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2790 SourceMeter® Switch System Specifications

7751/7752 SOURCE/SWITCH MODULE SPECIFICATIONS

2790 Resistance Mode Specifications with Cards[2,3]

(Module function accuracy specifications are for 2 years, 23°C, ±5°C)

Source Current	Maximum Resistance	Typ. Open Ckt. Voltage	Accuracy %Rdg + Ohms	Temperature Coefficient (0-18°C & 28-40°C)
50mA	20Ω	5.5V	0.09% + 0.6mΩ	(0.002%+.02mΩ)/°C
20mA	50Ω	5.5V	0.11% + 1.5mΩ	(0.003%+.05mΩ)/°C
10mA	100Ω	5.5V	0.16% + 3.0mΩ	(0.004%+.1mΩ)/°C
(Dry Circuit Ohms 1mA max with 7751 or 7752 card)				
1mA	*10Ω*	*20mV*	*1.10% + 30mΩ*	*(0.026%+.5mΩ)/°C*

(7751 Only)

Source Voltage	Resistance Range	Typ. Short Ckt. Current	Accuracy %Rdg + Ohms	Temperature Coefficient (0-18°C & 28-40°C)
500V	10MΩ–100MΩ	<1mA	1.2% + 20KΩ	(0.03%+200Ω)/°C
500V	100MΩ-1GΩ	<1mA	3.0% + 20KΩ	(0.12%+200Ω)/°C
50V	1MΩ-10MΩ	<1mA	1.2% + 20KΩ	(0.04%+200Ω)/°C
50V	10MΩ–100MΩ	<1mA	2.1% + 20KΩ	(0.13%+200Ω)/°C

Current Source Output

Output Level: Programmable 0 to 50mA (Ch. 27).

Programming Resolution: 10µA.

Output Voltage: 5.5V±10% compliance.

Accuracy: 0.06% + 10µA (2 yr Specification).

Settling Time: 1mS to 0.1% of final value (typ).

Temperature Coefficient: (0-18°C & 28-40°C) (0.001%+0.25µA)/°C

Dry Circuit Clamp (Ch. 24): 20mV±10%, Isource ≤1mA

Voltage Source Output (7751 Only)

Output Level: Programmable 50V to 500V (CH. 28).

Programming Resolution: 100mV.

Output Current: 50µA maximum for rated accuracy, <1mA typ into short circuit.

Accuracy: 0.5% + 0.1V (2yr Specification).

Settling Time: Rise Time: 50V to 500V step, 0.1% of final value, 250 ms max.

Fall Time: 500V to 50V step, 0.1% of final value, 1000 ms max.

Temperature Coefficient: (0-18°C & 28-40°C) (0.001%+0.005V)/°C

Safety Limit: Impedance limited maximum current of 1mA.

Cable Discharge (Ch. 20): 100kΩ Shunt

Max Capacitance: 1nF

Current Measure Input (7751 Only)

Accuracy: 0.5% (of reading) + 5nA (0-50µA) (2yr Specification).

Temperature Coefficient: (0-18°C & 28-40°C) (0.02%+0.5nA)/°C

Voltage Burden: <1mV.

Switching Capabilities (Bank 1 – Bank 4)

4 Channels: 1 Form A switch.

8 Channels: 4 4-pole or 8 2-pole signals into DMM or I/V converter.

Contact Check: 4-Wire contact check through internal DMM.

Relay Type: Latching electromechanical.

Actuation Time: <3ms.

Contact Life (typ): $>10^6$ operations at maximum source level. $>10^8$ operations cold switching.

Contact Resistance: <1 Ohm at end of contact life.

Contact Potential: <±2µV typical per contact pair, ±3µV max.

Connector Type: Plugable screw terminal, #22 AWG wire size.

Isolation Between any two Terminals[1]: >1GΩ, <100pF.

Isolation Between Terminals and Earth[1]: >1GΩ, <200pF.

Isolation Between Channel Groups[1]: >500GΩ, <100pF.

External Common Mode Voltage: 42V between any terminal and chassis. (Connect no external sources.)

7751 or 7752 Module Notes

[1] Isolation for channels 1-12, only one channel closed at a time, or all channels open.

[2] See User's manual for ohm specifications at sources other than those specified.

[3] All specifications valid for 1 NPLC ADC aperture setting.

