

M140

Multifunction calibrator



HIGHLIGHTS

- AC/DC voltage/current to 1000V/20A
- Basic accuracy 30 ppm
- AC/DC power, energy, phase shift, resistance, capacitance, frequency, TC, RTD
- Built-in process multimeter
- GPIB and RS-232 as standard

DESCRIPTION

Multifunction calibrator M140 is calibrator-tester for use in calibration laboratories as an electrical standard of voltage, current, resistance, capacity and frequency. Load capacity of the voltage output is 30 mA - enough for most high consumption analogue power-meters. Installed harmonic and non-harmonic shape signals allow for testing meter sensitivity to distorted signals by a signal with various crest factor. Frequency modes, suitable for calibration of multimeters and time bases of oscilloscopes, have adjustable 6-digit frequency, amplitude and duty ratio of the output signal. The calibrator can measure temperature with TC and RTD temperature sensors to show it on display or use for cold junction compensation.

Internal multimeter with basic capability to measure VDC, IDC, R and F process signals is standard part of M140 full version. Meter functions can run simultaneously with source functions to measure and evaluate output signals of various types of transducers as well as external sensors (strain gauge, pressure, torsion, strength, etc.).

Another useful feature of the multimeter is 10-point automated UUT test. The calibrator can be set to source an output signal in up to 10 predefined steps and compare UUT's output with predefined specifications and optionally operate the UUT or a switch using a relay output. The results are then displayed directly on the calibrator screen in a comprehensive table with PASS/FAIL sign at each step.

SPECIFICATION

DC/AC Voltage Ranges & 1 year Accuracy [ppm]

Range	DC	20 Hz – 10 kHz **	10 kHz – 50 kHz
0 mV * – 20 mV	300 + 10 µV	2 000 + 30 µV	2000 + 1000 + 20 µV
20 mV – 200 mV	100 + 15 µV	1 000 + 80 µV	1500 + 500 + 20 µV
200 mV – 2 V	30 + 16 µV	250 + 100 µV	500 + 200 µV
2 V – 20 V	30 + 100 µV	250 + 1 mV	500 + 6 mV
20 V – 240 V	30 + 1 mV	250 + 20 mV	—
240 V – 1000 V	50 + 50 mV	300 + 200 mV	—

* AC range starts at 0.1 mV.
** Frequency limited to 1 kHz above 200 V.

DC/AC Current Ranges & 1 year Accuracy [ppm]

Range	DC	20 Hz – 1 kHz	1 kHz – 5 kHz
0 µA * – 200 µA	500 + 20 nA	1500 + 20 nA	3000 + 220 nA
200 µA – 2 mA	200 + 100 nA	700 + 200 nA	2000 + 1 µA
2 mA – 20 mA	100 + 600 nA	500 + 1 µA	2000 + 10 µA
20 mA – 200 mA	100 + 6 µA	500 + 10 µA	2000 + 100 µA
200 mA – 2 A	150 + 100 µA	500 + 100 µA	—
10 A – 20 A **	200 + 2 mA	1000 + 6 mA	—

* AC range starts at 1 µA.
** Output current time is limited above 10 A. Max. 30 sec at 20 A.

TC Temperature Sensor Simulation

R	range [°C]	-50-0	0-400	400-1000	1000-1767	T	range [°C]	-200- -100	-100-0	0-100	100-400
	accuracy [°C]	3.2	2.1	1.4	1.7		accuracy [°C]	0.9	0.5	0.4	0.4
S	range [°C]	-50-0	0-250	250-1400	1400-1767	E	range [°C]	-250- -100	-100-280	280-600	600-1000
	accuracy [°C]	2.7	2.1	1.7	2.0		accuracy [°C]	1.6	0.4	0.5	0.5
B	range [°C]	400-800	800-1000	1000-1500	1500-1820	K	range [°C]	-200- -100	-100-480	480-1000	1000-1372
	accuracy [°C]	2.8	1.8	1.6	1.8		accuracy [°C]	1.0	0.6	0.7	0.8
J	range [°C]	-210- -100	-100-150	150-700	700-1200	N	range [°C]	-200- -100	-100-0	0-580	580-1300
	accuracy [°C]	0.9	0.5	0.6	0.7		accuracy [°C]	1.2	0.7	0.6	0.8

