M 142 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

Multifunction calibrator M142 is calibrator of electric quantities for application in calibration laboratories and in production lines where voltage, current, resistance, capacity and frequency meters are manufactured . 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.

Built -in process multimeter , standard part of M142 full version , can be used independently or simultaneously with source functions which makes testing transducers, regulators and evaluation units really easy. Using a single instrument you can evaluate output signals of various types of transducers and external sensors (strain gauge , pressure , torsion , strength , etc.), read them directly from calibrator display and use them in your calibrations.

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SPECIFICATION

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

Range	DC	20 Hz – 10 kHz *	10 kHz – 50 kHz	50 kHz – 100 kHz
1 mV – 20 mV	50 + 6 µV	2000 + 30 µV	2000 + 30 µV	10000 + 30 µV
20 mV – 200 mV	15 + 8 µV	1000 + 80 µV	1500 + 120 µV	3000 + 120 µV
200 mV – 2 V	12 + 10 µV	180 + 100 µV	500 + 200 µV	2000 + 1 mV
2 V – 20 V	10 + 50 µV	180 + 1 mV	500 + 6 mV	2000 + 10 mV
20 V – 240 V	15 + 500 µV	180 + 10 mV	–	–
240 V – 1000 V	50 + 20 mV	300 + 200 mV	–	–

* frequency is 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	5 kHz – 10 kHz
1 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	5000 + 1400 nA
2 mA – 20 mA	100 + 600 nA	500 + 1 µA	2000 + 10 µA	5000 + 14 µA
20 mA – 200 mA	100 + 6 µA	500 + 10 µA	2000 + 100 µA	5000 + 140 µA
200 mA – 2 A	150 + 100 µA	500 + 100 µA	–	–
2 A – 30 A *	200 + 2 mA	1000 + 6 mA	–	–

* Additional uncertainty applies above 20A: 900*(I-20) µA, where I is set output current in [A]. Frequency is limited to 40 – 500 Hz.

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]	1.8 – 1.4	1.4 – 0.7	0.7 – 0.6	0.6 – 0.5		accuracy [°C]	0.4 – 0.3	0.2	0.2	0.1
S	range [°C]	-50–0	0–250	250–1400	1400–1767	E	range [°C]	-250– -100	-100–280	280–600	600–1000
	accuracy [°C]	1.6 – 1.3	1.3 – 0.8	0.8 – 0.6	0.7 – 0.6		accuracy [°C]	0.7 – 0.2	0.2 – 0.1	0.1	0.1
B	range [°C]	400–800	800–1000	1000–1500	1500–1820	K	range [°C]	-200– -100	-100–480	480–1000	1000–1372
	accuracy [°C]	1.7 – 0.9	0.9 – 0.8	0.8 – 0.7	0.7 – 0.6		accuracy [°C]	0.5 – 0.2	0.2	0.3 – 0.2	0.3
J	range [°C]	-210– -100	-100–150	150–700	700–1200	N	range [°C]	-200– -100	-100–0	0–580	580–1300
	accuracy [°C]	0.3 – 0.2	0.2 – 0.1	0.2 – 0.1	0.2		accuracy [°C]	0.7 – 0.3	0.3	0.2	0.2

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 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	2 mA – 20 A	500 – 1500 ppm
AC Voltage	0.2 V – 240 V	300 – 1200 ppm
AC Current	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 %.

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
33 – 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
3.3–10MΩ	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.

Multimeter

Quantity	Range	Accuracy
DC voltage – DCV	0 – +/-20 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 – 2.5 kΩ	0.02 % + 10 mΩ
RTD temperature	-150 – +600 ˚C	0.1 ˚C
TC temperature	-250 – +1820 ˚C	0.4 – 2.5 ˚C

RTD Temperature Sensor Simulation

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