

**FLUKE®**

**Calibration**

# 8588A

Reference Multimeter

## Product Specifications

March 2019 Rev. B, 4/19

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## **General Specifications**

### **Power**

Voltage..... 100 V to 120 V, 200 V to 240 V  
Frequency..... 50/60 Hz  
Fuse..... T1.25AH 250V  
Consumption ..... 80 VA max  
Power cord..... IEC 60320-C13 receptacle, NEMA-5-15 plug, cable 3 core 18AWG to SVT

### **Dimensions**

Height ..... 88 mm (3.5 in)  
Width (excluding handles) ..... 431 mm (17 in)  
Width (including handles) ..... 440 mm (17.3 in)  
Depth (excluding handles)..... 475 mm (18.7 in)  
Depth (including handles)..... 510 mm (20.1 in)  
Weight..... 9.8 kg (21.5 lb)

### **Environment**

#### **Temperature**

Operating..... 0 °C to 50 °C  
Specified operation ..... 5 °C to 40 °C  
Storage ..... -20 °C to 70 °C  
Calibration (Tcal) ..... 20 °C to 25 °C  
Warm up ..... 3 hours to full specification

#### **Relative Humidity (non-condensing)**

Operating..... <90 % (5 °C to 40 °C)  
Storage ..... <95 % (0 °C to 70 °C)

#### **Altitude**

Operating..... 3000 m  
Storage ..... 12 000 m

Vibration and Shock ..... Complies with MIL-PRF-28800F Class 3

**Electromagnetic Compatibility (EMC)**

International..... IEC 61326-1: Controlled Electromagnetic

Environment

CISPR 11: Group 1, Class A

*Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.*

*Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.*

*Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.*

Korea (KCC)..... Class A Equipment (Industrial Broadcasting & Communication Equipment)

*Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.*

USA (FCC)..... 47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

**Safety Compliance**

Mains..... IEC 61010-1: Overvoltage Category II, Pollution Degree 2

Measurement ..... IEC 61010-2-030: Not Category rated, 1485 Vpk Maximum, 1050 Vrms Maximum

**Measurement Isolation**

Guard to Safety ground .... <700 pF, >10 GΩ

**Lo to Guard**

External Guard ON..... <1700 pF, >10 GΩ (not in Resistance function)

External Guard OFF ..... Lo and Guard terminals internally shorted (<1700 pF, >10 GΩ in Resistance)

Remote Interfaces ..... GPIB IEEE 488.2, USBTMC, Ethernet

**Electrical Specifications****Maximum Voltage and Current Inputs****Notes**

To avoid potential damage:

- This product must not be used to measure Category rated Mains Voltages.
- The maximum current available from voltage sources being measured must not exceed 200 mA.
- The maximum voltage from current sources being measured must not exceed 5 V.
- Do not permit transient voltages beyond the limits in the tables below.

Maximum dc input equal to maximum RMS input. Maximum peak input is RMS x 1.414.

Specifications apply equally to front and rear input terminals except where noted below.

Front to rear isolation allows opposing polarity of maximum terminal voltage on each input.

Digital I/O Ground (DigGnd) is internally connected to Safety Ground (Ground).

Maximum Common Mode voltage with respect to Safety Ground is  $1.7 \times 10^5$  VHz.

**DCV, ACV, Voltage Digitizing, DCI External Shunt, ACI Ext Shunt, and Thermocouple**

Maximum rms terminal voltages

						Hi	SENSE HI
							250 V
					SENSE LO	1050 V	1050 V
			LO	250 V	250 V	1050 V	1050 V
		A	250 V	250 V	250 V	1050 V	1050 V
	Guard	250 V	250 V	250 V	250 V	1050 V	1050 V
	DigGnd	650 V	650 V	650 V	650 V	1050 V	1050 V
Ground	0 V	650 V	650 V	650 V	650 V	1050 V	1050 V

The A terminal is open circuit in these functions.

**DCI, ACI, and Current Digitizing**

Maximum rms terminal voltages

						Hi	SENSE HI
							250 V
					SENSE LO	1050 V	1050 V
			LO	250 V	250 V	1050 V	1050 V
		A	5 V	250 V	250 V	1050 V	1050 V
	Guard	250 V	250 V	250 V	250 V	1050 V	1050 V
	DigGnd	650 V	650 V	650 V	650 V	1050 V	1050 V
Ground	0 V	650 V	650 V	650 V	650 V	1050 V	1050 V

**DCI, ACI, and Current Digitizing**

Maximum rms terminal Currents

	Guard	A	LO	SENSE LO	Hi	SENSE HI
Front Input	N/A	30.2 A	30.2 A	N/A	N/A	N/A
Rear Input	N/A	2.02 A	2.02 A	N/A	N/A	N/A

The SENSE LO, SENSE HI, and HI terminals are open circuit in these functions.  
The front input A terminal protection is automatic and self-resetting, and does not interrupt current flow.

**⚠ Caution**

**Damage will occur if >30.2 A is applied to the front current terminals and the current source maximum compliance is >5 V.**

The rear input A terminal is protected by a fuse on the rear panel.

**Resistance, Capacitance, and PRT**

Maximum rms terminal voltages

						Hi	SENSE HI
						1050 V	250 V
					SENSE LO	1050 V	1050 V
			LO	250 V	250 V	1050 V	1050 V
		A	250 V	250 V	250 V	250 V	250 V
	Guard	250 V	250 V	250 V	250 V	1050 V	1050 V
	DigGnd	650 V	650 V	650 V	650 V	1050 V	1050 V
Ground	0 V	650 V	650 V	650 V	650 V	1050 V	1050 V

The A terminal is open circuit in these functions.

**Performance Specifications**

The product specifications describe the Absolute Instrumental Uncertainty of the Product. The product specifications include stability, temperature, and humidity; within specified limits, linearity, line and load regulation, and the reference standard measurement uncertainty. The product specifications are provided at a 99 %, k=2.58, normally distributed and a 95 %, k=2, normally distributed level of confidence. Fluke Calibration guarantees product performance to the 99 % level of confidence.

**DC Voltage** <sup>[1][2][3][4]</sup>

DC Voltage maximum resolution is 8 digits

Aperture  $\geq 100 \mu\text{s}$

95 % Confidence			Relative Accuracy					Absolute Accuracy		
			$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range)}$							
Range	Zin	Full Scale	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal $\pm 1 \text{ }^\circ\text{C}$	90 day Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 1 \text{ }^\circ\text{C}$	2 years Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 5 \text{ }^\circ\text{C}$	2 year Tcal $\pm 5 \text{ }^\circ\text{C}$
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	202 mv	0.2 + 2.0	0.7 + 2.0	1.4 + 2.0	2.7 + 2.0	5.4 + 2.0	5.1 + 2.0	7.5 + 2.0	15 + 2.0
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	2.02 V	0.06 + 0.3	0.5 + 0.3	1.4 + 0.3	2.7 + 0.3	5.4 + 0.3	2.8 + 0.3	4.0 + 0.3	8.1 + 0.3
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	20.2 V	0.05 + 0.05	0.5 + 0.05	1.4 + 0.05	2.7 + 0.05	5.4 + 0.05	2.8 + 0.05	4.0 + 0.05	8.0 + 0.05
100 V	Auto, 10 M $\Omega$	202 V	0.4 + 0.3	1.0 + 0.3	2.6 + 0.3	4.0 + 0.3	8.0 + 0.3	4.1 + 0.3	6.5 + 0.3	13 + 0.3
100 V	1 M $\Omega$	202 V	2.0 + 5.0	2.0 + 5.0	4.5 + 5.0	9.0 + 5.0	18 + 5.0	9.0 + 5.0	15 + 5.0	30 + 5.0
1000 V	Auto, 10 M $\Omega$	1050 V	0.4 + 0.5	1.0 + 0.5	2.6 + 0.5	4.0 + 0.5	8.0 + 0.5	4.3 + 0.5	6.7 + 0.5	13 + 0.5
1000 V	1 M $\Omega$	1050 V	4.0 + 25	4.0 + 25	4.5 + 25	9.0 + 25	18 + 25	9.1 + 25	15 + 25	30 + 25

99 % Confidence			Relative Accuracy					Absolute Accuracy		
			$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range)}$							
Range	Zin	Full Scale	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal $\pm 1 \text{ }^\circ\text{C}$	90 day Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 1 \text{ }^\circ\text{C}$	2 years Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 5 \text{ }^\circ\text{C}$	2 year Tcal $\pm 5 \text{ }^\circ\text{C}$
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	202 mv	0.26 + 2.6	0.90 + 2.6	1.8 + 2.6	3.5 + 2.6	7.0 + 2.6	6.5 + 2.6	9.6 + 2.6	19 + 2.6
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	2.02 V	0.08 + 0.39	0.65 + 0.39	1.8 + 0.39	3.5 + 0.39	7.0 + 0.39	3.6 + 0.39	5.2 + 0.39	10 + 0.39
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	20.2 V	0.06 + 0.06	0.65 + 0.06	1.8 + 0.06	3.5 + 0.06	7.0 + 0.06	3.6 + 0.06	5.2 + 0.06	10 + 0.06
100 V	Auto, 10 M $\Omega$	202 V	0.52 + 0.39	1.3 + 0.39	3.4 + 0.39	5.2 + 0.39	10 + 0.39	5.3 + 0.39	8.4 + 0.39	17 + 0.39
100 V	1 M $\Omega$	202 V	2.6 + 6.5	2.6 + 6.5	5.8 + 6.5	12 + 6.5	23 + 6.5	12 + 6.5	19 + 6.5	39 + 6.5
1000 V	Auto, 10 M $\Omega$	1050 V	0.52 + 0.65	1.3 + 0.65	3.4 + 0.65	5.2 + 0.65	10 + 0.65	5.5 + 0.65	8.6 + 0.65	17 + 0.65
1000 V	1 M $\Omega$	1050 V	5.2 + 32	5.2 + 32	5.8 + 32	12 + 32	23 + 32	12 + 32	20 + 32	39 + 32

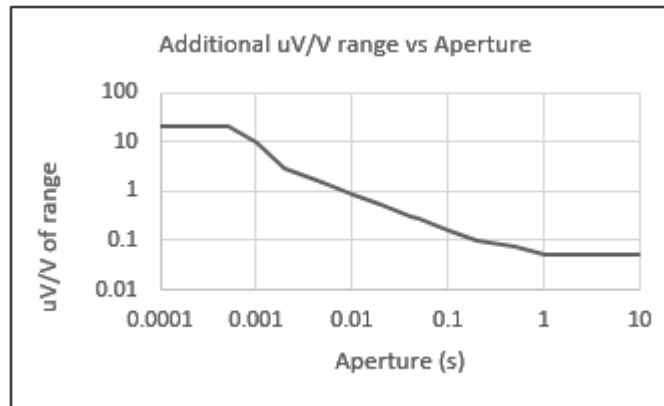
**Temperature Coefficient** (not applicable if within Tcal ± 1 °C)

Aperture ≥ 100 μs		Zin	± (μV/V of reading/°C + μV/V of range/°C) 5 °C to 40 °C <sup>[13]</sup>
Range			
100 mV	Auto, 10 MΩ, 1 MΩ		0.6 + 0.5
1 V	Auto, 10 MΩ, 1 MΩ		0.3 + 0.25
10 V	Auto, 10 MΩ, 1 MΩ		0.3 + 0.2
100 V	Auto, 10 MΩ		0.6 + 0.25
100 V	1 MΩ		1.5 + 0.25
1000 V	Auto, 10 MΩ		0.6 + 0.2
1000 V	1 MΩ		1.5 + 0.2

Aperture Range ..... 100 μs to 2 s in 200 ns increments, >2 s to 10 s in 1 ms increments.

Minimum trigger interval is the aperture plus 170 μs. For example at 50 Hz line frequency, 0.1plc, the minimum interval is 0.002 seconds + 0.00017 seconds = 0.00217 seconds (read rate 460 Hz).

