

# 8588A

Reference Multimeter

## Product Specifications



## 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

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

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

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

**Total Measurement Specification = (Reading spec + Range spec) + (Aperture spec + Aperture Range spec) + (Read Period Reading spec + Read Period Range spec)****Reading and Range Specification****Aperture  $\geq 100 \mu\text{s}$** 

|                 |        |                                       | Relative Accuracy   |                                     |  |   |  | Absolute Accuracy                              |  |  |   |
|-----------------|--------|---------------------------------------|---|-------------------------------------|--|---|--|--|--|--|---|
|                 |        |                                       | $\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$ |                                     |  |   |  |  |  |  |   |
| 95 % Confidence | Range  | Zin                                   | Full Scale  | Transfer,<br>20 min <sup>[15]</sup> | 24 Hour<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 90 day<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 365 day<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 2 years<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 365 day<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 365 day<br>Tcal $\pm 5 \text{ }^\circ\text{C}$ | 2 year<br>Tcal $\pm 5 \text{ }^\circ\text{C}$ |
|                 | 100 mV | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 202.000 000 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 $\Omega$ ,<br>1 M $\Omega$ | 2.02 000 00 mv  | 0.06 + 0.3                          | 0.5 + 0.3                                      | 1.4 + 0.3                                     | 2.7 + 0.3                                      | 5.4 + 0.3                                      | 2.8 + 0.3                                      | 2.9 + 0.3                                      | 5.8 + 0.3                                     |
|                 | 10 V   | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 20.200 000 0 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                                     | 2.9 + 0.05                                     | 5.8 + 0.05                                    |
|                 | 100 V  | Auto, 10 M $\Omega$                   | 202.000 000 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                                      | 4.3 + 0.3                                      | 8.5 + 0.3                                     |
|                 | 100 V  | 1 M $\Omega$                          | 202.000 000 V   | 2.0 + 5.0                           | 2.0 + 5.0                                      | 4.5 + 5.0                                     | 9.0 + 5.0                                      | 18 + 5.0                                       | 9.0 + 5.0                                      | 9.5 + 5.0                                      | 19 + 5.0                                      |
|                 | 1000 V | Auto, 10 M $\Omega$                   | 1050.000 00 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                                      | 4.4 + 0.5                                      | 8.9 + 0.5                                     |
|                 | 1000 V | 1 M $\Omega$                          | 1050.000 00 V   | 4.0 + 25                            | 4.0 + 25                                       | 4.5 + 25                                      | 9.0 + 25                                       | 18 + 25  | 9.1 + 25                                       | 9.6 + 25                                       | 19.2 + 25                                     |

|                 |        |                                       | Relative Accuracy   |                                     |  |   |  | Absolute Accuracy                              |  |  |   |
|-----------------|--------|---------------------------------------|---|-------------------------------------|--|---|--|--|--|--|---|
|                 |        |                                       | $\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$ |                                     |  |   |  |  |  |  |   |
| 99 % Confidence | Range  | Zin                                   | Full Scale  | Transfer,<br>20 min <sup>[15]</sup> | 24 Hour<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 90 day<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 365 day<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 2 years<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 365 day<br>Tcal $\pm 1 \text{ }^\circ\text{C}$ | 365 day<br>Tcal $\pm 5 \text{ }^\circ\text{C}$ | 2 year<br>Tcal $\pm 5 \text{ }^\circ\text{C}$ |
|                 | 100 mV | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 202.000 000 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 $\Omega$ ,<br>1 M $\Omega$ | 2.020 000 00 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                                     | 3.7 + 0.39                                     | 7.5 + 0.39                                    |
|                 | 10 V   | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 20.200 000 0 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                                     | 3.7 + 0.06                                     | 7.4 + 0.06                                    |
|                 | 100 V  | Auto, 10 M $\Omega$                   | 202.000 000 V   | 0.52 + 0.39                         | 1.3 + 0.39                                     | 3.4 + 0.39                                    | 5.2 + 0.39                                     | 10 + 0.39                                      | 5.3 + 0.39                                     | 5.5 + 0.39                                     | 11 + 0.39                                     |
|                 | 100 V  | 1 M $\Omega$                          | 202.000 000 V   | 2.6 + 6.5                           | 2.6 + 6.5                                      | 5.8 + 6.5                                     | 12 + 6.5                                       | 23 + 6.5                                       | 12 + 6.5                                       | 12.3 + 6.5                                     | 24.6 + 6.5                                    |
|                 | 1000 V | Auto, 10 M $\Omega$                   | 1050.000 00 V   | 0.52 + 0.65                         | 1.3 + 0.65                                     | 3.4 + 0.65                                    | 5.2 + 0.65                                     | 10 + 0.65                                      | 5.5 + 0.65                                     | 5.7 + 0.65                                     | 11.4 + 0.65                                   |
|                 | 1000 V | 1 M $\Omega$                          | 1050.000 00 V   | 5.2 + 32                            | 5.2 + 32                                       | 5.8 + 32                                      | 12 + 32  | 23 + 32  | 12 + 32  | 12.4 + 32                                      | 24.8 + 32                                     |

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

| Aperture $\geq 100$ $\mu$ s |                                    | $\pm$ ( $\mu$ V/V of reading/°C + $\mu$ V/V of range/°C) |
|-----------------------------|------------------------------------|--|
| Range                       | Zin                                | 5 °C to 40 °C <sup>[13]</sup>                            |
| 100 mV                      | Auto, 10 M $\Omega$ , 1 M $\Omega$ | 0.6 + 0.5  |
| 1 V                         | Auto, 10 M $\Omega$ , 1 M $\Omega$ | 0.3 + 0.25   |
| 10 V                        | Auto, 10 M $\Omega$ , 1 M $\Omega$ | 0.3 + 0.2  |
| 100 V                       | Auto, 10 M $\Omega$                | 0.6 + 0.25   |
| 100 V                       | 1 M $\Omega$                       | 1.5 + 0.25   |
| 1000 V                      | Auto, 10 M $\Omega$                | 0.6 + 0.2  |
| 1000 V                      | 1 M $\Omega$                       | 1.5 + 0.2  |

**Least Significant Digit by Range**

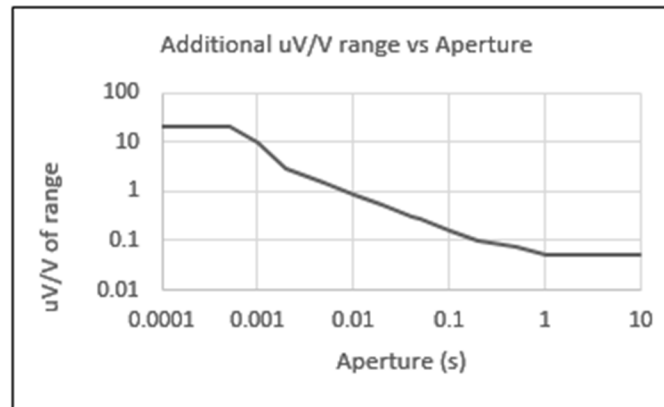
| Range  | LSD Sensitivity (8 Digit Setting) |
|--------|-----------------------------------|
| 100 mV | 1 nV                              |
| 1 V    | 10 nV                             |
| 10 V   | 100 nV                            |
| 100 V  | 1 $\mu$ V                         |
| 1000 V | 10 $\mu$ V                        |

