

228A Programmable Voltage/Current Source

AS A CONSTANT VOLTAGE SOURCE

| RANGE | OUTPUT | | | COMPLIANCE (Source or Sink) | | |
|-------|----------|------------|--------------------------------|-----------------------------|------------|-------------------------------|
| | MAXIMUM | RESOLUTION | ACCURACY* (1 Year) 18°–28°C | MAXIMUM | RESOLUTION | ACCURACY (1 Year) 18°–28°C |
| 100 V | ±101.0 V | 100 mV | ±(0.1% + 0.1 V) | ±1.010 A | 1 mA | ±(0.1% + 4 mA) |
| | | | | ±0.1010 A | 100 µA | ±(0.1% + 400 µA) |
| 10 V | ±10.10 V | 10 mV | ±(0.1% + 10 mV) | ±10.10 A | 10 mA | ±(0.5% + 40 mA) |
| | | | | ±1.010 A | 1 mA | ±(0.1% + 4 mA) |
| | | | | ±0.1010 A | 100 µA | ±(0.1% + 400 µA) |
| 1 V | ±1.010 V | 1 mV | ±(0.1% + 1.0 mV) | ±10.10 A | 10 mA | ±(0.5% + 40 mA) |
| | | | | ±1.010 A | 1 mA | ±(0.1% + 4 mA) |
| | | | | ±0.1010 A | 100 µA | ±(0.1% + 400 µA) |

*Above 0.4% of range.

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

±(0.1 × applicable accuracy specification)/°C.

NOISE:

| RANGE | 0.1–300 Hz | 0.1–300 kHz | 0.1–20 MHz* |
|-------|-------------|-------------|-------------|
| 100 V | 2.5 mV p-p | 15 mV p-p | 25 mV p-p |
| 10 V | 1.0 mV p-p | 15 mV p-p | 25 mV p-p |
| 1 V | 0.35 mV p-p | 15 mV p-p | 25 mV p-p |

*Typical.

AS A CONSTANT CURRENT SOURCE

| RANGE | OUTPUT | | | COMPLIANCE (Source or Sink) | | |
|-------|-----------|------------|--------------------------------|-----------------------------|------------|-------------------------------|
| | MAXIMUM | RESOLUTION | ACCURACY* (1 Year) 18°–28°C | MAXIMUM | RESOLUTION | ACCURACY (1 Year) 18°–28°C |
| 10 A | ±10.10 A | 10 mA | ±(0.5% + 10 mA) | ±10.10 V | 10 mV | ±(0.1% + 40 mV) |
| | | | | ±1.010 V | 1 mV | ±(0.1% + 4 mV) |
| 1 A | ±1.010 A | 1 mA | ±(0.1% + 1.0 mA) | ±101.0 V | 100 mV | ±(0.1% + 400 mV) |
| | | | | ±10.10 V | 10 mV | ±(0.1% + 40 mV) |
| | | | | ±1.010 V | 1 mV | ±(0.1% + 4 mV) |
| 0.1 A | ±0.1010 A | 100 µA | ±(0.1% + 0.1 mA) | ±101.0 V | 100 mV | ±(0.1% + 400 mV) |
| | | | | ±10.10 V | 10 mV | ±(0.1% + 40 mV) |
| | | | | ±1.010 V | 1 mV | ±(0.1% + 4 mV) |

*Above 0.4% of range.

NOISE:

| RANGE | 0.1–300 Hz | 0.1–300 kHz | 0.1–20 MHz* |
|-------|------------|-------------|-------------|
| 10 A | 5 mA p-p | 15 mA p-p | 25 mA p-p |
| 1 A | 1.5 mA p-p | 5 mA p-p | 25 mA p-p |
| 0.1 A | 0.5 mA p-p | 5 mA p-p | 3 mA p-p |

*Typical.

OUTPUT RESISTANCE (maximum):

100V Range: 10mΩ. 10V Range: 100µΩ. 1V Range: 100µΩ.