Additional errors (aperture ≥ 100 μs)	
Aperture	μV/V of reading
1 s to 10 s	0
100 ms to <1 s	0.05
10 ms to 100 ms	0.50
10 ms to 50 ms	1.00
2 ms	2.00
1 ms	10.00
< 500 μs	20.00





Aperture  $\geq 100 \mu\text{s}$ ; additional uncertainty with read rate: (Read Period = aperture + delay between readings)

Read Period	$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$
< 20 ms	0.2 + 0.0
< 10 ms	0.5 + 0.2
< 6 ms	5.0 + 0.5
< 3 ms	20 + 2.0
< 2 ms	40 + 5.0

Maximum Trigger Rate (Aperture = 100  $\mu\text{s}$ )..... (Ascii format - for faster sampling rates see Digitizing)  
 4700 readings/s  
 (Maximum Block size of 10 000 000 samples)

**Aperture <100  $\mu\text{s}$**

95 % Confidence

Range	Zin	Full Scale	Relative Accuracy				Absolute Accuracy		
			$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$						
			24 Hour Tcal $\pm 1 \text{ }^\circ\text{C}$	90 day Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 1 \text{ }^\circ\text{C}$	2 years Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 1 \text{ }^\circ\text{C}$	365 day Tcal $\pm 5 \text{ }^\circ\text{C}$	2 year Tcal $\pm 5 \text{ }^\circ\text{C}$
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	202 mv	3.3 + 15	20 + 15	44 + 15	62 + 15	45 + 15	63 + 15	80 + 15
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	2.02 V	3.3 + 15	20 + 15	44 + 15	62 + 15	45 + 15	59 + 15	76 + 15
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	20.2 V	3.3 + 15	20 + 15	44 + 15	62 + 15	45 + 15	59 + 15	76 + 15
100 V	Auto, 10 M $\Omega$	202 V	3.3 + 15	20 + 15	44 + 15	62 + 15	45 + 15	59 + 15	76 + 15
100 V	1 M $\Omega$	202 V	3.3 + 15	20 + 15	44 + 15	62 + 15	45 + 15	59 + 15	76 + 15
1000 V	Auto, 10 M $\Omega$	1050 V	3.3 + 15	20 + 15	44 + 15	62 + 15	45 + 15	63 + 15	80 + 15
1000 V	1 M $\Omega$	1050 V	4.0 + 15	20 + 15	44 + 15	62 + 15	45 + 15	63 + 15	80 + 15

99 % Confidence			Relative Accuracy				Absolute Accuracy			
			$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$							
Range	Zin	Full Scale	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 years Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$	
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	202 mv	4.3 + 19	26 + 19	57 + 19	80 + 19	58 + 19	81 + 19	103 + 19	
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	2.02 V	4.3 + 19	26 + 19	57 + 19	80 + 19	58 + 19	76 + 19	98 + 19	
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	20.2 V	4.3 + 19	26 + 19	57 + 19	80 + 19	58 + 19	76 + 19	98 + 19	
100 V	Auto, 10 M $\Omega$	202 V	4.3 + 19	26 + 19	57 + 19	80 + 19	58 + 19	76 + 19	98 + 19	
100 V	1 M $\Omega$	202 V	4.3 + 19	26 + 19	57 + 19	80 + 19	58 + 19	76 + 19	98 + 19	
1000 V	Auto, 10 M $\Omega$	1050 V	4.3 + 19	26 + 19	57 + 19	80 + 19	58 + 19	81 + 19	103 + 19	
1000 V	1 M $\Omega$	1050 V	5.2 + 19	26 + 19	57 + 19	80 + 19	58 + 19	81 + 19	103 + 19	

**Temperature Coefficient** (not applicable if within Tcal  $\pm 1^\circ\text{C}$ )

Aperture < 100 $\mu\text{s}$		$\pm (\mu\text{V/V of reading}/^\circ\text{C} + \mu\text{V/V of range}/^\circ\text{C})$
Range	Zin	5 $^\circ\text{C}$ to 40 $^\circ\text{C}$ <sup>[13]</sup>
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	4.5 + 12
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	3.3 + 9.3
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	3.3 + 9.3
100 V	Auto, 10 M $\Omega$	3.3 + 9.3
100 V	1 M $\Omega$	3.3 + 9.3
1000 V	Auto, 10 M $\Omega$	4.5 + 9.3
1000 V	1 M $\Omega$	4.5 + 9.3

Aperture <100  $\mu\text{s}$  "0" to 99.8  $\mu\text{s}$  in 200 ns increments

Minimum trigger interval is the aperture plus 30  $\mu\text{s}$ . For example, with aperture = 50  $\mu\text{s}$ , the minimum interval is 50  $\mu\text{s}$  + 30  $\mu\text{s}$  = 80  $\mu\text{s}$  (read rate 12.5 kHz). Note maximum read rate is limited to 20 kHz by other factors; see the System Speed specifications.

(There is an additional 30  $\mu\text{s}$  on each conversion).

**All Apertures**

CMRR [5] ..... 140 dB at dc and 1 Hz to 60 Hz (1 kΩ unbalance)

NMRR [5] ..... 70 dB at 50/60 Hz ±0.1 %

Protection ..... All Ranges 1 kV RMS

**Input Impedance**

Auto ..... 100 mV to 10 V Ranges ..... >1 TΩ

100 V and 1000 V Range ..... 10 MΩ ±1 %

10 MΩ ..... All Ranges ..... 10 MΩ ±1 %

1 MΩ ..... All Ranges ..... 1.01 MΩ ±1 %

Input Current ..... 100 mV to 10 V Ranges (Auto Zin) ..... ±20 pA ±1 pA/°C

Settling Time ..... to 10 μV/V of step size ..... <50 ms

**Ratio Accuracy**

Range to Range ..... Apply a Root Sum of Squares calculation of Net Front Input Accuracy and Net rear Input Accuracy.

Within Range ..... Using the 24 hour or 20 minute Transfer Uncertainty specifications as appropriate, apply a Root Sum of Squares calculation of specified accuracy of the Front Input signal and the specified accuracy of the Rear Input signal.

**DC Current** <sup>[1][2][3][4]</sup>

DC Current maximum resolution is 7 digits

**Aperture ≥100 μs**

95 % Confidence		Relative Accuracy					Absolute Accuracy		
		± (μA/A of reading + μA/A of range)							
Range	Full Scale	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 years Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
10 μA	20.2 μA	5.0 + 20	10 + 40	15 + 40	20 + 40	30 + 40	24 + 40	27 + 40	40 + 40
100 μA	202 μA	0.25 + 1	5.50 + 4	6.0 + 4	6.5 + 4	9.8 + 4	8.2 + 4	9.8 + 4	15 + 4
1 mA	2.02 mA	0.25 + 1	5.50 + 4	6.0 + 4	6.5 + 4	9.8 + 4	7.6 + 4	9.2 + 4	14 + 4
10 mA	20.2 mA	0.25 + 1	6.50 + 4	7.0 + 4	8.0 + 4	12 + 4	8.9 + 4	14 + 4	20 + 4
100 mA	202 mA	1.0 + 4	28 + 10	30 + 10	33 + 10	50 + 10	33 + 10	57 + 10	86 + 10
1 A	2.02 A	2.0 + 25	60 + 100	80 + 100	100 + 100	150 + 100	100 + 100	132 + 100	199 + 100
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	4.0 + 10	80 + 40	125 + 40	170 + 40	255 + 40	174 + 40	234 + 40	351 + 40
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	4.0 + 35	240 + 146	390 + 146	490 + 146	735 + 146	491 + 146	551 + 146	827 + 146

99 % Confidence		Relative Accuracy					Absolute Accuracy		
		± (µA/A of reading + µA/A of range)							
Range	Full Scale	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 years Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
10 µA	20.2 µA	6.45 + 26	13 + 52	19 + 52	26 + 52	39 + 52	31 + 52	35 + 52	52 + 52
100 µA	202 µA	0.32 + 1	7.1 + 5	7.7 + 5	8.4 + 5	13 + 5	11 + 5	13 + 5	19 + 5
1 mA	2.02 mA	0.32 + 1	7.1 + 5	7.7 + 5	8.4 + 5	13 + 5	10 + 5	12 + 5	18 + 5
10 mA	20.2 mA	0.32 + 1	8.4 + 5	9.0 + 5	10 + 5	15 + 5	11 + 5	18 + 5	26 + 5
100 mA	202 mA	1.3 + 5	36 + 13	39 + 13	43 + 13	64 + 13	43 + 13	74 + 13	111 + 13
1 A	2.02 A	2.6 + 32	77 + 129	103 + 129	129 + 129	194 + 129	130 + 129	171 + 129	256 + 129
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	5.2 + 13	103 + 52	161 + 52	219 + 52	329 + 52	224 + 52	302 + 52	453 + 52
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	5.2 + 45	310 + 188	503 + 188	632 + 188	948 + 188	634 + 188	711 + 188	1067 + 188

Temperature Coefficient (not applicable if within Tcal ± 1 °C)

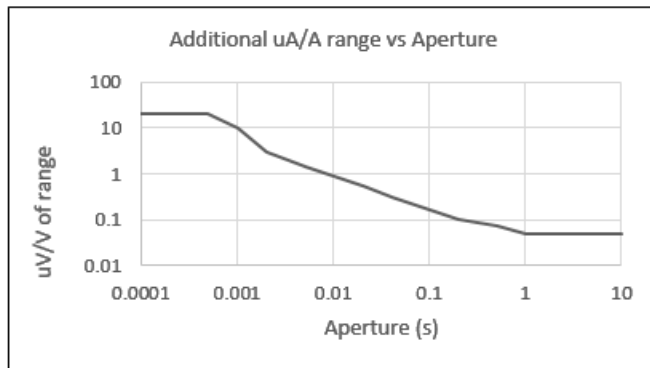
Aperture ≥100 µs

Range	± µA/A of reading/°C	
	15 °C to 30 °C	5 °C to 40 °C <sup>[13]</sup>
10 µA	0.6 or	0.9 + 5
100 µA	0.4 or	0.6 + 1
1 mA	0.4 or	0.6 + 0.5
10 mA	1.2 or	1.8 + 0.5
100 mA	6.0 or	9 + 0.5
1 A	8.0 or	12 + 0.5
10 A	15 or	15 + 3
30 A	15 or	15 + 1

Aperture range ..... 100 µs to 2 s in 200 ns increments, >2 s to 10 s in 1 ms increments.

Maximum trigger interval is the aperture plus 170 µs. For example at 50 Hz line frequency, 0.1plc, the maximum interval is 0.002 + 0.000170 seconds = 0.002170 seconds (read rate 460 Hz).

Additional errors (aperture $\geq 100 \mu\text{s}$ )	
Aperture	$\mu\text{A/A}$ of reading
1 s to 10 s	0
100 ms to <1 s	0.05
10 ms to 100 ms	0.50
10 ms to 50 ms	1.00
2 ms	2.00
1 ms	10.00
< 500 $\mu\text{s}$	20.00



Additional uncertainty with read rate

Read Rate	$\mu\text{A/A}$ of reading + $\mu\text{A/A}$ of range
> 1ms <5ms	20 + 0.5
< 1 ms < 4 ms	45 + 5

Aperture <100  $\mu\text{s}$

95 % Confidence

Range	Full Scale	Relative Accuracy				Absolute Accuracy		
		$\pm (\mu\text{A/A of reading} + \mu\text{A/A of range})$						
		24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 years Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$
10 $\mu\text{A}$	20.2 $\mu\text{A}$	35 + 80	40 + 80	44 + 80	66 + 80	46 + 80	58 + 80	87 + 80
100 $\mu\text{A}$	202 $\mu\text{A}$	5.5 + 70	22 + 70	44 + 70	66 + 70	44 + 70	56 + 70	84 + 70
1 mA	2.02 mA	5.5 + 70	22 + 70	44 + 70	66 + 70	44 + 70	56 + 70	84 + 70
10 mA	20.2 mA	6.5 + 70	22 + 70	44 + 70	66 + 70	44 + 70	56 + 70	84 + 70
100 mA	202 mA	18 + 70	22 + 70	44 + 70	66 + 70	44 + 70	76 + 70	114 + 70
1 A	2.02 A	60 + 125	65 + 125	110 + 125	165 + 125	110 + 125	142 + 125	214 + 125
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	80 + 160	125 + 160	180 + 160	270 + 160	184 + 160	244 + 160	366 + 160
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	240 + 180	390 + 180	500 + 180	750 + 180	501 + 180	561 + 180	842 + 180

99 % Confidence		Relative Accuracy				Absolute Accuracy		
		$\pm (\mu\text{A/A of reading} + \mu\text{A/A of range})$						
Range	Full Scale	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 years Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$
10 $\mu\text{A}$	20.2 $\mu\text{A}$	45 + 103	52 + 103	57 + 103	85 + 103	60 + 103	75 + 103	113 + 103
100 $\mu\text{A}$	202 $\mu\text{A}$	7.1 + 90	28 + 90	57 + 90	85 + 90	57 + 90	73 + 90	109 + 90
1 mA	2.02 mA	7.1 + 90	28 + 90	57 + 90	85 + 90	57 + 90	72 + 90	109 + 90
10 mA	20.2 mA	8.4 + 90	28 + 90	57 + 90	85 + 90	57 + 90	72 + 90	109 + 90
100 mA	202 mA	23 + 90	28 + 90	57 + 90	85 + 90	57 + 90	98 + 90	147 + 90
1 A	2.02 A	77 + 161	84 + 161	142 + 161	213 + 161	142 + 161	184 + 161	276 + 161
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	103 + 206	125 + 206	232 + 206	348 + 206	237 + 206	314 + 206	472 + 206
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	310 + 232	390 + 232	645 + 232	968 + 232	647 + 232	724 + 232	1086 + 232

Temperature Coefficient (not applicable if within Tcal  $\pm 1^\circ\text{C}$ )

Aperture <100  $\mu\text{s}$

Range	$\pm\mu\text{A/A}$ reading/ $^\circ\text{C}$		$\pm (\mu\text{V/V of}$ reading/ $^\circ\text{C} +$ $\mu\text{V/V of range}/^\circ\text{C})$	
	15 $^\circ\text{C}$ to 30 $^\circ\text{C}$		5 $^\circ\text{C}$ to 40 $^\circ\text{C}$ <sup>[13]</sup>	
10 $\mu\text{A}$	3.0	or	5 +	5
100 $\mu\text{A}$	3.0	or	5 +	1
1 mA	3.0	or	5 +	0.5
10 mA	3.0	or	5 +	0.5
100 mA	8.0	or	12 +	0.5
1 A	8.0	or	12 +	0.5
10 A	15	or	15 +	3
30 A	15	or	15 +	1

Aperture <100 μs "0" to 99.8 μs in 200 ns increments (there is an additional 30 μs on each conversion).

