# 1

# General Information

## 1.1 Introduction

This section contains general information about the Model 6517 Electrometer/High Resistance System. It is arranged in the following manner:

**1.2 Features**

**1.3 Warranty information**

**1.4 Manual addenda**

**1.5 Safety symbols and terms**

**1.6 Specifications**

**1.7 Inspection**

**1.8 Options and accessories**

## 1.2 Features

Some important Model 6517 features include:

- Full range of functions — Exceptional sensitivity and accuracy for voltage, current, charge, and V/I resistance and resistivity (surface and volume) measurements.With the Models 6517-RH and 6517-TP, relative humidity and external temperature can be measured.
- Voltage source — The internal 1000V V-Source can be configured with the ammeter to make V/I resistance/resistivity measurements, and to force voltage, measure current.
- Two-line display — Readings and front panel messages are provided on the top line (primary) 20-character, and bottom line (secondary) 32-character alphanumeric display. The multiple display provides supplemental information about the reading, such as min/max readings, bar graphs for the reading, and time and date.
- Reading and setup storage — Readings and setup data can be stored and recalled from memory. Over 15,000 readings can be stored in the buffer, and up to 10 instrument setups can be stored in memory.
- Test sequences — Built-in tests for the following applications: device characterization, resistivity, surface insulation resistance, and voltage sweeps.
- GPIB interface — Accommodates two separate languages for IEEE-488 operation. The SCPI language conforms to the IEEE-488.2 and SCPI standards. The 617 emulation mode (DDC language) allows the instrument to be controlled using device-dependent command programming.
- RS-232 interface — The instrument can instead be controlled over this serial interface using SCPI commands.
- Talk-only mode — From the front panel, you can set the instrument to send readings to a printer. Talk-only is available over both the GPIB and RS-232 interfaces.
- Scanning — The Model 6517 has an option slot that will accommodate an optional scanner card (Models 6521 and 6522). The instrument can also be configured to operate with an external switching system (i.e., Model 7001 or 7002) to scan external channels.
- Trigger link — This is a new trigger concept that provides more versatile and precise external triggering. It is in addition to the standard Trigger In/Meter Complete Out BNC external triggering techniques.
- Digital calibration — The instrument may be digitally calibrated from either the front panel, or over the RS-232 interface or GPIB bus (SCPI language).

## 1.3 Warranty information

Warranty information is located on the inside front cover of this instruction manual. Should your Model 6517 require warranty service, contact the Keithley representative or authorized repair facility in your area for further information. When returning the instrument for repair, be sure to fill out and include the service form at the back of this manual to provide the repair facility with the necessary information.

## 1.4 Manual addenda

Any improvements or changes concerning the instrument or manual will be explained in an addendum included with the manual. Be sure to note these changes and incorporate them into the manual.

## 1.5 Safety symbols and terms

The following symbols and terms may be found on an instrument or used in this manual.

The  symbol on an instrument indicates that the user should refer to the operating instructions located in the manual.

The  symbol on an instrument shows that high voltage may be present on the terminal(s). Use standard safety precautions to avoid personal contact with these voltages.

The  symbol indicates that the test fixture (i.e. Model 8009) must be connected to a safety earth ground using #18 AWG wire or larger.

The **WARNING** heading used in this manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading used in this manual explains hazards that could damage the instrument. Such damage may invalidate the warranty.

## 1.6 Specifications

Full Model 6517 specifications may be found immediately preceding the table of contents in this manual.

## 1.7 Inspection

The Model 6517 was carefully inspected, both electrically and mechanically before shipment. After unpacking all items from the shipping carton, check for any obvious signs of physical damage that may have occurred during transit. (Note: There may be a protective film over the display lens, which can be removed.) Report any damage to the shipping agent immediately. Save the original packing carton for possible future reshipment.

