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System Switch/Multimeter Specifications

SPECIFICATION CONDITIONS

This document contains specifications for the Model 3706A System Switch/Multimeter. Specifications are the standards against which the 3706A is tested. Upon leaving the factory, the 3706A meets these specifications.

DC SPECIFICATIONS

Conditions: 1 PLC or 5 PLC.

For <1 PLC, add appropriate “ppm of range” from the “RMS Noise” table. Includes rear-panel analog backplane connector and transducer conversion. Refer to footnotes for additional card uncertainties.

Accuracy: ± (ppm of reading + ppm of range) (ppm = parts per million; for example, 10 ppm = 0.001%)

Function	Range ¹	Resolution	Test current or burden voltage	Input resistance or open circuit voltage ²	24 hour ³ 23°C ± 1°	90 day 23°C ± 5°	1 year 23°C ± 5°	Temperature coefficient 0° to 18°C and 28°C to 50°C
Voltage ⁴	100.00000 mV ⁵	0.01 µV	—	>10 GΩ or 10 MΩ ± 1%	10 + 9	25 + 9	30 + 9	(1 + 5)/ °C
	1.0000000 V ⁵	0.1 µV	—	>10 GΩ or 10 MΩ ± 1%	7 + 2	25 + 2	30 + 2	(1 + 1)/ °C
	10.000000 V	1 µV	—	>10 GΩ or 10 MΩ ± 1%	7 + 2	20 + 2	25 + 2	(1 + 1)/ °C
	100.00000 V	10 µV	—	10 MΩ ± 1%	15 + 6	35 + 6	40 + 6	(5 + 1)/ °C
	300.0000 V	100 µV	—	10 MΩ ± 1%	20 + 6	35 + 6	40 + 6	(5 + 1)/ °C

¹ 20% overrange on dc functions except 1% on 300 V and 3.33% on 3 A.

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

Range	2W	Offset compensation off		Offset compensation on	
		4W	4W Kelvin	4W	4W Kelvin
1 Ω, 10 Ω	8.2 V	8.2 V	8.2 V	12.1 V	12.1 V
100 Ω, 1 kΩ	13.9 V	14.1 V	13.9 V	15.0 V	12.7 V
10 kΩ	9.1 V	9.1 V	9.1 V	0.0 V	0.0 V
100 kΩ, 1 MΩ	12.7 V	14.7 V	12.7 V	—	—
10 MΩ, 100 MΩ	6.4 V	6.4 V	6.4 V	—	—

³ Relative to calibration accuracy.

⁴ Add the following additional uncertainty with –ST accessory:

Cards	“ppm of range”			“ppm of reading + ppm of range”			
	100 mV	1 V	10 V	100 kΩ	1 MΩ	10 MΩ	100 MΩ
3720, 3721, 3722, and 3730	45	4.5	—	8 + 5	8 + 0.5	—	—
3723	60	6.0	—	8 + 6	8 + 0.5	—	—
3724	45	4.5	—	8 + 5	80 + 0.5	250 + 1	5000 + 1
3731	800	80	8	8 + 80	40 + 8	0 + 25	0 + 15
3732 (Quad 4x28)	200	20	2	8 + 20	40 + 2	0 + 7	0 + 4

⁵ When properly zeroed using REL function.



Function	Range ¹	Resolution	Test current or burden voltage	Input resistance or open circuit voltage ²	24 hour ³ 23°C ± 1°	90 day 23°C ± 5°	1 year 23°C ± 5°	Temperature coefficient 0° to 18°C and 28°C to 50°C
Resistance ^{4, 6, 7, 8}	1.0000000 Ω	0.1 μΩ	10 mA	8.2 V	15 + 80	40 + 80	60 + 80	(8 + 1)/ °C
	10.0000000 Ω	1 μΩ	10 mA	8.2 V	15 + 9	40 + 9	60 + 9	(8 + 1)/ °C
	100.000000 Ω	10 μΩ	1 mA	13.9 V	15 + 9	45 + 9	65 + 9	(8 + 1)/ °C
	1.0000000 kΩ	100 μΩ	1 mA	13.9 V	20 + 4	45 + 4	65 + 4	(8 + 1)/ °C
	10.0000000 kΩ	1 mΩ	100 μA	9.1 V	15 + 4	40 + 4	60 + 4	(8 + 1)/ °C
	100.000000 kΩ	10 mΩ	10 μA	14.7 V	20 + 4	45 + 5	65 + 5	(8 + 1)/ °C
	1.0000000 MΩ	100 mΩ	10 μA	14.7 V	25 + 4	50 + 5	70 + 5	(8 + 1)/ °C
	10.0000000 MΩ	1 Ω	0.64 μA // 10 MΩ	6.4 V	150 + 6	200 + 10	400 + 10	(70 + 1)/ °C
100.000000 MΩ	10 Ω	0.64 μA // 10 MΩ	6.4 V	800 + 30	2000 + 30	2000 + 30	(385 + 1)/ °C	
Dry circuit resistance ^{7, 9}	1.0000000 Ω	1 μΩ	10 mA	27 mV	25 + 80	50 + 80	70 + 80	(8 + 1)/ °C
	10.0000000 Ω	10 μΩ	1 mA	20 mV	25 + 80	50 + 80	70 + 80	(8 + 1)/ °C
	100.000000 Ω	100 μΩ	100 μA	20 mV	25 + 80	90 + 80	140 + 80	(8 + 1)/ °C
	1.0000000 kΩ	1 mΩ	10 μA	20 mV	25 + 80	180 + 80	400 + 80	(8 + 1)/ °C
	2.0000000 kΩ	10 mΩ	5 μA	20 mV	25 + 80	320 + 80	800 + 80	(8 + 1)/ °C
Continuity (2W)	1.000 kΩ	100 mΩ	1 mA	13.9 V	40 + 100	100 + 100	100 + 100	(8 + 1)/ °C
Current ¹⁰	10.0000000 μA	1 pA	<61 mV	—	40 + 50	300 + 50	500 + 50	(35 + 9)/ °C
	100.000000 μA	10 pA	<105 mV	—	50 + 9	300 + 30	500 + 30	(50 + 5)/ °C
	1.0000000 mA	100 pA	<130 mV	—	50 + 9	300 + 30	500 + 30	(50 + 5)/ °C
	10.0000000 mA	1 nA	<150 mV	—	50 + 9	300 + 30	500 + 30	(50 + 5)/ °C
	100.000000 mA	10 nA	<0.4 V	—	50 + 9	300 + 30	500 + 30	(50 + 5)/ °C
	1.0000000 A	100 nA	<0.6 V	—	200 + 60	500 + 60	800 + 60	(50 + 10)/ °C
	3.0000000 A	1 μA	<1.8 V	—	1000 + 75	1200 + 75	1200 + 75	(50 + 10)/ °C