Maximum trigger interval is the aperture plus 30 μs. For example with aperture = 50 μs, the maximum interval is 50 μs + 30 μs = 80 μs (read rate 12.5 kHz). Note maximum read rate is limited to 20 kHz by other factors; see the System Speed specifications

**All Apertures**

**Settling time**

- 10 μA to 100 mA Ranges to 20 μA/A of step size .....<1 s
- 1 A to 30A ranges to 100 μA/A of step size.....<1 s

**Current shunt self-heating time to settle to within specification**

- 1 A Range cold to final value.....20 μA/A in 2 minutes
- 10 A range cold to final value .....30 μA/A in 2 minutes
- 30 A range cold to final value .....30 μA/A in 2 minutes

**Input Impedance**

Range	Front	Rear
10 μA	100 Ω	100 Ω
100 μA	100 Ω	100 Ω
1 mA	10.5 Ω	10.8 Ω
10 mA	1.5 Ω	1.8 Ω
100 mA	0.8 Ω	1.1 Ω
1 A	0.4 Ω	0.6 Ω
10 A	10 m Ω	-
30 A	10 m Ω	-

Maximum burden voltage = 2.02 x Range x input Impedance  
 Measurement voltage burden = input current x Input impedance

**Protection**

Front Input..... 30 A rms, self-resettling  
 Rear Input..... 2 A rms, Rear Panel Fuse

**DCI Ext Shunt**

Accuracy of the Indicated current value ..... Combine by root sum of squares the accuracy specification of the external shunt with the 8588A DCV specification (noting 8588A Aperture setting)

Accuracy of the secondary reading (voltage) ..... 8588A DCV specification (noting 8588A Aperture setting)

**AC Voltage** <sup>[1][2][4][6][7]</sup>

AC Voltage maximum resolution is 7 digits

95 % Confidence			Relative Accuracy					Absolute Accuracy		
			± (µV/V of reading + µV/V of range)							
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
10 mV (Auto, 10 MΩ, 1 MΩ)	12.12 mv	1 - 2k	100 + 50	180 + 110	185 + 110	200 + 110	251 + 110	250 + 110	290 + 110	330 + 110
		2k - 10k	100 + 50	250 + 110	263 + 110	300 + 110	415 + 110	330 + 110	370 + 110	480 + 110
		10k - 30k	100 + 50	250 + 110	263 + 110	300 + 110	415 + 110	340 + 110	380 + 110	490 + 110
		30k - 100k	200 + 50	0.28% + 0.011%	0.29% + 0.011%	0.30% + 0.011%	0.35% + 0.011%	0.30% + 0.011%	0.30% + 0.011%	0.35% + 0.011%
		100k - 300k	300 + 50	0.90% + 0.04%	0.93% + 0.04%	1.0% + 0.04%	1.3% + 0.04%	1.0% + 0.04%	1.0% + 0.04%	1.3% + 0.04%
		300k - 1M	500 + 50	1.90% + 0.04%	1.93% + 0.04%	2.0% + 0.04%	2.3% + 0.04%	2.0% + 0.04%	2.0% + 0.04%	2.3% + 0.04%
100 mV (Auto, 10 MΩ, 1 MΩ)	121.2 mv	1 - 2k	10 + 5	30 + 5	40 + 5	60 + 5	108 + 5	68 + 5	88 + 5	130 + 5
		2k - 10k	10 + 5	50 + 5	66 + 5	100 + 5	180 + 5	110 + 5	130 + 5	200 + 5
		10k - 30k	10 + 10	100 + 10	132 + 10	200 + 10	361 + 10	210 + 10	230 + 10	380 + 10
		30k - 100k	15 + 15	250 + 50	331 + 50	500 + 50	901 + 50	510 + 50	530 + 50	920 + 50
		100k - 300k	15 + 20	0.10% + 0.03%	0.13% + 0.03%	0.20% + 0.03%	0.37% + 0.03%	0.20% + 0.03%	0.21% + 0.03%	0.38% + 0.03%
		300k - 1M	60 + 50	0.90% + 0.10%	0.93% + 0.10%	1.0% + 0.10%	1.3% + 0.10%	1.0% + 0.10%	1.1% + 0.10%	1.3% + 0.10%
		1M - 2M	100 + 200	1.40% + 0.50%	1.43% + 0.50%	1.50% + 0.50%	1.80% + 0.50%	1.50% + 0.50%	1.54% + 0.50%	1.82% + 0.50%
		<sup>[17]</sup> 2M - 4M	200 + 400	3.40% + 1.0%	3.56% + 1.0%	4.0% + 1.0%	5.42% + 1.0%	4.0% + 1.0%	4.1% + 1.0%	5.5% + 1.0%
<sup>[17]</sup> 4M - 8M	800 + 800	7.5% + 1.0%	7.63% + 1.0%	8.0% + 1.0%	9.35% + 1.0%	8.0% + 1.0%	8.4% + 1.0%	9.8% + 1.0%		
		<sup>[17]</sup> 8M - 10M	0.10% + 0.10%	15% + 1.0%	15% + 1.0%	15% + 1.0%	17% + 1.0%	15% + 1.0%	16% + 1.0%	17% + 1.0%



95 % Confidence		Relative Accuracy						Absolute Accuracy		
		± (μV/V of reading + μV/V of range)								
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
1 V 10 V (Auto, 10 MΩ, 1 MΩ)	1.212 V 12.12 V	1 - 2k	5 + 2	30 + 5	40 + 5	60 + 5	108 + 5	64 + 5	76 + 5	120 + 5
		2k - 10k	5 + 2	50 + 5	66 + 5	100 + 5	180 + 5	110 + 5	122 + 5	190 + 5
		10k - 30k	5 + 2	100 + 10	132 + 10	200 + 10	361 + 10	210 + 10	230 + 10	380 + 10
		30k - 100k	10 + 15	250 + 50	331 + 50	500 + 50	901 + 50	510 + 50	530 + 50	920 + 50
		100k - 300k	15 20	0.1% + 0.03%	0.13% + 0.03%	0.2% + 0.03%	0.36% + 0.03%	0.2% + 0.03%	0.21% + 0.03%	0.37% + 0.03%
		300k - 1M	60 + 50	0.9% + 0.1%	0.93% + 0.1%	1.0% + 0.1%	1.3% + 0.1%	1.0% + 0.1%	1.0% + 0.1%	1.3% + 0.1%
		1M - 2M	100 + 200	1.4% + 0.5%	1.43% + 0.5%	1.5% + 0.5%	1.8% + 0.5%	1.5% + 0.5%	1.5% + 0.5%	1.8% + 0.5%
	<sup>[17]</sup>	2M - 4M	200 + 400	3.4% + 1.0%	3.6% + 1.0%	4.0% + 1.0%	5.4% + 1.0%	4.0% + 1.0%	4.0% + 1.0%	5.5% + 1.0%
	<sup>[17]</sup>	4M - 8M	800 + 800	7.5% + 1.0%	7.6% + 1.0%	8.0% + 1.0%	9.4% + 1.0%	8.0% + 1.0%	8.2% + 1.0%	9.6% + 1.0%
	<sup>[17]</sup>	8M - 10M	0.1% + 0.1%	14.4% + 1.0%	14.6% + 1.0%	15.0% + 1.0%	16.7% + 1.0%	15.0% + 1.0%	15.4% + 1.0%	17.1% + 1.0%
100 V (10 MΩ)	121.2 V	1 - 1k	20 + 5	200 + 5	205 + 5	220 + 5	271 + 5	230 + 5	250 + 5	290 + 5
		1k - 2k	20 + 5	950 + 5	963 + 5	1000 + 5	1140 + 5	1000 + 5	1020 + 5	1160 + 5
		2k - 10k	100 + 5	1.9% + 0.001%	1.93% + 0.001%	2.0% + 0.001%	2.3% + 0.001%	2.0% + 0.001%	2.0% + 0.001%	2.3% + 0.001%
100 V (Auto, 1 MΩ)	121.2 V	1 - 2k	5 + 5	30 + 5	40 + 5	60 + 5	108 + 5	70 + 5	90 + 5	130 + 5
		2k - 10k	5 + 5	50 + 5	59 + 5	80 + 5	135 + 5	90 + 5	110 + 5	160 + 5
		10k - 30k	5 + 5	100 + 10	132 + 10	200 + 10	361 + 10	210 + 10	230 + 10	380 + 10
		30k - 100k	15 + 20	250 + 50	331 + 50	500 + 50	901 + 50	510 + 50	590 + 50	980 + 50
		100k - 300k	20 + 25	0.25% + 0.05%	0.28% + 0.05%	0.35% + 0.05%	0.55% + 0.05%	0.35% + 0.05%	0.37% + 0.05%	0.6% + 0.05%
		300k - 1M	70 + 50	0.9% + 0.5%	0.93% + 0.5%	1.0% + 0.5%	1.3% + 0.5%	1.0% + 0.5%	1.1% + 0.5%	1.3% + 0.5%
1000 V (10 MΩ)	1050 V	1 - 1k	20 + 7	200 + 10	205 + 10	220 + 10	271 + 10	230 + 10	250 + 10	290 + 10
		1k - 2k	20 + 7	950 + 10	963 + 10	1000 + 10	1137 + 10	1000 + 10	1020 + 10	1160 + 10
		2k - 10k	100 + 7	1.9% + 10	1.93% + 10	2.0% + 10	2.3% + 10	2.0% + 10	2.0% + 10	2.3% + 10
1000 V (Auto, 1 MΩ)	1050 V	1 - 2k	15 + 7	50 + 25	59 + 25	80 + 25	135 + 25	90 + 25	110 + 25	160 + 25
		2k - 10k	15 + 7	50 + 25	59 + 25	80 + 25	135 + 25	90 + 25	110 + 25	160 + 25
		10k - 30k	15 + 7	100 + 25	132 + 25	200 + 25	361 + 25	210 + 25	230 + 25	380 + 25
		30k - 100k	20 + 20	250 + 100	331 + 100	500 + 100	901 + 100	510 + 100	590 + 100	980 + 100

99 % Confidence			Relative Accuracy ± (µV/V of reading + µV/V of range)					Absolute Accuracy		
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
10 mV (Auto, 10 MΩ, 1 MΩ)	12.12 mv	1 - 2k	129 + 65	232 + 142	239 + 142	258 + 142	323 + 142	323 + 142	374 + 142	426 + 142
		2k - 10k	129 + 65	323 + 142	340 + 142	387 + 142	426 + 142	477 + 142	619 + 142	
		10k - 30k	129 + 65	323 + 142	340 + 142	387 + 142	439 + 142	490 + 142	632 + 142	
		30k - 100k	258 + 65	0.36% + 0.01%	0.37% + 0.01%	0.39% + 0.01%	0.45% + 0.01%	0.39% + 0.01%	0.39% + 0.01%	4.50% + 0.01%
		100k - 300k	387 + 65	1.16% + 0.05%	1.20% + 0.05%	1.29% + 0.05%	1.63% + 0.05%	1.29% + 0.05%	1.30% + 0.05%	1.63% + 0.05%
		300k - 1M	645 + 65	2.45% + 0.05%	2.49% + 0.05%	2.58% + 0.05%	2.93% + 0.05%	2.58% + 0.05%	2.60% + 0.05%	3.00% + 0.05%
100 mV (Auto, 10 MΩ, 1 MΩ)	121.2 mv	1 - 2k	13 + 6.5	39 + 6.5	51 + 6.5	77 + 6.5	140 + 6.5	88 + 6.5	114 + 6.5	168 + 6.5
		2k - 10k	13 + 6.5	65 + 6.5	85 + 6.5	129 + 6.5	233 + 6.5	142 + 6.5	168 + 6.5	258 + 6.5
		10k - 30k	13 + 13	129 + 13	171 + 13	258 + 13	465 + 13	271 + 13	297 + 13	490 + 13
		30k - 100k	19 + 19	323 + 65	427 + 65	645 + 65	1163 + 65	658 + 65	684 + 65	1190 + 65
		100k - 300k	19 + 26	0.13% + 387	0.17% + 0.04%	0.26% + 0.04%	0.48% + 0.04%	0.26% + 0.04%	0.27% + 0.04%	0.49% + 0.04%
		300k - 1M	77 + 65	1.16% + 1290	1.20% + 0.13%	1.29% + 0.13%	1.63% + 0.13%	1.29% + 0.13%	1.30% + 0.13%	1.64% + 0.13%
		1M - 2M	129 + 258	1.81% + 6450	1.85% + 0.65%	1.94% + 0.65%	2.28% + 0.65%	1.94% + 0.65%	1.99% + 0.65%	2.35% + 0.65%
		<sup>[17]</sup> 2M - 4M	258 + 516	4.39% + 12 900	4.59% + 1.29%	5.16% + 1.29%	6.99% + 1.29%	5.16% + 1.29%	5.29% + 1.29%	7.12% + 1.29%
<sup>[17]</sup> 4M - 8M	1032 + 1032	9.68% + 12 900	9.84% + 1.29%	10.3% + 1.29%	12.1% + 1.29%	10.3% + 1.29%	10.8% + 1.29%	12.6% + 1.29%		
	<sup>[17]</sup> 8M - 10M	1290 + 1290	18.6% + 12 900	18.8% + 1.29%	19.4% + 1.29%	21.5% + 1.29%	19.4% + 1.29%	20.1% + 1.29%	22.3% + 1.29%	

