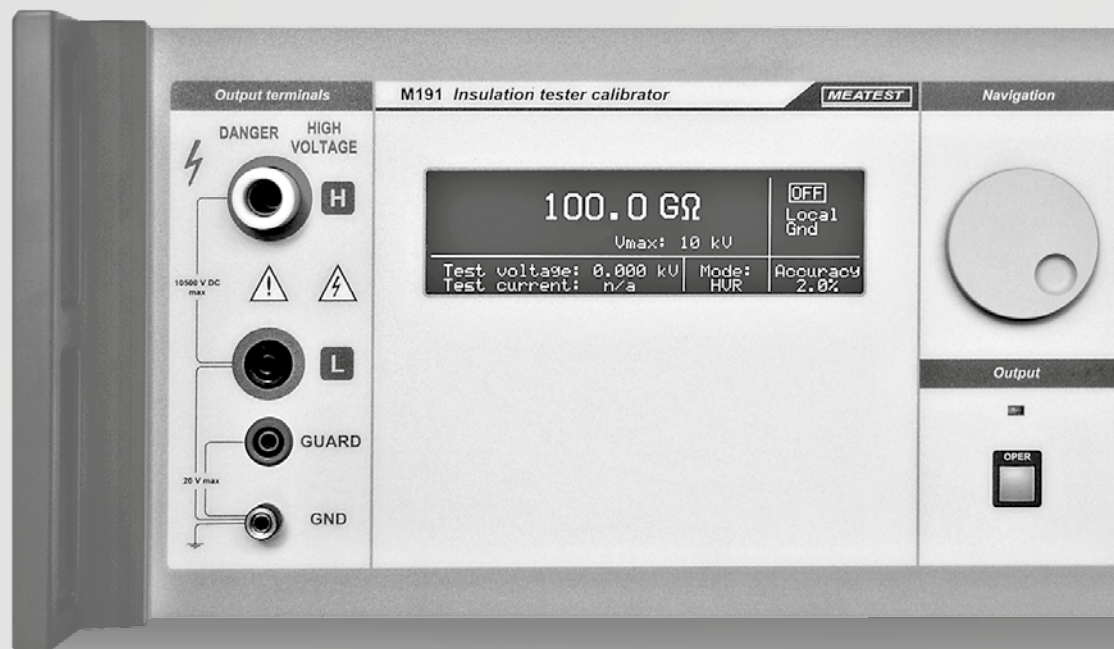


# ELECTRICAL CALIBRATION

detailed specifications



## **RANGE OF PRODUCTS**

Multifunction Calibrators	(pg. 3)
Power & Energy Calibrators	(pg. 14)
Special Laboratory Instruments	(pg. 20)
Programmable Decades	(pg. 28)
Calibration Software	(pg. 40)
Electromagnetic Flow Meters	

## **COMPANY PROFILE**

Meatest company was founded in 1991 and first designs date back another decade. With almost 40 years of experience in electrical metrology we make calibration and measurement equipment with lasting reliability, user-friendliness and high performance at the very top of our priorities.

Development is focused on robust and flexible solutions matching everyone's needs and making your work easier. Meatest developers account for full 25 % of Meatest staff. Utilizing decades of experience, sophisticated design, premium parts and ISO 9001:2015 framework they create unique instruments some of which don't have their counterpart anywhere in the world.

## **MADE TO LAST**

Customer support, as a way of keeping operating costs as low as possible, is taken very seriously in Meatest. More than 50 representatives are at your service all over the world, helping you to find the best solution to your needs. Standard 2 year warranty can be extended to up to 5 years for all our instruments and general lifetime support is limited only by availability of external parts. Recalibration and maintenance is a matter of weeks, not months.

# M140 M142

# MULTIFUNCTION CALIBRATORS



## HIGHLIGHTS

- AC/DC voltage/current to 1000V/30A
- Basic accuracy 10 ppm
- AC/DC power, energy, phase shift, resistance, capacitance, frequency, TC, RTD
- Build-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.

Model	Voltage	Current	Power	Frequency	Impedance	TC	RTD	Basic accuracy
M142	1000 V	30 A	2.4 kW	20 MHz	1 GΩ, 100 μF	✓	✓	10 ppm
M142i	1000 V	30 A	—	—	—	✓	—	10 ppm
M140	1000 V	20 A	2.4 kW	20 MHz	50 MΩ, 50 μF	✓	✓	30 ppm
M140i	1000 V	20 A	—	—	—	✓	—	30 ppm