**Aperture and Aperture Range Specification:**

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

Minimum trigger interval is the aperture plus 170  $\mu$ s. 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 $\geq 100$ $\mu$ s) |                      |
|---|----------------------|
| Aperture  | $\mu$ V/V of reading |
| 1 s to 10 s                                     | 0                    |
| <1 s  | 0.05                 |
| <100 ms   | 0.50                 |
| <10 ms  | 1.00                 |
| <2 ms   | 2.00                 |
| <1 ms   | 10.00                |
| < 500 $\mu$ s                                   | 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)

**Read Period Specification**  
**Aperture <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     | 24 Hour<br>Tcal $\pm 1^\circ\text{C}$                     | 90 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 2 years<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 5^\circ\text{C}$ | 2 year<br>Tcal $\pm 5^\circ\text{C}$ |
| 100 mV          | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 202.000 000 mv | 3.3 + 15  | 20 + 15                              | 44 + 15                               | 62 + 15                               | 45 + 15                               | 63 + 15                               | 80 + 15                              |
| 1 V             | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 2.020 000 00 V | 3.3 + 15  | 20 + 15                              | 44 + 15                               | 62 + 15                               | 45 + 15                               | 59 + 15                               | 76 + 15                              |
| 10 V            | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 20.200 000 0 V | 3.3 + 15  | 20 + 15                              | 44 + 15                               | 62 + 15                               | 45 + 15                               | 59 + 15                               | 76 + 15                              |
| 100 V           | Auto, 10 M $\Omega$                   | 202.000 000 V  | 3.3 + 15  | 20 + 15                              | 44 + 15                               | 62 + 15                               | 45 + 15                               | 59 + 15                               | 76 + 15                              |
| 100 V           | 1 M $\Omega$                          | 202.000 000 V  | 3.3 + 15  | 20 + 15                              | 44 + 15                               | 62 + 15                               | 45 + 15                               | 59 + 15                               | 76 + 15                              |
| 1000 V          | Auto, 10 M $\Omega$                   | 1050.000 00 V  | 3.3 + 15  | 20 + 15                              | 44 + 15                               | 62 + 15                               | 45 + 15                               | 63 + 15                               | 80 + 15                              |
| 1000 V          | 1 M $\Omega$                          | 1050.000 00 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<br>Tcal $\pm 1^\circ\text{C}$                     | 90 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 2 years<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 5^\circ\text{C}$ | 2 year<br>Tcal $\pm 5^\circ\text{C}$ |  |
| 100 mV          | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 202.000 000 mv | 4.3 + 19  | 26 + 19                              | 57 + 19                               | 80 + 19                               | 58 + 19                               | 81 + 19                               | 103 + 19                             |  |
| 1 V             | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 2.020.000.00 V | 4.3 + 19  | 26 + 19                              | 57 + 19                               | 80 + 19                               | 58 + 19                               | 76 + 19                               | 98 + 19                              |  |
| 10 V            | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 20.200 000 0 V | 4.3 + 19  | 26 + 19                              | 57 + 19                               | 80 + 19                               | 58 + 19                               | 76 + 19                               | 98 + 19                              |  |
| 100 V           | Auto, 10 M $\Omega$                   | 202.000 000 V  | 4.3 + 19  | 26 + 19                              | 57 + 19                               | 80 + 19                               | 58 + 19                               | 76 + 19                               | 98 + 19                              |  |
| 100 V           | 1 M $\Omega$                          | 202.000 000 V  | 4.3 + 19  | 26 + 19                              | 57 + 19                               | 80 + 19                               | 58 + 19                               | 76 + 19                               | 98 + 19                              |  |
| 1000 V          | Auto, 10 M $\Omega$                   | 1050.000 00 V  | 4.3 + 19  | 26 + 19                              | 57 + 19                               | 80 + 19                               | 58 + 19                               | 81 + 19                               | 103 + 19                             |  |
| 1000 V          | 1 M $\Omega$                          | 1050.000 00 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 $\mu\text{s}$ |                                    | $\pm (\mu\text{V/V of reading}/^\circ\text{C} + \mu\text{V/V of range}/^\circ\text{C})$<br>5 $^\circ\text{C}$ to 40 $^\circ\text{C}$ <sup>[13]</sup> |
|------------------------------|------------------------------------|--|
| Range                        | Zin                                |  |
| 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  |

**Least Significant Digit by Range**

| Range  | LSD Sensitivity<br>(8 Digit Setting) |
|--------|--------------------------------------|
| 100 mV | 1 nV                                 |
| 1 V    | 10 nV                                |
| 10 V   | 100 nV                               |
| 100 V  | 1 $\mu\text{V}$                      |
| 1000 V | 10 $\mu\text{V}$                     |

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 ±2 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

**Total Measurement Specification = (Reading spec + Range spec) + (Aperture spec + Aperture Range spec) + (Read Period Reading spec + Read Period Range spec)**

**Reading and Range Specification**

**Aperture ≥100 μs**

| 95 % Confidence     |                             | Relative Accuracy                   |                        |                       |                        |                        | Absolute Accuracy      |                        |                       |
|---------------------|-----------------------------|-------------------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|
|                     |                             | ± (μA/A of reading + μA/A of range) |                        |                       |                        |                        |                        |                        |                       |
| Range               | Full Scale                  | Transfer,<br>20 min <sup>[15]</sup> | 24 Hour<br>Tcal ± 1 °C | 90 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 2 years<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 5 °C | 2 year<br>Tcal ± 5 °C |
| 10 μA               | 20.200 000 μA               | 5.0 + 20                            | 10 + 40                | 15 + 40               | 20 + 40                | 30 + 40                | 24 + 40                | 27 + 40                | 40 + 40               |
| 100 μA              | 202.00 00 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                | 2.020 000 0 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               | 20.200 000 mA               | 0.25 + 1                            | 6.50 + 4               | 7.0 + 4               | 8.0 + 4                | 12 + 4                 | 8.9 + 4                | 14 + 4                 | 20 + 4                |
| 100 mA              | 202.000 00 mA               | 1.0 + 4                             | 28 + 10                | 30 + 10               | 33 + 10                | 50 + 10                | 33 + 10                | 57 + 10                | 86 + 10               |
| 1 A                 | 2.020 000 0 A               | 2.0 + 25                            | 60 + 100               | 80 + 100              | 100 + 100              | 150 + 100              | 100 + 100              | 132 + 100              | 199 + 100             |
| 10 A <sup>[8]</sup> | 20.200 000 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> | 30.200 000 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               | 20.200 000 µA               | 6.45 + 26                           | 13 + 52             | 19 + 52            | 26 + 52             | 39 + 52             | 31 + 52             | 35 + 52             | 52 + 52            |
| 100 µA              | 202.00 00 µA                | 0.32 + 1                            | 7.1 + 5             | 7.7 + 5            | 8.4 + 5             | 13 + 5              | 11 + 5              | 13 + 5              | 19 + 5             |
| 1 mA                | 2.020 000 0 mA              | 0.32 + 1                            | 7.1 + 5             | 7.7 + 5            | 8.4 + 5             | 13 + 5              | 10 + 5              | 12 + 5              | 18 + 5             |
| 10 mA               | 20.200 000 mA               | 0.32 + 1                            | 8.4 + 5             | 9.0 + 5            | 10 + 5              | 15 + 5              | 11 + 5              | 18 + 5              | 26 + 5             |
| 100 mA              | 202.000 00 mA               | 1.3 + 5                             | 36 + 13             | 39 + 13            | 43 + 13             | 64 + 13             | 43 + 13             | 74 + 13             | 111 + 13           |
| 1 A                 | 2.020 000 0 A               | 2.6 + 32                            | 77 + 129            | 103 + 129          | 129 + 129           | 194 + 129           | 130 + 129           | 171 + 129           | 256 + 129          |
| 10 A <sup>[8]</sup> | 20.200 000 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> | 30.200 000 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 |    | ± µA/A of reading/°C + µA/A of range/°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 + 0.6                               |
| 10 mA  | 1.2                  | or | 1.8 + 0.6                               |
| 100 mA | 6.0                  | or | 9 + 1                                   |
| 1 A    | 8.0                  | or | 12 + 1                                  |
| 10 A   | 15                   | or | 15 + 3                                  |
| 30 A   | 15                   | or | 15 + 1                                  |