99 % Confidence			Relative Accuracy					Absolute Accuracy			
			± (μV/V of reading + μV/V of range)								
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C	
1 V 10 V (Auto, 10 MΩ, 1 MΩ)	1.212 V 12.12 V	1 - 2k	6.5 + 2.6	39 + 6.5	51 + 6.5	77 + 6.5	140 + 6.5	83 + 6.5	98 + 6.5	155 + 6.5	
		2k - 10k	6.5 + 2.6	65 + 6.5	85 + 6.5	129 + 6.5	233 + 6.5	142 + 6.5	157 + 6.5	245 + 6.5	
		10k - 30k	6.5 + 2.6	129 + 13	171 + 13	258 + 13	465 + 13	271 + 13	297 + 13	490 + 13	
		30k - 100k	13 + 19	323 + 65	427 + 65	645 + 65	1160 + 65	658 + 65	684 + 65	1190 + 65	
		100k - 300k	19 + 26	0.13% + 0.4 %	0.17% + 0.04%	0.26% + 0.04%	0.46% + 0.04%	0.26% + 0.04%	0.27% + 0.04%	0.48% + 0.04%	
		300k - 1M	77 + 65	1.26% + 0.13%	1.20% + 0.13%	1.29% + 0.13%	1.61% + 0.13%	1.29% + 0.13%	1.30% + 0.13%	1.63% + 0.13%	
		1M - 2M	129 + 258	1.81% + 0.65%	1.9% + 0.65%	1.94% + 0.65%	2.28% + 0.65%	1.94% + 0.65%	1.96% + 0.65%	2.32% + 0.65%	
		<sup>[17]</sup> 2M - 4M	258 + 516	4.39% + 1.29%	4.6% + 1.29%	5.2% + 1.29%	6.98% + 1.29%	5.16% + 1.29%	5.21% + 1.29%	7.03% + 1.29%	
<sup>[17]</sup> 4M - 8M	0.1% + 0.1%	9.68% + 1.29%	9.8% + 1.29%	10.3% + 1.29%	12.1% + 1.29%	10.3% + 1.29%	10.6% + 1.29%	12.3% + 1.29%			
<sup>[17]</sup> 8M - 10M	0.13% + 0.13%	18.6% + 1.29%	19% + 1.29%	19.4% + 1.29%	21.6% + 1.29%	19.4% + 1.29%	19.9% + 1.29%	22.1% + 1.29%			
100 V (10 MΩ)	121.2 V	1 - 1k	26 + 6.5	258 + 6.5	265 + 6.5	284 + 6.5	350 + 6.5	297 + 6.5	323 + 6.5	374 + 6.5	
		1k - 2k	26 + 6.5	1230 + 6.5	1240 + 6.5	1290 + 6.5	1470 + 6.5	1290 + 6.5	1320 + 6.5	1500 + 6.5	
		2k - 10k	129 + 6.5	24 500 + 13	24 900 + 13	25 800 + 13	29 300 + 13	25 800 + 13	25 960 + 13	29 400 + 13	
100 V (Auto, 1 MΩ)	121.2 V	1 - 2k	6.5 + 6.5	39 + 6.5	51 + 6.5	77 + 6.5	140 + 6.5	90 + 6.5	116 + 6.5	168 + 6.5	
		2k - 10k	6.5 + 6.5	65 + 6.5	76 + 6.5	103 + 6.5	174 + 6.5	116 + 6.5	142 + 6.5	206 + 6.5	
		10k - 30k	6.5 + 6.5	129 + 13	171 + 13	258 + 13	465 + 13	271 + 13	297 + 13	490 + 13	
		30k - 100k	19 + 26	323 + 65	427 + 65	645 + 65	1160 + 65	658 + 65	761 + 65	1260 + 65	
		100k - 300k	26 + 32	0.32% + 0.06%	0.14% + 0.06%	0.45% + 0.06%	0.71% + 0.06%	0.45% + 0.06%	0.48% + 0.06%	0.73% + 0.06%	
		300k - 1M	90 + 65	1.16% + 0.65%	1.20% + 0.65%	1.29% + 0.65%	1.61% + 0.65%	1.29% + 0.65%	1.33% + 0.65%	1.67% + 0.65%	

99 % Confidence			Relative Accuracy					Absolute Accuracy		
			$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$							
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 year Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$
100 V (10 M $\Omega$ )	121.2 V	1 - 1k	26 + 6.5	258 + 6.5	265 + 6.5	284 + 6.5	350 + 6.5	297 + 6.5	323 + 6.5	374 + 6.5
		1k - 2k	26 + 6.5	1230 + 6.5	1240 + 6.5	1290 + 6.5	1470 + 6.5	1290 + 6.5	1320 + 6.5	1500 + 6.5
		2k - 10k	129 + 6.5	24 500 + 13	24 900 + 13	25 800 + 13	29 300 + 13	25 800 + 13	25 960 + 13	29 400 + 13
100 V (Auto, 1 M $\Omega$ )	121.2 V	1 - 2k	6.5 + 6.5	39 + 6.5	51 + 6.5	77 + 6.5	140 + 6.5	90 + 6.5	116 + 6.5	168 + 6.5
		2k - 10k	6.5 + 6.5	65 + 6.5	76 + 6.5	103 + 6.5	174 + 6.5	116 + 6.5	142 + 6.5	206 + 6.5
		10k - 30k	6.5 + 6.5	129 + 13	171 + 13	258 + 13	465 + 13	271 + 13	297 + 13	490 + 13
		30k - 100k	19 + 26	323 + 65	427 + 65	645 + 65	1160 + 65	658 + 65	761 + 65	1260 + 65
		100k - 300k	26 + 32	0.32% + 0.06%	0.14% + 0.06%	0.45% + 0.06%	0.71% + 0.06%	0.45% + 0.06%	0.48% + 0.06%	0.73% + 0.06%
300k - 1M	90 + 65	1.16% + 0.65%	1.20% + 0.65%	1.29% + 0.65%	1.61% + 0.65%	1.29% + 0.65%	1.33% + 0.65%	1.67% + 0.65%		
1000 V (10 M $\Omega$ )	1050 V	1 - 1k	26 + 9.0	258 + 13	265 + 13	284 + 13	350 + 13	297 + 13	323 + 13	374 + 13
		1k - 2k	26 + 9.0	0.12% + 13	0.14% + 0.06%	0.45% + 0.06%	0.71% + 0.06%	0.45% + 0.06%	0.48% + 0.06%	0.73% + 0.06%
		2k - 10k	129 + 9.0	2.5% + 13	1.20% + 0.65%	1.29% + 0.65%	1.61% + 0.65%	1.29% + 0.65%	1.33% + 0.65%	1.67% + 0.65%
1000 V (Auto, 1 M $\Omega$ )	1050 V	1 - 2k	19 + 9.0	65 + 32	76 + 32	103 + 32	174 + 32	116 + 32	142 + 32	206 + 32
		2k - 10k	19 + 9.0	65 + 32	76 + 32	103 + 32	174 + 32	116 + 32	142 + 32	206 + 32
		10k - 30k	19 + 9.0	129 + 32	171 + 32	258 + 32	465 + 32	271 + 32	297 + 32	490 + 32
		30k - 100k	26 + 26	323 + 129	427 + 129	645 + 129	1163 + 129	658 + 129	761 + 129	1264 + 129

**Temperature Coefficient** (not applicable if within Tcal  $\pm 1$  °C)

Range	Frequency (Hz)	$\pm \mu V/V$ of reading / °C	
		15 °C to 30 °C	5 °C to 15 °C, 30 °C to 40 °C
10 mV (Auto, 10 M $\Omega$ , 1 M $\Omega$ )	1 - 2k	10	15
	2k - 10k	10	15
	10k - 30k	10	15
	30k - 100k	10	15
	100k - 300k	15	20
	300k - 1M	30	50
100 mV (Auto, 10 M $\Omega$ , 1 M $\Omega$ )	1 - 2k	5	8
	2k - 10k	5	8
	10k - 30k	5	8
	30k - 100k	5	8
	100k - 300k	15	20
	300k - 1M	30	50
	1M - 2M	100	150
	2M - 4M <sup>[17]</sup>	250	400
1 V 10 V (Auto, 10 M $\Omega$ , 1 M $\Omega$ )	1 - 2k	3	5
	2k - 10k	3	5
	10k - 30k	5	8
	30k - 100k	5	8
	100k - 300k	15	20
	300k - 1M	30	50
	1M - 2M	50	80
	2M - 4M <sup>[17]</sup>	100	150
4M - 8M <sup>[17]</sup>	500	800	
8M - 10M <sup>[17]</sup>	1000	1500	

Range	Frequency (Hz)	$\pm \mu V/V$ of reading / °C	
		15 °C to 30 °C	5 °C to 15 °C, 30 °C to 40 °C
100 V (10 M $\Omega$ )	1 - 1k	5	8
	1k - 2k	5	8
	2k - 10k	30	50
100 V (Auto, 1 M $\Omega$ )	1 - 2k	5	8
	2k - 10k	5	8
	10k - 30k	5	8
	30k - 100k	20	30
	100k - 300k	40	60
1000 V (10 M $\Omega$ )	300k - 1M	80	120
	1 - 1k	5	8
	1k - 2k	5	8
	2k - 10k	30	50
1000 V (Auto, 1 M $\Omega$ )	1 - 2k	5	8
	2k - 10k	5	8
	10k - 30k	5	8
	30k - 100k	20	30

Reading Rate		
RMS Filter	Acquisition Time (seconds)	Read Rate (Hz)
0.1 Hz	62	0.016
1 Hz	6.2	0.16
10 Hz	0.62	1.6
40 Hz	0.156	6.4
100 Hz	0.063	16
1000 Hz	0.015	67

Read rate 3x slower for Extended HF.

Auto Counter Gate setting will not affect the read-rate. Setting Gate time manually may reduce the read rate.

Type ..... True RMS, AC Coupled measures AC component with up to 1000 V dc bias on any range  
 DC Coupling produces the root sum of squares of the ac and dc components  $\sqrt{(ac^2 + dc^2)}$

#### Specified Range

10 mV Range ..... From 10 % of range to full range

100 mV to 1 kV Ranges ..... From 1 % of range to full range

CMRR..... >90 dB dc to 60 Hz (1 k $\Omega$  unbalance)

Peak Input (RMS not to exceed full scale value)

10 mV to 100 V Ranges ..... .2 x Range

1000 V Range ..... 1050V \* 1.414

Protection on all ranges..... 1050 V RMS

#### Input Impedance

Auto ..... 10 mV to 10 V Ranges.....>1 T $\Omega$  in parallel with 80 pF  $\pm$ 5 pF

100 V and 1000 V Range..... 1.01 M $\Omega$   $\pm$ 1 % in parallel with 50 pF  $\pm$ 5 pF

10 M $\Omega$ ..... 10 mV to 10V Ranges..... 10 M $\Omega$   $\pm$ 1 % in parallel with 80 pF  $\pm$ 5 pF

100 V and 1000 V Range..... 10 M $\Omega$   $\pm$ 1 % in parallel with 50 pF  $\pm$ 5 pF

1 M $\Omega$ ..... 10 mV to 10V Ranges..... 1.01 M $\Omega$   $\pm$ 1 % in parallel with 80 pF  $\pm$ 5 pF

100 V and 1000 V Range..... 1.01 M $\Omega$   $\pm$ 1 % in parallel with 50 pF  $\pm$ 5 pF

DC Accuracy (DC Coupled) .....Add  $\pm$  (50  $\mu$ V/V of Reading + 50  $\mu$ V/V of Range + 20  $\mu$ V)

AC Coupling ..... 330 nF into 1.01 M $\Omega$  or 10 M $\Omega$

Volt.Hertz limit ..... 3 x 10<sup>7</sup> (allows 3 V at 10 MHz)

Frequency Secondary Measurement: see frequency counter specification

Other secondary reading values are not specified.

