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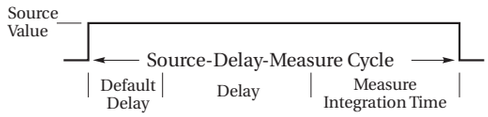
Find the *Keithley 238* at our website: *Click HERE*

238 High Current Source-Measure Unit

SOURCE-MEASURE UNIT: Sources voltage while measuring current, or sources current while measuring voltage.

FUNCTION: Can be used as DC source or meter, sweep source, or full source-measure unit.

SOURCE-DELAY-MEASURE CYCLE:



Default Delay: Fixed delay for instrument settling.

User Delay: Additional delay for device under test or system capacitance.

MEASURE:

Integration Time			
Fast	416	µs	4-digit resolution
Medium	4	ms	5-digit resolution
Line Cycle	16.67	ms (60 Hz)	5-digit resolution
	20.00	ms (50 Hz)	

Elapsed Time: Measures and stores time from sweep trigger to measurement complete for each step of sweep.

RANGING:

Source: Auto-ranging through keypad entry; fixed range selection using rotary dial and SELECT keys (DC function). Fully programmable in SWEEP function.

Measure: Auto or fixed range. Fixed range selection made by choice of COMPLIANCE value.

FILTER: Takes n measurements, calculates and outputs average (n = 2, 4, 8, 16, or 32, selectable).

SUPPRESS: Subtracts displayed measurement from subsequent readings.

MENU: DC Measurement Delay, Default Delay On/Off, Local/Remote Sense, 50/60Hz, IEEE Address, Self Tests.

DATA ENTRY: Numeric keypad or detented rotary dial.

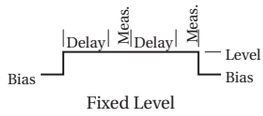
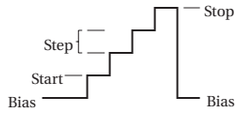
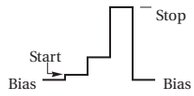
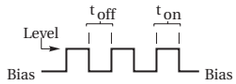
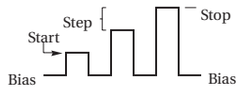
TRIGGER:

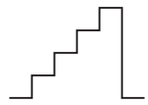
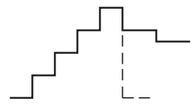
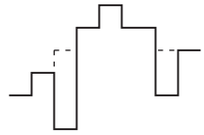
Input and Output: Set for any phase of SOURCE-DELAY-MEASURE sequence or trigger output at end of sweep.

Origin: Internal, External (including front panel MANUAL TRIGGER button), IEEE-488 bus (TALK, GET, "X").

MEMORY: Stores one full sweep (up to 1000 points) of source, delay, and measure values, elapsed times, and sweep parameters. Lithium battery backup.

INTERLOCK: Use with test fixture or external switch. Normally closed; open puts instrument in standby.

SWEEP WAVEFORMS	DESCRIPTION
 Fixed Level	LEVEL, COUNT (number of DELAY-MEASURE cycles), DELAY, BIAS
 Linear Stair	START, STOP, STEP, DELAY, BIAS
 Logarithmic Stair	START, STOP, POINTS/DECADE (5, 10, 25, or 50), DELAY, BIAS
 Pulse	LEVEL, COUNT, T_{ON}, T_{OFF}, BIAS
 Linear Stair Pulse	START, STOP, STEP, T_{ON}, T_{OFF}, BIAS
 Logarithmic Stair Pulse	START, STOP, POINTS/DECADE (5, 10, 25, or 50), T_{ON}, T_{OFF}, BIAS

WAVEFORM OPERATORS	DESCRIPTION
 Create	Allows selection of waveform parameters. Generates all source values.
 Append	Combines multiple waveforms and adds new points to those already in memory.
 Modify	Select and change any points in a previously created (or appended) waveform.

2/23/01
Rev. A

LTR	REVISIONS	APP.	DATE

DRN.	DATE
CKD.	DATE
APP.	DATE

KEITHLEY Keithley Instruments, Inc.
Cleveland, Ohio 44139

SPECIFICATIONS

PART NUMBER
SPEC-238

BRUNING 40-21 62198-SBG

FORM 28777A-SBG

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238 High Current Source-Measure Unit

VOLTAGE

	SOURCE V			MEASURE V		
	RANGE (Max. Value)	STEP SIZE	ACCURACY (1 Year, 18°–28°C)	RESOLUTION 4-Digit	RESOLUTION 5-Digit	ACCURACY[1] (1 Year, 18°–28°C)
	±1.5000 V	100 µV	±(0.033% +800 µV + [I_O/I_{FS}] × 600µV)[2]	100 µV	10 µV	±(0.028% + 450µV + [I_O/I_{FS}] × 600µV)[2]
	±15.000 V	1 mV	±(0.033% + 2.7mV)	1 mV	100 µV	±(0.025%+ 1.3mV)[2]
	±110.00 V	10 mV	±(0.033% + 24mV)	10 mV	1 mV	±(0.025%+ 10mV)

I_O = Output current; I_{FS} = Full scale on selected current range

[1] Specifications apply for 5-digit resolution. For 4-digit resolution add 100ppm of range. Assumes remote sense for I > 100µA.

[2] On the 1A range use [I_O/I_{FS}] × 250µV.

COMPLIANCE: Bipolar current limit set with single value.
Maximum: ±1A (±100mA on 110V range).
Minimum: ±1% of selected voltage range.
Accuracy, Step Size: Same as current source.

