

M143 Portable Multifunction Calibrator



1000 V and 20 A in a small housing

- *Wide voltage range from 0 to 1000 V DC/AC with an accuracy of 0.01 %*
- *Extended current range from 0 to 20 A DC/AC with an accuracy of 0.02 %*
- *Extended current range to 1000 A using Option 140-50 Current coil for calibration of clamp ammeters*
- *Sinusoidal & Non-sinusoidal waveforms*
- *Fix standard resistors 10 Ω to 100 MΩ in decimal values with calibration accuracy of 0.02 %*
- *Thermocouple temperature sensor simulation R, S, B, J, T, E, K, N in range from 250 °C to 1850 °C*
- *Cold junction automatic compensation using an external Pt1000 sensor*
- *RTD temperature sensor simulator option*
- *Power supply voltage 115/230V at 50/60 Hz*
- *Interface RS 232, IEEE488 (optional)*
- *Small dimensions, overall weight 9 kg*

The M143 Multifunction calibrator is a cost saving solution for calibration of electric meters with up to 1000 V and 20 A. It offers a basic accuracy of 0.01% in DC voltage for calibration of 3½ and 4½ digit multimeters. The resistance function is covered by eight fix resistors in range from 10 Ω to 100 MΩ. The calibrator offers TC temperature sensor simulation. It can be delivered optionally as well with RTD temperature sensor simulator. Thanks to its small dimensions and low weight the unit can be used easily for field calibration work.

The Model M143 is also suitable to production lines of panel meters, multimeters, transducers, measuring amplifiers, thermometers, and calibration laboratories where the calibrator can be applied as source of standard value for calibrations, verifications and adjustments of units under test.

RS-232 and (optionally) GPIB interface bus enable automated operation in remote mode offering time saving automatic calibrations..

Technical data

DC / AC SINE Wave Voltage

Voltage range : 0.0000 mV – 1000.00 V DC, 1.0000 mV – 1000.00 V AC
 Internal ranges: 100 mV, 1 V, 10 V, 100 V, 1000 V
 Resolution: 5½ digit
 Frequency range in AC mode: 1 mV - 10 V from 20 Hz to 2 kHz, 10 V – 1000 V from 40 Hz to 1 kHz
 Frequency accuracy: 0.01%
 Frequency setting resolution: 5½ digits

Voltage accuracy

DC Voltage		AC Voltage		
Range	% of value + % of range	Range	% of value + % of range	% of value + % z range
			20.000 Hz – 200.000 Hz	200.000 Hz -2000.00 Hz ¹
0.0000 mV – 10.0000 mV	0.050 + 0.10	1.0000 mV – 10.0000 mV	0.20 + 0.25	0.20 + 0.30
10.0000 mV – 100.000 mV	0.010 + 0.010	10.000 mV – 100.000 mV	0.10 + 0.05	0.15 + 0.07
0.10000 V – 1.00000 V	0.008 + 0.002	0.10000 V – 1.00000 V	0.05 + 0.005	0.07 + 0.01
1.0000 V – 10.0000 V	0.008 + 0.002	1.0000 V – 10.0000 V	0.05 + 0.005	0.07 + 0.03
10.000 V – 100.000 V	0.015 + 0.004	10.000 V – 100.000 V	0.05 + 0.010	0.07 + 0.03
100.00 V – 1000.00 V	0.018 + 0.004	100.00 V – 1000.00 V	0.07 + 0.020	0.10 + 0.03

¹ voltage ranges 100 and 1000V from 40 Hz to 1kHz

Auxiliary parameters

range	10mV	100mV	1V	10V	100V	1000V
THD ²	0,05% + 200 µV	0,05% + 300 µV	0,05%	0,05%	0,10%	0,15%
Maximal output current	5 mA	5 mA	10 mA	30 mA	10 mA	2 mA
Output impedance	< 10 mΩ	< 10 mΩ	< 10 mΩ	< 10 mΩ	< 100 mΩ	< 100 mΩ
Maximal capacitance load	500 pF	500 pF	500 pF	500 pF	300 pF	150 pF

² parameter includes non-linear distortion and non-harmonic noise in frequency range to 100 kHz