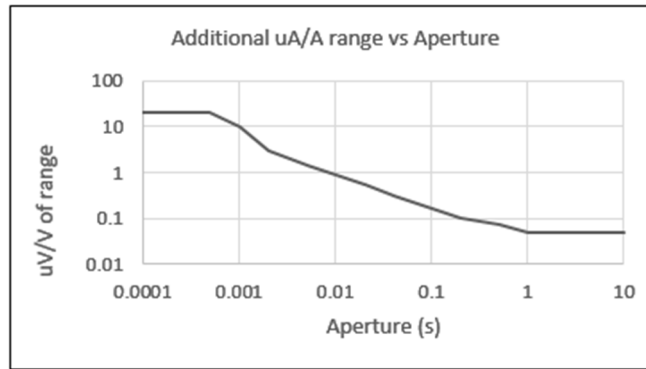
Least Significant Digit by Range

| Range  | LSD Sensitivity (7 Digit Setting) |
|--------|-----------------------------------|
| 10 µA  | 1 pA                              |
| 100 µA | 10 pA                             |
| 1 mA   | 100 pA                            |
| 10 mA  | 1 nA                              |
| 100 mA | 10 nA                             |
| 1 A    | 100 nA                            |
| 10 A   | 1 µA                              |
| 30 A   | 1 µA                              |

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 ≥ 100 μs) |                 |
|---------------------------------------|-----------------|
| Aperture                              | μA/A of reading |
| 1 s to 10 s                           | 0               |
| <1 s                                  | 0.05            |
| <100 ms                               | 0.50            |
| <10 ms                                | 1.00            |
| <2 ms                                 | 2.00            |
| <1 ms                                 | 10.00           |
| < 500 μs                              | 20.00           |



Aperture ≥ 100 μs; additional uncertainty with read rate: (Period = aperture + delay between readings)

| Read Period    | uV/V reading + | uV/V range |
|----------------|----------------|------------|
| <20 ms         | 0.2 +          | 0          |
| <10 ms         | 0.5 +          | 0.2        |
| <6 ms          | 5.0 +          | 0.5        |
| <3 ms          | 20.0 +         | 2          |
| 100 μs to 2 ms | 40.0 +         | 5          |

Aperture <100 μs

| Range               | Full Scale                  | Relative Accuracy                   |                       |                        |                        | Absolute Accuracy      |                        |                       |
|---------------------|-----------------------------|-------------------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|
|                     |                             | ± (μA/A of reading + μA/A of range) |                       |                        |                        |                        |                        |                       |
|                     |                             | 24 Hour<br>Tcal ± 1 °C              | 90 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 2 years<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 5 °C | 2 year<br>Tcal ± 5 °C |
| 10 μA               | 20.200 000 μA               | 35 + 80                             | 40 + 80               | 44 + 80                | 66 + 80                | 46 + 80                | 58 + 80                | 87 + 80               |
| 100 μA              | 202.000 00 μA               | 5.5 + 70                            | 22 + 70               | 44 + 70                | 66 + 70                | 44 + 70                | 56 + 70                | 84 + 70               |
| 1 mA                | 2.020 000 0 mA              | 5.5 + 70                            | 22 + 70               | 44 + 70                | 66 + 70                | 44 + 70                | 56 + 70                | 84 + 70               |
| 10 mA               | 20.200 000 mA               | 6.5 + 70                            | 22 + 70               | 44 + 70                | 66 + 70                | 44 + 70                | 56 + 70                | 84 + 70               |
| 100 mA              | 202. 000 00 mA              | 18 + 70                             | 22 + 70               | 44 + 70                | 66 + 70                | 44 + 70                | 76 + 70                | 114 + 70              |
| 1 A                 | 2.020 000 0 A               | 60 + 125                            | 65 + 125              | 110 + 125              | 165 + 125              | 110 + 125              | 142 + 125              | 214 + 125             |
| 10 A <sup>[8]</sup> | 20.200 000 A <sup>[8]</sup> | 80 + 160                            | 125 + 160             | 180 + 160              | 270 + 160              | 184 + 160              | 244 + 160              | 366 + 160             |
| 30 A <sup>[8]</sup> | 30.200 000 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<br>Tcal $\pm 1^\circ\text{C}$                     | 90 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 2 years<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 5^\circ\text{C}$ | 2 year<br>Tcal $\pm 5^\circ\text{C}$ |
| 10 $\mu\text{A}$    | 20.200 000 $\mu\text{A}$    | 45 + 103  | 52 + 103                             | 57 + 103                              | 85 + 103                              | 60 + 103                              | 75 + 103                              | 113 + 103                            |
| 100 $\mu\text{A}$   | 202.000 00 $\mu\text{A}$    | 7.1 + 90  | 28 + 90                              | 57 + 90                               | 85 + 90                               | 57 + 90                               | 73 + 90                               | 109 + 90                             |
| 1 mA                | 2.020 000 0 mA              | 7.1 + 90  | 28 + 90                              | 57 + 90                               | 85 + 90                               | 57 + 90                               | 72 + 90                               | 109 + 90                             |
| 10 mA               | 20.200 000 mA               | 8.4 + 90  | 28 + 90                              | 57 + 90                               | 85 + 90                               | 57 + 90                               | 72 + 90                               | 109 + 90                             |
| 100 mA              | 202.000 00 mA               | 23 + 90   | 28 + 90                              | 57 + 90                               | 85 + 90                               | 57 + 90                               | 98 + 90                               | 147 + 90                             |
| 1 A                 | 2.020 000 0 A               | 77 + 161  | 84 + 161                             | 142 + 161                             | 213 + 161                             | 142 + 161                             | 184 + 161                             | 276 + 161                            |
| 10 A <sup>[8]</sup> | 20.200 000 A <sup>[8]</sup> | 103 + 206   | 125 + 206                            | 232 + 206                             | 348 + 206                             | 237 + 206                             | 314 + 206                             | 472 + 206                            |
| 30 A <sup>[8]</sup> | 30.200 000 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             | $\pm\mu\text{A/A}$<br>reading/ $^\circ\text{C}$ |    | $\pm (\mu\text{V/V of}$<br>reading/ $^\circ\text{C} +$<br>$\mu\text{V/V of range}/^\circ\text{C})$ |     |
|-------------------|---|----|--|-----|
|                   | 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   |