NOISE (p-p typical):

RANGE	0.1–10Hz
110 V	< 3ppm of range
15 V	< 3ppm of range
1.5V	<10ppm of range

WIDEBAND NOISE: 0.1 to 20MHz, 8mV p-p typical.
OVERSHOOT: <0.01% (110V step, 10mA range).
SETTLING TIME: <500µs to 0.01% (110V step, 10mA range).
NMRR: >60dB at 50 or 60Hz (LINE CYCLE integration time selected).
CMRR: >120dB at DC, 50 or 60Hz (LINE CYCLE integration time selected).
INPUT IMPEDANCE (as a voltmeter): >10^{14}Ω paralleled by <20pF.

CURRENT

	SOURCE I			MEASURE I		
	RANGE (Max. Value)	STEP SIZE	ACCURACY (1 Year, 18°–28°C)	RESOLUTION 4-Digit	RESOLUTION 5-Digit	ACCURACY[1,2] (1 Year, 18°–28°C)
	±1.0000 nA	100 fA	±(0.3 %+ 450 fA)	100 fA	10 fA	±(0.3 % + 100 fA)[2]
	±10.000 nA	1 pA	±(0.3 %+ 2 pA)	1 pA	100 fA	±(0.3 % + 1 pA)
	±100.00 nA	10 pA	±(0.21%+ 20 pA)	10 pA	1 pA	±(0.21 % + 6 pA)
	±1.0000 µA	100 pA	±(0.05%+ 200 pA)	100 pA	10 pA	±(0.04 % + 6 pA)
	±10.000 µA	1 nA	±(0.05%+ 2 nA)	1 nA	100 pA	±(0.035% + 700 pA)
	±100.00 µA	10 nA	±(0.05%+ 20 nA)	10 nA	1 nA	±(0.035% + 6 nA)
	±1.0000 mA	100 nA	±(0.05%+ 200 nA)	100 nA	10 nA	±(0.035% + 60 nA)
	±10.000 mA	1 µA	±(0.05%+ 2 µA)	1 µA	100 nA	±(0.038% + 600 nA)
	±100.00 mA	10 µA	±(0.1 %+ 20 µA)	10 µA	1 µA	±(0.1 % + 6 µA)
	±1.0000 A	100 µA	±(0.12%+ 700 µA)	100 µA	10 µA	±(0.12 % + 300 µA)

[1] Specifications apply for 5-digit resolution. For 4-digit resolution, all offset terms are 200ppm of range.

[2] Offset specification applies for 23°C ± 1°C with suppression. Temperature coefficient 50fA/°C.

COMPLIANCE: Bipolar voltage limit set with single value.
Maximum: ±110V (±15V on the 1A range).
Minimum: ±1% of selected current range.
Accuracy, Step Size: Same as voltage source.

NOISE (p-p of range): 0.1–10Hz: <3ppm (<20ppm on 1nA, 10nA and 1A ranges).
OVERSHOOT: <0.01% typical (10mA step, R_L = 10kΩ).
SETTLING TIME: <500µs to 0.01% (10mA step, R_L = 10kΩ).
OUTPUT R, C: >10^{14}Ω paralleled by <20pF (on 1nA range).

EXECUTION SPEED

MINIMUM SOURCE-DELAY-MEASURE CYCLE TIME: 1ms.
RESPONSE TO IEEE-488 COMMAND (as a source): 25ms.
MEASUREMENT RATE: 1ms per point into internal buffer.
CONTINUOUS MEASUREMENT SPEED (source DC value over IEEE-488 bus): 110 readings per second.
TRIGGER LATENCY TIME: <2ms.

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, PP0, DC1, DT1, C0, E1.
All front panel functions and setups are available over the IEEE-488 bus, in addition to Status, Service Request, Output Format, EOI, Trigger, and Terminator.
IEEE-488 address is set from the front panel menu.

GENERAL

LOAD CAPACITANCE: Stable into 20,000pF typical.
REMOTE SENSE: Corrects for up to 2V drop in each output lead. Maximum 1kΩ per sense lead for rated accuracy. Residual output resistance (as a voltage source) is 0.5Ω.
GUARD:Output Resistance: ≤12kΩ.
Maximum Output Current: ±2mA.
Open Circuit Offset Relative to Output HI: ±2mV max.
ISOLATION (Output LO to chassis): Typically >10^{10}Ω in parallel with 650pF.
MAXIMUM COMMON MODE VOLTAGE: 200V peak.
CONNECTORS:Outputs: 3-lug triax.
Trigger Input/Output: BNC.
Interlock: 3-pin miniature DIN.
TEMPERATURE COEFFICIENT (0°–18°C & 28°–50°C): ±(0.1 × applicable accuracy specification)/°C.
ENVIRONMENT:
Operating: 0°–50°C, 70% relative humidity up to 35°C. Linearly derate 3% RH/°C, 35°–50°C.
Storage: –25° to 65°C.
WARM-UP: One hour to rated accuracy.
COOLING: Internal fan forced air cooling.
POWER: 105–125 or 210–250V AC (external switch selectable), 90–110V and 180–220V version available. 120VA max.
DIMENSIONS, WEIGHT: 89mm high × 435mm wide × 448mm deep (3½ in × 17⅛ in × 17⅝ in). Net weight 9kg (19.75 lb).
ACCESSORIES SUPPLIED:
Model 7078-TRX-10: Triax to Triax Cable, 3m (10 ft.) (2 supplied)
Model 236-ILC-3: Interlock Cable
ACCESSORIES AVAILABLE:
Model 8000-10: Equipment Rack for 3 SMUs (10 in.)
Model 8000-14: Equipment Rack for 4 SMUs (14 in.)

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