

# 228 SPECIFICATIONS

PART NUMBER

SPEC-228

## AS A CONSTANT VOLTAGE SOURCE

RANGE	OUTPUT		COMPLIANCE (Source or Sink)			
	MAXI-MUM	RESO-LUTION	ACCURACY* (1 YEAR) 18°-28°C	MAXI-MUM	RESO-LUTION	ACCURACY (1 YEAR) 18°-28°C
100V	±101.0V	100mV	±(0.1%+0.1 V)	±1.010 A	1mA	±(0.1% + 4mA) ±0.1010A 100 µA ±(0.1%+400 µA)
10V	±10.10V	10mV	±(0.1% + 10mV)	±10.10 A	10mA	±(0.5% + 40mA) ±1.010 A 1mA ±(0.1% + 4mA) ±0.1010A 100 µA ±(0.1%+400 µA)
1V	±1.010V	1mV	±(0.1%+1.0mV)	±10.10 A	10mA	±(0.5% + 40mA) ±1.010 A 1mA ±(0.1% + 4mA) ±0.1010A 100 µA ±(0.1%+400 µA)

\*Above 0.4% range.

TEMPERATURE COEFFICIENT (0°-18°C & 28°-50°C): ±(0.1×applicable accuracy specification)/°C.

NOISE:	RANGE	0.1-300Hz	0.1-300kHz	0.1-20MHz
	100V	5.0mV p-p	15mV p-p	25mV p-p typ.
	10V	2.0mV p-p	15mV p-p	25mV p-p typ.
	1V	0.7mV p-p	15mV p-p	25mV p-p typ.

OUTPUT RESISTANCE (max.): 100V Range: 10mΩ. 10V Range: 100 µΩ. 1V Range: 100 µΩ.

OUTPUT INDUCTANCE: 100µH typical.

SENSING: Rear panel switch selectable REMOTE and LOCAL sensing.

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.

## AS A CONSTANT CURRENT SOURCE

RANGE	OUTPUT (1 YR., 18°-28°C)		COMPLIANCE (Source or Sink)			
	MAXI-MUM	RESO-LUTION	ACCURACY* (1 YEAR) 18°-28°C	MAXI-MUM	RESO-LUTION	ACCURACY (1 YEAR) 18°-28°C
10 A	±10.10 A	10mA	±(0.5% + 10mA)	±10.10V	10mV	±(0.1% + 40mV) ±1.010V 1mV ±(0.1% + 4mV)
1 A	±1.010 A	1mA	±(0.1%+1.0mA)	±101.0V	100mV	±(0.1%+400mV) ±10.10V 10mV ±(0.1% + 40mV) ±1.010V 1mV ±(0.1% + 4mV)
0.1A	±0.1010A	100 µA	±(0.1%+0.1mA)	±101.0V	100mV	±(0.1%+400mV) ±10.10V 10mV ±(0.1% + 40mV) ±1.010V 1mV ±(0.1% + 4mV)

\*Above 0.4% of range.

TEMPERATURE COEFFICIENT (0°-18°C & 28°-50°C): ±(0.1×applicable accuracy specification)/°C.

NOISE:	RANGE	0.1-300Hz	0.1-300kHz	0.1-20MHz
	10 A	25 mA p-p	25mA p-p	25mA p-p typ.
	1 A	5 mA p-p	5mA p-p	10mA p-p typ.
	0.1A	0.5mA p-p	2mA p-p	3mA p-p typ.

OUTPUT RESISTANCE (min.): 10A Range: 10°Ω. 1A Range: 10°Ω. 0.1A Range: 10°Ω.

OUTPUT CAPACITANCE: 0.2µF typical.

OUTPUT LOAD: Must be non-inductive.

## 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 zero to 101% 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, RL1, 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.) indicate programmed values in Standby and output values in Operate.

READBACK ACCURACY: Same as output accuracy.

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

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.

STANDBY: Programs output to 0V, 0A without changing ranges or polarity. LINE REGULATION: Less than 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: Less than 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.

WARMUP: 10 minutes to rated accuracy.

POWER: 105-125 or 210-250 V ac (internally switch selectable), 50 or 60Hz, 300 VA maximum.

COOLING: Internal fan for forced air cooling.

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

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

## ACCESSORIES AVAILABLE:

Model 2288: Fixed Rack Mounting Kit  
Model 2289: Slide Rack Mounting Kit

Specifications subject to change without notice.

Model 7006-3: IEEE-488 Cable (3 ft.) Model 7008-6: IEEE-488 Cable (6 ft.)