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Designed for low current applications that require fast readings

LOW I/HIGH R PRODUCTS

486
487

Picoammeter
Picoammeter/Voltage Source





486:

- **10fA sensitivity**
- **180 readings per second**
- **IEEE-488 interface**

487:

- **Resistivity measurements (<1Ω to >10^{16}Ω)**
- **± 500V source**
- **10fA sensitivity**
- **180 readings per second**
- **IEEE-488 interface**

Ordering Information

486	Picoammeter
487	Picoammeter/Voltage Source

These products are available with an Extended Warranty.

Accessories Supplied

237-ALG-2 Low Noise Triax Cable, 3-Slot Triax to Alligator Clips, 2m (6.6 ft)

Model 487 also comes with 236-ILC-3 Interlock Cable, 3m (10 ft)

486 Picoammeter

The Model 486 is a 5½-digit autoranging picoammeter designed for low current applications where fast reading rates must be made. It offers a speed of 180 readings per second.

The 486 is ideal for low-level DC current applications, such as:

- PMT current measurements
- mass spectrometer current measurements
- probe current measurements in electrochemistry
- plasma generated currents
- ion chamber currents

Operation is fast and convenient. Selectable analog and digital filters provide optimum wide-band performance with minimum noise. Autoranging selects the most appropriate range within 100ms. The measurement buffer holds up to 512 readings for fast data acquisition. Any reading within the buffer may be displayed, or the entire buffer may be searched for the maximum and minimum values.

Other important features include REL, which allows measurements to be made relative to a selectable baseline. ZERO CHECK and CORRECT functions correct for voltage offset errors using front panel or software commands.

The IEEE-488 interface provides simple integration and convenient user interaction. Digital calibration can be accomplished over the bus or completely from the front panel. The display features three selectable intensities (bright, dim, and off) for use in light-sensitive environments.

487 Picoammeter/Voltage Source

The Model 487 is designed for measurement of low currents and very high resistances. This instrument incorporates all the capabilities of the 486, and adds a programmable ±500V source. This combination of picoammeter and voltage source provides a powerful high resistance meter and fast picoammeter in one instrument.

The 487 makes current measurements from 10fA to 2mA. Two voltage source ranges are available: a 500V range with 10mV resolution and a 50V range with 1mV resolution. A PRESET button allows the user to toggle between two separate source values.

The 487 sources up to 500V, measures the current with 10fA sensitivity, and then instantly calculates the resistance value, from 500mΩ to 5×10^{16}Ω. The unit displays either current or resistance. Reading intervals from 10ms to 1000s can be programmed, simplifying tests that require a predetermined "soak" time.

Two displays, one for current readings and one for voltage sourcing, permit the voltage setting and the measured current to be viewed throughout the measurement.

The Model 487 and the 6517A are the most effective test instruments for performing such tasks as resistivity, I-V measurements, component leakage, and insulation resistance. A common test procedure, written by the American Society of Testing and Materials, D257: D-C RESISTANCE OR CONDUCTANCE OF INSULATING MATERIALS, is easily performed with the 487 or the 6517A.

486
487

Picoammeter
Picoammeter/Voltage Source

AMMETER

RANGE	RESOLUTION	ACCURACY (1 Year)* 18°–28°C ±(%rdg+offset)	ANALOG OUTPUT Rise Time (10%–90%) Analog Filter OFF	ON
2 nA	10 fA	0.3 + 500 fA	12 ms	70 ms
20 nA	100 fA	0.2 + 3 pA	4 ms	17 ms
200 nA	1 pA	0.15 + 20 pA	800 µs	4 ms
2 µA	10 pA	0.15 + 200 pA	380 µs	2 ms
20 µA	100 pA	0.1 + 2 nA	160 µs	370 µs
200 µA	1 nA	0.1 + 20 nA	160 µs	370 µs
2 mA	10 nA	0.1 + 200 nA	160 µs	370 µs

* When properly zeroed.

MAXIMUM OVERLOAD: 350V peak on nA ranges and 2µA range; 50V peak on 20µA, 200µA, and 2mA ranges. Higher voltage sources must be current limited at 3mA.

INPUT VOLTAGE BURDEN: <200µV (18°–28°C) for inputs <100µA; <2mV for inputs ≥ 100µA; 20µV/°C temperature coefficient.

TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.15 × applicable accuracy specification)/ °C.

NMRR: >60dB at 50Hz (LINE 50Hz integration) or 60Hz (LINE 60Hz integration).

ANALOG OUTPUT:

Range: ±2V for full range input (non-inverting).

Accuracy: ±(2.5% + 3mV); resistive loads >2kΩ; 18°–28°C.