⁶ Specifications are for 4-wire Ω, 1Ω to 1 kΩ with offset compensation on. For the Model 3700 plug-in cards, LSYNC and offset compensation on. 1 Ω range is 4-wire only. The Model 3724 card, 1 kΩ to 100 MΩ and 3731 card, 100 Ω to 100 MΩ ranges only. For 2-wire Ω specifications, add the following to “ppm of range” uncertainty:

DMM connect relays	Rel enable	Rear-panel connector or 3700 card	3724 card	3731 card
CONNECT_ALL	ON	100 mΩ	500 mΩ	900 mΩ
CONNECT_ALL	OFF	1.5 Ω	64 Ω	2.3 Ω
CONNECT_TWO_WIRE	ON	700 mΩ	1.2 Ω	1.5 Ω
CONNECT_TWO_WIRE	OFF	1.5 Ω	64 Ω	2.3 Ω

⁷ Test current with `dmm.offsetcompensation=OFF` (±5%).

⁸ Add the following to “ppm of reading” uncertainty when using 3700 plug-in cards in operating environment ≥50% relative humidity.

Card	10 kΩ	100 kΩ	1 MΩ	10 MΩ	100 MΩ
3720, 3721, 3724, 3730, 3731, 3732 (Quad 4x28) with MTC D-shell connector	1 ppm	10 ppm	0.01%	0.1%	1%
3720, 3721, 3724, 3730, 3731, 3732 (Quad 4x28) with -ST screw terminal module	10 ppm	100 ppm	0.1%	1%	10%
3722 and 3723	10 ppm	100 ppm	0.1%	1%	10%

3700 plug-in cards operating environment: Specified for 0°C to 50°C, ≤70% relative humidity at 35°C.

⁹ Dry-Circuit Ω is 4-wire only. Specifications with offset compensation and LSYNC on.

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

¹⁰ Includes analog backplane 15-pin rear-panel connector. For 3721, refer to the DC Current table for additional uncertainties.

NOISE REJECTION

For L_{SYNC} on, line frequency ±0.1%.

	nPLC	5	1	≤ 0.2	≤ 0.01
L _{SYNC} on	NMRR	110 dB	90 dB	45 dB	—
L _{SYNC} off	NMRR	60dB, ±2 dB	60 dB, ±2 dB	—	—

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

nPLC	5	1	0.2 ¹³	≤0.2
CMRR	140 dB	140 dB	120 dB	80 dB

TEMPERATURE

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

Accuracy for all thermocouple types and the 100 Ω platinum, D100, and F100 RTD types based on ITS-90.
Accuracy for the PT385 and PT3916 RTD types based on IPTS-68.

THERMOCOUPLES

Type	Range	Resolution	Simulated reference junction	90 day / 1 year 23°C ± 5°		90 day / 1 year 23°C ± 5°	
				3720, 3721, or 3724 cards	Range	3720, 3721, or 3724 cards	Temperature coefficient 0°C to 18°C and 28°C to 50°C
J	-150°C to +760°C	0.001°C	0.2°C	1.0°C	-200°C to -150°C	1.5°C	0.03°C/°C
K	-150°C to +1372°C	0.001°C	0.2°C	1.0°C	-200°C to -150°C	1.5°C	0.03°C/°C
N	-100°C to +1300°C	0.001°C	0.2°C	1.0°C	-200°C to -100°C	1.5°C	0.03°C/°C
T	-100°C to +400°C	0.001°C	0.2°C	1.0°C	-200°C to -100°C	1.5°C	0.03°C/°C
E	-150°C to +1000°C	0.001°C	0.2°C	1.0°C	-200°C to -150°C	1.5°C	0.03°C/°C
R	+400°C to +1768°C	0.1°C	0.6°C	1.8°C	0°C to +400°C	2.3°C	0.03°C/°C
S	+400°C to +1768°C	0.1°C	0.6°C	1.8°C	0°C to +400°C	2.3°C	0.03°C/°C
B	+1100°C to +1820°C	0.1°C	0.6°C	1.8°C	+350°C to +1100°C	2.8°C	0.03°C/°C

4-Wire RTD or 3-Wire RTD: (100 Ω platinum [PT100], D100, F100, PT385, PT3916, or USER 0 Ω to 10 kΩ.) Selectable offset compensation on or off.

For 3-Wire RTD, `dmm.connect=dmm.CONNECT_FOUR_WIRE`, ≤ 0.1 Ω lead resistance mismatching in Input HI and LO. Add 0.25°C/ 0.1 Ω of lead resistance mismatch.

Type	Range	Resolution	Simulated reference junction	90 day / 1 year 23°C ± 5°		90 day / 1 year 23°C ± 5°	
				3720, 3721, or 3724 cards	Range	3720, 3721, or 3724 cards	Temperature coefficient 0°C to 18°C and 28°C to 50°C
4-Wire RTD	-200°C to +630°C	0.001°C			0.06°C		0.003°C/°C
3-Wire RTD	-200°C to +630°C	0.001°C			0.75°C		0.003°C/°C

Thermistor: (2.2 kΩ, 5 kΩ, and 10 kΩ). Not recommended with Model 3724 card.

Range	Resolution	90 day / 1 year 23°C ± 5° 3720, 3721, or 3724 cards	Temperature coefficient 0°C to 18°C and 28°C to 50°C
-810°C to +150°C	0.001°C	0.08°C	0.002°C/°C

DC SPEEDS VERSUS RMS NOISE

Single channel, 60 Hz (50 Hz) operation.