System Throughput

(Connect, source, measure, calculate)

0.01 NPLC, Filter Off, over GPIB Bus

High Ohms (Source V): 13 Rdgs/Sec[1]

Low Ohms (Source I): 9 Rdgs/Sec

1 NPLC, Filter On, Over GPIB Bus

High Ohms (Source V): 11 Rdgs/Sec[1]

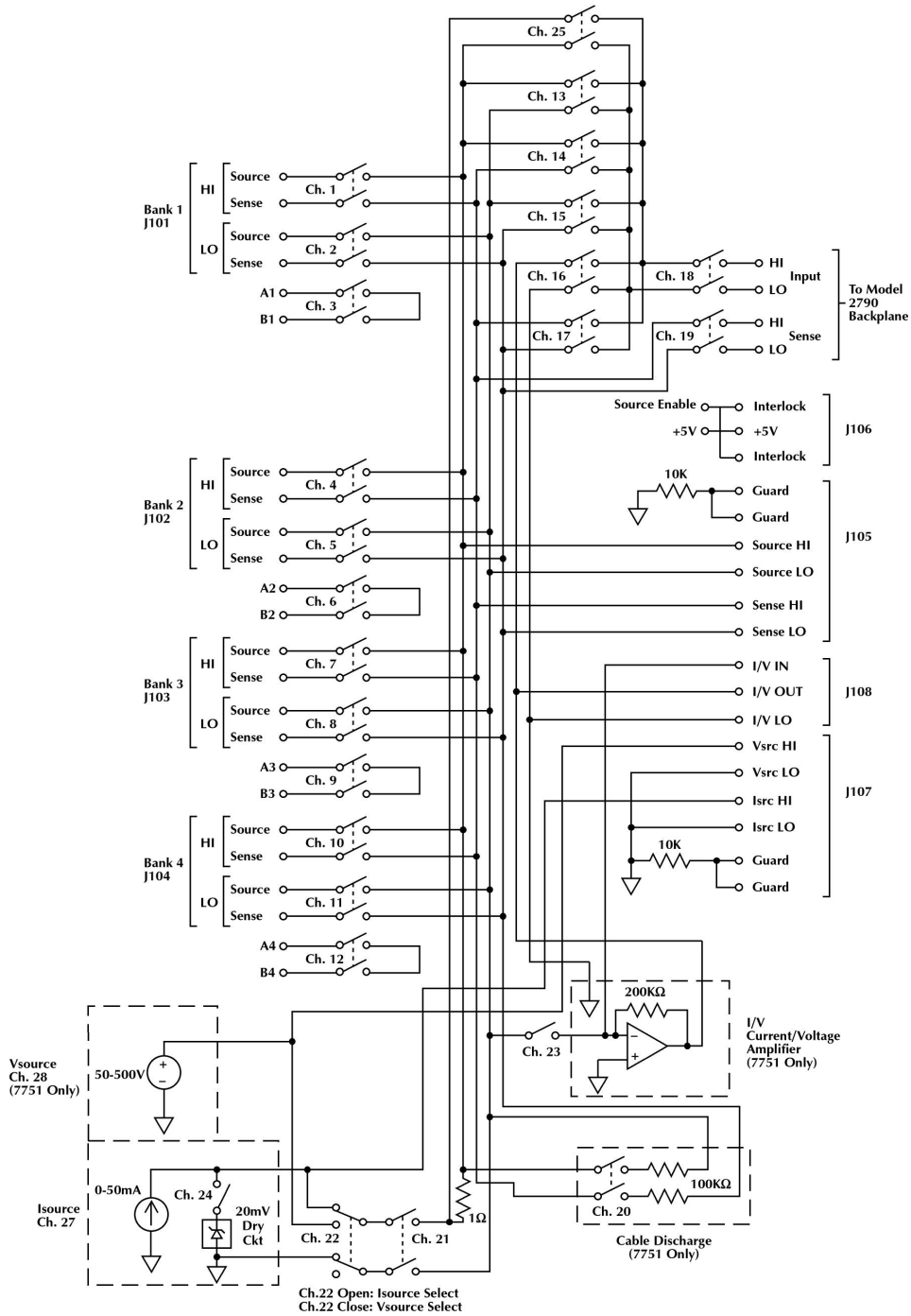
Low Ohms (Source I): 7 Rdgs/Sec

System Throughput Notes

1. Reset upon fixed Vsource level, no settling time.

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7751/7752 SOURCE/SWITCH MODULE SPECIFICATIONS