## VERSIONS

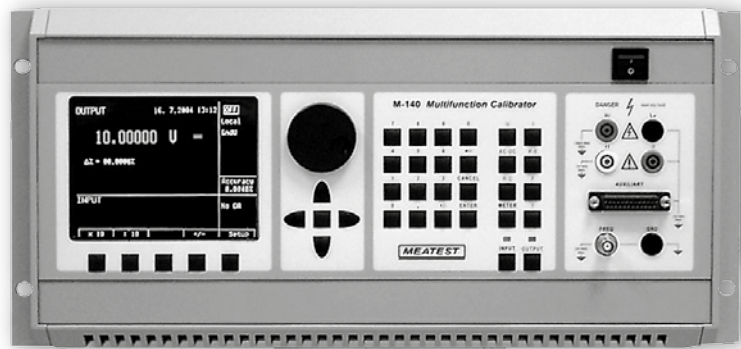
**Full version with power, impedance, frequency and RTD**



**Base version with voltage, current and thermocouples**



**19" rack mount**



### DC Voltage Ranges & Accuracy/1 year

Range	M140/M140i [ppm of value + V]	M142/M142i [ppm of value + V]
0 $\mu$ V – 20 mV	300 + 10 $\mu$ V	50 + 6 $\mu$ V
20 mV – 200 mV	100 + 15 $\mu$ V	15 + 8 $\mu$ V
200 mV – 2 V	30 + 16 $\mu$ V	12 + 10 $\mu$ V
2 V – 20 V	30 + 100 $\mu$ V	10 + 50 $\mu$ V
20 V – 240 V	30 + 1 mV	20 + 500 $\mu$ V
240 V – 1000 V	50 + 50 mV	50 + 20 mV

### DC Current Ranges & Accuracy/1 year

Range	M140/M140i [ppm of value + A]	M142/M142i [ppm of value + A]
0 $\mu$ A – 200 $\mu$ A	500 + 20 nA	500 + 20 nA
200 $\mu$ A – 2 mA	200 + 100 nA	200 + 100 nA
2 mA – 20 mA	100 + 600 nA	100 + 600 nA
20 mA – 200 mA	100 + 6 $\mu$ A	100 + 6 $\mu$ A
200 mA – 2 A	150 + 100 $\mu$ A	150 + 100 $\mu$ A
2 A – 20 A *1	200 + 2 mA	200 + 2 mA
20 A – 30 A *1	–	300 + 3 mA

\*1 Limited time of continuous current in range 10 to 30A

## SPECIFICATION

### AC Voltage Ranges & Accuracy/1 year

Range	M140/M140i [ppm of value + V]	M142/M142i [ppm of value + V]	all types [ppm of value + V]	M142/M142i [ppm of value + V]
	20 Hz - 10 kHz	20 Hz - 10 kHz	10 kHz - 50 kHz	50 kHz - 100 kHz
1 mV - 20 mV	2 000 + 30 $\mu$ V	2 000 + 30 $\mu$ V	2000 + 1000 + 20 $\mu$ V	1.0 + 0.10 + 20 $\mu$ V
20 mV - 200 mV	1 000 + 80 $\mu$ V	1 000 + 80 $\mu$ V	1500 + 500 + 20 $\mu$ V	0.3 + 0.05 + 20 $\mu$ V
200 mV - 2 V	250 + 100 $\mu$ V	180 + 100 $\mu$ V	500 + 200 $\mu$ V	0.2 + 1 mV
2 V - 20 V	250 + 1 mV	180 + 1 mV	500 + 6 mV	0.2 + 10 mV
20 V - 240 V *3	250 + 20 mV	180 + 20 mV	—	—
240 V - 1000 V	300 + 200 mV *2	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	M140/M140i [ppm of value + A]	M142/M142i [ppm of value + A]	all types [ppm of value + A]	M142/M142i [ppm of value + A]
	20 Hz - 1 kHz	20 Hz - 1 kHz	1 kHz - 5 kHz	5 kHz - 10 kHz
1 $\mu$ A - 200 $\mu$ A	1500 + 20 nA	1500 + 20 nA	3000 + 220 nA	—
200 $\mu$ A - 2 mA	700 + 200 nA	700 + 200 nA	2000 + 1 $\mu$ A	5000 + 1400 nA
2 mA - 20 mA	500 + 1 $\mu$ A	500 + 1 $\mu$ A	2000 + 10 $\mu$ A	5000 + 14 $\mu$ A
20 mA - 200 mA	500 + 10 $\mu$ A	500 + 10 $\mu$ A	2000 + 100 $\mu$ A	5000 + 140 $\mu$ A
200 mA - 2 A	500 + 100 $\mu$ A	500 + 100 $\mu$ A	—	—
10 A - 20 A *4 *6	1000 + 6 mA	1000 + 6 mA	—	—
20 A - 30 A *5	—	20000 + 9 mA	—	—

\*4 Continuous output current maximum time is 60 sec for set value 20 A, for M142 and 30 s for M140.

\*5 Continuous output current maximum time is 30 sec for set value 30 A.

\*6 When Option 140-50 Current coil is used, add uncertainty 0.3 % of the set current to the value specified in the above table. Output current is multiplied by factor 50.

