

## TRMS AC AMPS (Option 1930 and 1931) (5½ Digits)

RANGE	RESOLUTION	ACCURACY <sup>1</sup>		MAXIMUM VOLTAGE BURDEN
		± (%rdg + counts)	1 Year, 18°-28°C	
200 µA	1 nA	0.6 + 300	45Hz-10kHz	0.25 V
2 mA	10 nA	0.6 + 300		0.25 V
20 mA	100 nA	0.6 + 300		0.25 V
200 mA	1 µA	0.6 + 300		0.25 V
2 A	10 µA	0.6 + 300		2 V

<sup>1</sup> For sine wave inputs > 2000 counts.

**RESPONSE:** True root mean square, ac or ac + dc.

**CREST FACTOR:** Rated accuracy to 3. Specified for pulse width > 1ms, peak current ≤ 1.36 × range.

**AC + DC:** Add 60 counts to specified accuracy.

**SETTLING TIME:** 0.5 second to within 0.1% of change in reading.

**MAXIMUM ALLOWABLE INPUT:** 2A, 250V.

**OVERLOAD PROTECTION:** 2A fuse (250V) accessible from front panel.

**TEMPERATURE COEFFICIENT** (0°-18°C & 28°-50°C), ± (%rdg + counts): 0.04 + 10.

INPUT	ACCURACY ± dB 1 Year, 18°-28°C 45Hz-10kHz	RESOLUTION
-34 to +66 dB (20µA to 2A)	0.3	0.01 dB
-54 to -34 dB (2µA to 20µA)	2	0.01 dB

## IEEE-488 BUS IMPLEMENTATION

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

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

**INTERFACE FUNCTIONS:** SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PPO, DC1, DT1, C0, E1.

## GENERAL

**RANGING:** Manual or autoranging.

**MAXIMUM READING:** 2199999 counts in 6½-digit mode, except 1000000 on 1000V dc range and 700000 on 700V ac range.

**ZERO:** Control subtracts on-scale value from subsequent readings or allows value to be programmed.

**CONNECTORS:** Analog: Switch selectable front or rear, safety jacks. Digital: TRIGGER input and VOLTMETER COMPLETE output on rear panel, BNCs.

**WARMUP:** 1 hour to rated accuracy.

**DISPLAY:** 14, 0.5-in. alphanumeric LED digits with decimal point and polarity. Function and IEEE-488 bus status also indicated.

**ISOLATION:** Input Lo to IEEE Lo or power line ground: 500V peak. 5 × 10<sup>4</sup> max. V·Hz product. > 10<sup>10</sup>Ω paralleled by 400pF.

**DATA MEMORY:** 1 to 500 locations, programmable. Measurement intervals selectable from 1ms to 999999ms or triggered.

**BENCH READING RATE:** 5 readings/second (2/second on 20MΩ and 200MΩ ranges).

**FILTER:** Weighted average (exponential). Programmable weighting, 1 to 1/99.

**OPERATING ENVIRONMENT:** 0°-50°C, 0%-80% relative humidity up to 35°C; linearly derate 3% RH/°C, 35°C-50°C (0%-60% RH up to 28°C on 200MΩ range).

## TEMPERATURE (Thermocouple; over IEEE-488 Bus Only)

THERMOCOUPLE TYPE	RANGE	RESOLUTION	ACCURACY <sup>1</sup> 1 Year, 18°-28°C
J	-100 to +760°C	0.1°C	±0.5°C
K	-100 to +1372°C	0.1°C	±0.5°C
T	-100 to +400°C	0.1°C	±0.5°C
E	-100 to +1000°C	0.1°C	±0.6°C
R	0 to +1768°C	1 °C	±3 °C
S	0 to +1768°C	1 °C	±3 °C
B	+350 to +1821°C	1 °C	±5 °C

<sup>1</sup> Relative to external 0°C reference junction; exclusive of thermocouple errors. Junction temperature may be external.

## TEMPERATURE (RTD)

RANGE	RESOLUTION	4-WIRE ACCURACY <sup>2</sup> 1 Yr., 18°-28°C	TEMPERATURE COEFFICIENT
-100° to +630°C	0.01°C	±0.12°C	±(0.0013% + 0.005°C)/°C
-148° to +1100°F	0.01°F	±0.36°F	±(0.0013% + 0.01°F)/°F

<sup>2</sup> Excluding probe errors.

**RTD TYPE:** 100Ω platinum; DIN 43 760 or IPTS-68, alpha 0.00385 or 0.00392, 4-wire.

**MAXIMUM LEAD RESISTANCE** (each lead): 4-wire, 100.

**SENSOR CURRENT:** 1mA.

**COMMON MODE REJECTION:** < 0.005°C/V at dc, 50Hz or 60Hz (1000 unbalance, LO driven).

**MAXIMUM ALLOWABLE INPUT:** 350V peak, 250V rms, whichever is less.

**PROGRAMMABLE PARAMETERS:** Range, Function, Zero, Integration Period, Filter, EOI, Trigger, Terminator, Delay, 500-Reading Storage, Calibration, Display, Multiplex, Status, Service Request, Self Test, Output Format, Reference Junction, TRANSLATOR.