**AC Current** <sup>[1][2][4][6]</sup>

AC Current maximum resolution is 7 digits

95 % Confidence			Relative Accuracy					Absolute Accuracy		
			± (µA/A of reading + µA/A of range)							
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
10 µA	20.2 µA	1 - 2k	150.0 + 3	1500 + 250	1640 + 250	2000 + 250	3040 + 250	2010 + 250	2030 + 250	3070 + 250
		2k - 10k	150.0 + 3	1500 + 250	1640 + 250	2000 + 250	3040 + 250	2010 + 250	2030 + 250	3070 + 250
		10k - 30k	150.0 + 10	1500 + 250	1640 + 250	2000 + 250	3040 + 250	2010 + 250	2050 + 250	3090 + 250
100 µA 1 mA 10 mA	202 µA 2.02 mA 20.2 mA	1 - 2k	20.0 + 10	200 + 50	214 + 50	250 + 50	361 + 50	260 + 50	280 + 50	390 + 50
		2k - 10k	20.0 + 7	400 + 50	427 + 50	500 + 50	721 + 50	510 + 50	530 + 50	750 + 50
		10k - 30k	20.0 + 10	600 + 50	626 + 50	700 + 50	938 + 50	720 + 50	740 + 50	970 + 50
		30k - 100k	50.0 + 20	3500 + 100	3630 + 100	4000 + 100	5220 + 100	4010 + 100	4050 + 100	5270 + 100
100 mA	202 mA	1 - 2k	10.0 + 7	200 + 50	214 + 50	250 + 50	361 + 50	260 + 50	280 + 50	380 + 50
		2k - 10k	10.0 + 7	400 + 50	427 + 50	500 + 50	721 + 50	500 + 50	520 + 50	740 + 50
		10k - 30k	10.0 + 15	600 + 50	626 + 50	700 + 50	938 + 50	700 + 50	740 + 50	980 + 50
1 A	2.02 A	1 - 2k	10.0 + 10	200 + 100	214 + 100	250 + 100	361 + 100	260 + 100	300 + 100	400 + 100
		2k - 10k	10.0 + 10	400 + 100	427 + 100	500 + 100	721 + 100	510 + 100	550 + 100	770 + 100
		10k - 30k	10.0 + 20	600 + 100	626 + 100	700 + 100	938 + 100	710 + 100	790 + 100	1020 + 100
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	10 - 2k	50.0 + 20	300 + 50	477 + 50	800 + 50	1510 + 50	800 + 50	840 + 50	1550 + 50
		2k - 10k	50.0 + 20	480 + 50	577 + 50	800 + 50	1370 + 50	800 + 50	840 + 50	1410 + 50
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	10 - 2k	20.0 + 10	600 + 400	656 + 400	800 + 400	1220 + 400	800 + 400	840 + 400	1260 + 400
		2k - 10k	20.0 + 15	1100 + 400	1130 + 400	1200 + 400	1460 + 400	1200 + 400	1240 + 400	1500 + 400

99 % Confidence			Relative Accuracy					Absolute Accuracy			
			$\pm (\mu A/A \text{ of reading} + \mu A/A \text{ of range})$								
Range	Full Scale (rms)	Frequency (Hz)	Transfer, 20 min <sup>[16]</sup>	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 year Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$	
10 $\mu\text{A}$	20.2 $\mu\text{A}$	1 - 2k	194 + 4	1940 + 323	2120 + 323	2580 + 323	3920 + 323	2590 + 323	2620 + 323	3960 + 323	
		2k - 10k	194 + 4	1940 + 323	2120 + 323	2580 + 323	3920 + 323	2590 + 323	2620 + 323	3960 + 323	
		10k - 30k	194 + 13	1940 + 323	2120 + 323	2580 + 323	3920 + 323	2590 + 323	2620 + 323	3990 + 323	
100 $\mu\text{A}$	202 $\mu\text{A}$	1 - 2k	26 + 13	258 + 65	276 + 65	323 + 65	465 + 65	335 + 65	361 + 65	503 + 65	
		2k - 10k	26 + 9	516 + 65	551 + 65	645 + 65	930 + 65	658 + 65	684 + 65	968 + 65	
10 mA	20.2 mA	10k - 30k	26 + 13	774 + 65	808 + 65	903 + 65	1210 + 65	929 + 65	955 + 65	1250 + 65	
		30k - 100k	65 + 26	4520 + 129	4680 + 129	5160 + 129	6730 + 129	5170 + 129	5230 + 129	6800 + 129	
100 mA	202 mA	1 - 2k	13 + 9	258 + 65	276 + 65	323 + 65	465 + 65	335 + 65	361 + 65	490 + 65	
		2k - 10k	13 + 9	516 + 65	551 + 65	645 + 65	930 + 65	645 + 65	671 + 65	955 + 65	
		10k - 30k	13 + 19	774 + 65	808 + 65	903 + 65	1210 + 65	903 + 65	955 + 65	1260 + 65	
1 A	2.02 A	1 - 2k	13 + 13	258 + 129	276 + 129	323 + 129	465 + 129	335 + 129	387 + 129	516 + 129	
		2k - 10k	13 + 13	516 + 129	551 + 129	645 + 129	930 + 129	658 + 129	710 + 129	993 + 129	
		10k - 30k	13 + 26	774 + 129	808 + 129	903 + 129	1210 + 129	916 + 129	1020 + 129	1320 + 129	
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	10 - 2k	65 + 26	387 + 65	615 + 65	1030 + 65	1950 + 65	1030 + 65	1080 + 65	2000 + 65	
		2k - 10k	65 + 26	619 + 65	744 + 65	1030 + 65	1770 + 65	1030 + 65	1080 + 65	1820 + 65	
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	10 - 2k	26 + 13	774 + 516	846 + 516	1030 + 516	1570 + 516	1030 + 516	1080 + 516	1630 + 516	
		2k - 10k	26 + 19	1420 + 516	1460 + 516	1550 + 516	1880 + 516	1550 + 516	1600 + 516	1940 + 516	



**AC Current Temperature Coefficient** (not applicable if within Tcal  $\pm 1$  °C)

Range	Frequency (Hz)	$\pm \mu A/A$ of reading/°C	
		15 °C to 30 °C	5 °C to 15 °C, 30 °C to 40 °C
10 $\mu A$	1 - 10	5	8
	10 - 10k	5	8
	10k - 30k	10	15
100 $\mu A$	1 - 10	5	8
1 mA	10 - 10k	5	8
10 mA	10k - 30k	5	8
	30k - 100k	10	15
100 mA	1 - 10	5	8
	10 - 10k	5	8
	10k - 30k	10	15
1 A	1 - 10	10	15
	10 - 10k	10	15
	10k - 30k	20	30
10 A	1 - 10	10	15
	10 - 10k	10	15
30 A	1 - 10	10	15
	10 - 10k	10	15

**Settling time**

10  $\mu A$  to 100 mA Ranges to 20  $\mu A/A$  of step size ..... <1 s  
 1 A to 30 A ranges to 100  $\mu A/A$  of step size..... <1 s

**Current shunt self-heating time to settle to within specification**

1 A Range cold to final value ..... 20  $\mu A/A$  in 2 minutes  
 10 A range cold to final value ..... 50  $\mu A/A$  in 2 minutes  
 30 A range cold to final value ..... 50  $\mu A/A$  in 2 minutes  
 DC Accuracy (DC Coupled)..... Add  $\pm(100 \mu A/A$  Reading  
 +50  $\mu A/A$  Range + 20 nA)

**Input Impedance**

Range	Front	Rear
10 $\mu A$	100 $\Omega$	100 $\Omega$
100 $\mu A$	100 $\Omega$	100 $\Omega$
1 mA	10.5 $\Omega$	10.8 $\Omega$
10 mA	1.5 $\Omega$	1.8 $\Omega$
100 mA	0.8 $\Omega$	1.1 $\Omega$
1 A	0.4 $\Omega$	0.6 $\Omega$
10 A	10m $\Omega$	-
30 A	10m $\Omega$	-

Maximum burden voltage = 2.02 x Range x input Impedance  
 Measurement voltage burden = input current x Input impedance

**Protection**

Front Input.....30 A rms, self-resetting  
 Rear Input .....2 A rms, Rear Panel Fuse  
 Peak Input (RMS not to exceed full scale value)  
 10  $\mu A$  to 10A Ranges.....2 x Range  
 30 A Range .....30.2 \* 1.414

**Reading Rate**

RMS Filter	Acquisition time (seconds)	Read Rate (Hz)
0.1 Hz	62	0.016
1 Hz	6.2	0.16
10 Hz	0.62	1.6
40 Hz	0.156	6.4
100 Hz	0.063	16
1000 Hz	0.015	67

Auto Counter Gate setting will not affect the read-rate.  
 Setting Gate time manually may reduce the read rate.  
 Frequency as Secondary Measurement - see frequency counter specifications

**ACI Ext Shunt**

Accuracy of the Indicated current value ..... Combine by root sum of squares the accuracy specification of the external shunt with the 8588A ACV specification  
 Accuracy of the secondary reading (voltage) ..... 8588A ACV specification  
 Accuracy of the secondary reading (Frequency/Period) ..... Use the ACV Frequency specification  
 Other secondary reading values are not specified.

**Resistance <sup>[1][2][3][4][10]</sup>**

**Resistance 4 Wire**

Resistance maximum resolution is 8 digits

95 % Confidence			Relative Accuracy					Absolute Accuracy		
			± (μΩ/Ω of reading + μΩ/Ω of range)							
Range	Full Scale	"Mode"	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
1 Ω	2.02 Ω	Normal	2.0 + 4.0	5.0 + 4.0	8.0 + 4.0	10 + 4.0	20 + 4.0	11 + 4.0	17 + 4.0	25 + 4.0
10 Ω	20.2 Ω	Normal	0.8 + 1.4	2.5 + 1.4	4.5 + 1.4	7.0 + 1.4	14.0 + 1.4	7.7 + 1.4	10.1 + 1.4	15 + 1.4
100 Ω	202 Ω	Normal	0.2 + 0.5	1.5 + 0.5	4.0 + 0.5	7.0 + 0.5	14.0 + 0.5	7.2 + 0.5	9.2 + 0.5	14 + 0.5
1 kΩ	2.02 kΩ	Normal	0.2 + 0.5	1.0 + 0.5	3.5 + 0.5	7.0 + 0.5	14.0 + 0.5	7.1 + 0.5	9.1 + 0.5	14 + 0.5
10 kΩ	20.2 kΩ	Normal	0.2 + 0.5	1.0 + 0.5	3.5 + 0.5	7.0 + 0.5	14.0 + 0.5	7.2 + 0.5	9.2 + 0.5	14 + 0.5
100 kΩ	202 kΩ	Normal	0.2 + 0.5	1.0 + 0.5	3.5 + 0.5	7.0 + 0.5	14.0 + 0.5	7.3 + 0.5	9.3 + 0.5	14 + 0.5
1 MΩ	2.02 MΩ	Normal	0.5 + 1.0	2.0 + 1.0	4.0 + 1.0	7.0 + 1.0	14.0 + 1.0	8.2 + 1.0	10.6 + 1.0	16 + 1.0
10 MΩ	20.2 MΩ	Normal	2.5 + 10	3.5 + 10	6.0 + 10	9.0 + 10	18.0 + 10	11 + 10	19 + 10	28 + 10
100 MΩ	202 MΩ	Normal	15 + 100	20 + 100	25 + 100	30 + 100	60.0 + 100	39 + 100	119 + 100	179 + 100
1 GΩ	2.02 GΩ	Normal	200 + 1000	250 + 1000	350 + 1000	500 + 1000	1000 + 1000	505 + 1000	1310 + 1000	1960 + 1000
1 Ω	2.02 Ω	Lo Current	2.0 + 4.0	5.0 + 4.0	8.0 + 4.0	10 + 4.0	20 + 4.0	11 + 4.0	17 + 4.0	25 + 4.0
10 Ω	20.2 Ω	Lo Current	0.8 + 1.4	2.5 + 1.4	4.5 + 1.4	7.0 + 1.4	14 + 1.4	7.7 + 1.4	10 + 1.4	15 + 1.4
100 Ω	202 Ω	Lo Current	2.5 + 2.0	8.7 + 2.0	11.2 + 2.0	14 + 2.0	21 + 2.0	14.4 + 2.0	17 + 2.0	25 + 2.0
1 kΩ	2.02 kΩ	Lo Current	2.5 + 2.0	9.3 + 2.0	11.8 + 2.0	15 + 2.0	22 + 2.0	16 + 2.0	18 + 2.0	27 + 2.0
10 kΩ	20.2 kΩ	Lo Current	2.5 + 2.0	12.9 + 2.0	15.4 + 2.0	19 + 2.0	26 + 2.0	19 + 2.0	21 + 2.0	32 + 2.0
100 kΩ	202 kΩ	Lo Current	5.0 + 0.6	12.9 + 0.6	15.4 + 0.6	19 + 0.6	26 + 0.6	19 + 0.6	21 + 0.6	32 + 0.6
1 MΩ	2.02 MΩ	Lo Current	7.0 + 1.0	11.6 + 1.0	13.6 + 1.0	17 + 1.0	24 + 1.0	17 + 1.0	25 + 1.0	38 + 1.0
10 MΩ	20.2 MΩ	Lo Current	20 + 10	40 + 10	43 + 10	46 + 10	55 + 10	46 + 10	126 + 10	190 + 10
100 MΩ	202 MΩ	Lo Current	250 + 100	250 + 100	350 + 100	500 + 100	1000 + 100	515 + 100	1320 + 100	1970 + 100

			Relative Accuracy					Absolute Accuracy		
95 % Confidence			± (μΩ/Ω of reading + μΩ/Ω of range)							
Range	Full Scale	"Mode"	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
1 GΩ	2.02 GΩ	Lo Current	250 + 1000	250 + 1000	350 + 1000	500 + 1000	1000 + 1000	525 + 1000	1320 + 1000	1990 + 1000
10 MΩ	20.2 MΩ	HV	2.0 + 1	5.8 + 1	6.5 + 1	7.0 + 1	14 + 1	15 + 1	17 + 1	26 + 1
100 MΩ	202 MΩ	HV	3.5 + 10	7.4 + 10	8.0 + 10	9.0 + 10	18.0 + 10	60 + 10	68 + 10	102 + 10
1 GΩ	2.02 GΩ	HV	20 + 100	27 + 100	28 + 100	30 + 100	60.0 + 100	150 + 100	230 + 100	345 + 100
10 GΩ [14]	20.2 GΩ	HV	250 + 1000	250 + 1000	350 + 1000	500 + 1000	1000 + 1000	525 + 1000	1330 + 1000	1990 + 1000