### Function Shape (full versions only)

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

### Frequency (full versions only)

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 <sub>pk-pk</sub>	10 %	—	—

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

## Resistance (full versions only)

M140		M142	
Range	ppm of value + mΩ	Range	ppm of value + mΩ
0 Ω–100 Ω	300 + 10	0–10 Ω	300 + 5
100 Ω–400 Ω	150	10–33 Ω	150 + 5
400 Ω–2 kΩ	150	100–330 Ω	100 + 5
2kΩ–10 kΩ	150	330–1 kΩ	100
10 kΩ–40 kΩ	150	1–3.3 kΩ	100
40 kΩ–200 kΩ	150	3.3–10 kΩ	100
200kΩ–1 MΩ	500	10–33 kΩ	100
1 MΩ–4 MΩ	1000	33–100 kΩ	100
4 MΩ–20MΩ	2000	100–330 kΩ	100
20 MΩ–50MΩ	5000	330–1 MΩ	100
		1–3.3 MΩ	200
		3.3–10MΩ	500
		10–33 MΩ	1000
		33–100 MΩ	2000
		100 MΩ–1 GΩ	5000

Maximal compliance voltage on output terminals 5-8 Vpk for model M140 and 10-20 Vpk for model M142.

## Capacitance (full versions only)

M140		M142	
Range	% of value + pF	Range	% of value + pF
900 pF–2.5 nF	0.5 + 15	700 pF–1 nF	0.5 + 15
2.5 nF–10 nF	0.5	1 nF–3.3 nF	0.5 + 5
10 nF–50 nF	0.5	3.3 nF–10 nF	0.5
50 nF–250 nF	0.5	10 nF–33 nF	0.5
250 nF–1 μF	0.5	33 nF–100 nF	0.5
1 μF–3.5 μF	1	100 nF–330 nF	1
3.5 μF–5 μF	1	330 nF–1 μF	1
5 μF–10 μF	1.5	1 μF–3.3 μF	1.5
10 μF–50 μF	2.0	3.3 μF–10 μF	1.5
		10 μF–100 μF	2.0

Maximal compliance voltage on output terminals 5.5 Vpk.

## AC/DC Power & Energy (full versions only)

Function	Range	Accuracy
DC Voltage	0.2 V–240 V	40 to 150 ppm
DC Current	M-140: 2 mA–10 A M-142: 2 mA to 20A	500 to 1500 ppm
AC Voltage	0.2 V–240 V	300 to 1200 ppm
AC Current	M-140: 2 mA–10 A M-142: 2 mA to 20A	500 to 1500 ppm
Frequency	20–400 Hz	50 ppm
Power factor	-1 to +1	0.005–0.0005
Phase	0–360 °	0.15–0.25 °
Time in energy mode	10 s to 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 (full versions only)

Quantity	Range	Accuracy
DC voltage – DCV	0 to +/-12 V	0.01 % +500 μV
DC voltage – mVDC	0 to +/-2 V	0.02 % +7 μV
DC current	0 to +/-25 mA	0.015 % +300 nA
Frequency	1 Hz to 15 kHz	0.005
Resistance	0 to 2 kΩ	0.02 % + 10 mΩ
RTD temperature	-150 to +600 °C	0.1 °C
TC temperature	-250 to +1820 °C	0.4 to 4 °C
SGS sensors *8	depends on the sensor	0.05 % + 10 μV +sensor unc.

\* 8 M140 model only  
Voltage  
Input impedance  
Sensitivity  
Displayed unit  
Sorting function  
Max. supply current  
2 to 10 V DC  
min. 100 MΩ  
0.5 mV/V to 100 mV/V programmable  
1 x closure, 1 x opener  
40 mA

## RTD Temperature Sensor Simulation (full versions only)

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, ITS 68

## TC Temperature Sensor Simulation

<b>R</b>	range [°C]	-50-0	0-400	400-1000	1000v1767	<b>T</b>	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
<b>S</b>	range [°C]	-50-0	0-250	250-1400	1400-1767	<b>E</b>	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>B</b>	range [°C]	400-800	800-1000	1000-1500	1500-1820	<b>K</b>	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
<b>J</b>	range [°C]	-210--100	-100-150	150-700	700-1200	<b>N</b>	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:	450 x 480 x 150 mm/23 kg
Power supply:	115 V/230 V-50/60 Hz
Max. power consumption:	250 VA

## MAIN DISPLAY

Auxiliary information  
grounding, local/remote control,  
current coil application

Output ON/OFF indication

Output signal waveform

Current time and date indication

Output parameters field

Main parameter of the output signal

Additional parameters  
of the output signal like:  
waveform, frequency,  
absolute or relative Deviation