NON-SINE Wave Voltage

Voltage range: 1.0000 mV_{pk} – 10.0000 V_{pk}
 Waveform type: saw, triangle, square sym, truncated sin
 Frequency range: 20.000 to 80.000 Hz
 Accuracy of frequency: 0.3 %

DC / AC SINE Wave Current

Current range summary: 0.000 µA – 20.000 A DC, 1.000 µA – 20.000 A AC
 Internal ranges : 200 uA, 2 mA, 20 mA, 200 mA, 2 A, 20 A
 Frequency range in AC mode: 20 Hz to 1 kHz, accuracy of frequency 0.01%

Current accuracy

DC Current		AC Current		
Range	% of value + % of range	Range	% of value + % of range	% of value + % z range
			20.000 Hz – 200.000 Hz	200.000 Hz -1000.00 Hz ³
0.000 µA – 200.000 µA	0.050 + 0.010	1.000 µA – 200.000 µA	0.25 + 0.010	0.30 + 0.25
0.20000 mA – 2.00000 mA	0.025 + 0.005	0.20000 mA – 2.00000 mA	0.10 + 0.010	0.20 + 0.05
2.0000 mA – 22.0000 mA	0.015 + 0.003	2.0000 mA – 20.0000 mA	0.07 + 0.005	0.20 + 0.05
22.000 mA – 200.000 mA	0.015 + 0.003	20.000 mA – 200.000 mA	0.07 + 0.005	0.20 + 0.05
0.2000 A – 2.0000 A	0.015 + 0.005	0.2000 mA – 2.0000 A	0.10 + 0.005	0.25 + 0.05
2.0000 A – 20.000 A	0.1 + 0.01	2.0000 mA – 20.000 A	0.20 + 0.015	0.25 + 0.05

³ current range 20 A from 20 Hz to 500 Hz

Auxiliary parameters

Range	200 µA	2 mA	20 mA	200 mA	2 A	20 A
Maximal inductive load	400 µH	400 µH	400 µH	400 µH	200 µH	200 µH
Maximal compliance voltage (pk)	2 V	2 V	2 V _{ac} , 7 V _{dc}	2 V	2 V	1.5 V
THD ³	0,15%	0,10%	0,10%	0,10%	0,20%	0,40%

³ parameter includes non-linear distortion and non-harmonic noise in frequency range to 100 kHz

NON-SINE Wave Current

Voltage range: 100.000 μ A_{pk} – 2.000 00 A_{pk}
 Waveform type: saw, triangle, square sym, truncated sin
 Frequency range: 20.000 to 80.000 Hz
 Amplitude accuracy: 0.3 %
 Frequency accuracy: 0.01 %

Resistance

Number of resistances: 8
 Range: 10 Ω to 100 M Ω
 Calibration value resolution: 5 dig
 Maximal test voltage: 50 V_{rms} or 0.1W, what is lower
 Type of connection: two-wire

Accuracy

Nominal value (Ω)	10	100	1 k	10 k	100 k	1 M	10 M	100 M
Max. calibration difference to nominal value (%)	5	1	0.5	0.5	0.5	0.5	1	5
Accuracy of calibration value (%)	0.03 + 25 m Ω	0.05	0.02	0.02	0.02	0.05	0.05	0.5

TC / RTD⁴ Temperature Sensor Simulation

TC sensor types: R, S, B, J, T, E, K, N
 TC temperature simulation range: -250.0 °C to +1820.0 °C depending on type
 TC cold junction compensation: fixed in range -5.0 °C to 50.0 °C
 automatic using external temperature sensor
 TC compensation accuracy: 0.2 °C
 RTD sensor types: Pt 1.385, Pt 1.392, Ni
 RTD temperature simulation range : -50.0 °C to +850.0 °C depending on sensor type
 Range of R0 coefficient : 100 Ω to 1000 Ω
 Type of connection: four-terminal
 Temperature scale : IPTS68, ITS90
 Temperature units : °C, °F
 Resolution of temperature setting : 0.1 °C/°F