**STORAGE ENVIRONMENT:** -25° to +65°C.

**POWER:** 105-125V or 210-250V, internal switch selected, 50Hz or 60Hz, 40VA max. 90-110V and 180-220V versions available upon request.

**DIMENSIONS, WEIGHT:** 89mm high × 438mm wide × 441mm deep (3½ in. × 17¼ in. × 17¼ in.). Net weight 7.4kg (15 lbs.).

## ACCESSORIES AVAILABLE:

- Model 1600A: High Voltage Probe
- Model 1651: 50-Ampere Shunt
- Model 1681: Clip-On Test Lead Set
- Model 1682A: RF Probe
- Model 1685: Clamp-On Current Probe
- Model 1751: General Purpose Test Leads
- Model 1754: Universal Test Lead Kit
- Model 1930: True RMS ACV Option
- Model 1931: Current Option
- Model 1938: Fixed Rack Mounting Kit
- Model 1939: Slide Rack Mounting Kit
- Model 7007-1: Shielded IEEE-488 Cable, 1m
- Model 7007-2: Shielded IEEE-488 Cable, 2m
- Model 7008-3: IEEE-488 Cable, 3 ft. (0.9m)
- Model 7008-6: IEEE-488 Cable, 6 ft. (1.8m)

Specifications subject to change without notice.

### DC VOLTS

(6 1/2 Digits)

RANGE	RESOLUTION	INPUT RESISTANCE	ACCURACY <sup>1</sup> ± (%rdg + counts)			TEMPERATURE COEFFICIENT ± (%rdg + counts)/°C 0°-18° & 28°-50°C
			24 Hr., <sup>2</sup> 23° ± 1°C	90 Days, 18°-28°C	1 Year, 18°-28°C	
200 mV	100 nV	>1 GΩ	0.0020 + 20 <sup>3</sup>	0.005 + 20 <sup>3</sup>	0.008 + 20 <sup>3</sup>	0.0006 + 10
2 V	1 μV	>1 GΩ	0.0013 + 10	0.003 + 20	0.0038 + 20	0.0003 + 1
20 V	10 μV	10 MΩ	0.0015 + 10	0.006 + 10	0.008 + 30	0.0007 + 1
200 V	100 μV	10 MΩ	0.0025 + 10	0.006 + 10	0.008 + 30	0.0007 + 1
1000 V	1 mV	10 MΩ	0.004 + 10	0.007 + 10	0.009 + 50	0.0007 + 1

<sup>1</sup>For 5 1/2-digit accuracy, divide count error by 10. <sup>2</sup>Relative to calibration standards. <sup>3</sup>When properly zeroed.

**ANALOG SETTling TIME:** < 1ms (< 2ms on 200mV range), to 0.01% of step change.

**CMRR:** > 120dB at dc, 50Hz or 60Hz (± 0.05%) with 1kΩ in either lead.

**NMRR:** > 60dB at 50Hz or 60Hz (± 0.05%).

**LINEARITY:** Linearity is defined as the maximum deviation from a straight line between the readings at zero and full range: 10ppm of range for 2V-200V ranges; 15ppm of range for 200mV range; at 23°C ± 1°C.

**MAXIMUM ALLOWABLE INPUT:** 1000V peak.

**MAXIMUM MEASUREMENT RATES**  
(Into internal memory, filter and multiplex off):

3 1/2 Digit 1000 rdg/s	4 1/2 Digit 333 rdg/s	5 1/2 Digit 25 rdg/s	6 1/2 Digit 25 rdg/s
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### TRMS AC VOLTS

(Option 1930)  
(5 1/2 Digits)

RANGE	RESOLUTION		ACCURACY <sup>1</sup> ± (%rdg + counts)			
	6 1/2	5 1/2	20Hz-50Hz <sup>2</sup>	50Hz-10kHz <sup>2</sup>	10kHz-20kHz <sup>2</sup>	20kHz-100kHz <sup>2</sup>
2 V	1 μV	10 μV	1 + 100	0.25 + 100	0.35 + 300	1 + 500
20 V	10 μV	100 μV	1 + 100	0.25 + 100	0.35 + 300	1 + 500
200 V	100 μV	1 mV	1 + 100	0.25 + 100	0.35 + 300	1 + 500
700 V	1 mV	10 mV	1 + 100	0.35 + 100	0.5 + 300	1 + 500

<sup>1</sup>Multiply digit error by 10 for 6 1/2-digit accuracy. <sup>2</sup>For sinewave inputs > 2,000 counts. <sup>3</sup>For sinewave inputs > 20,000 counts.