METER field

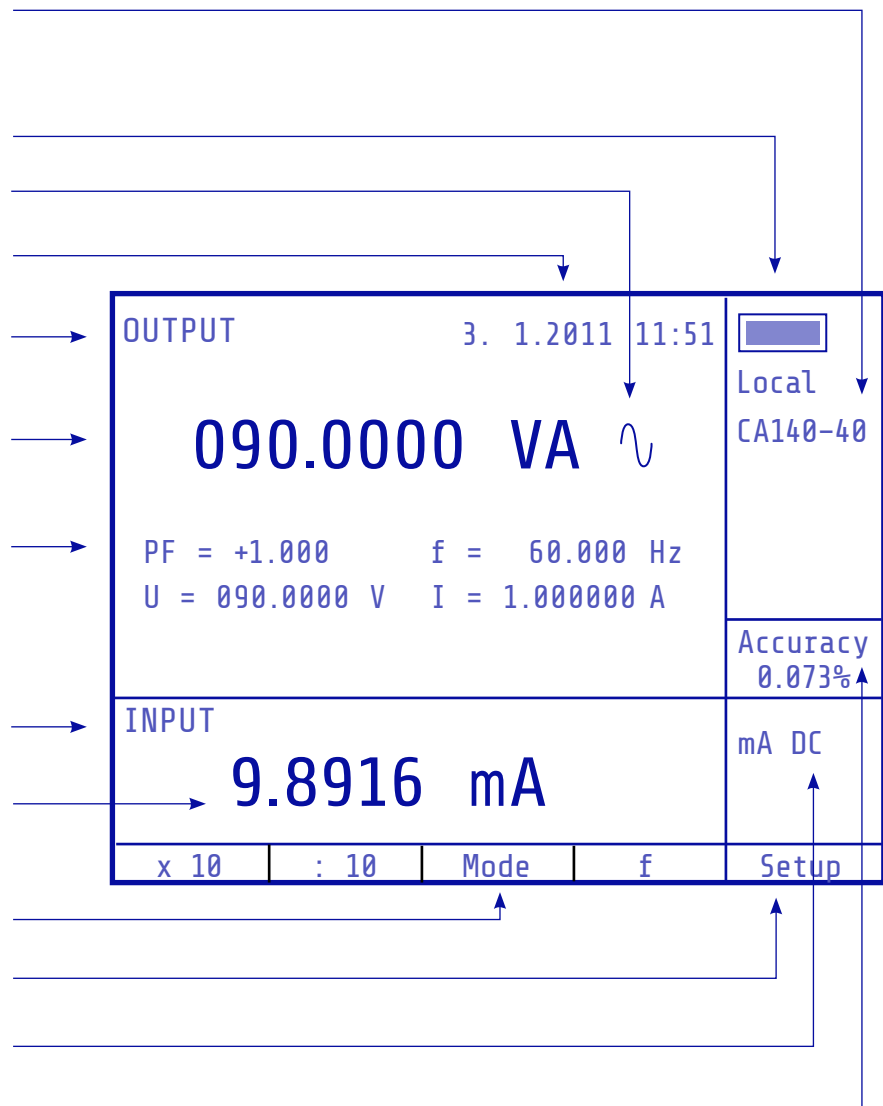
Value measured by  
internal meter

Line with display button description

SETUP menu

METER selected function

Calculated accuracy



## OPTIONS AND ACCESORIES

### Option 140-01 Cable Adapter



140-01 cable adapter is designed for easy connection of unit under test to M140/M142 multifunction calibrator. Basic part of the adapter is metal working pad with integrated voltage and current outputs with banana ends. The adapter is connected to the calibrator via front panel AUXILIARY connector and main output terminals. On bottom side it contains mounted Pt100 temperature sensor through which ambient temperature is measured and value is applied for automatic compensation of cold junction temperature of simulated thermocouples.

Application: multimeter, ammeter, voltmeter calibration  
 Dimensions: 230 mm x 75 mm x 290 mm  
 Weight: 1 kg  
 Connection: safety  $\varnothing$  4 mm banana

### Option 140-41 Cable Adapter for M140



Cable adapter Option 140-41 is especially suitable for process and simultaneous calibrations. It enables to apply all input and output functions of the M140 multifunction Calibrator with output/input located on the AUXILIARY output connector on the calibrator front panel. Typical application is calibration and testing of such meters and transducers that need simulation of temperature sensors on the input side and measuring of output signal 20 mA/10V on the output side. When used in TESTER mode, additional relay contact of type PASS/FAIL is located on the adapter.

Application: Strain gauge sensor measuring  
 Voltage/Current/Resistance/Frequency measuring  
 Simultaneous calibration and measurements  
 Dimensions/Weight: 105 mm x 50 mm x 170 mm/0.5 kg

### Option 40 Cable Adapter



Cable adapter CANON 25-2 x Banana. With the adapter external source of signal can be measured with internal build-in multimeter. Option 40 enables measuring of DC voltage to 12 V, DC current to 25 mA, frequency to 15 kHz and temperature of TC temperature sensors.