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2790 MAINFRAME FUNCTION SPECIFICATION

MAINFRAME FUNCTION ACCURACY SPECIFICATIONS ARE FOR 1 YEAR, 23°C±5°C

DC MEASUREMENT SPECIFICATIONS[1]

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

ACCURACY: ±(ppm of reading + ppm of range)
(ppm = parts per million) (e.g., 10ppm = 0.001%)

Function	Range	Resolution	Test Current (±5%) or Burden Voltage	Input Resistance or Open Ckt. Voltage[3]	24 Hour[4] 23°C ±1°	90 Day 23°C ±5°	1 Year 23°C ±5°	Temperature Coefficient 0°-18°C & 28°-40°C
Voltage	100.0000 mV	0.1 µV		>10 GΩ	15 + 30	25 + 70	30 + 70	(1 + 5)/°C
	1.000000 V	1.0 µV		>10 GΩ	15 + 6	25 + 7	30 + 7	(1 + 1)/°C
	10.00000 V	10 µV		>10 GΩ	10 + 4	20 + 5	30 + 5	(1 + 1)/°C
	100.0000 V	100 µV		10 MΩ ±1%	15 + 6	45 + 9	55 + 9	(5 + 1)/°C
	1000.000 V[5]	1 mV		10 MΩ ±1%	20 + 6	35 + 9	50 + 9	(5 + 1)/°C
Resistance[6, 8]	100.0000 Ω	100 µΩ	1 mA	6.6 V	20 + 20	80 + 20	100 + 20	(8 + 1)/°C
	1.000000 kΩ	1 mΩ	1 mA	6.6 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	10.00000 kΩ	10 mΩ	100 µA	6.6 V	20 + 6	80 + 6	100 + 6	(8 + 1)/°C
	100.0000 kΩ	100 mΩ	10 µA	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	1.000000 MΩ	1.0 Ω	10 µA	12.8 V	20 + 6	80 + 10	100 + 10	(8 + 1)/°C
	10.00000 MΩ[7]	10 Ω	Note 7	7.0 V	150 + 6	200 + 10	400 + 10	(30 + 1)/°C
	100.0000 MΩ[7]	100 Ω	Note 7	7.0 V	800 + 30	3000 + 30	3000 + 30	(150 + 1)/°C
Continuity (2W)	1.000 kΩ	100 mΩ	1 mA	6.6 V	40 + 100	100 + 100	100 + 100	(8 + 1)/°C
Current	20.00000 mA	10 nA	<0.2 V		60 + 15	300 + 40	500 + 40	(50 + 5)/°C
	100.0000 mA	100 nA	<0.05 V		100 + 150	300 + 400	500 + 400	(50 + 50)/°C
	1.000000 A	1.0 µA	<0.3 V[9]		200 + 15	500 + 40	800 + 40	(50 + 5)/°C
	3.000000 A	10 µA	<1.0 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

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

Range	Resolution	Accuracy 1 Year (23°C ± 5°C)	Temperature Coefficient 0-18°C & 28°-40°C
4-Wire RTD: (100Ω platinum [PT100], D100, F100, PT385, PT3916, or user type. Offset compensation On.)			
-200°C to 630°C	0.01°C	0.06°C	0.003°C/°C
Thermistor: (2.2kΩ, 5kΩ, and 10kΩ)[18]			
-80°C to 150°C	0.01°C	0.08°C	0.002°C/°C

DC Speed vs. Noise Rejection

Rate	Filter	Readings/s[11]	Digits	RMS Noise 10V Range	NMRR	CMRR[13]
10	50	0.01 (0.08)	6.5	< 1.2 µV	110 dB[12]	120 dB
1	Off	15 (12)	6.5	< 4 µV	90 dB[12]	120 dB
0.1	Off	500 (400)	5.5	< 22 µV	–	80 dB
0.01	Off	2000 (1800)	4.5	< 150 µV	–	80 dB

DC Operating Characteristics[15]