1 PLC and 5 PLC RMS noise are included in dc specifications.

				RMS noise ¹¹ PPM of range				
				RMS noise calculator: Add 2.5 × "RMS Noise" to "ppm of range" (for example, 10 V at 0.006 PLC) "ppm of range" = 2.5 × 7.0 ppm + 2 ppm				
Function	NPLC	Aperture (ms)	Digits	100 mV	1 V	10 V	100 V	300 V
DCV	5 ¹²	83.3 (100)	7½	1.0	0.07	0.05	0.7	0.2
	1 ¹²	16.7 (20)	7½	0.9	0.12	0.1	0.8	0.35
	0.2 ^{12, 13}	3.33 (4.0)	6½	2.5	0.32	0.3	2.5	1.0
	0.2 ¹²	3.33 (4.0)	6½	3.5	1.7	0.7	3.5	1.5
	0.06 ¹⁴	1.0 (1.2)	5½	12	3.0	1.5	8.0	3.5
	0.006 ¹⁴	0.100 (0.120)	4½	55	15	7.0	70	35
	0.0005 ¹⁴	0.0083 (0.01)	3½	325	95	95	900	410
				10 Ω to 100 Ω	1 kΩ	10 kΩ		
2WΩ (≤10 kΩ)	5 ¹²	83.3 (100)	7½	2.0	0.5	0.4	—	—
	1 ¹²	16.7 (20)	7½	3.5	0.8	0.6	—	—
	0.2 ^{12, 13}	3.33 (4.0)	6½	6.5	1.7	1.5	—	—
	0.2 ¹²	3.33 (4.0)	6½	8.0	4.5	5.5	—	—
	0.06 ¹⁴	1.0 (1.2)	5½	15	6	6.5	—	—
	0.006 ¹⁴	0.100 (0.120)	4½	60	15	15	—	—
	0.0005 ¹⁴	0.0083 (0.01)	3½	190	190	190	—	—
				10 μA	100 μA	1 mA to 100 mA	1 A	3 A
DCI	5 ¹²	83.3 (100)	7½	3.5	1.6	1.6	2.9	2.0
	1 ¹²	16.7 (20)	6½	3.5	1.1	1.1	2.2	1.8
	0.2 ^{12, 13}	3.33 (4.0)	5½	50	5.0	3.0	4.0	8.0
	0.2 ¹²	3.33 (4.0)	4½	100	35	12	4.0	8.0
	0.06 ¹⁴	1.0 (1.2)	4½	350	35	20	8.0	20
	0.006 ¹⁴	0.100 (0.120)	4½	400	200	40	50	100
	0.0005 ¹⁴	0.0083 (0.01)	3½	2500	450	250	325	750
				1 Ω	10 Ω to 100 Ω	1 kΩ	10 kΩ	
4WΩ	5 ¹²	83.3 (100)	7½	5.5	0.8	0.5	0.5	
	1 ¹²	16.7 (20)	7½	15	1.4	0.5	0.7	
	0.2 ^{12, 13}	3.33 (4.0)	5½	100	30	10	50	
	0.2 ¹²	3.33 (4.0)	5½	300	50	10	63	
	0.06 ¹⁴	1.0 (1.2)	4½	500	50	15	70	
	0.006 ¹⁴	0.100 (0.120)	4½	750	75	30	100	
	0.0005 ¹⁴	0.0083 (0.01)	3½	3500	450	250	250	

¹¹ `dmm.autozero=dmm.ON`. RMS Noise using low thermal short for DCV, 2WΩ, 4WΩ, and Dry-Circuit Ω. For DCI, `dmm.connect=dmm.CONNECT NONE` or 0. For RTD, Noise using low thermal 190 Ω precision resistor. Includes Model 3721 card accuracies. RMS Noise values are typical.

¹² DMM configured for single reading, `dmm.measurecount=1` and `print(dmm.measure())`. May require additional settling delays for full accuracy depending on measurement configuration.

¹³ For L_{SYNC} On.

¹⁴ DMM configured for multisample readings and single buffer transfer, `dmm.measurecount=1000`, `buf=dmm.makebuffer(1000)`, `dmm.measure(buf)`, and `printbuffer(1, 1000, buf)`.

				RMS noise ¹¹ PPM of range				
				RMS noise calculator: Add 2.5 × "RMS Noise" to "ppm of range" (for example, 10 V at 0.006 PLC) "ppm of range" = 2.5 × 7.0 ppm + 2 ppm				
Function	NPLC	Aperture (ms)	Digits	100 mV	1 V	10 V	100 V	300 V
				1 Ω	10 Ω to 100 Ω	1 kΩ	10 kΩ	
4WΩ OCOMP	5 ¹²	83.3 (100)	7½	5.5	0.8	0.5	0.5	—
	1 ¹²	16.7 (20)	7½	16	1.5	0.7	1.5	—
	0.2 ^{12, 13}	3.33 (4.0)	6½	45	4.5	2.1	3.5	—
	0.2 ¹²	3.33 (4.0)	5½	500	50	13	30	—
	0.0005 ¹⁴	0.0083 (0.01)	3½	4500	650	400	400	—
				1 Ω to 10 Ω	100 Ω	1 kΩ	2 kΩ	
Dry-CktΩ OCOMP	5 ¹²	83.3 (100)	6½	8.0	10	10	8.0	—
	1 ¹²	16.7 (20)	5½	17	22	25	28	—
	0.2 ^{12, 13}	3.33 (4.0)	4½	50	50	50	50	—
	0.2 ¹²	3.33 (4.0)	3½	500	1000	1000	1500	—
	0.0005 ¹⁴	0.0083 (0.01)	2½	8500	8500	8500	8500	—