If an additional manual is required; order the appropriate manual package:

- Model 6517 User's Manual — Keithley P/N 6517-900-00
- Model 6517 Repair Manual — Keithley P/N 6517-902-00
- Model 6517 Getting Started Manual — Keithley P/N 6517-903-00
- Model 6517 Calibration Manual — Keithley P/N 6517-905-00

## 1.8 Options and accessories

The following options and accessories are available from Keithley for use with the Model 6517:

**Model 237-ALG-2 Triax Cable:** This is a 2-meter (6.6 ft.) low noise triax cable terminated with a 3-slot male triax connector on one end and 3 alligator clips on the other.

**Model 237-BNC-TRX Adapter:** This is a male BNC to 3-lug female triax adapter (guard disconnected). It is used to terminate a triax cable with a BNC plug. Suitable for use with the Model 6517 V-Source in high voltage applications.

**Model 237-TRX-T Adapter:** This is a 3-slot male to dual 3-lug female triax tee adapter for use with 7078-TRX triax cables. Suitable for use with the Model 6517 V-Source in high voltage applications.

**Model 237-TRX-NG Adapter:** This is a 3-slot male triax to female BNC adapter (guard removed) for non-guarded measurements. This adapter allows you to connect a BNC cable to the triax input of the Model 6517. Suitable for use with the Model 6517 V-Source in high voltage applications.

**Model 237-TRX-TBC Connector:** This is a 3-lug female triax bulkhead connector with cap for assembly of custom panels and interface connections. Suitable for use with the Model 6517 V-Source in high voltage applications.

**Model 1050 Padded Carrying Case:** A carrying case for a Model 6517. Includes handles and shoulder strap.

**Model 4288-1 Single Fixed Rack Mount Kit:** Mounts a single Model 6517 in a standard 19-inch rack.

**Model 4288-2 Side-by-side Rack Mount Kit:** Mounts two instruments (Models 182, 428, 486, 487, 2001, 2002, 6517, 7001) side-by-side in a standard 19-inch rack.

**Model 4288-3 Side-by-side Rack Mount Kit:** Mounts a Model 6517 and a Model 199 side-by-side in a standard 19-inch rack.

**Model 4288-4 Side-by-side Rack Mount Kit:** Mounts a Model 6517 and a 5¼-inch instrument (Models 195A, 196, 220, 224, 230, 263, 595, 614, 617, 705, 740, 775, etc.) side-by-side in a standard 19-inch rack.

**Model 5156 Electrometer Calibration Standard Set:** This calibration fixture contains standardized resistors and capacitors needed to calibrate the Model 6517.

**Model 6517-ILC-3 Safety Interlock Cable:** Designed to connect the lid interlock circuit of the Model 8009 test fixture to the interlock circuit of the Model 6517.

**Model 6517-RH Humidity Probe with Cable:** This sensor allows the Model 6517 to make relative humidity measurements (0 to 100%).

**Model 6517-TP Thermocouple with Leads:** This type K thermocouple sensor allows the Model 6517 to make external temperature measurements from -190°C to 1350°C.

**Model 6521 Low Current Scanner Card:** This 10-channel low current scanner card is terminated with BNC connectors and plugs into the option slot of the Model 6517.

**Model 6522 Low Current/Low Voltage Scanner Card:** This 10-channel low current/low voltage scanner card is terminated with triax connectors and plugs into the option slot of the Model 6517.

**Models 7007-1 and 7007-2 Shielded IEEE-488 Cables:** Connect the Model 6517 to the IEEE-488 bus using shielded cables and connectors to reduce electromagnetic interference (EMI). The Model 7007-1 is one meter long; the Model 7007-2 is two meters long.

**Models 7078-TRX-3, 7078-TRX-10 and 7078-TRX-20 Triax Cables:** These are low noise triax cables terminated at both ends with 3-slot male triax connectors. The -3 model is 3 ft. (0.9m) in length, the -10 model is 10 ft. (3m) in length, and the -20 model is 20 ft. (6m) in length.

**Model 7078-TRX-TBC Connector:** This is a 3-lug female triax bulkhead connector with cap for assembly of custom panels and interface connections. Suitable for use with the Model 6517 V-Source in high voltage applications.

