

SMU2090 Source-Measure-Unit

The mb-Technologies Source-Measure-Unit SMU1090 is designed for testing high-power semiconductor devices at high accuracy. This instrument combines a bipolar voltage source for voltages from 1 mV to ± 200 V (4 ranges), a bipolar current source for currents from 1 pA to ± 20 A (12 ranges), a voltage meter and a current meter. When used as voltage source, a current compliance can be defined, likewise, when used as a current source, a voltage compliance can be used.

The Source-Measure-Unit can be used as stand-alone measurement unit or as part of a larger test system. Up to 128 units can be controlled by one personal computer using a high-speed bus system.

In order to achieve accurate measurements the Source-Measure-Unit has separate Force and Sense connections (Kelvin guarding) which eliminate voltage drop across cables and connectors when measuring higher currents. The cables and connectors are actively guarded and shielded (tri-axial connections) to avoid leakage and noise when measuring lower currents. This also speeds up measurements as the cable capacitance is virtually eliminated by the active guard. Each unit has a ground sense input which needs to be connected to a central ground hub together with the other instruments involved.

The Source-Measure-Unit has a microcontroller build into. In addition to basic measurement operations like averaging and auto-ranging it allows approx. 40000 test operations and 10000 results to be executed and stored independently of the main computer.

Features:

- Full power four quadrant operation
- Separate Force/Sense connections
- All signal paths guarded and shielded
- Common ground sense connection
- Large internal program and data memory
- Internal voltage and current auto-range
- Local trigger bus to communicate with other instruments
- Calibration data stored on-board
- High speed communication interface

Power:

Output Voltage	Output Current	Maximum Output Power
≤ 5 V	± 20 A	100 W
5...10 V	± 10 A	100 W
20 .. 50 V	± 1 A	50 W
> 20 V	± 250 mA	50 W

Voltage Ranges

Voltage Range	Force Resolution	Measure Resolution	Accuracy
200 V	10 mV	1 mV	0.05% (value) + 0.05% (range)
20 V	1 mV	100 µV	0.05% (value) + 0.05% (range)
2 V	100 µV	10 µV	0.05% (value) + 0.05% (range)
200 mV	10 µV	1 µV	0.20% (value) + 0.20% (range)

Current Ranges

Current Range	Force Resolution	Measure Resolution	Accuracy
20 A	1 mA	100 µA	0.10% (value) + 0.10% (range)
10 A	500 µA	50 µA	0.10% (value) + 0.10% (range)
1 A	50 µA	5 µA	0.10% (value) + 0.10% (range)
100 mA	5 µA	500 nA	0.05% (value) + 0.05% (range)
10 mA	500 nA	50 nA	0.05% (value) + 0.05% (range)
1 mA	50 nA	5 nA	0.05% (value) + 0.05% (range)
100 µA	5 nA	500 pA	0.05% (value) + 0.05% (range)
10 µA	500 pA	50 pA	0.05% (value) + 0.05% (range)
1 µA	50 pA	5 pA	0.05% (value) + 0.05% (range)
100 nA	5 pA	500 fA	0.10% (value) + 0.10% (range)
10 nA	500 fA	50 fA	0.20% (value) + 0.20% (range)
1 nA	50 fA	5 fA	0.50% (value) + 0.50% (range)

Specification Conditions:

- Accuracy is defined as percentage of set value or reading + offset
- 23°C ± 5°C, RH < 60%. Unspecified for operation at other temperatures or relative humidity.
- At least 30 minutes warm-up after power-on.
- Integration "long", accuracy specifications double for integration "normal", 5 times for "fast".
- Kevin-connections and guarding plus shielding of cables.
- Calibration interval is 1 year.

Supplemental Information:

Compliance Accuracy

Compliance accuracy is 2x the source specification.

Settling and Measurement Time

Settling time is typical 20 ms for current ranges ≥ 1 A, 4 ms for current ranges ≥ 1 μ A. This also includes voltage and current measurement.

Overshoot

Overshoot is typical within specification limits.

Noise

Voltage force noise is typical $< 0.01\%$ of range max. 5 mV. Current force noise is typical $< 0.1\%$ of range. Measurement noise is typical $<$ specification accuracy.

Remote Sensing

For remote sensing the maximum acceptable voltage drop over the cable resistor in series with the Force connection is 1 V, i.e. the parasitic resistance must be not higher than 0.05 Ohms for 20 A output current.

Self Protection

The unit is protected against shorts to any voltage within ± 210 V for infinite periods of time however connecting the outputs to any device delivering voltages outside these values will immediately destroy the unit and void warranty.

Power Requirements

230 VAC 50/60 Hz 600 VA

Dimensions

480 mm x 175 mm x 465 mm (W x H x D)