				Measurements into buffer ¹⁵ (readings/s)		Measurement to computer ¹⁵ (ms / rdg) autozero off		
Function	NPLC	Aperture (ms)	Digits	Autozero on	Autozero off	Ethernet	GPIB	USB
DCV	5 ¹²	83.3 (100)	7½	9.5 (8)	12 (10)	86.3 (104)	86.1 (102.8)	86.3 (103.1)
	1 ¹²	16.7 (20)	7½	42 (33)	59.8 (49.5)	19.4 (22.7)	19.5 (22.8)	19.9 (23.2)
	0.2 ^{12, 13}	3.33 (4.0)	6½	50 (40)	60 (50)	19.4 (22.7)	19.5 (22.8)	19.9 (23.2)
	0.2 ¹²	3.33 (4.0)	6½	120 (100)	295 (235)	7.6 (8.3)	6.2 (6.8)	6.4 (7.0)
	0.06 ¹⁴	1.0 (1.2)	5½	205 (165)	935 (750)	1.40 (1.80)	1.50 (1.80)	1.60 (2.30)
	0.006 ¹⁴	0.100 (0.120)	4½	218 (215)	6,200 (5,500)	0.55 (0.57)	0.65 (0.67)	0.75 (0.77)
	0.0005 ¹⁴	0.0083 (0.01)	3½	270 (270)	14,600 (14,250)	0.50 (0.5)	0.60 (0.60)	0.70 (0.70)
2WΩ (≤10 kΩ)	5 ¹²	83.3 (100)	7½	9.5 (8)	12 (10)	87.0 (105)	86.1 (103)	86.5 (104)
	1 ¹²	16.7 (20)	7½	42 (33)	59.8 (49.5)	21.0 (24.3)	19.5 (22.8)	19.9 (23.2)
	0.2 ^{12, 13}	3.33 (4.0)	6½	50 (40)	60 (50)	21.0 (24.3)	19.5 (22.8)	19.9 (23.2)
	0.2 ¹²	3.33 (4.0)	6½	120 (100)	295 (235)	7.6 (8.3)	6.2 (6.8)	6.4 (7.0)
	0.06 ¹⁴	1.0 (1.2)	5½	205 (165)	935 (750)	1.40 (1.80)	1.50 (1.80)	1.60 (2.30)
	0.006 ¹⁴	0.100 (0.120)	4½	218 (215)	6,200 (5,500)	0.55 (0.57)	0.65 (0.67)	0.75 (0.77)
	0.0005 ¹⁴	0.0083 (0.01)	3½	270 (270)	14,100 (13,700)	0.50 (0.5)	0.60 (0.60)	0.70 (0.70)

¹⁵ Reading rates are for 60 Hz (50 Hz) operation using factory defaults operating conditions `dmm.reset("all")`, Autorange off, `dmm.autodelay=dmm.OFF`, `dmm.opendetector=dmm.OFF`, `format.data.=format.SREAL`. Ranges listed in the following table.

Function	Range
DCV	10 V
2WΩ or 4WΩ	1 kΩ
DCI	1 mA
Dry Circuit Ω	10 Ω
Dry Circuit Ω, Offset Comp OFF	2 kΩ, 60 rdg/s maximum
Dry-Circuit Ω, Offset Comp ON	2 kΩ, 29.5 rdg/s maximum
ACI	1 mA
ACV	1 V
T/C	Use DCV rates
Thermistor	Use 2WΩ rates

Speeds are typical and include measurement and data transfer out the ethernet, GPIB or USB.

Function	NPLC	Aperture (ms)	Digits	Measurements into buffer ¹⁵ (readings/s)		Measurement to computer ¹⁵ (ms / rdg) autozero off		
				Autozero on	Autozero off	Ethernet	GPIB	USB
DCI	5 ¹²	83.3 (100)	7½	9.5 (8)	12 (10)	88 (103)	86.1 (102.8)	86.3 (103.1)
	1 ¹²	16.7 (20)	6½	42 (33)	59.8 (49.5)	21.0 (22.7)	19.5 (22.8)	19.8 (23.1)
	0.2 ^{12, 13}	3.33 (4.0)	5½	50 (40)	60 (50)	19.4 (22.7)	19.5 (22.8)	19.8 (23.1)
	0.2 ¹²	3.33 (4.0)	4½	120 (100)	295 (235)	7.6 (8.3)	6.2 (6.8)	6.4 (7.0)
	0.06 ¹⁴	1.0 (1.2)	4½	205 (165)	935 (750)	1.40 (1.80)	1.50 (1.80)	1.60 (2.30)
	0.006 ¹⁴	0.100 (0.120)	4½	218 (215)	6,200 (5,500)	0.55 (0.57)	0.65 (0.67)	0.75 (0.77)
0.0005 ¹⁴	0.0083 (0.01)	3½	270 (270)	14,100 (13,700)	0.50 (0.5)	0.60 (0.60)	0.70 (0.70)	
4WΩ	5 ¹²	83.3 (100)	7½	5 (4)	5.9 (4.7)	173 (206)	173 (206)	173 (206)
	1 ¹²	16.7 (20)	7½	23.5 (18.5)	29 (23)	39 (46)	39 (46)	39 (46)
	0.2 ^{12, 13}	3.33 (4.0)	5½	26.5 (21)	30 (24)	39 (46)	39 (46)	39 (46)
	0.2 ¹²	3.33 (4.0)	5½	80 (60)	120 (95)	12.3 (14.5)	11.3 (13.3)	11.7 (13.7)
	0.06 ¹⁴	1.0 (1.2)	4½	140 (110)	285 (225)	6.2 (7.2)	6.3 (7.3)	6.5 (7.6)
	0.006 ¹⁴	0.100 (0.120)	4½	200 (195)	580 (565)	4.2 (4.4)	4.3 (4.5)	4.6 (4.8)
0.0005 ¹⁴	0.0083 (0.01)	3½	210 (205)	650 (645)	4.2 (4.4)	4.3 (4.5)	4.6 (4.8)	
4WΩ OCOMP	5 ¹²	83.3 (100)	7½	2.5 (2.0)	2.9 (2.3)	343 (427)	341 (425)	342 (426)
	1 ¹²	16.7 (20)	7½	12.7(10)	14 (11.2)	77 (95)	74 (92)	75 (93)
	0.2 ^{12, 13}	3.33 (4.0)	6½	14 (11.2)	15 (12)	70 (86.5)	70 (86.5)	70 (86.5)
	0.2 ¹²	3.33 (4.0)	5½	46.5 (37)	56 (44)	22.7 (25)	20.5 (23)	21.1 (24)
	0.0005 ¹⁴	0.0083 (0.01)	3½	129 (125)	215 (210)	6.7 (6.7)	6.8 (6.8)	7 (7)
Dry-CktΩ OCOMP	5 ¹²	83.3 (100)	6½	2.5 (2.0)	2.9 (2.3)	347 (430)	345 (428)	346 (429)
	1 ¹²	16.7 (20)	5½	12 (9.5)	13 (10)	80 (99)	77 (95)	78 (97)
	0.2 ^{12, 13}	3.33 (4.0)	4½	14 (11.2)	15 (12)	70 (86.5)	70 (86.5)	70 (86.5)
	0.2 ¹²	3.33 (4.0)	3½	35 (30)	45 (36)	27 (33)	25 (31)	26 (32)
	0.0005 ¹⁴	0.0083 (0.01)	2½	84 (84)	115 (110)	10.7 (10.7)	10.7 (10.7)	11 (11)