Least Significant Digit by Range

| Range             | LSD Sensitivity<br>(7 Digit Setting) |
|-------------------|--------------------------------------|
| 10 $\mu\text{A}$  | 1 pA                                 |
| 100 $\mu\text{A}$ | 10 pA                                |
| 1 mA              | 100 pA                               |
| 10 mA             | 1 nA                                 |
| 100 mA            | 10 nA                                |
| 1 A               | 100 nA                               |
| 10 A              | 1 $\mu\text{A}$                      |
| 30 A              | 1 $\mu\text{A}$                      |

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

Maximum trigger interval is the aperture plus 30  $\mu$ s. For example with aperture = 50  $\mu$ s, the maximum interval is 50  $\mu$ s + 30  $\mu$ s = 80  $\mu$ s (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  $\mu$ A to 100 mA Ranges to 20  $\mu$ A/A of step size .....<1 s

1 A to 30A 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 .....30  $\mu$ A/A in 2 minutes

30 A range cold to final value .....30  $\mu$ A/A in 2 minutes

**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        | 10 m $\Omega$ | -             |
| 30 A        | 10 m $\Omega$ | -             |

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

**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<br>(Auto,<br>10 MΩ,<br>1 MΩ)  | 12.120 000 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           | 330 + 110          | 370 + 110           | 480 + 110           |                    |
|                                     |                  | 10k - 30k               | 100 + 50                         | 250 + 110           | 263 + 110          | 300 + 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% + .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<br>(Auto,<br>10 MΩ,<br>1 MΩ) | 121.200 00 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             | 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%       |
|                                     |                  | <sup>[17]</sup> 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<br>10 V<br>(Auto,<br>10 MΩ,<br>1 MΩ) | 1.212 000 0 V<br>12.120 000 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<br>(10 MΩ)                         | 121.200 00 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<br>(Auto,<br>1 MΩ)                 | 121.200 00 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<br>(10 MΩ)                        | 1050.000 0 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<br>(Auto,<br>1 MΩ)                | 1050.000 0 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   |  |   |  |   | Absolute Accuracy                          |  |   |
|---|------------------|-------------------------|---|--|---|--|---|--|--|---|
| Range   | Full Scale (rms) | Frequency (Hz)          | $\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$ |  |   |  |   |  |  |   |
|   |                  |                         | Transfer, 20 min <sup>[16]</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 year 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 $\pm 5\text{ }^\circ\text{C}$ |
| 10 mV<br>(Auto,<br>10 M $\Omega$ ,<br>1 M $\Omega$ )  | 12.120 000 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                                  | 536 + 142                                 | 426 + 142                                  | 477 + 142                                  | 619 + 142                                 |
|   |                  | 10k - 30k               | 129 + 65  | 323 + 142                                  | 340 + 142                                 | 387 + 142                                  | 536 + 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<br>(Auto,<br>10 M $\Omega$ ,<br>1 M $\Omega$ ) | 121.200 00 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                  |                                    |                                   |
|--|-------------------------------|----------------|---|------------------------------------|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|------------------------------------|-----------------------------------|
|  |                               |                | $\pm (\mu V/V \text{ of reading} + \mu V/V \text{ of range})$ |                                    |                                   |                                    |                                   |                                    |                                    |                                   |
| 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 $\pm 5^\circ\text{C}$ |
| 1 V<br>10 V<br>(Auto,<br>10 M $\Omega$ ,<br>1 M $\Omega$ ) | 1.212 000 0 V<br>12.120 000 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<br>(10 M $\Omega$ )                                  | 121.200 00 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<br>(Auto,<br>1 M $\Omega$ )                          | 121.200 00 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<br>(10 M $\Omega$ )                                 | 1050 000 0 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<br>(Auto,<br>1 M $\Omega$ )                         | 1050 000 0 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)           | $\pm \mu\text{V/V}$ of reading / °C |                               |
|--|--------------------------|-------------------------------------|-------------------------------|
|  |                          | 15 °C to 30 °C                      | 5 °C to 15 °C, 30 °C to 40 °C |
| 10 mV<br>(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<br>(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<br>10 V<br>(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                                 |                               |
|  | 1000                     | 1500                                |                               |
|  | 8M - 10M <sup>[17]</sup> | 1000                                | 1500                          |

| Range                           | Frequency (Hz) | $\pm \mu\text{V/V}$ of reading / °C |                               |
|---------------------------------|----------------|-------------------------------------|-------------------------------|
|                                 |                | 15 °C to 30 °C                      | 5 °C to 15 °C, 30 °C to 40 °C |
| 100 V<br>(10 M $\Omega$ )       | 1 - 1k         | 5                                   | 8                             |
|                                 | 1k - 2k        | 5                                   | 8                             |
|                                 | 2k - 10k       | 30                                  | 50                            |
| 100 V<br>(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<br>(10 M $\Omega$ )      | 300k - 1M      | 80                                  | 120                           |
|                                 | 1 - 1k         | 5                                   | 8                             |
|                                 | 1k - 2k        | 5                                   | 8                             |
|                                 | 2k - 10k       | 30                                  | 50                            |
| 1000 V<br>(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             |

**Least Significant Digit by Range**

| Range  | LSD Sensitivity<br>(7 Digit Setting) |
|--------|--------------------------------------|
| 10 mV  | 1 nV                                 |
| 100 mV | 10 nV                                |
| 1 V    | 100 nV                               |
| 10 V   | 1 μV                                 |
| 100 V  | 10 μV                                |
| 1000 V | 100 μV                               |

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 kΩ 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 TΩ in parallel with 80 pF ±5 pF  
 100 V and 1000 V Range ..... 1.01 MΩ ±1 % in parallel with 50 pF ±5 pF  
 10 MΩ ..... 10 mV to 10V Ranges ..... 10 MΩ ±1 % in parallel with 80 pF ±5 pF  
 100 V and 1000 V Range ..... 10 MΩ ±1 % in parallel with 50 pF ±5 pF  
 1 MΩ ..... 10 mV to 10V Ranges ..... 1.01 MΩ ±1 % in parallel with 80 pF ±5 pF  
 100 V and 1000 V Range ..... 1.01 MΩ ±1 % in parallel with 50 pF ±5 pF

DC Accuracy (DC Coupled)..... Add ± (50 μV/V of Reading + 50 μV/V of Range + 20 μV)  
 AC Coupling..... 330 nF into 1.01 MΩ or 10 MΩ