Impedance: <100Ω, DC–2kHz.

RANGING: Automatic or manual.

AUTORANGING TIME: <200ms to final range (analog filter OFF).

MAXIMUM READING RATES (readings/second):

INTEGRATION SETTING	RESOLUTION	EXTERNAL CONTINUOUS INTO DATA STORE	TRIGGERED INTO DATA STORE	VIA IEEE-488 BUS**
FAST	4½-Digit	100	180	16
LINE 60Hz	5½-Digit	40	44	14
LINE 50Hz	5½-Digit	33	38	12

** One-shot on TALK, G7 data format.

VOLTAGE SOURCE (487 only):

RANGE (maximum value)	STEP SIZE (typical)	ACCURACY (1 Year) 18°–28°C ±(%setting+offset)	NOISE (p-p)*** 0.1–10Hz	TEMPERATURE COEFFICIENT 0°–18°C & 28°–50°C
±505.00 V	10 mV	0.15 + 40 mV	<1.5 mV	80 ppm + 2 mV/°C
±50.500 V	1 mV	0.1 + 4 mV	<150 µV	50 ppm + 200µV/°C

*** With LO terminal connected to chassis.

SELECTABLE CURRENT LIMIT: 2.5mA ±0.5mA or 25µA ±5µA.

WIDEBAND NOISE: <30mV p-p 0.1Hz to 20MHz.

TIME STABILITY: ±(0.003% + 1mV) over 24 hours at constant temperature.

OUTPUT RESISTANCE: <2.5Ω.

V/I OHMS (487 only)

Used with voltage source; resistance calculated from voltage setting and measured current. V/I OHMS accuracy equals voltage source accuracy plus ammeter accuracy. Typical accuracy better than 0.6% for readings between 1kΩ and 1TΩ.



486 Rear Panel



487 Rear Panel

IEEE-488 BUS IMPLEMENTATION

PROGRAMMABLE PARAMETERS: All parameters programmable except for IEEE-488 bus address and frequency for line integration.

TRIGGER TO FIRST BYTE: <50ms (trigger on TALK, ATN false to talker DAV true, G7 data format).

GENERAL

DATA STORE and MIN/MAX: Stores up to 512 readings and identifies minimum and maximum reading.

PROGRAMMABLE READING INTERVAL: 10ms to 999.999s in 1ms increments.

TRIGGER: One-shot or continuous from front panel, IEEE-488 bus, and rear panel BNC.

PROGRAMMABLE TRIGGER DELAY: 1ms to 999.999s in 1ms increments.

DISPLAY: One ten character plus one eight character alphanumeric LED displays with normal/dim/off intensity control.

MAXIMUM VOLTAGE BETWEEN VOLTAGE SOURCE AND CURRENT METER: 500V DC.

MAXIMUM VOLTAGE BETWEEN CHASSIS AND VOLTAGE SOURCE OR CURRENT METER: 500V DC.

REAR PANEL CONNECTORS:

Input Connector: 3-lug triax.

Analog Output: 5-way binding post.

External Trigger and Meter Complete: BNC connectors.

IEEE-488 Connector: Chassis grounded.

Voltage Source Output (487 only): 5-way binding post.

Interlock Connector (487 only): 3-pin miniature DIN.

EMC: Conforms to European Union Directive 89/336/EEC.

SAFETY: Conforms to European Union Directive 73/23/EEC (meets EN61010-1/IEC 1010).

ENVIRONMENT: Operating: 0°–50°C, <70% RH up to 35°C; linearly derate 3% RH/°C, up to 50°C. **Storage:** –25° to 60°C.

WARM-UP: 2 hours to rated accuracy.

POWER: 105–125V AC or 210–250V AC (external switch selectable), 90–110V and 180–220V AC version available. 50Hz or 60Hz, 45VA maximum.

DIMENSIONS: 90mm high × 213mm wide × 397mm deep (3½ in × 8⅜ in × 15⅝ in).

ACCESSORIES AVAILABLE

CABLES

236-ILC-3	Safety Interlock Cable
237-ALG-2	Low Noise Cable
7078-TRX-3	3-Slot Male Triax to 3-Slot Male Triax Cable, 0.9m (3 ft)

ADAPTERS

6171	3-Slot Male Triax to 2-Lug Female Triax
6172	2-Slot Male Triax to 3-Lug Female Triax
7078-TRX-BNC	3-Slot Male Triax to BNC Adapter

TEST FIXTURE

8008	Resistivity Chamber

RACK MOUNTS

4288-1	Single Fixed Rack Mount Kit
4288-2	Dual Fixed Rack Mount Kit
4288-4	Dual Fixed Rack Mount Kit

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