RTD SPEEDS VERSUS NOISE

Single channel, 60 Hz (50 Hz) operation.

1 PLC and 5 PLC noise are included in RTD Specifications.					
Function	NPLC	Aperture (ms)	Digits	Add °C to reading ¹¹	
				4-wire	3-wire
OCOMP OFF	5 ¹²	83.3 (100)	7½	0	0
	1 ¹²	16.7 (20)	7½	0	0
	0.2 ^{12, 13}	3.33 (4.0)	5½	0.01	0.01
	0.2 ¹²	3.33 (4.0)	5½	0.18	0.18
	0.06 ¹⁴	1.0 (1.2)	4½	0.24	0.24
	0.006 ¹⁴	0.100 (0.120)	4½	0.37	0.37
0.0005 ¹⁴	0.0083 (0.01)	3½	3.10	3.10	
OCOMP ON	5 ¹²	83.3 (100)	7½	0	0
	1 ¹²	16.7 (20)	7½	0	0
	0.2 ^{12, 13}	3.33 (4.0)	6½	0.02	0.02
	0.2 ¹²	3.33 (4.0)	5½	0.38	0.38
	0.0005 ¹⁴	0.0083 (0.01)	3½	4.67	4.67

				Measurements into buffer ¹⁵ (readings/s)		Measurement to computer ¹⁵ (ms/readings) Autozero off		
Function	NPLC	Aperture (ms)	Digits	Autozero on	Autozero off	Ethernet	GPIB	USB
OCOMP OFF	5 ¹²	83.3 (100)	7½	5 (4)	5.9 (4.7)	173 (206)	173 (206)	173 (206)
	1 ¹²	16.7 (20)	7½	23.5 (18.5)	29 (23)	39 (46)	39 (46)	39 (46)
	0.2 ^{12, 13}	3.33 (4.0)	5½	26.5 (21)	30 (24)	39 (46)	39 (46)	39 (46)
	0.2 ¹²	3.33 (4.0)	5½	80 (60)	120 (95)	12.3 (14.5)	11.3 (13.3)	11.7 (13.7)
	0.06 ¹⁴	1.0 (1.2)	4½	140 (110)	285 (225)	6.2 (7.2)	6.3 (7.3)	6.5 (7.6)
	0.006 ¹⁴	0.100 (0.120)	4½	200 (195)	580 (565)	4.2 (4.4)	4.3 (4.5)	4.6 (4.8)
OCOMP ON	0.0005 ¹⁴	0.0083 (0.01)	3½	209 (205)	650 (645)	4.2 (4.4)	4.3 (4.5)	4.6 (4.8)
	5 ¹²	83.3 (100)	7½	2.5 (2.0)	2.9 (2.3)	343 (427)	341 (425)	342 (426)
	1 ¹²	16.7 (20)	7½	12.7(10)	14 (11.2)	77 (95)	74 (92)	75 (93)
	0.2 ^{12, 13}	3.33 (4.0)	6½	14 (11.2)	15 (12)	70 (86.5)	70 (86.5)	70 (86.5)
	0.2 ¹²	3.33 (4.0)	5½	46.0 (37)	56 (44)	22.7 (25)	20.5 (23)	21.1 (24)
	0.0005 ¹⁴	0.0083 (0.01)	3½	128 (125)	215 (210)	6.7 (6.7)	6.8 (6.8)	7 (7)

SYSTEM PERFORMANCE^{12, 15}

3½ digit mode, autozero off, and nPLC = 0.0005. Time includes function change from either DCV or 2WΩ to listed function.

Function	Function change (ms)	Range change (ms)	Autorange (ms)
DCV or 2WΩ (<10 kΩ)	10	10	10
4WΩ (<10 k)	20	20	20
DCI	10	10	10
Frequency or Period ¹⁶	110	10	—
ACV or ACI ¹⁶	20	85	300

Buffer transfer speed	Ethernet	GPIB	USB
Average for 1000 readings	2450/s	2000/s	1800/s
Average for 1000 readings with timestamp	2300/s	1800/s	1600/s

Card	Command	Single command execution time (ms)		
		Ethernet	GPIB	USB
3720, 3721, 3722, 3730	<code>channel.close (ch_list)</code> or <code>channel.open (ch_list)</code>	5.7	5.8	6.1
3723, 3724, 3731, 3732¹⁷	<code>channel.close (ch_list)</code> or <code>channel.open (ch_list)</code>	2.3	2.4	2.7
3740	<code>channel.close (ch_list 1 to 28)</code> or <code>channel.open (ch_list 1 to 28)</code>	10.7	10.8	11.1
	<code>channel.close (ch_list 29 to 32)</code> or <code>channel.open (ch_list 29 to 32)</code>	22.7	22.8	23.1

¹⁶ For DCV or 2W to Frequency or Period, `dmm.nplc=0.2` and `dmm.aperture=0.01` s. For ACI or ACV, `dmm.detectorbandwidth=300`. For ACI or ACV with `dmm.autodelay=dmm.ON`, best speed is 65 ms.

¹⁷ Speeds are within same Mux bank. Add an additional 8 ms when changing banks or slots.