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<br>± (µA/A of reading + µA/A 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 µA               | 20.200 000 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              | 202.000 00 µA               | 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           |          |          |
| 10 mA               | 20.200 000 mA               | 30k - 100k     | 50.0 + 20  | 3500 + 100          | 3630 + 100         | 4000 + 100          | 5220 + 100         | 4010 + 100          | 4050 + 100          | 5270 + 100         |          |          |
|                     |                             | 100 mA         | 202 000 00 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           |          |          |
| 1 A                 | 2.020 000 0 A               | 10k - 30k      | 10.0 + 15  | 600 + 50            | 626 + 50           | 700 + 50            | 938 + 50           | 700 + 50            | 740 + 50            | 980 + 50           |          |          |
|                     |                             | 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          |          |          |
| 10 A <sup>[8]</sup> | 20.200 000 A <sup>[8]</sup> | 10k - 30k      | 10.0 + 20  | 600 + 100           | 626 + 100          | 700 + 100           | 938 + 100          | 710 + 100           | 790 + 100           | 1020 + 100         |          |          |
|                     |                             | 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> | 30.200 000 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  |                     |                     |                    |
|---------------------|-----------------------------|----------------|-------------------------------------|---------------------|--------------------|---------------------|--------------------|---------------------|---------------------|--------------------|
|                     |                             |                | ± (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               | 20.200 000 μA               | 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 μA              | 202.000 00 μA               | 1 - 2k         | 26 + 13                             | 258 + 65            | 276 + 65           | 323 + 65            | 465 + 65           | 335 + 65            | 361 + 65            | 503 + 65           |
| 1 mA                | 2.020 000 0 mA              | 2k - 10k       | 26 + 9                              | 516 + 65            | 551 + 65           | 645 + 65            | 930 + 65           | 658 + 65            | 684 + 65            | 968 + 65           |
| 10 mA               | 20.200 000 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              | 202 000 00 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                 | 2.020 000 0 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> | 20.200 000 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> | 30.200 000 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,<br>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                               |
|             | 1 - 10         | 5                           | 8                                |
| 100 mA      | 10 - 10k       | 5                           | 8                                |
|             | 10k - 30k      | 10                          | 15                               |
|             | 1 - 10         | 10                          | 15                               |
| 1 A         | 10 - 10k       | 10                          | 15                               |
|             | 10k - 30k      | 20                          | 30                               |
|             | 1 - 10         | 10                          | 15                               |
| 10 A        | 10 - 10k       | 10                          | 15                               |
|             | 1 - 10         | 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



**Least Significant Digit by Range**

| Range       | LSD Sensitivity<br>(7 Digit Setting) |
|-------------|--------------------------------------|
| 10 $\mu$ A  | 1 pA                                 |
| 100 $\mu$ A | 10 pA                                |
| 1 mA        | 100 pA                               |
| 10 mA       | 1 nA                                 |
| 100 mA      | 10 nA                                |
| 1 A         | 100 nA                               |
| 10 A        | 1 $\mu$ A                            |
| 30 A        | 1 $\mu$ A                            |

*Least Significant Digit by Range*

**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**

**Total Measurement Specification = (Reading spec + Range spec) + (Aperture spec + Aperture Range spec) + (Read Period Reading spec + Read Period Range spec)**

**Reading and Range Specification**

Resistance maximum resolution is 8 digits

|                 |                         |        | Relative Accuracy   |                            |                           |                            |                           | Absolute Accuracy          |                            |                           |
|-----------------|-------------------------|--------|---|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|----------------------------|---------------------------|
| 95 % Confidence |                         |        | $\pm (\mu\Omega/\Omega \text{ of reading} + \mu\Omega/\Omega \text{ of range})$ |                            |                           |                            |                           |                            |                            |                           |
| Range           | Full Scale              | "Mode" | Transfer,<br>20 min <sup>[15]</sup>   | 24 Hour<br>Tcal $\pm 1$ °C | 90 day<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 1$ °C | 2 year<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 5$ °C | 2 year<br>Tcal $\pm 5$ °C |
| 1 $\Omega$      | 2.020 000 00 $\Omega$   | 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 $\Omega$     | 20.200 000 0 $\Omega$   | 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 $\Omega$    | 202.000 000 $\Omega$    | 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 k $\Omega$    | 2.020 000 00 k $\Omega$ | 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 k $\Omega$   | 20.200 000 0 k $\Omega$ | 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 k $\Omega$  | 202. 000 000 k $\Omega$ | 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 M $\Omega$    | 2.020 000 00 M $\Omega$ | 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                 | 20.200 000 0 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                | 202.000 000 0 MΩ | Normal     | 15 + 100   | 20 + 100   | 25 + 100   | 30 + 100   | 60.0 + 100  | 39 + 100   | 119 + 100   | 179 + 100   |
| 1 GΩ                  | 2.020 000 00 GΩ  | Normal     | 200 + 1000 | 250 + 1000 | 350 + 1000 | 500 + 1000 | 1000 + 1000 | 505 + 1000 | 1310 + 1000 | 1960 + 1000 |
| 1 Ω                   | 2.020 000 00 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                  | 20.200 000 0 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                 | 202.000 000 0 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                  | 2.020 000 00 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                 | 20.200 000 0 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                | 202.000 000 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                  | 2.020 000 00 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                 | 20.200 000 0 MΩ  | Lo Current | 20 + 10    | 40 + 10    | 43 + 10    | 46 + 10    | 55 + 10     | 46 + 10    | 126 + 10    | 190 + 10    |
| 100 MΩ                | 202.000 000 MΩ   | Lo Current | 250 + 100  | 250 + 100  | 350 + 100  | 500 + 100  | 1000 + 100  | 515 + 100  | 1320 + 100  | 1970 + 100  |
| 1 GΩ                  | 2.020 000 00 GΩ  | Lo Current | 250 + 1000 | 250 + 1000 | 350 + 1000 | 500 + 1000 | 1000 + 1000 | 525 + 1000 | 1320 + 1000 | 1990 + 1000 |
| 10 MΩ                 | 20.200 000 0 MΩ  | HV         | 2.0 + 1    | 5.8 + 1    | 6.5 + 1    | 7.0 + 1    | 14 + 1      | 15 + 1     | 17 + 1      | 26 + 1      |
| 100 MΩ                | 202.000 000 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                  | 2.020 000 00 GΩ  | HV         | 20 + 100   | 27 + 100   | 28 + 100   | 30 + 100   | 60.0 + 100  | 150 + 100  | 230 + 100   | 345 + 100   |
| 10 GΩ <sup>[14]</sup> | 20.200 000 0 GΩ  | HV         | 250 + 1000 | 250 + 1000 | 350 + 1000 | 500 + 1000 | 1000 + 1000 | 525 + 1000 | 1330 + 1000 | 1990 + 1000 |