60Hz (50Hz) Operation

Function	Digits	Readings/s	PLCs
DCV, DCI, Ohms (<10M), Thermistor	6.5[11, 15]	5 (4)	10
	6.5[15]	30 (24)	1
	6.5[11, 15]	50 (40)	1
	5.5[11, 15]	100 (80)	0.1
	5.5[15, 16]	250 (200)	0.1
	5.5[16]	480 (400)	0.1
	4.5[16]	2000 (1800)	0.01
4W Ohms (<10M)	6.5[15]	1.4 (1.1)	10
	6.5[15]	15 (12)	1
	5.5[16]	33 (25)	0.1
RTD	6.5[15]	0.9 (0.7)	10
	6.5[15]	8 (6.4)	1
	5.5[15, 16]	18 (14.4)	0.1
Channel (Ratio), Channel (AVG)	6.5[15]	2.5 (2)	10
	6.5[15]	15 (12)	1
	5.5[16]	25 (20)	0.1

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MAINFRAME FUNCTION SPECIFICATION

DC System Speeds[14, 17]

RANGE CHANGES[15]: 50/s (42/s).
FUNCTION CHANGES[15]: 50/s (42/s).
AUTORANGE TIME[15]: < 30ms.
ASCII READINGS TO RS-232 (19.2k BAUD): 55/s.
MAX. INTERNAL TRIGGER RATE: 2000/s.
MAX. EXTERNAL TRIGGER RATE: 375/s.

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%.
INPUT BIAS CURRENT: <100pA at 23°C.
COMMON MODE CURRENT: <500nAp-p at 50Hz or 60Hz.
INPUT PROTECTION: Front, 1000V, Rear, 300V, 7702 card only.

Resistance

MAX 4WΩ LEAD RESISTANCE: 10% of range per lead for 100Ω and 1kΩ ranges; 1kΩ per lead for all other ranges.
OFFSET COMPENSATION: Selectable on 4WΩ, 100Ω, 1kΩ, and 10kΩ ranges.
CONTINUITY THRESHOLD: Adjustable 1 to 1000 Ω.
INPUT PROTECTION: Front, 1000V Source Inputs, 350V Sense Inputs, Rear, 300V, 7702 card only.

DC Current

Shunt Resistors: 100mA–3A, 0.1Ω. 20mA, 5Ω.
Input Protection: 3A, 250V fuse.

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, 100Ω 30ppm, <1MΩ 2ppm, 10mA and 1A 10ppm, 100mA 40ppm.
[3] ±2% (measured with 10MΩ input resistance DMM, >10GΩ DMM on 10MΩ and 100MΩ ranges).
[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, 100Ω with offset compensation on. With offset compensation on, OPEN CKT. VOLTAGE is 12.8V. For 2-wire Ω add 1Ω additional uncertainty.
[7] Must have 10% matching of lead resistance in Input HI and LO. Test current +0.7µA||10MΩ
[8] Add the following to "ppm of reading" uncertainty when using plug in modules:

	10 kΩ	100 kΩ	1 MΩ	10 MΩ	100 MΩ
7702, 7751, 7752				220 ppm	2200 ppm

[9] Add 1V when used with plug-in modules.
[10] For RATIO, DCV only. For AVERAGE, DCV only. Available with plug-in modules only.
[11] Auto zero off.
[12] For LSYNC On, line frequency ±0.1 %. For LSYNC Off, use 60dB for 1PLC.
[13] For 1kΩ unbalance in LO lead.
[14] Speeds are for 60Hz (50Hz) operation using factory defaults operating conditions (*RST). Autorange off, Display off, Limits off, Trigger delay = 0.
[15] Speeds include measurements and binary data transfer out the GPIB.
[16] Sample count = 1024, auto zero off.
[17] Auto zero off, NPLC = 0.01.
[18] 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

2790 SourceMeter® Switch System Specifications

MAINFRAME FUNCTION SPECIFICATION

AC MEASUREMENT SPECIFICATIONS[1]

Function	Range	Resolution	All Ranges Calibration Cycle	All Ranges 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						
	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						
	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-5 kHz**			
Current[2]	1.000000 A	1.0 µA	90 Day/1 Year	0.30 + 0.04	0.10 + 0.04			
	3.00000 A	10 µA		0.35 + 0.06	0.15 + 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 3.33 ppm 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
20Hz - 30Hz	0.3	—
30Hz - 50Hz	0	—
50Hz - 100Hz	0	1.0
100Hz - 200Hz	0	0.18
200Hz - 300Hz	0	0.10
> 300Hz	0	0

CREST FACTOR[5]:	1–2	2–3	3–4
Additional Uncertainty:	0.05	0.15	0.30

AC MEASUREMENT CHARACTERISTICS

AC Volts

MEASUREMENT METHOD: AC-coupled, True RMS.