**RESPONSE:** True root mean square, ac or ac + dc.

**CREST FACTOR:** Rated accuracy to 3. Specified for pulse widths > 10μs, peak voltage ≤ 1.36 × range.

**AC + DC:** Add 60 counts to specified accuracy.

**INPUT IMPEDANCE:** 1MΩ shunted by < 120pF.

**CMRR:** > 60dB at 50Hz or 60Hz (± 0.05%) with 1kΩ in either lead.

**3dB BANDWIDTH:** 500kHz typical.

**MAXIMUM ALLOWABLE INPUT:** 1000V peak ac + dc, 2 × 10<sup>7</sup>V•Hz.

**SETTLING TIME:** 0.5 second to within 0.1% of change in reading.

**TEMPERATURE COEFFICIENT** (0°-18°C & 28°-50°C):

< ± (0.1 × applicable accuracy specification)°C below 50kHz, ± (0.2x) for 50kHz to 100kHz.

**dB (Ref. = 1V):**

INPUT	ACCURACY ± dB		RESOLUTION
	20Hz-20kHz	1 Year, 18°-28°C 20kHz-100kHz	
-14 to +57 dB (20mV to 700V)	0.2	0.4	0.01 dBV
-34 to -14 dB (20mV to 200mV)	1.5	3 <sup>1</sup>	0.01 dBV

<sup>1</sup>Typical.

### OHMS

(6 1/2 Digits)

RANGE	RESOLUTION	CURRENT THROUGH UNKNOWN	ACCURACY <sup>1</sup> ± (%rdg + counts)			TEMPERATURE COEFFICIENT ± (%rdg + counts)/°C 0°-18° & 28°-50°C
			24 Hr., <sup>5</sup> 23° ± 1°C	90 Days, 18°-28°C	1 Year, 18°-28°C	
200 Ω <sup>2</sup>	100 μΩ	1 mA	0.0025 + 20 <sup>3</sup>	0.007 + 20 <sup>3</sup>	0.010 + 20 <sup>3</sup>	0.001 + 7
2 kΩ <sup>2</sup>	1 mΩ	1 mA	0.0025 + 20	0.005 + 20	0.007 + 20	0.001 + 1
20 kΩ <sup>2</sup>	10 mΩ	100 μA	0.0025 + 20	0.005 + 20	0.007 + 20	0.001 + 1
200 kΩ	100 mΩ	10 μA	0.0035 + 20	0.007 + 20	0.010 + 20	0.001 + 1
2 MΩ	1 Ω	1 μA	0.005 + 20	0.010 + 20	0.010 + 20	0.001 + 1
20 MΩ	10 Ω	100 nA	0.04 + 20	0.070 + 20	0.070 + 20	0.010 + 1
200 MΩ <sup>4</sup>	1 kΩ	100 nA <sup>6</sup>	3.2 + 2	3.2 + 2	3.2 + 2	0.23 + 1

<sup>1</sup>For 5 1/2-digit accuracy, divide count error by 10.

<sup>2</sup>4-wire accuracy, 2000-20kΩ ranges.

<sup>3</sup>When properly zeroed.

<sup>4</sup>Resolution on 200MΩ range is limited to 5 1/2 digits.

<sup>5</sup>Relative to calibration standards.

<sup>6</sup>Nominal short circuit current.

**CONFIGURATION:** Automatic 2- or 4-wire.

**MAX. ALLOWABLE INPUT:** 300V rms, 425V peak, whichever is less.

**MAXIMUM OPEN CIRCUIT VOLTAGE:** -7V.

**LINEARITY:** Linearity is defined as the maximum deviation from a straight line between the readings at zero and full range: 20ppm of range for 2000-20kΩ ranges, at 23°C ± 1°C.

### DC AMPS

(Option 1931)  
(5 1/2 Digits)

RANGE	RESOLUTION	ACCURACY ± (%rdg + counts) 1 Year, 18°-28°C	MAXIMUM VOLTAGE BURDEN
200 μA	1 nA	0.09 + 10	0.25 V
2 mA	10 nA	0.09 + 10	0.25 V
20 mA	100 nA	0.09 + 10	0.25 V
200 mA	1 μA	0.09 + 10	0.28 V
2 A	10 μA	0.09 + 10	1 V

**MAXIMUM ALLOWABLE INPUT:** 2A, 250V.

**OVERLOAD PROTECTION:** 2A fuse (250V), accessible from front panel.

**TEMPERATURE COEFFICIENT** (0°-18°C & 28°-50°C), (± %rdg + counts)/°C: 0.001 × 0.5.

### LOW FREQUENCY AC VOLTS

(5 1/2 Digits):

RANGE	RESOLUTION	ACCURACY (1 Year) ± (%rdg + counts) 18°-28°C	
		18°-28°C	18°-28°C
200 mV	100 μV	2 + 3	2 + 3
2 V	1 mV	2 + 3	2 + 3
20 V	10 mV	2 + 3	2 + 3
200 V	100 mV	2 + 3	2 + 3
700 V	1 V	2 + 3	2 + 3

**RESPONSE:** True root mean square, ac + dc.

**BANDWIDTH:** 0.1 to 10Hz.