can be used for outputting digital patterns. The two ports can be combined to output a 16-bit word, or dual or quad 8-bit bytes.

The 7707 can also be configured (in blocks of 8) as digital inputs.

Typical digital output (no external power supply)



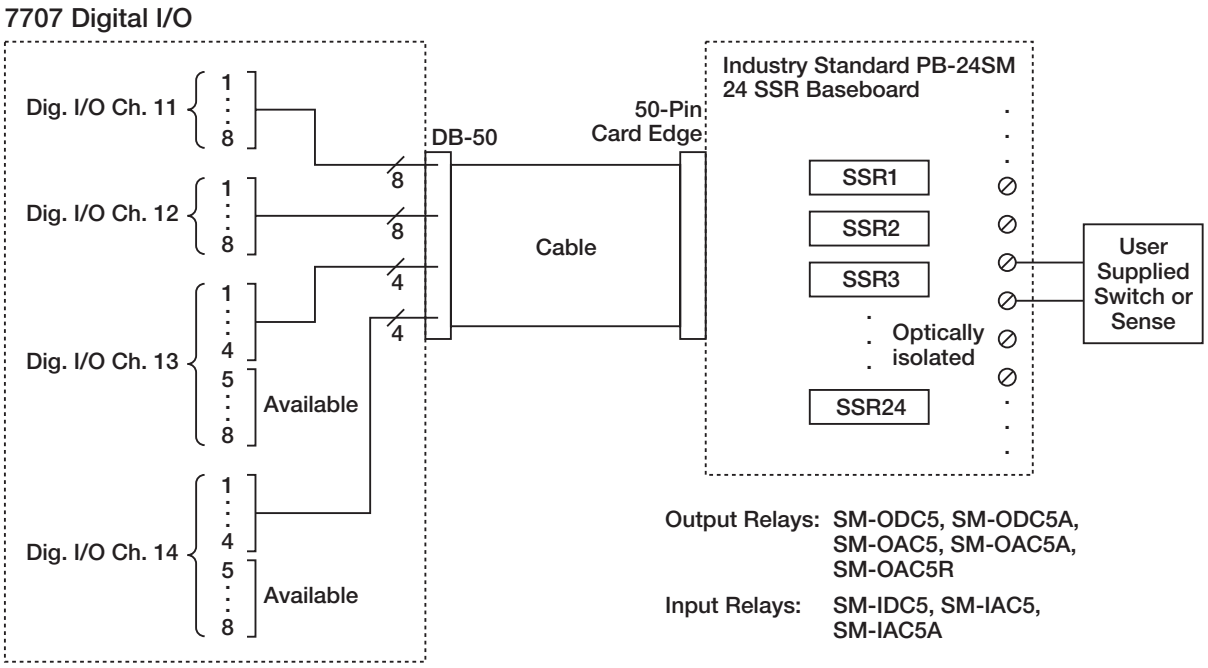
7706 analog output



NOTE: The 7706 module has two ±12V analog output channels.

Analog Output and Digital I/O Examples (continued)

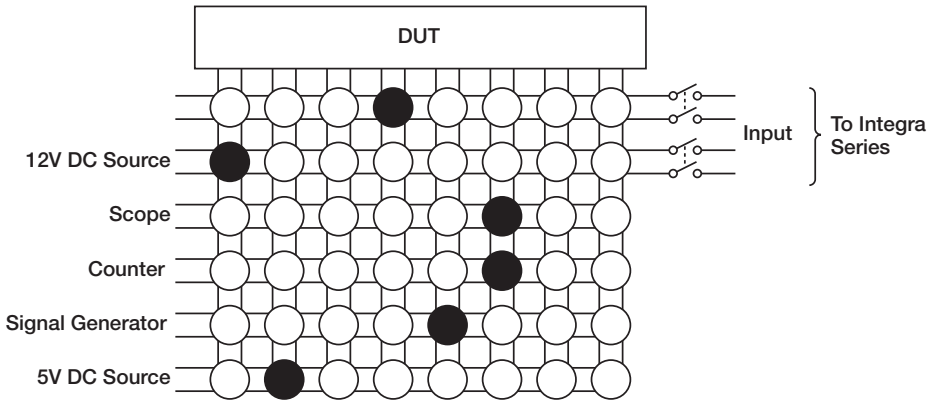
Connecting the Model 7707 Digital I/O module to industry standard solid-state relays (SSRs) to switch high VA (up to 980VA).



CAUTION: Adequate insulation barriers must be used on PB-24SM and cable for systems with >42V.