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

INPUT PROTECTION: 1000Vp or 400VDC, 300Vrms with 7702 module.

AC Current

MEASUREMENT METHOD: AC-coupled, True RMS.

SHUNT RESISTANCE: 0.1Ω.

BURDEN VOLTAGE: 1A <0.3Vrms, 3A <1Vrms. Add 1Vrms when used with 7702 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.

MAXIMUM CREST FACTOR: 5 at full-scale.

VOLT HERTZ PRODUCT: <= 8×10^7.

AC OPERATING CHARACTERISTICS[7]

60Hz (50Hz) Operation

Function	Digits	Readings/s	Rate	Bandwidth
ACV, ACI	6.5[8]	2s/Reading	SLOW	3 Hz-300kHz
	6.5[8]	1.4 (1.1)	MED	30 Hz-300kHz
	6.5[9]	4.8 (4)	MED	30 Hz-300kHz
	6.5[9]	35 (28)	FAST	300 Hz-300kHz
Frequency, Period	6.5	1 (1)	SLOW	3 Hz-300kHz
	5.5	9 (9)	MED	30 Hz-300kHz
	4.5	35 (35)	FAST	300 Hz-300kHz
	4.5[10]	65 (65)	FAST	300 Hz-300kHz

2790 SourceMeter® Switch System Specifications

MAINFRAME FUNCTION SPECIFICATION

AC System Speeds[7, 11]

RANGE CHANGES[12]: 4/s (3/s).
FUNCTION CHANGES[12]: 4/s (3/s).
AUTORANGE TIME: < 3s.
ASCII READINGS TO RS-232 (19.2k baud): 50/s.
MAX. INTERNAL TRIGGER RATE: 300/s.
MAX. EXTERNAL TRIGGER RATE: 250/s.

AC Notes

[1] 20% overrange except on 750V and 3A.

[2] Specifications 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°–40°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 and <500Hz. (Guaranteed by design for Crest Factors >4.3)

[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. Includes measurement and binary data transfer out GPIB.

[8] 0.01% of step settling error. Trigger delay = 400ms.

[9] Trigger delay = 0.

[10] Sample count = 1024.

[11] DETector:BANDwidth 300 with nPLC = 0.01.

[12] Maximum useful limit with trigger delay = 175ms.

Internal Scanner Speeds:

Into and Out of Memory to GPIB[1]

7702 Scanning DCV: 60/s

Internal Scanner Speed Notes:

[1] Speeds are 60Hz or 50Hz operation using factory default conditions (*RST). NPLC = 0.01. Auto Zero off, Auto Range off, and Display off. Sample count =1024. Includes measurement and binary data transfer out GPIB.

GENERAL SPECIFICATIONS

POWER SUPPLY: 100V / 120V / 220V / 240V +10%, -5%.

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

POWER CONSUMPTION: 28VA.

OPERATING ENVIRONMENT: Specified for 0°C to 40°C. Specified to 60% R.H. at 35°C.

STORAGE ENVIRONMENT: -40°C to 70°C.

BATTERY: Lithium battery-backed memory, 3 years @ 23°C.

WARRANTY: 1 year.

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 × 370mm deep (3.5 in. × 8.375 in. × 14.563 in.).

Bench Configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4.125 in. × 9.375 in. × 14.563 in.).

SHIPPING WEIGHT: 6.5kg (14 lbs).

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 33V.

EARTH ISOLATION: 500Vpeak, >10GΩ and <150pF any terminal to chassis.

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.

External Trigger Jitter: <1ms.

Memory Size: 55,000 readings.

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

REMOTE INTERFACE:

GPIB (IEEE-488.2) and RS-232C.

SCPI (Standard Commands for Programmable Instruments)

ACCESSORIES SUPPLIED: User Manual and Reference Manual, Screw Driver.

MODULES SUPPORTED: Models 7751, 7752, and 7702.

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