### Option 60 Cable Adapter



Cable adapter CANON 25-4 x Banana. Four terminal resistance measurement in build-in meter is accessible with the adapter. The option enables also direct measuring of ambient temperature via external RTD temperature sensors.

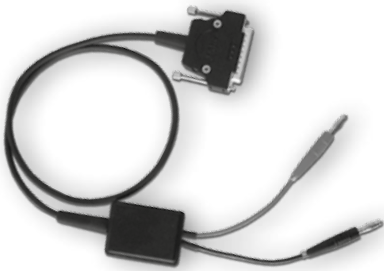


### Option 70 Adapter



Cable adapter CANON 25-4 x Banana. Four-terminal output in resistance mode of M140 is accessible with the adapter. Four-terminal output is more accurate than front panel output, especially for low resistance values.

### Option 80 Cable Adapter



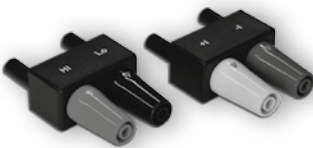
Using the adapter temperature of external thermocouple sensors and mVDC to 2 V can be directly measured. M142 only.

### Option 90 External Temperature Sensor



Ambient temperature can be measured with Pt100 sensor directly. M142 only.

### Option 100 Terminal Adapter



Terminal adapter converts front panel terminal distance from 25 mm to 3/4"

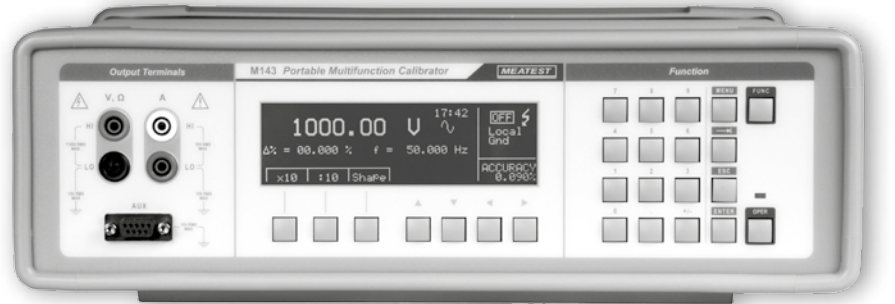
### Option 140-50 Current Coil



25/50 turns current coil for calibration of clamp ammeters. Maximal range 1500 A.

**M143**  
**M143i**

# PORTABLE MULTIFUNCTION CALIBRATOR



## HIGHLIGHTS

- AC/DC voltage/current up to 1000 V/20 A
- Basic accuracy 60 ppm, cold junction compensation
- Calibration of clamp meters up to 1000 A using 140-50 Current Coil
- Non-sinusoidal waveforms, resistance, frequency, TC, RTD
- Fixed standard resistors from 10 Ω to 100 MΩ
- GPIB and RS-232 interface
- Compact dimensions, overall weight 9 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. Thanks to its small dimensions and low weight the calibrator can be applied easily for field calibrations.

M143's 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.

## SPECIFICATION

### DC/AC Voltage

Voltage range summary:	0.0000 mV – 1000.00 VDC, 1.0000 mV – 1000.00 VAC
Resolution:	5½ digit
Wave form:	sin, saw, triangle, square sym, truncated sin

### DC/AC Current

Current range summary:	0.000 μA – 20.000 ADC, 1.000 μA – 20.000 AAC (M143i version to 2A only)
Resolution:	5½ digit

## Voltage accuracy

Range	% of value + % of range		
	DC	20-200 Hz	0.2-10 kHz <sup>*1</sup>
0.0000 mV - 10.0000 mV <sup>*2</sup>	0.050 + 0.070	0.20 + 0.25	0.20 + 0.30
10.000 mV - 100.000 mV	0.010 + 0.0070	0.10 + 0.05	0.15 + 0.07
0.10000 V - 1.00000 V	0.006 + 0.0010	0.05 + 0.005	0.07 + 0.01
1.0000 V - 10.0000 V	0.006 + 0.0005	0.05 + 0.005	0.07 + 0.03
10.000 V - 100.000 V	0.006 + 0.0010	0.05 + 0.010	0.07 + 0.03
100.00 V - 1000.00 V	0.010 + 0.0020	0.07 + 0.020	0.10 + 0.03

\*1 voltage ranges 100 and 1000V from 40 Hz to 1kHz  
 \*2 AC range starts at 1 mV