**Model 8002-ILC-3 Safety Interlock Cable:** Designed to connect the lid interlock circuit of the Model 8002A test fixture to the interlock circuit of the Model 6517.

**Model 8002A High Resistance Test Fixture:** Used with the Model 6517 to make accurate high resistance measurements of DUT. Designed to minimize leakage currents that can corrupt the integrity of the measurement.

**Model 8009 Resistivity Test Fixture:** This is a guarded test fixture for measuring volume and surface resistivities. It can accommodate sheet samples 64 to 102mm (2-1/2 to 4 in.) in diameter and up to 3.175mm (1/8 in.) thick.

**Models 8501-1 and 8501-2 Trigger Link Cables:** Connect the Model 6517 to other instruments with Trigger Link connectors (e.g., Model 7001 Switch System). The Model 8501-1 is one meter long; the Model 8501-2 is two meters long.

**Model 8502 Trigger Link Adapter:** Allows you to connect the Trigger Link of the Model 6517 to instruments that use the standard BNC (In/Out) external triggering technique.

**Model 8503:** Extension cable for the Model 6517-RH relative humidity sensor.

**Model 8530 IEEE-488 to Centronics Printer Adapter Cable:** Translates the IEEE-488 connector pinout and signal level to a Centronics termination. This permits a standard Centronics parallel printer to be connected to a Model 6517 in TALK-ONLY mode.

**Model 8606 High Performance Probe Tip Kit:** Consists of two spade lugs, two alligator clips, and two spring hook test probes. (The spade lugs and alligator clips are rated at 30V RMS, 42.4V peak; the test probes are rated at 1000V.) These components are designed to be used with high performance test leads terminated with banana plugs, such as the Model 8607 High Performance Banana Cables.

**Model 8607 High Performance Banana Cables:** Consists of two high voltage (1000V) banana cables. The cables are terminated with banana plugs that have retractable sheaths.

**CS-751 Barrel Adapter:** This is a barrel adapter that allows you to connect two triax cables together. Both ends of the adapter are terminated with 3-lug female triax connectors.

# A
# Specifications

# MODEL 6517 SPECIFICATIONS

## VOLTS

| RANGE | 5½ DIGIT RESOLUTION | ACCURACY (1 Yr.)[1] 18°– 28°C ±(% rdg + counts) | TEMPERATURE COEFFICIENT 0°– 18°C & 28°– 50°C ±(% rdg + counts)/°C |
|---|---|---|---|
| 2 V | 10 µV | 0.025 + 4 | 0.003 + 2 |
| 20 V | 100 µV | 0.025 + 3 | 0.002 + 1 |
| 200 V | 1 mV | 0.06 + 3 | 0.002 + 1 |

Note: [1]When properly zeroed, 5½ digit, 1 PLC (power line cycle), median filter on, digital filter =10 readings.

**NMRR:** 60dB on 2V, 20V, >55dB on 200V, at 50Hz or 60Hz ±0.1%.

**CMRR:** >120dB at DC, 50Hz or 60Hz.

**INPUT IMPEDANCE:** >200TΩ in parallel with 20pF, < 2pF guarded (10MΩ with zero check on).

**SMALL SIGNAL BANDWIDTH AT PREAMP OUTPUT:** Typically 100kHz (–3db).

## AMPS

| RANGE | 5½ DIGIT RESOLUTION | ACCURACY (1 Yr.)[1] 18°– 28°C ±(% rdg + counts) | TEMPERATURE COEFFICIENT 0°–18°C & 28°–50°C ±(% rdg + counts)/°C |
|---|---|---|---|
| 20 pA | 100 aA[2] | 1 + 30 | 0.1 + 5 |
| 200 pA | 1 fA[2] | 1 + 5 | 0.1 + 1 |
| 2 nA | 10 fA | 0.2 + 30 | 0.1 + 2 |
| 20 nA | 100 fA | 0.2 + 5 | 0.03 + 1 |
| 200 nA | 1 pA | 0.2 + 5 | 0.03 + 1 |
| 2 µA | 10 pA | 0.1 + 10 | 0.005 + 2 |
| 20 µA | 100 pA | 0.1 + 5 | 0.005 + 1 |
| 200 µA | 1 nA | 0.1 + 5 | 0.005 + 1 |
| 2 mA | 10 nA | 0.1 + 10 | 0.008 + 2 |
| 20 mA | 100 nA | 0.1 + 5 | 0.008 + 1 |

