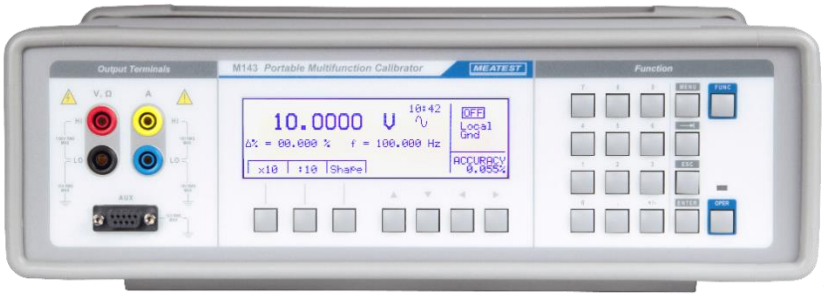
M143

Portable Multifunction Calibrator



HIGHLIGHTS

- **AC/DC voltage/current to 1000V/20A**
- **Basic accuracy 60 ppm**
- **Sinusoidal & Non-sinusoidal waveforms**
- **Small dimensions, overall weight 11 kg**

DESCRIPTION

M143/143i Multifunction calibrator is cost saving solution for calibration of meters of electric quantities up to 1000 V and 20 A. It offers basic accuracy 0.01% in DC voltage needed for calibration of 3½ and 4½ digit multimeters. 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 calibrator can be applied easily for field calibrations.

The calibrator main application field are 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.

Interface RS-232 and optionally GPIB interface bus enable automated operation in remote mode offering time saving automatic calibrations. Model M143/143i is fully compatible with Meatest calibration SW package CALIBER/WinQbase

SPECIFICATION

Specifications below describe 1-year absolute accuracy of this product including long-term stability, linearity, load and line regulation and reference standard measurement uncertainty as well as ambient conditions within specified limits.

GENERAL DATA

Warm-up time	60 minutes
Reference temperature	+21 °C – +25 °C
Operating temperature	+10 °C – +40 °C
Storage temperature	-10 °C – +55 °C
Temperature coefficient	15 % of accuracy / °C outside Tref
Max relative humidity	-10 – 30 °C: 80 % 30 – 40 °C: 70 % 40 – 55 °C: 40 %
Power supply	115/230V - 50/60 Hz, 250 VA max
Dimensions (W x H x D)	325 x 111 x 316 mm
Weight	11 kg
Interfaces	RS232, IEEE488 (optional)

DC/AC Voltage

Voltage range summary	DC: 0 mV – 1000 V AC sine: 1 mV – 1000 V Non-sine: 1 mVpk – 10 Vpk
Internal ranges	100 mV, 1 V, 10 V, 100 V, 1000 V
Frequency range	Sine <10 V: 20 Hz – 10 kHz Sine >10 V: 40 Hz – 1 kHz Non-sine <10 V: 20 Hz – 80 Hz
Frequency accuracy and resolution	0.01%, 5 digit
Non-sine waveform types	saw, triangle, square, truncated sin
Non-sine amplitude accuracy	0.3 % of peak value

Ranges, resolution, 1 year accuracy [% of value]

Range	DC	20 Hz – 400 Hz	400 Hz – 10 000 Hz
1.0000 mV – 10.0000 mV	0.05 + 7 µV	0.2 + 25 µV	0.2 + 30 µV
10.000 mV - 100.000 mV	0.01 + 7 µV	0.1 + 50 µV	0.15 + 70 µV
0.10000 V – 1.00000 V	0.006 + 10 µV	0.05 + 50 µV	0.07 + 100 µV
1.0000 V – 10.0000 V	0.006 + 50 µV	0.05 + 500 µV	0.07 + 3 mV
10.000 V – 100.000 V	0.006 + 1 mV	0.05 + 10 mV *1	0.07 + 30 mV *1
100.00 V – 1000.00 V	0.01 + 20 mV	0.07 + 200 mV *1	0.1 + 300 mV *1

*1 Limited to 40 Hz – 1 kHz, sine waveform only.

Auxiliary parameters

Range	THD *2	Max. DC/AC Current	Max. load capacitance	Output impedance	Overload protection
10 mV	0.05 % + 200 µV	3 / 3 mA	3 nF	< 10 mΩ	60 Vpk
100 mV	0.05 % + 300 µV	5 / 5 mA	3 nF	< 10 mΩ	60 Vpk
1 V	0.1 %	20 / 10 mA	3 nF	< 10 mΩ	60 Vpk
10 V	0.1 %	50 / 50 mA	10 nF	< 10 mΩ	60 Vpk
100 V	0.1 %	20 / 10 mA	10 nF	< 100 mΩ	250 Vpk
1000 V	0.2 %	2 / 1.5 mA	3 nF	< 100 mΩ	1500 Vpk

*2 Includes non-linear distortion and non-harmonic noise up to 100 kHz.