Matrix Configuration Example

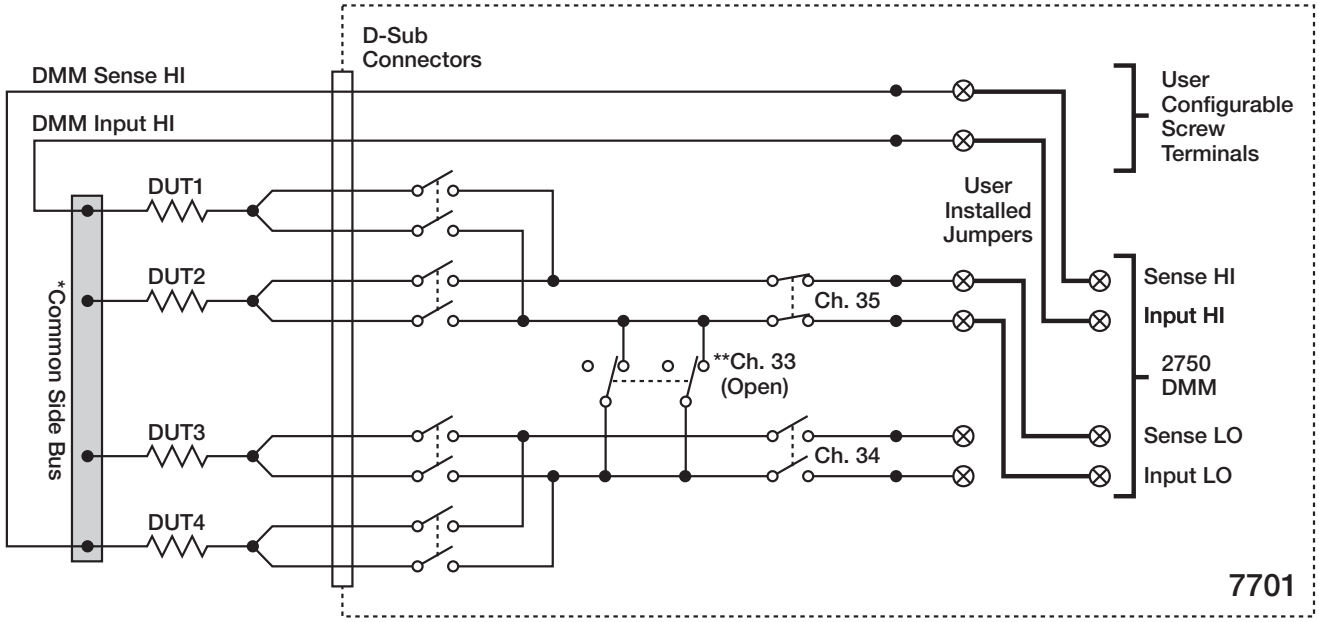
7709 6x8 Matrix configuration example



The 7709 Matrix Module can connect any combination of six differential channels of instrumentation to any combination of eight differential DUT channels. The instrumentation can be the Integra system's internal DMM or external equipment (AC and DC sources, internal or external meters, oscilloscopes, etc.) This matrix configuration allows wide flexibility for complex test systems.

7701 Configuration Example

7701 32-Channel common-side
4-wire Ohms configuration example



*NOTE: Common side connections must be made carefully to eliminate all lead resistance from the 4-wire ohms measurement. The common side bus should be a single wire or bus bar that connects the HI side of all the DUTs. DMM Input HI should be connected to one end of the common side bus and DMM Sense HI should be connected to the other end.

**NOTE: Refer to ROUTE:MULT section of the 2700, 2701, or 2750 manual for more information.

Integra Series Multimeter/Switch Systems

Integra Series Multimeter/Switch Systems

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SWEDEN:	c/o Regus Business Centre • Frosundaviks Allé 15, 4tr • 169 70 Solna • 08-509 04 600 • Fax: 08-655 26 10

No. 2393
0103

2700/2750 Software Options

	Startup Software (TestPoint Runtime)	ExceLINX-1A[4]	TestPoint	XLinx[2]	Instrument Drivers
Data-logging without programming	X	X	X	X	
Move data into Excel for post-acquisition analysis			[1]	X	
Stream live data directly into Excel		X			
Save data to disk - all channels	X	X	[1]	X	[1]
Graph up to 4 channels			[1]	X	[1]
Graph up to 8 channels	X		[1]		[1]
Graph over 8 channels		X	[1]		[1]
Graph while scanning	X	X	[1]	X	[1]
Scan all channels on supported modules	X	X	[1]	X	[1]
Configure trigger source	X	X	[1]	X	[1]
Remote data-logging		X	[1]	X	[1]
DCV, DCI, ACV, ACI, ohms (2 & 4 wire), continuity, frequency, period	X	X	[1]	X	[1]
Temperature - thermocouple	X	X	[1]	X	[1]
Temperature - thermistors, RTD's		X	[1]	X	[1]
Limits, filtering, scaling		X	[1]		[1]
Limits can control chassis digital outputs		X	[1]		[1]
Analog output, digital IO			[1]		[1]
On/Off control of switches on a module			[1]		[1]
Help - online & context sensitive	X	X	X	X	X
Control sequences or custom algorithms			[1]		[1]
Create semi-custom app using Startup Software as foundation			[1]		
Create free runtimes			[1]		
Optional toolkits: Internet Toolkit, Database Toolkit, Statistical Process Control Toolkit			[1]		
Create custom app w/ LabView, LabWindows CVI, VB, C++					[1]
Supports multiple instruments simultaneously			[1]		[1]
Supports: 7700, 7702, 7708	X	X	[1]	X	[1]
Supports: 7701, 7703, 7705, 7706, 7707, 7709			[1]		[1]
Available When?	8/1/01	8/1/01	Now	Now	Now
Available from:	Free - download IntegraUp&Running from Web	$395 - order ExceLINX-1A CD from Keithley	$995 - order TestPoint CD from Keithley[3]	Free - XLinx bundled with instrument	Free - download KE2700 driver from Web

[1] Feature requires custom programming.

[2] XLinx is only available for the 2700, not the 2750.

[3] Internet Toolkit, Database Toolkit, SPC Toolkit, or the Suite that contains TestPoint and all of the toolkits are available from Keithley.

[4] ExceLINX for the 2700/2750 is different from ExceLINX for our Data Acq boards.
- ExceLINX for 2700/2750 is ExceLINX-1A, which is only on CD-ROM and costs $395 (requires Office 97 or 2000).
- ExceLINX for Data Acq boards is ExceLINX-DAS, which only available for download from the Web and is FREE.

Downloads are available from www.keithley.com

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