Note: [1]When properly zeroed, 5½ digit, 1 PLC (power line cycle), median filter on, digital filter =10 readings.
[2]aA =$10^{-18}$A, fA=$10^{-15}$A.

**INPUT BIAS CURRENT:** <3fA at TCAL. Temperature coefficient = 0.5fA/°C.

**INPUT BIAS CURRENT NOISE:** <750aA p-p (capped input), 0.1Hz to 10Hz bandwidth, damping on. Digital filter = 40 readings.

**INPUT VOLTAGE BURDEN at TCAL ± 1°C:**

<20µV on 20pA, 2nA, 20nA, 2µA, 20µA ranges.

<100µV on 200pA, 200nA, 200µA ranges.

<2mV on 2mA range.

<4mV on 20mA range.

**TEMPERATURE COEFFICIENT OF INPUT VOLTAGE BURDEN:**

<10µV/°C on pA, nA, µA ranges.

**PREAMP SETTLING TIME (to 10% of final value):** 2.5s typical on pA ranges, damping off, 4s typical on pA ranges damping on, 9ms on nA ranges, 1ms on µA and mA ranges.

**NMRR:** >95dB on pA, 60dB on nA, µA, and mA ranges at 50Hz or 60Hz ±0.1%.

## COULOMBS

| RANGE | 5½ DIGIT RESOLUTION | ACCURACY (1 Yr.)[1,2] 18°– 28°C ±(% rdg + counts) | TEMPERATURE COEFFICIENT 0°– 18°C & 28°– 50°C ±(% rdg + counts)/°C |
|---|---|---|---|
| 2 nC | 10 fC | 0.4 + 5 | 0.04 + 3 |
| 20 nC | 100 fC | 0.4 + 5 | 0.04 + 1 |
| 200 nC | 1 pC | 0.4 + 5 | 0.04 + 1 |
| 2 µC | 10 pC | 0.4 + 5 | 0.04 + 1 |

Note: [1]Charge acquisition time must be <1000s, derate 1% for each additional 10,000s.
[2]When properly zeroed, 5½ digit, 1 PLC (power line cycle), median filter on, digital filter =10 readings.

**INPUT BIAS CURRENT:** <4fA at TCAL. Temperature coefficient = 0.5fA/°C.

## OHMS

| RANGE | 5½ DIGIT RESOLUTION | ACCURACY[1] (10-100% Range) 18°-28°C (1 Yr.) ± (% rdg + cts) | TEMPERATURE COEFFICIENT (10-100% Range) 0°-18°C & 28°-50°C ± (% rdg + cts) | TEST VOLTS | AMPS RANGE |
|---|---|---|---|---|---|
| 2 MΩ | 10 Ω | 0.125 + 1 | 0.01 + 1 | 40 V | 200 µA |
| 20 MΩ | 100 Ω | 0.125 + 1 | 0.01 + 1 | 40 V | 20 µA |
| 200 MΩ | 1 kΩ | 0.15 + 1 | 0.015 + 1 | 40 V | 2 µA |
| 2 GΩ | 10 kΩ | 0.225 + 1 | 0.035 + 1 | 40 V | 200 nA |
| 20 GΩ | 100 kΩ | 0.225 + 1 | 0.035 + 1 | 40 V | 20 nA |
| 200 GΩ | 1 MΩ | 0.35 + 1 | 0.110 + 1 | 40 V | 2 nA |
| 2 TΩ | 10 MΩ | 0.35 + 1 | 0.110 + 1 | 400 V | 2 nA |
| 20 TΩ | 100 MΩ | 1.025 + 1 | 0.105 + 1 | 400 V | 200 pA |
| 200 TΩ | 1 GΩ | 1.15 + 1 | 0.125 + 1 | 400 V | 20 pA |

Note: [1]Specifications are for auto V-source ohms, when properly zeroed 5½ digit, 1 PLC, median filter on, digital filter = 10 readings. If user selectable voltage is required, use manual mode. Manual mode displays resistance (up to $10^{18}$Ω) calculated from measured current. Accuracy is equal to accuracy of V-source plus accuracy of selected Amps range.

