SPECIFICATIONS

428 SPECIFICATIONS

GAIN SETTING V/A	ACCURACY[1] 18°–28°C ±(% input + offset)	ACCURACY[1] TEMPERATURE COEFFICIENT ±(% input + offset)/°C	LOW NOISE[2] RISE TIME (10%–90%) msec.	LOW NOISE[2] NOISE RMS	MAXIMUM SPEED RISE TIME (10%–90%) µsec.[3]	MAXIMUM SPEED NOISE RMS[3]	DC INPUT RESISTANCE
10^3	0.45 + 1.2 µA	0.01 + 40 nA	0.1	90 nA	2	100 nA	< 0.6 Ω
10^4	0.31 + 120 nA	0.01 + 4 nA	0.1	9 nA	2	15 nA	< 0.7 Ω
10^5	0.31 + 12 nA	0.01 + 400 pA	0.1	900 pA	5	2 nA	< 1.6 Ω
10^6	0.34 + 1.2 nA	0.01 + 40 pA	0.1	90 pA	10	500 pA	< 10 Ω
10^7	0.5 + 122 pA	0.015 + 4.3 pA	0.1	9 pA	15	200 pA	<100 Ω
10^8	1.4 + 14 pA	0.015 + 700 fA	1	0.5 pA	40	30 pA	< 1 kΩ
10^9	2.5 + 3 pA	0.025 + 300 fA	10	50 fA	100	10 pA	< 10 kΩ
10^{10}	2.5 + 1.6 pA	0.025 + 250 fA	100	4 fA	250	2 pA	<100 kΩ
10^{11}*	2.7 + 1.6 pA	0.028 + 250 fA	300	1.2 fA	250	2 pA	<100 kΩ

[1] When properly zeroed using zero correct.
[2] Selectable filtering will improve noise specifications; see operator's manual for details (typical value shown).
[3] With up to 100pF shunt capacitance; autofilter on; low pass filter off.
* 10^{11} setting is 10^{10} setting with GAIN ×10 enabled; other entries are for GAIN ×10 disabled.

INPUT:
Voltage Burden: <200µV (18°–28°C) for inputs <100µA; <10mV for 10mA input; 20µV/°C temperature coefficient.
Maximum Overload: 100V on 10^4 to 10^{11}V/A ranges; 10V on 10^3V/A range. Higher voltage sources must be current limited at 10mA.

OUTPUT:
Range: ±10V, 1mA; bias voltage off.
Impedance: <100Ω DC–175kHz.

LOW PASS FILTER:
Ranges: 10µsec. to 300msec. (±25%) in 1, 3, 10 sequence or OFF.
Attenuation: 12dB/octave.

GAIN ×10: Rise time, noise, and input resistance are unchanged when selecting GAIN ×10; gain accuracy and temperature coefficient are degraded by 0.2% and 0.003%/°C respectively.

CURRENT SUPPRESSION:

RANGE	RESOLUTION	ACCURACY ±(%setting + offset)
±5 nA	1 pA	3.0 + 10 pA
±50 nA	10 pA	1.6 + 100 pA
±500 nA	100 pA	0.8 + 1 nA
±5 µA	1 nA	0.7 + 10 nA
±50 µA	10 nA	0.6 + 100 nA
±500 µA	100 nA	0.6 + 1 µA
±5 mA	1 µA	0.6 + 10 µA

BIAS VOLTAGE:
Range: ±5V.
Resolution: 2.5mV.
Accuracy: ±(1.1%rdg + 25mV).

IEEE-488 BUS IMPLEMENTATION (428-PROG ONLY)

MULTILINE COMMANDS: DCL, LLO, SDC, GTL, UNT, UNL, SPE, SPD.
UNILINE COMMANDS: IFC, REN, EOI, SRQ, ATN.
INTERFACE FUNCTIONS: SH1, AH1, T6, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1.
PROGRAMMABLE PARAMETERS: All parameters and controls programmable except for IEEE-488 bus address.
EXECUTION SPEED: (measured from DAV true to RFD true on bus)
Zero correct and autosuppression commands: <3 sec.
Save/Recall Configuration commands: <500 msec.
All other commands: <40 msec.

GENERAL

DISPLAY: Ten character alphanumeric LED display with normal/dim/off intensity control.
REAR PANEL CONNECTORS:
Input BNC: Common connected to chassis through 1kΩ.
Output BNC: Common connected to chassis.
IEEE-488 Connector: 428-PROG only.
5-Way Binding Post: Connected to chassis.
WARM-UP: 1 hour to rated accuracy.
ENVIRONMENT: Operating: 0°–50°C, <70% R.H. up to 35°C; linearly derate R.H. 3%/°C up to 50°C. **Storage:** –25°C to 65°C.
POWER: 105–125 VAC or 210–250 VAC, switch selected. (90–110/180–220 VAC available.) 50Hz or 60Hz. 45VA maximum.
DIMENSIONS, WEIGHT: 90mm high × 213mm wide × 397mm deep (3½ in. × 8⅜ in. × 15⅝ in.). Net weight 3.4kg (7.4 lbs.).
ACCESSORIES SUPPLIED: Instruction Manual, Quick Reference Guide, power line cord.