| 99 % Confidence |                 |            | Relative Accuracy                   |                        |                       |                        |                       | Absolute Accuracy      |                        |                       |  |
|-----------------|-----------------|------------|-------------------------------------|------------------------|-----------------------|------------------------|-----------------------|------------------------|------------------------|-----------------------|--|
|                 |                 |            | ± (μΩ/Ω of reading + μΩ/Ω of range) |                        |                       |                        |                       |                        |                        |                       |  |
| Range           | Full Scale      | "Mode"     | Transfer,<br>20 min <sup>[15]</sup> | 24 Hour<br>Tcal ± 1 °C | 90 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 2 year<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 5 °C | 2 year<br>Tcal ± 5 °C |  |
| 1 Ω             | 2.0200 000 00 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            | 20.200 000 0 Ω  | Normal     | 1.0 + 1.8                           | 3.2 + 1.8              | 5.8 + 1.8             | 9.0 + 1.8              | 18 + 1.8              | 9.9 + 1.8              | 13.0 + 1.8             | 20 + 1.8              |  |
| 100 Ω           | 202.000 000 0 Ω | Normal     | 0.3 + 0.6                           | 1.9 + 0.6              | 5.2 + 0.6             | 9.0 + 0.6              | 18 + 0.6              | 9.2 + 0.6              | 11.8 + 0.6             | 18 + 0.6              |  |
| 1 kΩ            | 2.020 000 00 kΩ | Normal     | 0.3 + 0.6                           | 1.3 + 0.6              | 4.5 + 0.6             | 9.0 + 0.6              | 18 + 0.6              | 9.1 + 0.6              | 11.7 + 0.6             | 18 + 0.6              |  |
| 10 kΩ           | 20.200 000 0 kΩ | Normal     | 0.3 + 0.6                           | 1.3 + 0.6              | 4.5 + 0.6             | 9.0 + 0.6              | 18 + 0.6              | 9.2 + 0.6              | 11.8 + 0.6             | 18 + 0.6              |  |
| 100 kΩ          | 202.000 000 kΩ  | Normal     | 0.3 + 0.6                           | 1.3 + 0.6              | 4.5 + 0.6             | 9.0 + 0.6              | 18 + 0.6              | 9.4 + 0.6              | 11.9 + 0.6             | 18 + 0.6              |  |
| 1 MΩ            | 2.020 000 00 MΩ | Normal     | 0.6 + 1.3                           | 2.6 + 1.3              | 5.2 + 1.3             | 9.0 + 1.3              | 18 + 1.3              | 10.6 + 1.3             | 13.7 + 1.3             | 21 + 1.3              |  |
| 10 MΩ           | 20.200 000 0 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          | 202.000 000 MΩ  | Normal     | 19 + 129                            | 26 + 129               | 32 + 129              | 39 + 129               | 77.4 + 129            | 50 + 129               | 154 + 129              | 230 + 129             |  |
| 1 GΩ            | 2.020 000 00 GΩ | Normal     | 258 + 1290                          | 323 + 1290             | 452 + 1290            | 645 + 1290             | 1290 + 1290           | 652 + 1290             | 1690 + 1290            | 2530 + 1290           |  |
| 1 Ω             | 2.020 000 00 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            | 20.200 000 0 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           | 202.000 000 0 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   | 2.020 000 00 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  | 20.200 000 0 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 | 202.000 000 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   | 2.020 000 00 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  | 20.200 000 0 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,<br>20 min <sup>[15]</sup> | 24 Hour<br>Tcal ± 1 °C | 90 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 2 year<br>Tcal ± 1 °C | 365 day<br>Tcal ± 1 °C | 365 day<br>Tcal ± 5 °C | 2 year<br>Tcal ± 5 °C |
| 100 MΩ                | 202.000 000 MΩ  | Lo Current | 323 + 129                           | 323 + 129              | 452 + 129             | 645 + 129              | 1290 + 129            | 664 + 129              | 1700 + 129             | 2540 + 129            |
| 1 GΩ                  | 2.020 000 00 GΩ | Lo Current | 323 + 1290                          | 323 + 1290             | 452 + 1290            | 645 + 1290             | 1290 + 1290           | 677 + 1290             | 1700 + 1290            | 2570 + 1290           |
| 10 MΩ                 | 20.200 000 0 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                | 202.000 000 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                  | 2.020 000 00 GΩ | HV         | 26 + 129                            | 35 + 129               | 36 + 129              | 39 + 129               | 77.4 + 129            | 194 + 129              | 297 + 129              | 445 + 129             |
| 10 GΩ <sup>[14]</sup> | 20.200 000 0 GΩ | HV         | 323 + 1290                          | 323 + 1290             | 452 + 1290            | 645 + 1290             | 1290 + 1290           | 677 + 1290             | 1720 + 1290            | 2570 + 1290           |

## Least Significant Digit by Range

| Range  | LSD Sensitivity<br>(8 Digit Setting) |
|--------|--------------------------------------|
| 1 Ω    | 10 nΩ                                |
| 10 Ω   | 100 nΩ                               |
| 100 Ω  | 1 μΩ                                 |
| 1 kΩ   | 10 μΩ                                |
| 10 kΩ  | 100 μΩ                               |
| 100 kΩ | 1 mΩ                                 |
| 1 mΩ   | 10 mΩ                                |
| 10 mΩ  | 100 mΩ                               |
| 100 mΩ | 1 Ω                                  |
| 1 GΩ   | 10 Ω                                 |
| 10 GΩ  | 100 Ω                                |

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

| Range                         | "Mode"     | $\pm$ ( $\mu\Omega/\Omega$ of reading/°C |                                       | $+$ $\Omega/^\circ\text{C}$   |
|-------------------------------|------------|--|---------------------------------------|-------------------------------|
|                               |            | 15 °C to 30 °C                           | or<br>5 °C to 15 °C<br>30 °C to 40 °C | 5 °C to 40 °C <sup>[16]</sup> |
| 1 $\Omega$                    | Normal     | 1.5                                      | or 2.5 +                              | 1.5 $\mu$                     |
| 10 $\Omega$                   | Normal     | 0.6                                      | or 1.0 +                              | 25 $\mu$                      |
| 100 $\Omega$                  | Normal     | 0.5                                      | or 0.8 +                              | 250 $\mu$                     |
| 1 k $\Omega$                  | Normal     | 0.5                                      | or 0.8 +                              | 2.5 $\mu$                     |
| 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 μs to 2 s in 200 ns increments, >2 s to 10 s in 1 ms increments

Additional errors with aperture

| Aperture | μΩ/Ω of reading + μΩ/Ω of range |
|----------|---------------------------------|
| <20 ms   | 0 + 0.5                         |
| <4 ms    | 1 + 2                           |
| < 2 ms   | 10 + 10                         |
| <1ms     | 20 + 20                         |

Additional uncertainty with read rate: (Period = aperture + delay between readings)

| Read Period | uΩ/Ω reading + | uΩ/Ω range |
|-------------|----------------|------------|
| < 20 ms     | 0.2 +          | 0          |
| < 10 ms     | 0.5 +          | 0.2        |
| < 6 ms      | 5.0 +          | 0.5        |
| < 3 ms      | 20.0 +         | 2          |
| < 2 ms      | 40.0 +         | 5          |

Maximum Trigger Rate (Aperture ≤ 100 μs) .. 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 μs. 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 Ω to 10 kΩ ranges. Read Rate reduced in Tru Ohms Mode. Specification for Tru Ohms same as corresponding Normal or Lo Current ranges.