## Current accuracy

Range	% of value + % of range		
	DC	20-200 Hz	0.2-1 kHz
0.000 $\mu$ A - 200.000 $\mu$ A <sup>*3</sup>	0.050 + 0.010	0.25 + 0.010	0.20 + 0.10
0.20000 mA - 2.00000 mA	0.025 + 0.005	0.10 + 0.010	0.10 + 0.02
2.0000 mA - 22.0000 mA	0.015 + 0.003	0.07 + 0.005	0.10 + 0.02
22.000 mA - 200.000 mA	0.015 + 0.003	0.07 + 0.005	0.10 + 0.02
0.2000 A - 2.0000 A	0.015 + 0.005	0.10 + 0.005	0.15 + 0.05
2.0000 A - 20.000 A <sup>*4</sup> <sup>*5</sup>	0.1 + 0.01	0.20 + 0.015	0.25 + 0.05

\*3 AC range starts at 1  $\mu$ A  
 \*4 continuous output ON in current range 10 A to 20 A is limited to 5 minutes max.  
 \*5 20 A range in M143 model only

## Resistance

Number of fix resistances: 8, 10  $\Omega$  to 100 M $\Omega$  Basic accuracy: 0.02 %

## TC/RTD (optionally) Temperature Sensor Simulation

TC sensor types: R, S, B, J, T, E, K, N Basic accuracy: 0.1  $^{\circ}$ C  
 TC temp. simulation range: -250.0  $^{\circ}$ C to +1820.0  $^{\circ}$ C  
 RTD sensor types: Pt 1.385, Pt 1.392, Ni Basic accuracy: 0.2  $^{\circ}$ C to 2.7  $^{\circ}$ C  
 RTD temp. simulation range: -200.0  $^{\circ}$ C to +850.0  $^{\circ}$ C

## Frequency Output

Waveform type: positive 5 V<sub>pk</sub> Basic accuracy: 0.01 %  
 Frequency range: 0.1000 Hz to 2.00000 MHz

## GENERAL DATA

Interface: RS232, (IEEE488 as option)  
 Reference temperature: 21 ... 25  $^{\circ}$ C  
 Operating temperature: 10 ... 40  $^{\circ}$ C  
 Storage temperature: -10 ... +55  $^{\circ}$ C  
 Power supply: 115/230 VAC, 50/60 Hz  
 Consumption: 250 VA max  
 Dimensions: W 390 mm, H 128 mm, D 430 mm  
 Weight: 9 kg

## Models:

M143 1000 V/20 A model with RS232  
 M143i 1000 V/2 A model with RS232  
 M143(i) RTD model with built-in RTD simulator  
 M143(i) GPIB model with RS232 and GPIB interface

## MAIN DISPLAY

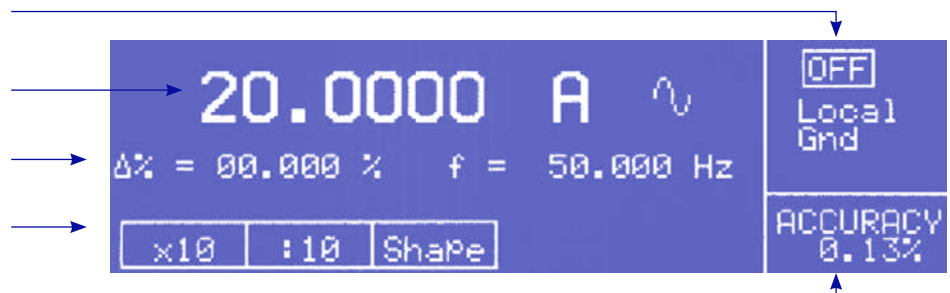
Output and remote control status

Set calibration value (V, A,  $\Omega$ ,  $^{\circ}$ C)

Auxiliary parameters

Softkey functions

Calibration uncertainty (%)



# M160

# PRECISION DC CALIBRATOR



## HIGHLIGHTS

- DC Voltage up to 100.0000 V, 20 ppm
- DC Current up to 50.0000 mA, 50 ppm
- Reference temperature range 13–33 °C
- Resistance, frequency, RTD
- TC simulation R, S, B, J, T, E, K, N, M, C, D, G2
- GPIB, USB, RS-232 and ethernet interface

## DESCRIPTION

Precision DC calibrator M160 is a portable source of industrial process signals including DC voltage, DC current, thermocouple and RTD simulation, resistance and frequency. Unlike most of the other process calibrators, the M160 comes with exceptional 20 ppm accuracy over 20 °C-wide reference temperature range. All these features are combined with user friendly interface multi-interface remote control and robust design make this calibrator ideal for both calibration laboratories as well as industry professionals. Main parameters of both generated and measured signals are displayed on large LCD together with function-specific tooltip, providing auxiliary information like range, accuracy or load limit. Instrument can be connected to different ATE systems via RS232, USB, LAN or GPIB interface.

M160 is sophisticated instrument with its own recalibration procedure. The procedure enables to correct any deviation without mechanical adjustment.

