

M142

Multifunction calibrator



HIGHLIGHTS

- AC/DC voltage/current to 1000V/30A
- Basic accuracy 10 ppm
- AC/DC power, energy, phase shift, resistance, capacitance, frequency, TC, RTD
- Built-in process multimeter
- GPIB and RS-232 as standard

DESCRIPTION

M140/142 series represents category of multifunction calibrators of electric quantities for general application. Various versions offer different range of electric functions, accuracies and user comfortability. Build-in multimeter enables complex testing and calibrating of sources and meters of electric quantities. Multimeters, scopes, power meters, etc. can be directly calibrated with the instrument in sourcing mode. In measuring mode, the calibrator can be used for testing of DC voltage/current sources, for temperature measurements and for measuring other non-electric quantities through external sensors. Simultaneous generation and measurement allows calibration, adjusting and testing of various types of regulators, panel-meters, converters, indicators etc. Either manual control from the front panel keyboard, or remote control via GPIB bus or via RS-232 is available.

DC Voltage Ranges & Accuracy/1 year

Range	[ppm of value]
0 μ V – 20 mV	50 + 6 μ V
20 mV – 200 mV	15 + 8 μ V
200 mV – 2 V	12 + 10 μ V
2 V – 20 V	10 + 50 μ V
20 V – 240 V	20 + 500 μ V
240 V – 1000 V	50 + 20 mV

DC Current Ranges & Accuracy/1 year

Range	[ppm of value]
0 μ A – 200 μ A	500 + 20 nA
200 μ A – 2 mA	200 + 100 nA
2 mA – 20 mA	100 + 600 nA
20 mA – 200 mA	100 + 6 μ A
200 mA – 2 A	150 + 100 μ A
2 A – 20 A *1	200 + 2 mA
20 A – 30 A *1	300 + 3 mA

*1 Output current time is limited above 10 A.

SPECIFICATION

AC Voltage Ranges & Accuracy/1 year

Range	[ppm of value + V]		
	20 Hz – 10 kHz	10 kHz – 50 kHz	50 kHz – 100 kHz
1 mV – 20 mV	2 000 + 30 μ V	2000 + 1000 + 20 μ V	1.0 + 0.10 + 20 μ V
20 mV – 200 mV	1 000 + 80 μ V	1500 + 500 + 20 μ V	0.3 + 0.05 + 20 μ V
200 mV – 2 V	180 + 100 μ V	500 + 200 μ V	0.2 + 1 mV
2 V – 20 V	180 + 1 mV	500 + 6 mV	0.2 + 10 mV
20 V – 240 V *3	180 + 20 mV	–	–
240 V – 1000 V	300 + 200 mV *2	–	–

*2 valid for $f < 1000$ Hz *3 frequency in range 200 to 240 V is limited to 1 kHz

AC Current Ranges & Accuracy/1 year

Range	[ppm of value + A]		
	20 Hz – 1 kHz	1 kHz – 5 kHz	5 kHz – 10 kHz
1 μ A – 200 μ A	1500 + 20 nA	3000 + 220 nA	–
200 μ A – 2 mA	700 + 200 nA	2000 + 1 μ A	5000 + 1400 nA
2 mA – 20 mA	500 + 1 μ A	2000 + 10 μ A	5000 + 14 μ A
20 mA – 200 mA	500 + 10 μ A	2000 + 100 μ A	5000 + 140 μ A
200 mA – 2 A	500 + 100 μ A	–	–
10 A – 20 A *4	1000 + 6 mA	–	–
20 A – 30 A	20000 + 9 mA	–	–

*4 Output current time is limited above 10 A. Max. 60 sec at 20 A, 30 sec at 30 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 \pm 2 °C
Dimensions /Weight :	450 x 480 x 150 mm /23 kg
Power supply :	115V/230 V-50 /60 Hz
Max . power consumption :	250 VA

Function Shape

Range of voltage :	1 mV to 200 V
Range of current :	100 µA 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	M142: 2 mA-20 A	500-1500 ppm
AC Voltage	0.2 V-240 V	300-1200 ppm
AC Current	M142: 2 mA-20 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 µV
DC voltage - mVDC	0 - +/-2 V	0.02 % +7 µV
DC current	0 - +/-25 mA	0.015 % +300 nA
Frequency	1 Hz-15 kHz	0.005
Resistance	0-2 kΩ	0.02 % + 10 mΩ
RTD temperature	-150 - +600 °C	0.1 °C
TC temperature	-250 - +1820 °C	0.4-4 °C

Voltage: 2 to 10 V DC
Input impedance: min. 100 MΩ
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
0-10 Ω	300 + 5 mΩ	700 pF - 1 nF	0.5 + 15 pF
10-33 Ω	150 + 5 mΩ	1 nF - 3.3 nF	0.5 + 5 pF
100-330 Ω	100 + 5 mΩ	3.3 nF - 100 nF	0.5
330 Ω - 1 MΩ	100	100 nF - 1 µF	1
1-3.3 MΩ	200	1 µF - 10 µF	1.5
3.3-10 MΩ	500	10 µF - 100 µF	2.0
10-33 MΩ	1000		
33-100 MΩ	2000		
100 MΩ-1 GΩ	5000		

Maximum compliance voltage 10-20 Vpk in resistance mode, 5.5 Vpk in capacitance mode.

RTD Temperature Sensor Simulation

Type:	Pt 1.385, Pt 1.392, Ni
Range of R0:	20 to 2 k
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

**RTD Temperature Sensor
Simulation
(full version)**

Type:	Pt 1.385, Pt 1.392, Ni
Range of RO:	20 Ω to 2 k Ω
Range of temperature:	-200 to +850 $^{\circ}\text{C}$
Temperature accuracy:	0.04 $^{\circ}\text{C}$ to 0.5 $^{\circ}\text{C}$
Temperature scale:	ITS 90, PTS 68

**Function Shape
(full version)**

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