AC speeds Single channel, 60 Hz (50 Hz) operation				Measurements into buffer ¹⁵ (rdg/s)			Measurement to computer ¹⁵ (ms / rdg)		
Function	Detector bandwidth	NPLC	Aperture (ms)	Digits	Autozero On	Autozero Off	Ethernet	GPIOB	USB
ACI / ACV	3	n/a	n/a	6½	0.45 (0.45)	n/a	2150 (2150)	2150 (2150)	2150 (2150)
	30	n/a	n/a	6½	2.5 (2.5)	n/a	400 (400)	400 (400)	400 (400)
	300	1.0 ¹²	16.67 (20)	6½	42 (33)	59.5 (50)	19.4 (22.7)	19.5 (22.8)	19.8 (23.1)
	300	0.2 ¹²	3.33 (4.0)	6½	120 (100)	295 (235)	7.6 (8.3)	6.2 (6.8)	6.4 (7.0)
	300	0.06 ¹⁴	1.0 (1.2)	5½	170 (165)	935 (750)	1.40 (1.80)	1.50 (1.80)	1.60 (2.30)
	300	0.006 ¹⁴	0.100 (0.120)	4½	218 (215)	6,200 (5,500)	0.55 (0.57)	0.65 (0.67)	0.75 (0.77)
	300	0.0005 ¹⁴	0.0083 (0.01)	3½	218 (215)	14,600 (14,250)	0.50 (0.5)	0.60 (0.60)	0.70 (0.70)
Frequency or Period	n/a		10 to 273	n/a	2 × input period + Gate time	n/a	2x input period + Gate time + 2.7 ms	2x input period + Gate time + 2.8 ms	2x input period + Gate time + 3.1 ms

DC MEASUREMENT CHARACTERISTICS

DC VOLTS

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

Input impedance:

100 mV to 10 V ranges: Selectable >10 GΩ // <400 pF or 10 MΩ ±1%.

100 V to 300 V ranges: 10 MΩ ±1%.

Input bias current: <50 pA at 23°C with `dmm.autozero=dmm.OFF` or `dmm.inputdivider=dmm.ON`.

Common mode current: <500 nA peak-to-peak for ≤1 MHz.

Autozero off error: For DCV ±1°C and ≤10 minutes, add ±(8 ppm of reading + 5 μV).

Input protection: 300 V all ranges.

Common mode voltage: 300 V dc or 300 V_{RMS} (425 V peak for ac waveforms) between any terminal and chassis.

RESISTANCE

Maximum 4WΩ lead resistance: 5 Ω per lead for 1 Ω range, 10% of range per lead for the 10 Ω to 1 kΩ ranges; 1 kΩ per lead for all other ranges.

For dry circuit.

Maximum 4WΩ lead resistance: 0.5 Ω per lead for 1 Ω range; 10% of range per lead for 10 Ω to 100 Ω ranges; 50 Ω per lead for 1 kΩ to 2 kΩ range.

Input impedance:

- **1 Ω to 10 Ω ranges:** 99 kΩ ±1% // <1 μF.
- **100 Ω to 2 kΩ ranges:** 10 MΩ ±1% // <0.015 μF.

Offset compensation: Selectable on 4WΩ 1 Ω to 10 kΩ ranges.

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

Continuity threshold: Adjustable 1 Ω to 1000 Ω.

Autozero off error: For 2WΩ ±1 °C and ≤10 minutes, add ±(8 ppm of reading + 0.5 mΩ for 10 Ω and 5 mΩ for all other ranges).

Input protection: 300 V all ranges.

DC CURRENT

Autozero off error: For $\pm 1^\circ\text{C}$ and ≤ 10 minutes, add $\pm(8 \text{ ppm of reading} + \text{range error})$. Refer to the following table.

Range	3 A	1 A	100 mA	10 mA	1 mA	100 μA	10 μA
Shunt resistance Guaranteed by design	0.05 Ω	0.05 Ω	1 Ω	10 Ω	100 Ω	1 k Ω	6 k Ω
Burden voltage	<1.75 V	<0.55 V	<0.4 V	<150 mV	<130 mV	<105 mV	<61 mV
Burden voltage with 3721 card	<2.35 V	<1.15 V	<0.4 V	<150 mV	<130 mV	<105 mV	<61 mV
Autozero off "of range" error	100 μA	100 μA	5 μA	0.5 μA	50 nA	5 nA	0.85 nA
For each additional amp after ± 1.5 A input, add the following to ppm of range	—	120	60	60	60	60	95

Input protection: 3 A, 250 V fuse.

THERMOCOUPLES

Conversion: ITS-90.

Reference junction: Internal, External, or Simulated (Fixed).

Open lead detector: Selectable per channel. Open $>1.15 \text{ k} \pm 50 \Omega$. Default on.

Common mode isolation: 300 V dc or 300 V_{RMS} (425 V_{PEAK} for ac waveforms), $>10 \text{ G}\Omega$ and $<350 \text{ pF}$ any terminal to chassis.

AC

VOLTAGE FUNCTION¹⁸

Accuracy: $\pm (\% \text{ of reading} + \% \text{ of range}) 23^\circ\text{C} \pm 5^\circ$.