GENERAL DATA

Warm up time:	60 min
Storing temperature:	0 to 40 °C @ max. 80 % r.h.
Reference temperature:	23 °C ± 2 °C
Dimensions & weight:	470 x 150 x 520 mm (W, H, D), 23 kg
Power supply:	115 V/230 V-50/60 Hz
Max. power consumption:	250 VA

ADDITIONAL FULL VERSION FUNCITONS

Function Shape

Range of voltage:	1 mV to 200 V
Range of current:	100 μ A to 2 A
Output waveform:	square, positive, negative, symmetrical, ramp A, ramp B, triangle, truncated sinus
Peak value accuracy:	0.3 %

AC/DC Power & Energy

Function	Range	Accuracy
DC Voltage	0.2 V–240 V	40–150 ppm
DC Current	2 mA–10 A	500–1500 ppm
AC Voltage	0.2 V–240 V	300–1200 ppm
AC Current	2 mA–10 A	500–1500 ppm
Frequency	20–400 Hz	50 ppm
Power factor	-1 – +1	0.005–0.0005
Phase	0–360°	0.15–0.25°
Time in energy mode	10 s–1999 s	0.1 s

Accuracy of AC power depends on set value of voltage, current, phase.
Best accuracy is 0.08 %.
Accuracy in energy mode depends on set value of voltage, current, phase and time. Best accuracy is 0.09 %.

Multimeter

Quantity	Range	Accuracy
DC voltage – DCV	0 – +/-12 V	0.01 % +500 μ V
DC voltage – mVDC	0 – +/-2 V	0.02 % +7 μ V
DC current	0 – +/-25 mA	0.015 % +300 nA
Frequency	1 Hz–15 kHz	0.005
Resistance	0–2 k Ω	0.02 % + 10 m Ω
RTD temperature	-150 – +600 °C	0.1 °C
TC temperature	-250 – +1820 °C	0.4–4 °C
Strain gauge sensors *	depends on the sensor	0.05 % + 10 μ V +sensor unc.

* Voltage 2 to 10 V DC
Input impedance min. 100 M Ω
Sensitivity 0.5 mV/V to 100 mV/V
Displayed unit programmable
Sorting function 1 x closure, 1 x opener
Max. supply current 40 mA

Resistance and Capacitance

Range	ppm of value	Range	% of value
0 – 100 Ω	300 + 10 m Ω	900 pF – 2.5 nF	0.5 + 15 pF
100 Ω – 200 k Ω	150	2.5 nF – 1 μ F	0.5
200 k Ω – 1M Ω	500	1 μ F – 5 μ F	1
1 – 4 M Ω	1000	5 μ F – 10 μ F	1.5
4 – 20 M Ω	2000	10 μ F – 50 μ F	2
20 – 50 M Ω	5000		

Maximum compliance voltage 5 – 8 Vpk in resistance mode, 5.5 Vpk in capacitance mode.

RTD Temperature Sensor Simulation

Type:	Pt 1.385, Pt 1.392, Ni
Range of RO:	20 Ω to 2 k Ω
Range of temperature:	-200 to +850 °C
Temperature accuracy:	0.04 °C to 0.5 °C
Temperature scale:	ITS 90, PTS 68

Frequency

Type	Range	Frequency acc.	Amplitude	Amplitude acc. [%]	Ratio	Ratio acc.
PWM (POS, NEG, SYM)	0.1 Hz – 100 kHz	0.005 %	1 mV – 10 V	0.1 %	0.1 – 0.99	0.0005
HSO *7	0.1 Hz – 20 MHz	0.005 %	5 V _{pk-pk}	10 %	—	—

*7 Rise time of generated output waveform in HSO function < 5 ns