OUTPUT INDUCTANCE:

100µH typical.

SENSING:

REMOTE or LOCAL.

REMOTE SENSING:

Corrects for up to 0.5V drop per output lead. Maximum 5Ω per sense lead for rated accuracy.

Maximum 0.5Ω per sense lead for rated output resistance.

CURRENT MONITOR OUTPUT

SCALE FACTOR: 1V = 100% of range.

ACCURACY: Same as constant current mode.

BANDWIDTH: 5kHz typical.

OUTPUT RESISTANCE: 10kΩ.

EXTERNAL MODULATION

INPUT RESISTANCE: 6.8kΩ.

SENSITIVITY: –10V increases magnitude of programmed output by 100% of full scale; +10V decreases magnitude of programmed output by 100% of full scale.

ACCURACY: 2% typical, DC to 60Hz.

MAXIMUM MODULATION: Modulation and programmed setting should not cause operation exceeding the range of 0 to 100% of full scale.

MODULATION FREQUENCY: 600Hz bandwidth.

IEEE-488 BUS IMPLEMENTATION (IEEE-488-1978)

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, RLI, PP0, DC1, DT1, C0, E1.

PROGRAMMABLE PARAMETERS: Output (Operate or Standby), Range, Voltage, Current, Trigger Mode, Sink, Modulation (Voltage or Current), Display Mode, Output Prefix (data format on readback), SRQ Mask, EOI, Terminator Characters, Status, Self Test, Memory Location (100 point memory), Dwell Time.

GENERAL

DISPLAY: Dual 3½-digit LED (0.5 in) displays indicate programmed values in Standby and output values in Operate.

FRONT PANEL PROGRAMS: COPY, SINK, IEEE Address, MOD V, MOD I, TEST, RESET.

READBACK ACCURACY: Same as output accuracy.

STANDBY: Programs output to 0V, 0A without changing ranges or polarity.

LOAD TRANSIENT RECOVERY TIME: With a resistive load the output will recover 90% of any load changes within 1ms after end of changes, provided the changes do not cause transfer to another control mode.

LINE REGULATION: <0.01% output change for AC power line changes within specified limits.

PROGRAM MEMORY (battery backed-up): Stores up to 100 output settings.

Range of Dwell Times: 10ms to 1000s.

Accuracy of Dwell Times: ±(0.05% + 2ms).

BATTERY BACKUP: Rechargeable 3.6V nickel-cadmium. 1 month retention of data with unit turned off.

TRIGGER: IN and OUT TTL-compatible.

PROGRAMMING RESPONSE TIME: <100ms on fixed range (typical).

MAXIMUM COMMON MODE VOLTAGE (output or output common to chassis): 100V DC.

OUTPUT CONNECTIONS: Quick disconnect card with screw terminals for output, modulation, current monitor, and external sense. BNC (chassis isolated) connectors for TRIGGER IN/OUT.

SELF TEST: Analog and digital circuits tested at power-on. Power supplies, temperatures, and output continuously monitored.

WARM-UP: 10 minutes to rated accuracy.

COOLING: Internal fan for forced air cooling.

POWER: 105–125 or 210–250V AC (internally switch selectable), 50 or 60Hz, 500VA maximum.

ENVIRONMENT: Operating: 0° to 50°C, <80% non-condensing RH below 35°C. **Storage:** –25° to 70°C.

DIMENSIONS, WEIGHT: 133mm high × 435mm wide × 448mm deep (5¼ in × 17¼ in × 17½ in). Net weight 10.9kg (24 lb).

ACCESSORIES SUPPLIED: Output Connector, instruction manual.

ACCESSORIES AVAILABLE:

Model 2288: Fixed Rack Mounting Kit

Model 2289: Slide Rack Mounting Kit

Model 7008-3: IEEE-488 Cable, 0.9m (3 ft)

Model 7008-6: IEEE-488 Cable, 1.8m (6 ft)