**PREAMP SETTLING TIME:** Add voltage source settling time to preamp settling time in Amps specification.

## VOLTAGE SOURCE

| RANGE | STEP SIZE | ACCURACY (1 Yr.) 18°– 28°C ±(% setting+offset) | TEMPERATURE COEFFICIENT 0°– 18°C & 28°– 50°C ±(% setting+offset)/°C |
|---|---|---|---|
| 100 V | 5 mV | 0.15 + 10 mV | 0.005 + 1 mV |
| 1000 V | 50 mV | 0.15 + 100 mV | 0.005 + 10 mV |

**MAXIMUM OUTPUT CURRENT:**

±10mA; active current limit at <11.5mA for 100V range.

±1mA; active current limit at <1.15mA for 1000V range.

**SETTLING TIME:**

<8ms to rated accuracy for 100V range.

<50ms to rated accuracy for 1000V range.

**NOISE**:

<150µV p-p from 0.1Hz to 10Hz for 100V range.

<1.5mV p-p from 0.1Hz to 10Hz for 1000V range.

## TEMPERATURE (THERMOCOUPLE)

| THERMOCOUPLE TYPE | RANGE | ACCURACY (1 Yr.)[1] 18°– 28°C ±(% rdg + °C) |
|---|---|---|
| K | –25°C to 150°C | ± (0.3% ± 1.5°C) |

Note: [1]Excluding probe errors, TCAL ± 5°C, 1 PLC integration time.

## HUMIDITY

| RANGE | ACCURACY (1 Yr.)[1] 18°– 28°C ±(% rdg + % RH) |
|---|---|
| 0 - 100% | ± (0.3% +0.5) |

Note: [1]Humidity probe accuracy must be added. This is ± 3% RH, for Model 6517-RH, up to 65°C probe environment, not to exceed 85°C.

## IEEE-488 BUS IMPLEMENTATION

**MULTILINE COMMANDS:** DCL, LLO, SDC, GET, GTL, UNT, UNL, SPE, SPD.

**IMPLEMENTATION:** SCPI (IEEE-488.2, SCPI-1994.0); DDC (IEEE-488.1).

**UNILINE COMMANDS:** IFC, REN, EOI, SRQ, ATN.

**INTERFACE FUNCTIONS:** SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E1.

**PROGRAMMABLE PARAMETERS:** Function, Range, Zero Check, Zero Suppress, EOI (DDC mode only), Trigger, Terminator (DDC mode only), 100-Reading Storage (DDC mode), 15706 Max. Reading Storage (SCPI mode), Calibration (SCPI mode only), V-Source Output, Display Format, SRQ, Status (including V-Source I-Limit), Output Format, Guard.

**ADDRESS MODES:** TALK ONLY and ADDRESSABLE.

**TRIGGER TO READING DONE:** 150ms typical, with external trigger.

**RS-232 IMPLEMENTATION:**

**Supports:** SCPI 1994.0.

**Baud Rates:** 300, 600, 1200, 2400, 4800, 9600, 19.2k.

**Protocols:** Xon/Xoff, 7 or 8 bit ASCII, parity-odd/even/none.

**Connector:** DB-9 TXD/RXD/GND.

## GENERAL

**DISPLAY:** 6½-digit vacuum fluorescent multiline.

**OVERRANGE INDICATION:** Display reads "OVERFLOW".

**RANGING:** Automatic or manual.

**CONVERSION TIME:** Selectable 0.01 PLC to 10 PLC.

**PROGRAMS:** Provide front panel access to IEEE address, choice of engineering units or scientific notation, and digital calibration.