Range ¹⁹	Resolution	Calibration cycle	3 Hz to 5 Hz	5 Hz to 10 Hz	10 Hz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 300 kHz
100.0000 mV	0.1 μV	90 day	1.0 + 0.03	0.30 + 0.03	0.05 + 0.03	0.11 + 0.05	0.6 + 0.08	4.0 + 0.5
1.000000 V	1 μV	(100 mV to 100 V)						
10.00000 V	10 μV	1 year	1.0 + 0.03	0.30 + 0.03	0.06 + 0.03	0.12 + 0.05	0.6 + 0.08	4.0 + 0.5
100.0000 V	100 μV	(100 mV to 100 V)						
300.000 V	1 mV	90 day	1.0 + 0.05	0.30 + 0.05	0.05 + 0.05	0.11 + 0.08	0.6 + 0.11	4.0 + 0.8
300.0000 V	1 mV	1 year	1.0 + 0.05	0.30 + 0.05	0.06 + 0.05	0.12 + 0.08	0.6 + 0.11	4.0 + 0.8
		Temp. coeff. $^\circ\text{C}^{20}$ (all ranges)	0.10 + 0.003	0.030 + 0.003	0.005 + 0.003	0.006 + 0.005	0.01 + 0.006	0.03 + 0.01

¹⁸ Specifications are for Detector Bandwidth 3 and sinewave inputs $>5\%$ of range. Detector Bandwidth 3 and 30 are multi-sample A/D conversions. Detector bandwidth 300 is a single A/D conversion, programmable from 0.0005 plc to 15 plc. Default condition set to 1 plc.
¹⁹ 20% overrange on ac functions except 1% on 300 V and 3.33% on 3 A. Default resolution is 5½ digits; maximum usable resolution is 6½ with 7½ digits programmable.
²⁰ Applies to 0°C to 18°C and 28°C to 50°C .

CURRENT FUNCTION¹⁸

Range ¹⁹	Resolution	Calibration cycle	3 Hz to 5 Hz	5 Hz to 10 Hz	10 Hz to 2 kHz	2 kHz to 5 kHz	5 kHz to 10 kHz
1.000000 mA ²¹	1 nA	90 day / 1 year	1.0 + 0.04	0.30 + 0.04	0.08 + 0.03	0.09 + 0.03	0.09 + 0.03
10.00000 mA	10 nA		1.0 + 0.04	0.30 + 0.04	0.08 + 0.03	0.09 + 0.03	0.09 + 0.03
100.0000 mA	100 nA		1.0 + 0.04	0.30 + 0.04	0.08 + 0.03	0.09 + 0.03	0.09 + 0.03
1.000000 A	1 µA		1.0 + 0.04	0.30 + 0.04	0.20 + 0.04	0.88 + 0.04	2.0 + 0.04
3.00000 A	10 µA		1.0 + 0.05	0.30 + 0.05	0.20 + 0.05	0.88 + 0.05	2.0 + 0.05
		Temp. Coeff. /°C²⁰ (all ranges)	0.10 + 0.004	0.030 + 0.004	0.005 + 0.003	0.006 + 0.005	0.006 + 0.005

FREQUENCY²² AND PERIOD FUNCTIONS

Accuracy: ±(ppm of reading + offset ppm)

Range ¹⁹	Resolution	Calibration cycle	3 Hz to 500 kHz	3 Hz to 500 kHz	333 ms to 2 µs
100.0000 mV to 300.000 V	0.333 ppm	90 day / 1 year (all ranges)	80 + 0.333	80 + 0.333	(0.25 s gate)
	3.33 ppm		80 + 3.33	80 + 3.33	(100 ms gate)
	33.3 ppm		80 + 33.3	80 + 33.3	(10 ms gate)

ADDITIONAL UNCERTAINTY ±(% OF READING)

Low frequency uncertainty	Detector bandwidth		
	3 (3 Hz to 300 kHz)	30 (30 Hz to 300 kHz)	300 (300 Hz to 300 kHz)
20 Hz to 30 Hz	0	0.3	—
30 Hz to 50 Hz	0	0	—
50 Hz to 100 Hz	0	0	4.0
100 Hz to 200 Hz	0	0	0.72
200 Hz to 300 Hz	0	0	0.18
300 Hz to 500 Hz	0	0	0.07
>500 Hz	0	0	0

Additional uncertainty ±(% of reading)	Detector bandwidth	Crest factor ²³ Maximum crest factor: 5 at full scale			
		1 - 2	2 - 3	3 - 4	4 - 5
5 Hz to 10 Hz	3	0.50	1.20	1.30	1.40
10 Hz to 30 Hz	3	0.20	0.30	0.60	0.90
30 Hz to 100 Hz	3 or 30	0.20	0.30	0.60	0.90
>100 Hz	3 or 30	0.05	0.15	0.30	0.40
300 Hz to 500 Hz	300 only	0.50	1.20	1.30	1.40
≥500 Hz	300 only	0.05	0.15	0.30	0.40

²¹ For Model 3721, 1 mA ACI, add 0.05% to “of reading” uncertainty from 250 Hz to 10 kHz.

²² Specified for square wave inputs. Input signal must be >10% of ACV range. If input is <20 mV on the 100 mV range then the frequency must be >10 Hz. For sinewave inputs, frequency must be >100 Hz

²³ Applies for non-sinewave inputs, 5 Hz to 10 kHz, and dc content ≤3% of range.

AC MEASUREMENT CHARACTERISTICS

AC VOLTS

Measurement method: AC-coupled, true RMS.

Input impedance: $1\text{ M}\Omega \pm 2\%$ // by $<150\text{ pF}$.

Input protection: 300 V dc or 300 V_{RMS} rear inputs or 37xx cards.

AC CURRENT

Measurement method: AC-coupled, True RMS.

Range	3 A	1 A	100 mA	10 mA	1 mA
Shunt resistance Guaranteed by design	0.05 Ω	0.05 Ω	1.0 Ω	10 Ω	100 Ω
Burden voltage rear panel	$<1.75\text{ V}_{\text{RMS}}$	$<0.55\text{ V}_{\text{RMS}}$	$<0.4\text{ V}_{\text{RMS}}$	$<150\text{ mV}_{\text{RMS}}$	$<125\text{ mV}_{\text{RMS}}$
Burden voltage 3721 card	$<2.4\text{ V}_{\text{RMS}}$	$<1.0\text{ V}_{\text{RMS}}$	$<0.6\text{ V}_{\text{RMS}}$	$<200\text{ mV}_{\text{RMS}}$	$<130\text{ mV}_{\text{RMS}}$

Input protection: 3 A, 250 V fuse.

FREQUENCY AND PERIOD

Measurement method: Reciprocal counting technique.

Gate time: `dmm.aperture=0.273` to `0.01`. Default 0.01 s.

AC GENERAL

AC CMRR²⁴: 70 dB

Volt * Hertz Product: $\leq 8 \times 10^7\text{ Volt} * \text{Hz}$ (guaranteed by design), $\leq 2.1 \times 10^7\text{ Volt} * \text{Hz}$ verified. Input frequency verified for $\leq 3 \times 10^5\text{ Hz}$.