Accuracy

TC sensor simulation			RTD sensor simulation ⁵		
Thermocouple type	Temperature simulation range [°C]	Uncertainty [°C]	Temperature sensor type	Temperature range [°C]	Uncertainty [°C]
R	-50.0 to +1767.0	1.2 to 2.5	Pt100 - Pt200	-200.0 ... 0.0	0.2
S	-50.0 to +1767.0	1.5 to 2.2	Pt100 - Pt200	0.0 ... 850.0	0.1
B	400.0 to +1820.0	1.3 to 2.7	Pt200 - Pt1000	-200.0 ... 0.0	0.1
J	-210.0 to +1200.0	0.3 to 0.9	Pt200 - Pt1000	0.0 ... 850.0	0.1
T	-200.0 to +400.0	0.3 to 0.9	Ni100 - Ni200	-60.0 ... 0.0	0.2
E	-250.0 to +1000.0	0.2 to 1.7	Ni100 - Ni200	0.0 ... 300.0	0.1
K	-200.0 to +1372.0	0.4 to 0.8	Ni200 - Ni1000	-60.0 ... 0.0	0.1
N	-200.0 to +1300.0	0.5 to 1.3	Ni200 - Ni1000	0.0 ... 300.0	0.1

⁴ RTD sensor simulation is available as extra ordered option

⁵ Specification is valid for four-terminal connection

Frequency Output

Waveform type: positive 5V_{pk} (TTL)
 Amplitude accuracy: 10 %
 Output resistance: 50 Ω \pm 5 %
 Frequency range: 0.100 0 Hz to 2.000 00 MHz
 Frequency accuracy: 0.01 %

Content of Delivery

M143 Portable Multifunction Calibrator

Test Lead 1000V/20 A length 1m, 2 pcs

Power Line Cord

Opt 143-60 RTD Simulator Cable Adapter (optionally)
RS232 Cable
Operation Manual

Opt 143-90 Pt1000 External Temperature Sensor

General data

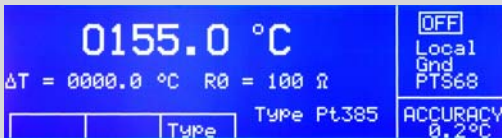
Reference temperature range: 23 °C ± 2 °C (for above shown uncertainties)
 Relative humidity: <80 % to 30 °C, <70 % to 40 °C, <40 % to 50 °C
 Temperature coefficient: In extended temperature range +5 °C to +40 °C multiply uncertainty parameters 0.15x / °C
 Absolute accuracy definition: M143 specifications include stability, temperature coefficient, linearity, line and load regulation, and the traceability of the external standards used for calibration.
 Specification confidence interval: 99 %
 Safety standards : Complies with EN/IEC 61010-1:2001
 Range of working temperatures: +10 °C ... +40 °C
 Range of storing temperatures: - 20 °C ... +50 °C
 Power supply: 115/230V - 50/60 Hz
 Power consumption: 250 VA max
 Dimensions (W x H x D): 325 x 111 x 316 mm
 Weight: 9 kg
 Interface: RS232, (IEEE488 as option)

M143 is equipped with blue display with wide viewing. The display contains basic data related to selected function. Three soft buttons with functionally orientated meaning simplify manual control. Display shows always actual accuracy in set test point.



Presence of dangerous voltage over 100 V at the output terminals is always indicated by „Dangerous voltage“ sign. Calibrator indicates dangerous voltage by beeping.

AC/DC maximal output current is 20 A.
Output current in range 10 to 20 A has limited period for which it can be continuously applied.



For temperature sensor simulation one of temperature scales PTS68 or ITS90 can be selected
Two types of Pt temperature sensors are predefined, PT 1.385 and PT 1.392.

Calibrator readjustment is simple and user-friendly.
Access to calibration values is protected by password.



Option 140-50 Current coil with multiplying coefficient x25 and x50 is a useful tool for calibration of clamp ammeters up to 1000 A at 50/60 Hz signal frequency.

External temperature sensor Pt1000 can be used for automatic compensation of cold junction of simulated thermocouple sensors.



Option 143-60 Cable adapter is designed for simulation of RTD temperature sensors. The adapter is connected to the front panel AUX connector. Platinum and nickel sensors temperature dependency is predefined in the calibrator.