### DC Voltage source accuracy

Range/Resolution	Accuracy	Max. load
0.0000–300.0000 mV	20 ppm + 3 µV	50 mA
0.000000–3.000000 V	20 ppm + 20 µV	50 mA
0.00000–30.00000 V	20 ppm + 200 µV	50 mA
0.0000–100.0000 V	20 ppm + 1 mV	25 mA

### DC Current source accuracy

Range/Resolution	Accuracy	Max. load
0.0000–25.0000 mA	50 ppm + 1 µA	100 V
0.0000–50.0000 mA	50 ppm + 1 µA	30 V

### Frequency source accuracy

Range/Resolution	Accuracy
10.0000–200.0000 mHz	50 ppm
200.001–2000.000 mHz	50 ppm
2.00001–20.00000 Hz	50 ppm
20.0001–200.0000 Hz	50 ppm
200.01–2000.00 Hz	50 ppm
2.0001–4.0000 kHz	100 ppm
4.001–10.000 kHz	600 ppm
10.01–15.00 kHz	1500 ppm

Max. load 30V/50mA or internal pull up to +5V.

## SPECIFICATION

### Frequency meter accuracy

Summary range:	10 mHz to 100 kHz
Frequency resolution:	5½ digits
Accuracy:	50 ppm

### TC Simulation

TC types:	R, S, B, J, T, E, K, N, M, C, D, G2
Resolution:	0.01 °C
Accuracy:	0.1 – 0.8 °C, see user's manual for detailed specification
External RJ accuracy:	0.02 °C (option)

### RTD Simulation (option)

RTD types:	Pt, Ni
Resolution:	0.01 °C
Accuracy:	0.1 – 0.2 °C, see user's manual for detailed specification

### Real Resistance Decade (option)

Resistance range:	10 Ω – 300 kΩ
Resolution:	from 0.0001 Ω
Accuracy:	0.02 %

## GENERAL DATA

Reference temperature:	+13 °C ... +33 °C
Operating temperature:	+5 °C ... +45 °C
Storage temperature:	-10 °C ... +55 °C
Remote control:	RS232 interface (optionally USB, LAN, IEEE488)
Power supply:	115/230 Vac, 50/60 Hz, 60 W max
Dimensions:	W 390 mm, H 128 mm, D 310 mm
Weight:	5.5 kg

### Accessory

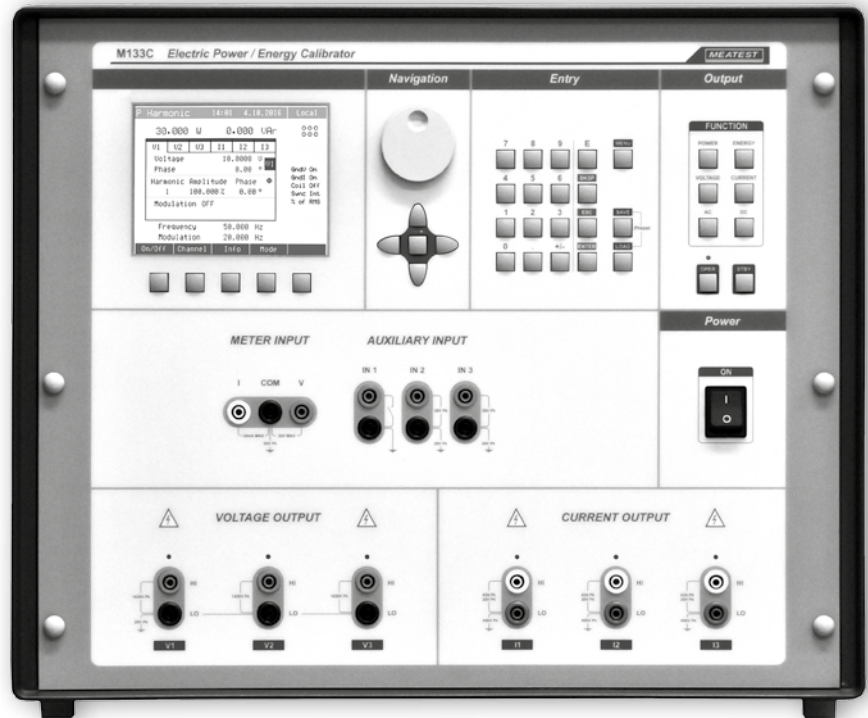
Option 160-60 – frequency measurement adapter
Option 160-70 – resistance measurement adapter
Option 91 – external RJ for thermocouples

### Ordering codes

Functions	M160i-Vxxxx – U, I, TC, Frequency M160-Vxxxx v U, I, TC, Frequency, RTD, R
Bus	M160-V1xxx – RS232 M160-V2xxx – RS232, USB, LAN, GPIB
Housing	M160-Vxx0x – table version M160-Vxx1x – module 19", 3HE