			Relative Accuracy					Absolute Accuracy		
99 % Confidence			± (μΩ/Ω of reading + μΩ/Ω of range)							
Range	Full Scale	"Mode"	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
1 Ω	2.02 Ω	Normal	2.6 + 5.2	6.5 + 5.2	10.3 + 5.2	13 + 5.2	26 + 5.2	14 + 5.2	21 + 5.2	32 + 5.2
10 Ω	20.2 Ω	Normal	1.0 + 1.8	3.2 + 1.8	5.8 + 1.8	9.0 + 1.8	18.1 + 1.8	9.9 + 1.8	13.0 + 1.8	20 + 1.8
100 Ω	202 Ω	Normal	0.3 + 0.6	1.9 + 0.6	5.2 + 0.6	9.0 + 0.6	18.1 + 0.6	9.2 + 0.6	11.8 + 0.6	18 + 0.6
1 kΩ	2.02 kΩ	Normal	0.3 + 0.6	1.3 + 0.6	4.5 + 0.6	9.0 + 0.6	18.1 + 0.6	9.1 + 0.6	11.7 + 0.6	18 + 0.6
10 kΩ	20.2 kΩ	Normal	0.3 + 0.6	1.3 + 0.6	4.5 + 0.6	9.0 + 0.6	18.1 + 0.6	9.2 + 0.6	11.8 + 0.6	18 + 0.6
100 kΩ	202 kΩ	Normal	0.3 + 0.6	1.3 + 0.6	4.5 + 0.6	9.0 + 0.6	18.1 + 0.6	9.4 + 0.6	11.9 + 0.6	18 + 0.6
1 MΩ	2.02 MΩ	Normal	0.6 + 1.3	2.6 + 1.3	5.2 + 1.3	9.0 + 1.3	18.1 + 1.3	10.6 + 1.3	13.7 + 1.3	21 + 1.3
10 MΩ	20.2 MΩ	Normal	3.2 + 13	4.5 + 13	7.7 + 13	11.6 + 13	23.2 + 13	14 + 13	24 + 13	36 + 13
100 MΩ	202 MΩ	Normal	19 + 129	26 + 129	32 + 129	39 + 129	77.4 + 129	50 + 129	154 + 129	230 + 129
1 GΩ	2.02 GΩ	Normal	258 + 1290	323 + 1290	452 + 1290	645 + 1290	1290 + 1290	652 + 1290	1690 + 1290	2530 + 1290
1 Ω	2.02 Ω	Lo Current	2.6 + 5.2	6.5 + 5.2	10.3 + 5.2	13 + 5.2	26 + 5.2	14 + 5.2	21 + 5.2	32 + 5.2
10 Ω	20.2 Ω	Lo Current	1.0 + 1.8	3.2 + 1.8	5.8 + 1.8	9.0 + 1.8	18 + 1.8	9.9 + 1.8	13 + 1.8	20 + 1.8
100 Ω	202 Ω	Lo Current	3.2 + 2.6	11.2 + 2.6	14.4 + 2.6	18 + 2.6	27 + 2.6	18.6 + 2.6	22 + 2.6	33 + 2.6
1 kΩ	2.02 kΩ	Lo Current	3.2 + 2.6	12.0 + 2.6	15.2 + 2.6	20 + 2.6	29 + 2.6	20 + 2.6	23 + 2.6	35 + 2.6
10 kΩ	20.2 kΩ	Lo Current	3.2 + 2.6	16.6 + 2.6	19.9 + 2.6	24 + 2.6	33 + 2.6	25 + 2.6	28 + 2.6	41 + 2.6
100 kΩ	202 kΩ	Lo Current	6.5 + 0.8	16.6 + 0.8	19.9 + 0.8	24 + 0.8	33 + 0.8	25 + 0.8	28 + 0.8	41 + 0.8
1 MΩ	2.02 MΩ	Lo Current	9.0 + 1.3	14.9 + 1.3	17.5 + 1.3	21 + 1.3	30 + 1.3	22 + 1.3	33 + 1.3	49 + 1.3
10 MΩ	20.2 MΩ	Lo Current	26 + 13	52 + 13	55 + 13	59 + 13	71 + 13	60 + 13	163 + 13	245 + 13

99 % Confidence			Relative Accuracy					Absolute Accuracy		
			± (μΩ/Ω of reading + μΩ/Ω of range)							
Range	Full Scale	"Mode"	Transfer, 20 min <sup>[15]</sup>	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C
100 MΩ	202 MΩ	Lo Current	323 + 129	323 + 129	452 + 129	645 + 129	1290 + 129	664 + 129	1700 + 129	2540 + 129
1 GΩ	2.02 GΩ	Lo Current	323 + 1290	323 + 1290	452 + 1290	645 + 1290	1290 + 1290	677 + 1290	1700 + 1290	2570 + 1290
10 MΩ	20.2 MΩ	HV	2.6 + 1.29	7.5 + 1.29	8.4 + 1.29	9.0 + 1.29	18 + 1.29	19 + 1.29	22 + 1.29	34 + 1.29
100 MΩ	202 MΩ	HV	4.5 + 12.9	9.5 + 12.9	10.3 + 12.9	11.6 + 12.9	23.2 + 12.9	77 + 12.9	88 + 12.9	132 + 12.9
1 GΩ	2.02 GΩ	HV	26 + 129	35 + 129	36 + 129	39 + 129	77.4 + 129	194 + 129	297 + 129	445 + 129
10 GΩ <sup>[14]</sup>	20.2 GΩ	HV	323 + 1290	323 + 1290	452 + 1290	645 + 1290	1290 + 1290	677 + 1290	1720 + 1290	2570 + 1290

**Temperature Coefficient** (not applicable if within Tcal  $\pm 1$  °C)

Range	"Mode"	$\pm \mu\Omega/\Omega$ of reading/°C 15 °C to 30 °C		$\pm (\mu\Omega/\Omega$ of reading/°C + $\Omega/^\circ\text{C})$ 5 °C to 40 °C <sup>[13]</sup>
1 $\Omega$	Normal	1.5	or	2.5 + 1.5 $\mu$
10 $\Omega$	Normal	0.6	or	1.0 + 15 $\mu$
100 $\Omega$	Normal	0.5	or	0.8 + 20 $\mu$
1 k $\Omega$	Normal	0.5	or	0.8 + 200 $\mu$
10 k $\Omega$	Normal	0.5	or	0.8 + 2 m
100 k $\Omega$	Normal	0.5	or	0.8 + 20 m
1 M $\Omega$	Normal	0.6	or	1.0 + 200 m
10 M $\Omega$	Normal	2	or	3.0 + 2
100 M $\Omega$	Normal	20	or	30 + 20
1 G $\Omega$	Normal	200	or	300 + 200
1 $\Omega$	Lo Current	1.5	or	2.5 + 1.5 $\mu$
10 $\Omega$	Lo Current	0.6	or	1.0 + 15 $\mu$
100 $\Omega$	Lo Current	0.6	or	1.0 + 150 $\mu$
1 k $\Omega$	Lo Current	0.6	or	1.0 + 1.5 m
10 k $\Omega$	Lo Current	0.6	or	1.0 + 15 m
100 k $\Omega$	Lo Current	0.6	or	1.0 + 20 m
1 M $\Omega$	Lo Current	2	or	3.0 + 200 m
10 M $\Omega$	Lo Current	20	or	30 + 2
100 M $\Omega$	Lo Current	200	or	300 + 20
1 G $\Omega$	Lo Current	200	or	300 + 100
10 M $\Omega$	HV	0.6	or	1.0 + 2.5
100 M $\Omega$	HV	2	or	3.0 + 25
1 G $\Omega$	HV	20	or	30 + 250
10 G $\Omega$ <sup>[14]</sup>	HV	200	or	300 + 2.5 k

**Voltage and Current Parameters**

Range	"Mode"	Measurement Current	Measurement Voltage at Full Scale
1 $\Omega$	Normal	100 mA	200 mV
10 $\Omega$	Normal	10 mA	200 mV
100 $\Omega$	Normal	10 mA	2 V
1 k $\Omega$	Normal	1 mA	2 V
10 k $\Omega$	Normal	100 $\mu$ A	2 V
100 k $\Omega$	Normal	100 $\mu$ A	20 V
1 M $\Omega$	Normal	10 $\mu$ A	20 V
10 M $\Omega$	Normal	1 $\mu$ A	20 V
100 M $\Omega$	Normal	100 nA	20 V
1 G $\Omega$	Normal	10 nA	20 V
1 $\Omega$	Lo Current	100 mA	200 mV
10 $\Omega$	Lo Current	10 mA	200 mV
100 $\Omega$	Lo Current	1 mA	200 mV
1 k $\Omega$	Lo Current	100 $\mu$ A	200 mV
10 k $\Omega$	Lo Current	10 $\mu$ A	200 mV
100 k $\Omega$	Lo Current	10 $\mu$ A	2 V
1 M $\Omega$	Lo Current	1 $\mu$ A	2 V
10 M $\Omega$	Lo Current	100 nA	2 V
100 M $\Omega$	Lo Current	10 nA	2 V
1 G $\Omega$	Lo Current	10 nA	20 V
10 M $\Omega$	HV	10 $\mu$ A	200 V
100 M $\Omega$	HV	1 $\mu$ A	200 V
1 G $\Omega$	HV	100 nA	200 V
10 G $\Omega$ <sup>[14]</sup>	HV	10 nA	200 V

Aperture.....100  $\mu$ s to 2 s in 200 ns increments, >2 s to 10 s in 1 ms increments

Additional errors with aperture

Aperture	$\mu\Omega/\Omega$ of reading + $\mu\Omega/\Omega$ of range
<10 ms	0 + 0.5
<4 ms	1 + 2
< 2 ms	10 + 10
<1ms	20 + 20

Additional errors with read rate:

Read Rate	$\mu\Omega/\Omega$ of reading + $\mu\Omega/\Omega$ of range
> 1ms <5ms	20 + 0.5
< 1 ms	45 + 5

Maximum Trigger Rate (Aperture  $\leq$  100  $\mu$ s) ...4700 readings/s (Ascii format - for faster sampling rates see Digitizing).

(Maximum Block size of 10 000 000 samples)

Minimum trigger interval is the aperture plus 170  $\mu$ s. For example at 50 Hz line frequency, 0.1 plc, the minimum interval is 0.002 + 0.00017 seconds = 0.00217 seconds (read rate 460 Hz).

Tru Ohms mode available on 1  $\Omega$  to 10 k $\Omega$  ranges. Read Rate reduced in Tru Ohms Mode. Specification for Tru Ohms same as corresponding Normal or Lo Current ranges.

2 Wire Adder ..... $\pm(10 \text{ pA}/I_r) \times 10^6 \mu\Omega/\Omega$  of Reading  $\pm 50 \text{ m}\Omega \pm 3 \text{ m}\Omega/^\circ\text{C}$ ,

where  $I_r$  is the measurement current, where the temperature related factor is based on the temperature difference between the present operating temperature and the temperature where the instrument was last zeroed.

Maximum 4 wire Lead Resistance .....10  $\Omega$  in any or all leads, 1  $\Omega$  on the 1  $\Omega$  Range

**$\Omega$  Guarding**

Range.....Minimum Parallel Guard Resistance ..... $R_x = R_d \times (1 + (R_d \times R_g)/(R_a \times R_b))$  where  $R_x$  = Resistor being measured

1  $\Omega$ , 10  $\Omega$ .....200  $\Omega$ ..... $R_d$  = displayed value

100  $\Omega$ .....2 k $\Omega$ ..... $R_a$  = parallel resistor from Hi to Guard

1 k $\Omega$ , 10 k $\Omega$ , 100 k $\Omega$ , 1 M $\Omega$ .....20 k $\Omega$ ..... $R_b$  = parallel resistor from Lo to Guard

10 M $\Omega$ , 100 M $\Omega$ , 1 G $\Omega$ , 10 G $\Omega$ .....200 k $\Omega$ ..... $R_g$  =  $\Omega$  Guard lead resistance (< 1  $\Omega$ )

Full Scale Measurement Voltage

Normal Mode ..... 200 mV / 2 V / 20 V  
 Lo Current Mode ..... 20 mV/200 mV / 2 V / 20 V  
 High Voltage Mode ..... 200 V

Protection (All Ranges)..... 1050 V RMS

Ratio Accuracy

Range to Range ..... Combine total Front Input accuracy and total Rear Input accuracy by Root Sum of Squares  
 Within Range ..... Using the 24 hour or 20 minute Transfer Uncertainty specifications as appropriate, apply a Root Sum of Squares combination of the specified accuracy of the Front Input signal and the specified accuracy of the Rear Input signal

Settling Time

Filter Off ..... Up to 100 kΩ Range <0.05 s to 10 μΩ/Ω  
 Filter On ..... Up to 100 kΩ Range <1 s to 10 μΩ/Ω

**Digitizing** [2][3][4][9][18][19]

**Digitize DC Voltage**

18-bit resolution for aperture 0 to ≤3 ms

95 % Confidence			Relative Accuracy				Absolute Accuracy			
			± (μV/V of reading + μV/V of range)							
Range	Zin	Full Scale	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 years Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C	
100 mV	Auto, 10 MΩ, 1 MΩ	202 mV	3.3 + 15	20 + 15	44 + 15	62 + 15	49 + 15	67 + 15	80 + 15	
1 V	Auto, 10 MΩ, 1 MΩ	2.02 V	3.3 + 15	20 + 15	44 + 15	62 + 15	49 + 15	63 + 15	76 + 15	
10 V	Auto, 10 MΩ, 1 MΩ	20.2 V	3.3 + 15	20 + 15	44 + 15	62 + 15	49 + 15	63 + 15	76 + 15	
100 V	Auto, 10 MΩ	202 V	3.3 + 15	20 + 15	44 + 15	62 + 15	49 + 15	63 + 15	76 + 15	
100 V	1 MΩ	202 V	3.3 + 15	20 + 15	44 + 15	62 + 15	49 + 15	63 + 15	76 + 15	
1000 V	Auto, 10 MΩ	1050 V	3.3 + 15	20 + 15	44 + 15	62 + 15	49 + 15	67 + 15	80 + 15	
1000 V	1 MΩ	1050 V	4.0 + 15	20 + 15	44 + 15	62 + 15	49 + 15	67 + 15	80 + 15	