GENERAL SPECIFICATIONS

Expansion slots: 6.

Power line: Universal, 100 V to 240 V.

Line frequency: 50 Hz and 60 Hz, automatically sensed at power-up.

Power consumption: 28 VA with DMM and display, up to 140 VA with six 3700 cards.

Operating environment: Specified for 0°C to 50°C, $\leq 80\%$ relative humidity RH at 35°C, altitude up to 2000 meters.

Storage environment: -40°C to 70°C.

Real time clock: Battery backed, 10 years typical life.

Warranty: One year.

EMC: Conforms to European Union EMC Directive.

Safety: Conforms to European Union Low Voltage Directive.

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

Warmup: Two hours to rated accuracy.

²⁴ For 1 k Ω unbalance in LO lead.

DIMENSIONS

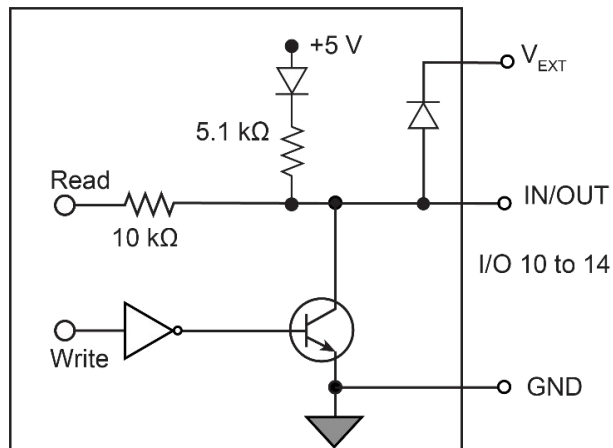
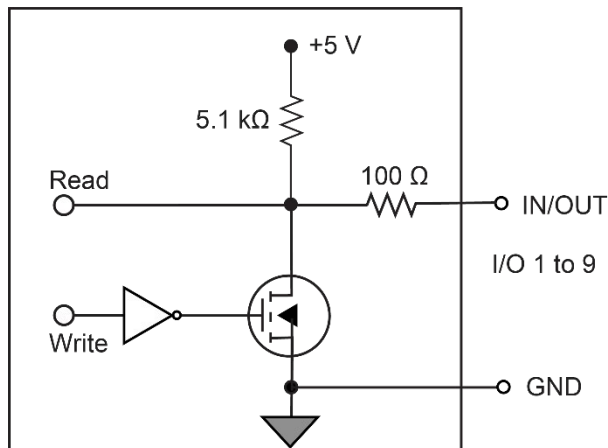
	High	Wide	Deep
Rack mounted	89 mm (3.5 in.)	483 mm (19 in.)	457 mm (18 in.)
Bench configuration (includes handle and feet)	104 mm (4.125 in.)	483 mm (19 in.)	457 mm (18 in.)

Shipping weight: 13 kg (28 lb).

DIGITAL I/O

25-pin female D-shell.

	I/O 1 to 9	I/O 10 to 14	Vext
I _{SINK} , maximum	5 mA	250 mA	—
I _{SOURCE} , maximum	960 μ A	980 μ A	—
Absolute V _{IN}	5.25 V to -0.25 V	5.25 V to -0.25 V	5 V to 33 V
V _{IH} minimum	2.2 V	2.2 V	—
V _{IL} maximum	0.7 V	0.7 V	—
V _{OL} maximum at 5 mA I _{SINK}	0.7 V	0.7 V	—
V _{OL} maximum at I _{SINK} maximum	—	2.3 V	—
V _{OH} minimum, 0.4mA sour	2.7 V	2.4 V	—
Minimum V _{IN} pulse	2 μ s	10 μ s	—
Minimum V _O pulse	1 μ s	50 μ s	—



TRIGGERING AND MEMORY

Window filter sensitivity: 0.01%, 0.1%, 1%, 10%, or full-scale of range (none).

Trigger delay: 0 to 99 hours (10 μ s step size)

External trigger delay: <10 μ s.

Memory: Up to 650,000 timestamped readings with web page disabled. Additional memory available with external flash drive.

Nonvolatile memory: Single user save setup, with up to 75 DMM configurations and \geq 600 channel patterns (dependent on name length, DMM function and configuration, and pattern image size). Additional memory available with external flash drive.

MATH FUNCTIONS

Rel, dB, Limit Test, %, 1/x, and $mX + b$ with user-defined display.

REMOTE INTERFACE

Ethernet: RJ-45 connector, LXI Class C V1.3, 10/100BT, auto-MDIX.

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

USB device (rear panel, type B): USB 2.0, high speed, USBTMC compliant.

USB host (front panel, type A): USB 2.0, high speed, support for flash drives.

LXI COMPLIANCE

LXI Class B V1.3 with V2.0 IEEE 1588-2008 precision time protocol.

LXI TIMING (APPLIES TO SCANNING) AND SPECIFICATION

Receive LAN[0-7] event delay: Not specified. Minimum, 800 μ s typical, not specified maximum.

Alarm to trigger delay: 25 μ s. Minimum 50 μ s. Typical, not specified maximum.

Generate LAN[0-7] event: Not specified. Minimum, 800 μ s. Typical, not specified maximum.

[Minimums are probabilistic and represent a 95% confidence factor.]

Clock accuracy: 25 ppm.

Synchronization accuracy: < 150 ns. [Probabilistic and represent a 95% confidence factor.]

Timestamp accuracy: 100 μ s.

Timestamp resolution: 20 ns.

LANGUAGE

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

IP CONFIGURATION

Static, DHCP, or mDNS.

PASSWORD PROTECTION

11 characters

MINIMUM COMPUTER HARDWARE

Intel Pentium 3, 800 MHz, 512 Mbyte RAM, 210 Mbyte disk space or better.

OPERATING SYSTEMS AND SOFTWARE

Windows 2000 and XP compatible, supports Web browsers with Java plug-in (requires Java plug-in 1.6 or higher). Web pages served by 3706A.