2 Wire Adder ..... ±(10 pA/Ir) x 10<sup>6</sup> μΩ/Ω of Reading ±50 mΩ ±3 mΩ/°C),

where Ir 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 Ω in any or all leads, 1 Ω on the 1 Ω Range

Ω 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 Ω, 10 Ω ..... 200 Ω .....  $R_d$  = displayed value  
 100 Ω ..... 2 kΩ .....  $R_a$  = parallel resistor from Hi to Guard  
 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ ..... 20 kΩ .....  $R_b$  = parallel resistor from Lo to Guard

10 M $\Omega$ , 100 M $\Omega$ , 1 G $\Omega$ , 10 G $\Omega$ .....200 k $\Omega$ .....Rg =  $\Omega$  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 k $\Omega$  Range <0.05 s to 10  $\mu\Omega/\Omega$

Filter On..... Up to 100 k $\Omega$  Range <1 s to 10  $\mu\Omega/\Omega$

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

#### Digitize DC Voltage

18-bit resolution for aperture 0 to  $\leq 3$  ms

| 95 % Confidence |                                       |            | Relative Accuracy   |   |  |  | Absolute Accuracy                          |  |   |
|-----------------|---------------------------------------|------------|---|---|--|--|--|--|---|
|                 |                                       |            | $\pm (\mu\text{V/V of reading} + \mu\text{V/V of range})$ |   |  |  |  |  |   |
| Range           | Zin                                   | Full Scale | 24 Hour<br>Tcal $\pm 1$ $^{\circ}\text{C}$                | 90 day<br>Tcal $\pm 1$ $^{\circ}\text{C}$ | 365 day<br>Tcal $\pm 1$ $^{\circ}\text{C}$ | 2 years<br>Tcal $\pm 1$ $^{\circ}\text{C}$ | 365 day<br>Tcal $\pm 1$ $^{\circ}\text{C}$ | 365 day<br>Tcal $\pm 5$ $^{\circ}\text{C}$ | 2 year<br>Tcal $\pm 5$ $^{\circ}\text{C}$ |
| 100 mV          | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 202 mV     | 3.3 + 15  | 20 + 15                                   | 44 + 15                                    | 62 + 15                                    | 49 + 15                                    | 67 + 15                                    | 80 + 15                                   |
| 1 V             | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 2.02 V     | 3.3 + 15  | 20 + 15                                   | 44 + 15                                    | 62 + 15                                    | 49 + 15                                    | 63 + 15                                    | 76 + 15                                   |
| 10 V            | Auto, 10 M $\Omega$ ,<br>1 M $\Omega$ | 20.2 V     | 3.3 + 15  | 20 + 15                                   | 44 + 15                                    | 62 + 15                                    | 49 + 15                                    | 63 + 15                                    | 76 + 15                                   |
| 100 V           | Auto, 10 M $\Omega$                   | 202 V      | 3.3 + 15  | 20 + 15                                   | 44 + 15                                    | 62 + 15                                    | 49 + 15                                    | 63 + 15                                    | 76 + 15                                   |
| 100 V           | 1 M $\Omega$                          | 202 V      | 3.3 + 15  | 20 + 15                                   | 44 + 15                                    | 62 + 15                                    | 49 + 15                                    | 63 + 15                                    | 76 + 15                                   |
| 1000 V          | Auto, 10 M $\Omega$                   | 1050 V     | 3.3 + 15  | 20 + 15                                   | 44 + 15                                    | 62 + 15                                    | 49 + 15                                    | 67 + 15                                    | 80 + 15                                   |
| 1000 V          | 1 M $\Omega$                          | 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<br>Tcal $\pm 1^\circ\text{C}$                     | 90 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 2 years<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 1^\circ\text{C}$ | 365 day<br>Tcal $\pm 5^\circ\text{C}$ | 2 year<br>Tcal $\pm 5^\circ\text{C}$ |  |
| 100 mV          | Auto, 10 M $\Omega$ ,<br>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 $\Omega$ ,<br>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 $\Omega$ ,<br>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  $\leq 3$  ms

95 % Confidence

| Range               | Full Scale            | Relative Accuracy   |                           |                            |                            | Absolute Accuracy          |                            |                           |
|---------------------|-----------------------|---|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------------|
|                     |                       | $\pm (\mu\text{A/A of reading} + \mu\text{A/A of range})$ |                           |                            |                            |                            |                            |                           |
|                     |                       | 24 Hour<br>Tcal $\pm 1$ °C                                | 90 day<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 1$ °C | 2 years<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 5$ °C | 2 year<br>Tcal $\pm 5$ °C |
| 10 $\mu\text{A}$    | 20.2 $\mu\text{A}$    | 35 + 80   | 40 + 80                   | 44 + 80                    | 66 + 80                    | 48 + 80                    | 60 + 80                    | 78 + 80                   |
| 100 $\mu\text{A}$   | 202 $\mu\text{A}$     | 6 + 70  | 22 + 70                   | 44 + 70                    | 66 + 70                    | 48 + 70                    | 60 + 70                    | 78 + 70                   |
| 1 mA                | 2.02 mA               | 6 + 70  | 22 + 70                   | 44 + 70                    | 66 + 70                    | 48 + 70                    | 60 + 70                    | 78 + 70                   |
| 10 mA               | 20.2 mA               | 7 + 70  | 22 + 70                   | 44 + 70                    | 66 + 70                    | 48 + 70                    | 60 + 70                    | 78 + 70                   |
| 100 mA              | 202 mA                | 18 + 70   | 22 + 70                   | 44 + 70                    | 66 + 70                    | 48 + 70                    | 80 + 70                    | 90 + 70                   |
| 1 A                 | 2.02 A                | 60 + 125  | 65 + 125                  | 110 + 125                  | 165 + 125                  | 112 + 125                  | 144 + 125                  | 197 + 125                 |
| 10 A <sup>[8]</sup> | 20.2 A <sup>[8]</sup> | 80 + 160  | 125 + 160                 | 180 + 160                  | 270 + 160                  | 184 + 160                  | 244 + 160                  | 330 + 160                 |
| 30 A <sup>[8]</sup> | 30.2 A <sup>[8]</sup> | 240 + 180   | 390 + 180                 | 500 + 180                  | 750 + 180                  | 501 + 180                  | 561 + 180                  | 810 + 180                 |

99 % Confidence

| Range               | Full Scale            | Relative Accuracy   |                           |                            |                            | Absolute Accuracy          |                            |                           |
|---------------------|-----------------------|---|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------------|
|                     |                       | $\pm (\mu\text{A/A of reading} + \mu\text{A/A of range})$ |                           |                            |                            |                            |                            |                           |
|                     |                       | 24 Hour<br>Tcal $\pm 1$ °C                                | 90 day<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 1$ °C | 2 years<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 1$ °C | 365 day<br>Tcal $\pm 5$ °C | 2 year<br>Tcal $\pm 5$ °C |
| 10 $\mu\text{A}$    | 20.2 $\mu\text{A}$    | 45 + 103  | 52 + 103                  | 57 + 103                   | 85 + 103                   | 62 + 103                   | 78 + 103                   | 101 + 103                 |
| 100 $\mu\text{A}$   | 202 $\mu\text{A}$     | 7 + 90  | 28 + 90                   | 57 + 90                    | 85 + 90                    | 62 + 90                    | 78 + 90                    | 101 + 90                  |
| 1 mA                | 2.02 mA               | 7 + 90  | 28 + 90                   | 57 + 90                    | 85 + 90                    | 62 + 90                    | 78 + 90                    | 101 + 90                  |
| 10 mA               | 20.2 mA               | 8 + 90  | 28 + 90                   | 57 + 90                    | 85 + 90                    | 62 + 90                    | 78 + 90                    | 101 + 90                  |
| 100 mA              | 202 mA                | 23 + 90   | 28 + 90                   | 57 + 90                    | 85 + 90                    | 62 + 90                    | 104 + 90                   | 126 + 90                  |
| 1 A                 | 2.02 A                | 77 + 161  | 84 + 161                  | 142 + 161                  | 213 + 161                  | 144 + 161                  | 186 + 161                  | 254 + 161                 |
| 10 A <sup>[8]</sup> | 20.2 A <sup>[8]</sup> | 103 + 206   | 161 + 206                 | 232 + 206                  | 348 + 206                  | 237 + 206                  | 315 + 206                  | 426 + 206                 |
| 30 A <sup>[8]</sup> | 30.2 A <sup>[8]</sup> | 310 + 232   | 503 + 232                 | 645 + 232                  | 968 + 232                  | 646 + 232                  | 724 + 232                  | 1046 + 232                |

If Filter Off is selected, add 40  $\mu\text{A/A}$  of reading + 70  $\mu\text{A/A}$  of range.