99 % Confidence			Relative Accuracy				Absolute Accuracy		
			$\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$						
Range	Zin	Full Scale	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 years Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	202 mv	4.3 + 19	26 + 19	57 + 19	80 + 19	63 + 19	86 + 19	103 + 19
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	2.02 V	4.3 + 19	26 + 19	57 + 19	80 + 19	63 + 19	81 + 19	98 + 19
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	20.2 V	4.3 + 19	26 + 19	57 + 19	80 + 19	63 + 19	81 + 19	98 + 19
100 V	Auto, 10 M $\Omega$	202 V	4.3 + 19	26 + 19	57 + 19	80 + 19	63 + 19	81 + 19	98 + 19
100 V	1 M $\Omega$	202 V	4.3 + 19	26 + 19	57 + 19	80 + 19	63 + 19	81 + 19	98 + 19
1000 V	Auto, 10 M $\Omega$	1050 V	4.3 + 19	26 + 19	57 + 19	80 + 19	63 + 19	86 + 19	103 + 19
1000 V	1 M $\Omega$	1050 V	5.2 + 19	26 + 19	57 + 19	80 + 19	63 + 19	86 + 19	103 + 19

If Filter Off is selected, add 40  $\mu\text{V/V}$  of reading + 35  $\mu\text{V/V}$  of range

#### Temperature Coefficient (not applicable if within Tcal $\pm 1^\circ\text{C}$ )

Range	Zin	$\pm (\mu\text{V/V of reading} / ^\circ\text{C}$ $+ \mu\text{V/V of Range}/^\circ\text{C})$
		5 $^\circ\text{C}$ to 40 $^\circ\text{C}$ <sup>[13]</sup>
100 mV	Auto, 10 M $\Omega$ , 1 M $\Omega$	4.5 + 12.0
1 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	3.3 + 9.30
10 V	Auto, 10 M $\Omega$ , 1 M $\Omega$	3.3 + 9.30
100 V	Auto, 10 M $\Omega$	3.3 + 9.30
100 V	1 M $\Omega$	3.3 + 9.30
1000 V	Auto, 10 M $\Omega$	4.5 + 9.30
1000 V	1 M $\Omega$	4.5 + 9.30

#### Low Pass Filter Bandwidths

Filter	Bandwidth
Off	100mV to 10 V ranges are approximately 15MHz-20MHz BW.
100 kHz	Approximates to single pole RC up to 10MHz
3 MHz	4-pole at 3MHz



**Digitize DC Current**

18-bit Resolution for Aperture 0 to ≤3 ms

95 % Confidence

		Relative Accuracy				Absolute Accuracy			
		± (μA/A of reading + μA/A of range)							
Range	Full Scale	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 years Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C	
10 μA	20.2 μA	35 + 80	40 + 80	44 + 80	66 + 80	48 + 80	60 + 80	90 + 80	
100 μA	202 μA	6 + 70	22 + 70	44 + 70	66 + 70	48 + 70	60 + 70	90 + 70	
1 mA	2.02 mA	6 + 70	22 + 70	44 + 70	66 + 70	48 + 70	60 + 70	90 + 70	
10 mA	20.2 mA	7 + 70	22 + 70	44 + 70	66 + 70	48 + 70	60 + 70	90 + 70	
100 mA	202 mA	18 + 70	22 + 70	44 + 70	66 + 70	48 + 70	80 + 70	120 + 70	
1 A	2.02 A	60 + 125	65 + 125	110 + 125	165 + 125	112 + 125	144 + 125	216 + 125	
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	80 + 160	125 + 160	180 + 160	270 + 160	184 + 160	244 + 160	366 + 160	
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	240 + 180	390 + 180	500 + 180	750 + 180	501 + 180	561 + 180	842 + 180	

99 % Confidence

		Relative Accuracy				Absolute Accuracy			
		± (μA/A of reading + μA/A of range)							
Range	Full Scale	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 years Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C	
10 μA	20.2 μA	45 + 103	52 + 103	57 + 103	85 + 103	62 + 103	78 + 103	117 + 103	
100 μA	202 μA	7 + 90	28 + 90	57 + 90	85 + 90	62 + 90	78 + 90	117 + 90	
1 mA	2.02 mA	7 + 90	28 + 90	57 + 90	85 + 90	62 + 90	78 + 90	117 + 90	
10 mA	20.2 mA	8 + 90	28 + 90	57 + 90	85 + 90	62 + 90	78 + 90	117 + 90	
100 mA	202 mA	23 + 90	28 + 90	57 + 90	85 + 90	62 + 90	104 + 90	155 + 90	
1 A	2.02 A	77 + 161	84 + 161	142 + 161	213 + 161	144 + 161	186 + 161	278 + 161	
10 A <sup>[8]</sup>	20.2 A <sup>[8]</sup>	103 + 206	161 + 206	232 + 206	348 + 206	237 + 206	315 + 206	472 + 206	
30 A <sup>[8]</sup>	30.2 A <sup>[8]</sup>	310 + 232	503 + 232	645 + 232	968 + 232	646 + 232	724 + 232	1100 + 232	

If Filter Off is selected, add 40 μA/A of reading + 70 μA/A of range.

**Temperature Coefficient** (not applicable if within Tcal  $\pm 1$  °C)

Range	$\pm$ $\mu$ A/A reading/°C	
	15 °C to 30 °C	5 °C to 40 °C <sup>[13]</sup>
10 $\mu$ A	3.0 or 5.0 + 5	
100 $\mu$ A	3.0 or 5.0 + 1	
1 mA	3.0 or 5.0 + 0.5	
10 mA	3.0 or 5.0 + 0.5	
100 mA	8.0 or 12 + 0.5	
1 A	8.0 or 12 + 0.5	
10 A	15.0 or 15 + 3	
30 A	15.0 or 15 + 1	

**Digitizing: Voltage and Current**

Digitizing internal buffer capacity

Non-time-stamped	10 000 000
Time-stamped	5 000 000

Maximum Digitizing Sample rate:

Internal trigger	5 MHz
External trigger	5 MHz

**Dynamic Performance (for 2xFull Scale pk-pk signal)**

RMS Signal to noise ratio (Aperture = 0 ns)

Filter	100kHz	3MHz	Full
Range			
100mV	76 dB	70 dB	60 dB
1V	80 dB	80 dB	80 dB
10V	80 dB	80 dB	80 dB
100V	80 dB	80 dB	80 dB
1000V	80 dB	80 dB	80 dB

**Low Pass Filter bandwidths**

Range	Bandwidth with Filter Setting		
	100 kHz	3 MHz	Off
10 $\mu$ A	100 kHz	500kHz	500kHz
100 $\mu$ A	100 kHz	500kHz	500kHz
1mA	100 kHz	2MHz	2MHz
10mA	100 kHz	4MHz	4MHz
100mA	100 kHz	2MHz	2MHz
1A	100 kHz	500kHz	500kHz
10A	100 kHz	200kHz	200kHz
30A	100 kHz	200kHz	200kHz

**Dynamic Performance (for 2xFull Scale pk-pk signal)**

FFT harmonics and spuri at 1kHz (Aperture = 0 ns)

Filter	100kHz	3MHz	Full
Range			
100mV	-100 dB	-80 dB	-74 dB
1V	-100 dB	-100 dB	-90 dB
10V	-100 dB	-100 dB	-100 dB
100V	-94 dB	-94 dB	-94 dB
1000V	-100 dB	-100 dB	-100 dB

**Dynamic Performance (for 2xFull Scale pk-pk signal)**

RMS Signal to noise ratio (Aperture = 0 ns)

Filter	100kHz	3MHz	Full
Range			
10 $\mu$ A	60 dB	51 dB	50 dB
100 $\mu$ A	76 dB	70 dB	70 dB
1 mA	80 dB	74 dB	74 dB
10 mA	80 dB	77 dB	76 dB
100 mA	70 dB	66 dB	60 dB
1 A	70 dB	66 dB	60 dB
10 A	67 dB	62 dB	62 dB
30 A	77 dB	72 dB	72 dB

**Dynamic Performance (for 2xFull Scale pk-pk signal)**

FFT harmonics and spuri at 1kHz (Aperture = 0 ns)

Filter	100kHz	3MHz	Full
Range			
10 $\mu$ A	-74 dB	-62 dB	-62 dB
100 $\mu$ A	-90 dB	-80 dB	-80 dB
1 mA	-94 dB	-80 dB	-80 dB
10 mA	-94 dB	-92 dB	-90 dB
100 mA	-92 dB	-76 dB	-76 dB
1 A	-90 dB	-80 dB	-76 dB
10 A	-80 dB	-78 dB	-76 dB
30 A	-90 dB	-88 dB	-86 dB

**Capacitance**

Capacitance Lol OFF

Capacitance maximum resolution is 5 digits

95 % Confidence

Range	Range Minimum	Range maximum (FS)	Source Current	Nominal Ramp Up Time	Relative Accuracy				Absolute Accuracy		
					$\pm (\mu F/F \text{ of reading} + \mu F/F \text{ of range})$						
					24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 year Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$
1 nF	0 nF	2.02 nF	10 nA	1 PLC	250 + 1000	500 + 1000	1000 + 1000	1500 + 1000	1036 + 1000	1840 + 1000	2750 + 1000
10 nF	1.8 nF	20.2 nF	100 nA	1 PLC	150 + 200	300 + 200	600 + 200	900 + 200	608 + 200	808 + 200	1210 + 200
100 nF	18 nF	202 nF	1 $\mu$ A	1 PLC	100 + 100	200 + 100	400 + 100	600 + 100	408 + 100	488 + 100	732 + 100
1 $\mu$ F	0.18 $\mu$ F	2.02 $\mu$ F	10 $\mu$ A	1 PLC	100 + 100	200 + 100	400 + 100	600 + 100	406 + 100	414 + 100	621 + 100
10 $\mu$ F	1.8 $\mu$ F	20.2 $\mu$ F	100 $\mu$ A	1 PLC	100 + 100	200 + 100	400 + 100	600 + 100	410 + 100	418 + 100	627 + 100
100 $\mu$ F	18 $\mu$ F	202 $\mu$ F	1 mA	1 PLC	150 + 100	300 + 100	600 + 100	900 + 100	605 + 100	613 + 100	919 + 100
1 mF	0.18 mF	2.02 mF	10 mA	1 PLC	150 + 100	300 + 100	600 + 100	900 + 100	607 + 100	615 + 100	922 + 100
10 mF	1.8 mF	20.2 mF	10 mA	0.2 s	175 + 100	350 + 100	700 + 100	1050 + 100	705 + 100	713 + 100	1070 + 100
100 mF	18 mF	202 mF	10 mA	2 s	175 + 100	350 + 100	700 + 100	1050 + 100	705 + 100	713 + 100	1070 + 100

99 % Confidence					Relative Accuracy				Absolute Accuracy			
					± (μF/F of reading + μF/F of range)							
Range	Range Minimum	Range maximum (FS)	Source Current	Nominal Ramp Up Time	24 Hour Tcal ± 1 °C	90 day Tcal ± 1 °C	365 day Tcal ± 1 °C	2 year Tcal ± 1 °C	365 day Tcal ± 1 °C	365 day Tcal ± 5 °C	2 year Tcal ± 5 °C	
1 nF	0 nF	2.02 nF	10 nA	1 PLC	323 + 1290	645 + 1290	1290 + 1290	1940 + 1290	1336 + 1290	2370 + 1290	3550 + 1290	
10 nF	1.8 nF	20.2 nF	100 nA	1 PLC	194 + 258	387 + 258	774 + 258	1160 + 258	784 + 258	1040 + 258	1560 + 258	
100 nF	18 nF	202 nF	1 μA	1 PLC	129 + 129	258 + 129	516 + 129	774 + 129	526 + 129	629 + 129	944 + 129	
1 μF	0.18 μF	2.02 μF	10 μA	1 PLC	129 + 129	258 + 129	516 + 129	774 + 129	523 + 129	534 + 129	801 + 129	
10 μF	1.8 μF	20.2 μF	100 μA	1 PLC	129 + 129	258 + 129	516 + 129	774 + 129	529 + 129	540 + 129	809 + 129	
100 μF	18 μF	202 μF	1 mA	1 PLC	194 + 129	387 + 129	774 + 129	1160 + 129	780 + 129	791 + 129	1190 + 129	
1 mF	0.18 mF	2.02 mF	10 mA	1 PLC	194 + 129	387 + 129	774 + 129	1160 + 129	783 + 129	793 + 129	1190 + 129	
10 mF	1.8 mF	20.2 mF	10 mA	0.2 s	226 + 129	452 + 129	903 + 129	1360 + 129	909 + 129	920 + 129	1380 + 129	
100 mF	18 mF	202 mF	10 mA	2 s	226 + 129	452 + 129	903 + 129	1360 + 129	909 + 129	919 + 129	1380 + 129	

Temperature Coefficient (not applicable if within Tcal ±1 °C)