**MAXIMUM INPUT:** 250V peak, DC to 60Hz sine wave; 10s per minute maximum on mA ranges.

**MAXIMUM COMMON MODE VOLTAGE (DC to 60Hz sine wave):** Electrometer, 500V peak; V Source, 750V peak.

**ISOLATION (Meter COMMON to chassis):** Typically $10^{10}\Omega$ in parallel with 500pF.

**INPUT CONNECTOR:** Three lug triaxial on rear panel.

**2V ANALOG OUTPUT:** 2V for full range input. Inverting in Volts mode. Output impedance 10kΩ.

**PREAMP OUTPUT:** Provides a guard output for Volts measurements. Can be used as an inverting output or with external feedback in Amps and Coulombs modes.

**EXTERNAL TRIGGER:** TTL compatible External Trigger and Electrometer Complete.

**GUARD:** Switchable voltage guard available.

**DIGITAL I/O AND TRIGGER LINE:** Available, see manual for usage.

**EMI/RFI:** Meets VDE-0871 and FCC Class B limits.

**TEST SEQUENCES:** Device-Characterization (Diode, Capacitor, Cable, Resistor), Resistivity, Surface-Insulation-Resistance, Sweep.

**READING STORAGE:** 100 readings (DDC mode), 15706 max. readings (SCPI mode).

**READING RATE:**

| | |
|---|---|
| To internal buffer | 125 readings/second[1] |
| To IEEE-488 bus | 115 readings/second[1,3] |
| To front panel | 17 readings/second[2] |
| Bus transfer | 2500 readings/second[3] |

Note: [1] 0.01 PLC, digital filters off, front panel off, temperature + RH off.
[2] 1.00 PLC, digital filters off, temperature + RH off.
[3] Binary transfer mode.

**DIGITAL FILTER:** Median and averaging.

**ENVIRONMENT:**

**Operating:** 0°-50°C; relative humidity 70% non-condensing, up to 35°C.

**Storage:** –25° to +65°C.

**WARM-UP:** 1 hour to rated accuracy (see manual for recommended procedure).

**POWER:** 105–125V or 210–250V (external switch selected), 90–110V (internal modification required), 50–60Hz, 50VA.

**PHYSICAL:**

**Case Dimensions:** 90mm high × 214mm wide × 369mm deep (3½ in. × 8½ in. × 14½ in.).

**Working Dimensions:** From front of case to rear including power cord and IEEE-488 connector: 15.5 inches.

**Net Weight:** <4.6 kg (<10.1 lbs.).

**Shipping Weight:** <9.5 kg (<21 lbs.).

**ACCESSORIES SUPPLIED:**

Model 237-ALG-2 Low Noise Triax Cable, 3-slot Triax to Alligator clips 2m (6.6 ft.).

Model 8607 Safety High Voltage Dual Test Leads.

Model 6517-TP Thermocouple Input Lead.

CS-459 Interlock Connector.

Specifications subject to change without notice.

## A.1 Accuracy calculations

The information shows how to calculate accuracy for volts, amps, ohms and coulombs.

### A.1.1 Calculating volts accuracy

From the specifications, Volts is calculated as follows:

Accuracy = ±(% rdg + counts)

The following example shows how to compute accuracy for the 2V range:

Assume that the voltage you are measuring is reading exactly 1.00000V on the 2V range.

From the specs:

Accuracy = ±(0.025% of 1V + 4 counts)
= ±(0.00025V + 4 counts)
= ±(0.00025V + 0.00004V)
= ±0.00029V

Note: 4 counts on the 2V range equals 0.00004 V

Thus, the accuracy range for the 1.00000V reading is 0.99971V to 1.00029V.

### A.1.2 Calculating amps accuracy

From the specifications, Amps is calculated as follows:

Accuracy = ±(% rdg + counts)

The following example shows how to compute accuracy for the 20mA range:

Assume that the current you are measuring is reading exactly 10.0000mA on the 20mA range.