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

| Range             | $\pm \mu\text{A/A reading}/^\circ\text{C}$ |                               |
|-------------------|--|-------------------------------|
|                   | 15 °C to 30 °C                             | 5 °C to 40 °C <sup>[13]</sup> |
| 10 $\mu\text{A}$  | 3.0 or                                     | 5.0 + 5                       |
| 100 $\mu\text{A}$ | 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                        |

**Low Pass Filter bandwidths**

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

**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  |        |       |       |
| 100 mV | 76 dB  | 70 dB | 60 dB |
| 1 V    | 80 dB  | 80 dB | 80 dB |
| 10 V   | 80 dB  | 80 dB | 80 dB |
| 100 V  | 80 dB  | 80 dB | 80 dB |
| 1000 V | 80 dB  | 80 dB | 80 dB |

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

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

| Filter | 100kHz  | 3MHz    | Full    |
|--------|---------|---------|---------|
| Range  |         |         |         |
| 100 mV | -100 dB | -80 dB  | -74 dB  |
| 1 V    | -100 dB | -100 dB | -90 dB  |
| 10 V   | -100 dB | -100 dB | -100 dB |
| 100 V  | -94 dB  | -94 dB  | -94 dB  |
| 1000 V | -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 spurious 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                  |                                    |                                   |  |
|-------------------|--------------------|--------------------|-------------------|----------------------|---|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|------------------------------------|-----------------------------------|--|
|                   |                    |                    |                   |                      | $\pm (\mu\text{F}/\text{F of reading} + \mu\text{F}/\text{F of range})$ |                                   |                                    |                                   |                                    |                                    |                                   |  |
| 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 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 $\mu\text{A}$   | 1 PLC                | 129 + 129   | 258 + 129                         | 516 + 129                          | 774 + 129                         | 526 + 129                          | 629 + 129                          | 944 + 129                         |  |
| 1 $\mu\text{F}$   | 0.18 $\mu\text{F}$ | 2.02 $\mu\text{F}$ | 10 $\mu\text{A}$  | 1 PLC                | 129 + 129   | 258 + 129                         | 516 + 129                          | 774 + 129                         | 523 + 129                          | 534 + 129                          | 801 + 129                         |  |
| 10 $\mu\text{F}$  | 1.8 $\mu\text{F}$  | 20.2 $\mu\text{F}$ | 100 $\mu\text{A}$ | 1 PLC                | 129 + 129   | 258 + 129                         | 516 + 129                          | 774 + 129                         | 529 + 129                          | 540 + 129                          | 809 + 129                         |  |
| 100 $\mu\text{F}$ | 18 $\mu\text{F}$   | 202 $\mu\text{F}$  | 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  $\pm 1^\circ\text{C}$ )

| Range             | $\pm \mu\text{F}/\text{F of reading}$      |   |
|-------------------|--|---|
|                   | 15 $^\circ\text{C}$ to 30 $^\circ\text{C}$ | 5 $^\circ\text{C}$ to 15 $^\circ\text{C}$<br>30 $^\circ\text{C}$ to 40 $^\circ\text{C}$ |
| 1 nF              | 200  | 300   |
| 10 nF             | 50   | 75  |
| 100 nF            | 20   | 30  |
| 1 $\mu\text{F}$   | 2  | 3   |
| 10 $\mu\text{F}$  | 2  | 3   |
| 100 $\mu\text{F}$ | 2  | 3   |
| 1 mF              | 2  | 3   |
| 10 mF             | 2  | 3   |
| 100 mF            | 2  | 3   |

## Least Significant Digit by Range

| Range       | LSD Sensitivity<br>(5 Digit Setting) |
|-------------|--------------------------------------|
| 1 nF        | 0.01 pF                              |
| 10 nF       | 0.1 pF                               |
| 100 nF      | 1 pF                                 |
| 1 $\mu$ F   | 10 pF                                |
| 10 $\mu$ F  | 100 pF                               |
| 100 $\mu$ F | 1 nA                                 |
| 1 mF        | 10 nF                                |
| 10 mF       | 100 nF                               |
| 100 mF      | 1 $\mu$ F                            |

## 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  $\pm 1$  °C)

| $\pm \mu\text{F}/\text{F}$ of reading |                |                                 |
|---------------------------------------|----------------|---------------------------------|
| Range                                 | 15 °C to 30 °C | 5 °C to 15 °C<br>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 $\mu\text{F}$ | 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 $\mu\text{F}$ | 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** <sup>[2]</sup> <sup>[12]</sup>

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

PRT R0 = 100  $\Omega$

Maximum secondary resistance reading uncertainty (99 %)

Temperature  $\leq 545.06$  K:  $\pm 1.95$  m $\Omega$

Temperature  $> 545.06$  K:  $\pm 5.1$  m $\Omega$

Maximum Temperature readout uncertainty (99 %)

Temperature  $\leq 545.06$  K:  $\pm 5.3$  mK

Temperature  $> 545.06$  K: 18.2 mK

PRT R0 = 25  $\Omega$

Maximum secondary resistance reading uncertainty (99 %):  $\pm 1.19$  m $\Omega$

Maximum temperature readout uncertainty (99 %):  $\pm 18.5$  mK

**Thermocouple** <sup>[2][12]</sup>

| Type | Maximum Secondary Reading Uncertainty (μV) |         | Maximum Temperature Reading Uncertainty (mK) |         | Conversion Algorithm        |
|------|--|---------|--|---------|-----------------------------|
|      | (<0 °C)                                    | (≥0 °C) | (<0 °C)                                      | (≥0 °C) |                             |
| B    | -  | 0.35    | -  | 928.57  | NIST Monograph 175          |
| C    | -  | 0.50    | -  | 50.50   | IEC 60584-1: 2013 algorithm |
| E    | 0.32                                       | 0.76    | 85.45  | 10.06   | NIST Monograph 175          |
| J    | 0.31                                       | 0.71    | 15.15  | 12.43   | NIST Monograph 175          |
| K    | 0.30                                       | 0.62    | 184.18                                       | 17.16   | NIST Monograph 175          |
| L    | 0.31                                       | 0.61    | 9.91   | 9.83    | ITS 90 algorithm            |
| N    | 0.29                                       | 0.57    | 308.13                                       | 15.76   | NIST Monograph 174          |
| R    | 0.26                                       | 0.40    | 67.88  | 50.98   | NIST Monograph 175          |
| S    | 0.26                                       | 0.38    | 62.83  | 49.06   | NIST Monograph 175          |
| T    | 0.30                                       | 0.40    | 114.66                                       | 6.79    | NIST Monograph 175          |
| U    | 0.30                                       | 0.48    | 14.99  | 8.54    | ITS 90 algorithm            |

Secondary readings at 99 % confidence.

Temperature readings are calculated from the algorithm stated.

**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

| <b>Gate time</b> | <b>Display Resolution</b> |
|------------------|---------------------------|
| 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-byte 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