± μF/F of reading		
Range	15 °C to 30 °C	5 °C to 15 °C 30 °C to 40 °C
1 nF	200	300
10 nF	50	75
100 nF	20	30
1 μF	2	3
10 μF	2	3
100 μF	2	3
1 mF	2	3
10 mF	2	3
100 mF	2	3

**Capacitance Lo I ON**

					Relative Accuracy				Absolute Accuracy			
95 % Confidence					$\pm (\mu\text{F}/\text{F of reading} + \mu\text{F}/\text{F of range})$							
Range	Range Minimum	Range maximum (FS)	Source Current	Nominal Ramp Up Time	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 year Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$	
1 mF	0.18 mF	2.02 mF	1 mA	0.2 s	150 + 100	300 + 100	600 + 100	900 + 100	607 + 100	615 + 100	922 + 100	
10 mF	1.8 mF	20.2 mF	1 mA	2 s	175 + 100	350 + 100	700 + 100	1050 + 100	705 + 100	713 + 100	1070 + 100	
100 mF	18 mF	202 mF	1 mA	2 s	175 + 100	350 + 100	700 + 100	1050 + 100	705 + 100	713 + 100	1070 + 100	

					Relative Accuracy				Absolute Accuracy			
99 % Confidence					$\pm (\mu\text{F}/\text{F of reading} + \mu\text{F}/\text{F of range})$							
Range	Range Minimum	Range maximum (FS)	Source Current	Nominal Ramp Up Time	24 Hour Tcal $\pm 1^\circ\text{C}$	90 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	2 year Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 1^\circ\text{C}$	365 day Tcal $\pm 5^\circ\text{C}$	2 year Tcal $\pm 5^\circ\text{C}$	
1 mF	0.18 mF	2.02 mF	1 mA	0.2 s	194 + 129	387 + 129	774 + 129	1161 + 129	783 + 129	793 + 129	1190 + 129	
10 mF	1.8 mF	20.2 mF	1 mA	2 s	226 + 129	452 + 129	903 + 129	1355 + 129	909 + 129	920 + 129	1380 + 129	
100 mF	18 mF	202 mF	1 mA	2 s	226 + 129	452 + 129	903 + 129	1355 + 129	909 + 129	919 + 129	1380 + 129	

**Temperature Coefficient** (not applicable if within Tcal  $\pm 1^\circ\text{C}$ )

$\pm \mu\text{F}/\text{F of reading}$		
Range	15 °C to 30 °C	5 °C to 15 °C 30 °C to 40 °C
1 mF	2	3
10 mF	2	3
100 mF	2	3

Capacitance measurement is made using a precision current sink producing a linear voltage ramp. Discharge is also linear at the stated current.

The resultant waveform is therefore not directly comparable to a sinusoidal LCR meter.

Discharge current (Normal I)

1 nF to 100  $\mu\text{F}$  ..... 1.2 mA

1 mF to 100 mF ..... 12 mA

Discharge current (Lo I)

All ranges ..... 1.2 mA

Maximum open circuit voltage ..... 3 V

	Read Times			
	50 Hz		60 Hz	
	Normal	Lo I	Normal	Lo I
1 nF-100 $\mu$ F	76 ms	N/A	69 ms	N/A
1 mF	76 ms	436 ms	69 ms	436 ms
10 mF	436 ms	4.04 s	436 ms	4.04 s
100 mF	4.04 s	4.04 s	4.04 s	4.04 s

	Reading / Second			
	50 Hz		60 Hz	
	Normal	Lo I	Normal	Lo I
1 nF-100 $\mu$ F	13	N/A	14	N/A
1 mF	13	2.3	14	2.3
10 mF	2.3	0.24	2.3	0.24
100 mF	0.24	0.24	0.24	0.24

### **PRT Temperature** [2][11][12]

#### **PRT Temperature readout accuracy (99 % Confidence)**

Secondary resistance reading accuracy (99 %):  $\pm 0.5$  m $\Omega$

Temperature readout values are calculated using the IEC 60751 industrial PRT (385 curve) conversion algorithm

Temperature readout accuracy ( $R_o = 100$ ):  $\pm 5$  mK

Temperature readout accuracy ( $R_o = 25$ ):  $\pm 10$  mK

### **Thermocouple**

#### **Thermocouple temperature readout accuracy 99 % [2][12]**

Secondary voltage reading accuracy (99 %):  $\pm 5$   $\mu$ V

Temperature readout values are calculated:

Types K, S, J, E, B, R:  $\pm 5$  mK

(NIST Monograph 175 conversion algorithm)

Type T:  $\geq 120$  K (-123  $^{\circ}$ C):  $\pm 5$  mK

<120 K (-123  $^{\circ}$ C):  $\pm 15$  mK

(NIST Monograph 175 conversion algorithm)

Type N:  $\geq 120$  K (-153  $^{\circ}$ C):  $\pm 5$  mK

$\geq 100$  K, < 120 K ( $\geq -173$   $^{\circ}$ C < -153  $^{\circ}$ C )  $\pm 25$  mK

<100 K ( < -173  $^{\circ}$ C):  $\pm 50$  mK

(NIST Monograph 175 conversion algorithm)

Types L, U:  $\pm 5$  mK

(ITS 90 algorithm)

Type C:  $\pm 5$  mK

(IEC 60584-1: 2013 algorithm)

**Notes to Performance Specifications**

1. Specifications apply for default configuration for aperture and resolution.
2. Assumes 3-hour warm-up period.
3. Input zero or offset null required whenever the temperature moves more than  $\pm 1$  °C from the temperature at which the previous Zero operation was performed. Or NULL using Math.
4. For all specification tables, TCal = Ambient calibration temperature.
5. Integration time >1 Power Line cycle.
6. Valid for ac signals >1 % Full Scale. Signals must be DC coupled <40 Hz.
7. Maximum Volt.Hertz  $3 \times 10^7$
8. 8558A front terminal maximum is 2 A. Maximum input to rear terminals for both 8558A and 8588A is 2 A.
9. DCV Digitizing and DCV aperture <100  $\mu$ s: for inputs >160 % of range add 20  $\mu$ V/V of range.
10. Tru Ohms mode available on 2  $\Omega$  to 20 k $\Omega$  ranges. Read Rate reduced in Tru Ohms Mode. Specification for Tru Ohms same as corresponding Normal or Lo Current range.
11. Valid for 4-wire sensor.
12. Not including sensor uncertainty.
13. The zero TC specification only needs to be applied if an input zero has not been performed within  $\pm 1$  °C of the current operating temperature.
14. >2 G $\Omega$  Relative Humidity Operating <80 % to 30 °C <70 % to 40 °C.
15. Transfer specification for DCV, DCI, and Ohms applies to measurement made between 10 % and 120 % of range for deviations of up to 10 % of the initial measurement made using the same configuration for range, filter, aperture, delay etc. Specification accounts for linearity and noise but excludes temperature coefficient which should be calculated from the data provided according to the environment in which the instrument is used.
16. Transfer specification for ACV and ACI applies to measurements made between 10 % of range and full scale and accounts for deviations of up to 1 % of frequency and 10 % of amplitude of the initial measurement. Measurement must be made using the same configuration for range, filter, aperture, delay etc. The quoted transfer specification accounts for linearity, flatness and noise but excludes temperature coefficient which should be calculated from the data provided according to the environment in which the instrument is used.
17. Extended HF mode must be selected.
18. Differential non-linearity is included in the specification.
19. For AC signals refer to the ACV/ACI specification.

**RF Power**

The 8588A does not add any measurement uncertainty to the Power readout. Refer to the specification of the power sensor connected.

**Frequency Counter**

99 % Confidence

**Input Rear BNC**

Minimum frequency ..... 10 Hz  
 Maximum frequency ..... 100 MHz  
 Maximum V ..... 5 Vpk  
 Minimum V ..... 0.5 Vpp

**Gate time****Display Resolution**

1 s.....	8½
100 ms.....	7½
10 ms.....	6½
1 ms.....	5½
100 µs .....	4½

**Input Signal Voltage**

Minimum frequency ..... 1 Hz  
 Maximum frequency ..... 10 MHz  
 Signal Amplitude > 10 % of Range to limit set by maximum VHz

**Input Signal Current**

Minimum frequency ..... 1 Hz  
 Maximum frequency ..... 100 kHz  
 Signal Amplitude > 10 % of Range or >20 µA

**Frequency Accuracy**

Initial adjustment ..... ±0.1 µHz/Hz  
 Temperature coefficient..... ±0.05 µHz/Hz  
 Operating temperature range ..... ±0.5 µHz/Hz  
 Aging ..... ±1.0 µHz/Hz per year



**System Speed**

Change configuration and take one reading in remote control	GPIB	USB	Ethernet		
DCV ≤10 V range to/from DCV ≤10 V range	125/s	150/s	130/s		
DCV to DCV > 10 V range	50/s	50/s	55/s		
Other function to DCV	50/s	50/s	55/s		
Reading Speed	To Volatile memory		To GPIB	To USB	To Ethernet
DCV, DCI readings	20 000/s		-	-	-
DCV, DCI readings	100 000/s	[F]	-	-	-
Normal Ohms, DCI Ext Shunt, Thermocouple, and PRT 2W	4 700/s		-	-	-
ACV, ACI, ACI Ext Shunt (1 kHz filter)	66/s		-	-	-
Capacitance	13/s		-	-	-
Digitize capture rate into volatile buffer	5 000 000/s		-	-	-
Digitize captured data transfer to volatile memory	500 000/s		-	-	-
DCV, DCI single "READ?"s	-	[e]	230/s	230/s	230/s
DCV, DCI SYNC triggered TALK? to GPIB	-	[e]	1500/s	n/a	n/a
DCV, DCI SYNC triggered TALK? to GPIB	-	[b]	2000/s	n/a	n/a
DCV, DCI SYNC triggered TALK? to GPIB	-	[B]	2000/s	n/a	n/a
DCV, DCI continuous FNOW?	-	[b][F]	200 000/s	500 000/s	75 000/s
DCV, DCI continuous FNOW?	-	[B][F]	100 000/s	300 000/s	75 000/s
Bus Transfer Speed					
Readings from volatile memory	-	[e]	4000/s	30 000/s	50 000/s
Readings from volatile memory	-	[b]	8000/s	100 000/s	180 000/s
Readings from volatile memory	-	[B]	7000/s	90 000/s	180 000/s
Readings from volatile memory	-	[b][F]	200 000/s	500 000/s	200 000/s
Readings from volatile memory	-	[B][F]	100 000/s	400 000/s	200 000/s
Notes:					
[e] = engineering format rounded to 4.5 digits for display					
[b] = 2 byte binary format					
[B] = 4 byte binary format					
[F] = 2-byte or 4-bite binary captured with DISP OFF, STATS OFF, and PRESET FAST mode. PRESET FAST selects 2 byte binary, 4 byte can be set if required.					

**Tru Ohms, Scan, and auto-range front/rear settling delay times**

- Range of setting ..... 0 s to 65 000 s
- Resolution of setting ..... 1 ms
- Accuracy of setting ..... 0.5 ms

**External Frequency Reference Clock**

Frequency Ref In BNC	Maximum input	±5 Vpk
	Minimum input	0.2 Vpp
	Impedance	50 Ω
	Frequency – user selectable	1 MHz / 10 MHz
	Frequency lock range	±5 μHz/Hz

**Triggering**

UI Delay Resolution Settings		
Time (seconds)		
From	Up to	Setting Resolution
0	0	N/A
0.000 000 030	40.000 000 00	10 ns
40.000 000 00	400.000 000 0	100 ns
400.000 000 0	4000.000 000	1 μs
4000.000 000	40 000.000 00	10 μs
40 000.000 00	400 000.000 0	100 μs
400 000.000 0	4 000 000.000	1 ms

Note setting resolution is also pkpk jitter for delays (but not timers)

Timer resolution settings		
Time (seconds)		
From	Up to	Setting Resolution
0.000 000 02	40.000 000 00	10 ns
40.000 000 00	400.000 000 0	100 ns
400.000 000 0	4000.000 000	1 μs
4000.000 000	40 000.000 00	10 μs
40 000.000 00	400 000.000 0	100 μs
400 000.000 0	4 000 000.000	1 ms

**Trigger Latency**

Digitizing and AC functions

Ext Trigger edge at rear BNC to ADC conversion begin ..... 60 ns to 100 ns

Jitter ..... 10 ns pkpk

Maximum input frequency..... 25 MHz

DC functions, Ohms; Capacitance; PRT; Thermocouple

Ext Trigger edge at rear BNC to ADC conversion begin ..... 2.8 μs

Jitter ..... 0.2 μs

DC functions, aperture ≥ 100 μs: aperture closed to reading complete .... <170 μs

Conversion time overhead (additional to aperture setting)

Digitize ..... 200 ns ..... 200 ns

DC functions, aperture <100 μs ..... 30 μs ..... 30 μs

Trigger source INTERNAL (signal level)

Setting resolution ..... 1 % of range ..... 1 % of range

Accuracy ..... 5 % of range ..... 5 % of range

Range ..... ±200 % ..... ±200 %

Trig In BNC

Maximum input ..... ±5 Vpk

Threshold selectable..... TTL or ±0.1 V

Impedance ..... 10 kΩ

Trig Out BNC

Output levels ..... 3.3 V / 0 V

Source selectable from:

Off

Signal acquired - 1 μs pulse

Aperture open - level

Reading count complete - 1 μs pulse

On event - 1 μs pulse when an enabled event occurs in operation status register or questionable status registers

Reading complete - 1 μs pulse

Output polarity ..... Negative or positive pulse or level