DC/AC Current

Voltage range summary	DC: 0 µA – 20 A [*3] AC Sine: 1 µA – 20 A [*3] Non-sine: 100 µApk – 2 Apk
Internal ranges	200 µA, 2 mA, 20 mA, 200 mA, 2 A, 20 A [*3]
Frequency range	Sine: 20 Hz – 1 kHz Non-sine <2A: 20 Hz – 80 Hz
Frequency accuracy and resolution	0.01%, 5 digit
Non-sine waveform types	saw, triangle, square, truncated sin
Non-sine amplitude accuracy	0.3 % of peak value

Ranges, resolution, 1 year accuracy [% of value]

Range	DC	20 Hz – 200 Hz	200 Hz – 1 kHz
1.000 µA – 200.000 µA	0.05 + 20 nA	0.25 + 20 nA	0.2 + 200 nA
0.20000 mA – 2.00000 mA	0.025 + 100 nA	0.1 + 200 nA	0.1 + 400 nA
2.0000 mA – 20.0000 mA	0.015 + 600 nA	0.07 + 1 µA	0.1 + 4 µA
20.000 mA – 200.000 mA	0.015 + 6 µA	0.07 + 10 µA	0.1 + 40 µA
0.2000 A – 2.0000 A	0.015 + 100 µA	0.1 + 100 µA	0.15 + 1 mA
2.0000 A – 20.000 A [*3]	0.1 + 2 mA	0.2 + 3 mA	0.25 + 10 mA

*3 M143i version lacks 20A amplifier and so is limited to 2A.

Auxiliary parameters

Range	THD [*4]	Max. DC/AC Voltage	Max. load Inductance	Overload protection
200 µA	0.15 %	2 / 2 V	400 µH	15 Vpk
2 mA	0.1 %	2 / 2 V	400 µH	15 Vpk
20 mA	0.1 %	7 / 2 V	400 µH	15 Vpk
200 mA	0.1 %	2 / 2 V	400 µH	15 Vpk
2 A	0.2 %	2 / 2 V	200 µH	15 Vpk
20 A [*3 *6]	0.3 % [*5]	2 / 2 V	200 µH	15 Vpk

*4 Includes non-linear distortion and non-harmonic noise up to 100 kHz.
*5 Up to 0.6% below 30 Hz.
*6 Continuous output up to 10 A is not time-limited. Maximum duration at 20 A is 5 minutes, 15 minutes at 10 A. Cooldown takes typically around 5 minutes.

Resistance (2W)

Nominal value	Max. deviation	Accuracy
10 Ω	5 %	0.03 % + 25 mΩ
100 Ω	1 %	0.05 %
1 kΩ	0.5 %	0.02 %
10 kΩ	0.5 %	0.02 %
100 kΩ	0.5 %	0.02 %
1 MΩ	0.5 %	0.05 %
10 MΩ	1 %	0.05 %
100 MΩ	5 %	0.5 %

Compliance voltage 50 Vrms, maximum dissipation power 0.1 W.

RTD temperature sensor simulation (4W) [*7]

Type	Range	Accuracy
Pt100 – Pt200	-200.0 – 850.0 °C	0.1 – 0.2 °C
Pt200 – Pt1000	-200.0 – 850.0 °C	0.1 °C
Ni100 – Ni200	-60.0 – 300.0 °C	0.1 – 0.2 °C
Ni200 – Ni1000	-60.0 – 300.0 °C	0.1 °C

*7 RTD temperature sensor simulator is an optional extra. Pt standards: IPTS68 and ITS90.

TC temperature sensor simulation

Type	Range	Accuracy *8
R	-50 – 1767 °C	1.2 – 2.5 °C
S	-50 – 1767 °C	1.5 – 2.2 °C
B	400 – 1820 °C	1.3 – 2.7 °C
J	-210 – 1200 °C	0.3 – 0.9 °C
T	-200 – 400 °C	0.3 – 0.9 °C
E	-250 – 1000 °C	0.2 – 1.7 °C
K	-200 – 1372 °C	0.4 – 0.8 °C
N	-200 – 1300 °C	0.5 – 1.3 °C
C	0 – 2315 °C	0.6 – 1.2 °C
D	0 – 2315 °C	0.6 – 1.1 °C
G2	0 – 2315 °C	0.6 – 5.0 °C
M	-50 – 1410 °C	0.2 – 0.3 °C

*8 Accuracy is based on manual cold junction compensation. Add 0.2 °C for automatic compensation based on external temperature sensor. Compensation range is -5 – 50 °C.

Frequency

Frequency range	0.1000 Hz – 2.00000 MHz
Frequency accuracy	0.005 %
Waveform type	positive 5 Vpk
Amplitude accuracy	10 %
Output resistance	50 Ω ± 5 %

Versions

M143i	2A base version
M143	Full version with 20A amplifier
RTD	RTD simulator extension
GPIB	GPIB interface extension

Multimeter calibration (application)

Clampmeter calibration with 140-50 Current Coil (application)