From the specs:

Accuracy = ±(0.1% of 10mA + 5 counts)
= ±(0.01mA + 5 counts)
= ±(0.01mA + 0.0005mA)
= ±0.0105mA

Note: 5 counts on the 20mA range equals 00.0005mA

Thus, the accuracy range for the 10.0000mA reading is 9.9895mA to 10.0105mA.

### A.1.3 Calculating ohms accuracy

The following information shows how to calculate ohms accuracy for both Auto V-Source Ohms and Manual V-Source Ohms.

#### Auto V-Source ohms

From the specifications, Auto V-Source Ohms accuracy is calculated as follows:

Accuracy = ±(% rdg + counts)

The following example shows how to compute Auto V-Source Ohms accuracy for the 2MΩ range:

Assume that the resistor you are measuring is reading exactly 1.00000MΩ on the 2MΩ range.

From the specs:

Accuracy = ±(0.125% of 1MΩ + 1 count)
= ±(1250Ω + 1 count)
= ±(1250Ω + 10Ω)
= ±1260Ω

Note: 1 count on the 2MΩ range (0.00001MΩ) equals 10Ω

Thus, the accuracy range for the 1.00000MΩ Auto V-Source reading is 0.99874MΩ to 1.00126MΩ.

#### Manual V-Source ohms

Accuracy for Manual V-Source Ohms is determined by calculating the accuracy of the amps measurement and the accuracy of the V-Source. Accuracy for ohms is then calculated (R = V/I) using the worst case amps and volts readings.

The following example shows how to compute Manual V-Source Ohms accuracy:

Assume that the test voltage is set for 100.000V, AUTO measurement range is enabled, and the resistor you are measuring is reading exactly 01.0000MΩ. Also assume that the amps reading is 1.000e-04 A (100.000µA) on the 200µA range. This reading is available as a multiple (NEXT) display (MEAS and SRC).

Amps accuracy for the 100µA reading (200µA range) is calculated as follows:

Accuracy = ±(% rdg + counts)
= ±(0.1% of 100µA + 5 counts)
= ±(0.1µA + 5 counts)
= ±(0.1µA + 0.005µA)
= ±(0.105µA)

Note: 5 counts on the 200µA range equals 000.005µA

Thus, the accuracy range for a 100.000µA reading is 99.895µA to 100.105µA.

V-Source accuracy (100V on the 100V range) is calculated as follows:

Accuracy = ±(% setting + offset)
= ±(0.15% of 100V + 10mV)
= ±(0.15V + 0.01V)
= ±(0.16V)

Thus, the accuracy range for the 100V V-Source setting is 99.84V to 100.16V.

Ohms can then be calculated (R = V/I) using amps and V-Source accuracy as follows:

$$\text{Ohms Upper Limit Accuracy} = \frac{100.16\text{V}}{99.895\mu A}$$

$$= 1.00265\text{M}\Omega$$

$$\text{Ohms Lower Limit Accuracy} = \frac{99.84\text{V}}{100.105\mu A}$$

$$= 0.99735\text{M}\Omega$$

$$\text{Accuracy} = \pm 2650\Omega$$

Thus, the accuracy range for the 01.0000MΩ Manual V-Source reading is 00.9974MΩ to 01.0027MΩ.

### A.1.4 Calculating coulombs accuracy

From the specifications, Coulombs is calculated as follows:

Accuracy = ±(% rdg + counts)

The following example shows how to compute accuracy for the 2µC range:

Assume that the charge you are measuring is reading exactly 1.00000µC on the 2µC range.

From the specs:

Accuracy = ±(0.4% of 1µC + 5 counts)
= ±(0.004µC + 5 counts)
= ±(0.004µC + 0.00005µC)
= ±0.00405µC

Note: 5 counts on the 2µC range equals 0.00005µC

Thus, the accuracy range for the 1.00000µC reading is 0.99595µC to 1.00405µC.