# M133C

# ELECTRIC POWER / ENERGY CALIBRATOR



## HIGHLIGHTS

- Power quality and energy functions three and single phase version
- AC power up to 3x 18 kVA, DC up to 25.2 kW
- Phase accuracy 0.02°, frequency range 15-1000 Hz
- Calibration of clamp meters up to 2250 A
- Floating current outputs, up to 5 Vrms
- Built-in process multimeter
- GPIB, RS-232 and ethernet as standart

## DESCRIPTION

M133C is electric AC/DC power and energy calibrator for calibration of power meters, power transducers, power quality analysers and generally all kinds of power measuring devices

Full version of M133C calibrator can generate four types of power distortion: harmonic up to 50 products, interharmonic up to 5 kHz, amplitude modulation using symmetrical sine or square wave envelope and finally dip/swell amplitude modulation using custom square wave envelope. All the parameters including distortion can be set independently for each phase.

M133C is more than just a sophisticated power source. Using built-in process multimeter, both transducer inputs and outputs can be handled by the M133C at the same time so you can calibrate it more easily, using no other calibration equipment. Floating current outputs can be connected directly with voltage outputs o allow for 3-wire power meter calibration. One calibrator, many applications - saving your time, space and costs.

## SPECIFICATION

### DC/AC voltage sinus

Voltage range:	1 Vdc to 280 Vdc, 1 Vac to 600 Vac
Resolution:	5½ dig.
Frequency range:	DC, 15 Hz to 1000 Hz. Synchronization to mains frequency or external signal is available.
Frequency accuracy:	0.005 %
Frequency resolution:	0.001 Hz, 0.01 Hz above 500 Hz
Distortion of output signal:	< 0.05 %

Range	% of value + % of range	Max. burden (mA)	% of value + % of range	Max. burden (mA)	% of value + % of range	Max. burden *
	DC	DC	15 - 40 Hz 70 - 1000 Hz	15 - 40 Hz 70 - 1000 Hz	40 - 70 Hz	40 - 70 Hz
1.0000 - 10.0000 V	0.015 + 0.01	100	0.02 + 0.01	100	0.015 + 0.01	100
10.0001 - 30.0000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	200
30.001 - 70.000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	300
70.001 - 140.000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	300
140.001 - 280.000 V	0.015 + 0.01	150	0.02 + 0.01	150	0.015 + 0.01	200
280.001 - 600.000 V**	—	—	0.03 + 0.01	50	0.02 + 0.01	60

\*Sum of all currents (three phases) for M133C (M133Ci) is limited to 400 mA \*\*Only fundamental harmonic in range over 280 Vac, frequency range 20 - 1000 Hz

### DC/AC current sinus

Current range:	0.005 A to 30 A
Resolution:	5½ dig.
Frequency range:	DC, 15 Hz to 1000 Hz.
Frequency accuracy:	0.005 %
Frequency resolution:	0.001 Hz, 0.01 Hz above 500 Hz
Distortion of output signal:	< 0.1 %

Range	% of value + % of range	Max. voltage (V)	% of value + % of range	% of value + % of range	Max. voltage (V)	Max. voltage (V)
	DC	DC	15 - 40 Hz 70 - 1000 Hz	40 - 70 Hz	15 - 400 Hz	400 - 1000 Hz
0.005000 - 0.300000 A	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
0.30001 - 1.00000 A	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
1.00001 - 2.00000 A	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
2.00001 - 5.00000 A	0.025 + 0.01	5	0.03 + 0.02	0.025 + 0.01	3.5	3.5
5.0001 - 10.0000 A	0.03 + 0.015	5	0.04 + 0.02	0.03 + 0.015	3.5	3.5
10.0001 - 30.0000 A	0.035 + 0.015	5	0.05 + 0.02	0.035 + 0.015	3.5	3.5

Additional uncertainty with applied current coil Opt.140-50 is 0.3 %. Output current is multiplied by factor 50.

### Phase shift voltage/current - Power factor

Phase shift range:	0.00° to +359.99°
Frequency range:	15 Hz to 1000 Hz
Phase shift resolution:	0.01°
Power factor range:	-1 to +1
Power factor resolution:	0.001
Power factor accuracy:	dPF = 100*(1 - cos(φ+dφ)/cos φ) (%)

### Phase shift accuracy φ (internal synchronization)

Frequency (Hz)	15-70	15-70	15-70	70-400	400-1000
Current (A)	0.008-0.1	0.1-10	10-30	0.008-30	0.008-30
Accuracy φ (°)	0.05	0.02	0.05	0.1	0.4

## DC electric power

Total range: 0.005 W to 8400 W (420 kW with current coil option 140-50)  
Quantity: W

Current range	Voltage range				
	1 V - 10 V	10 V - 30 V	30 V - 70 V	70 V - 140 V	140 V - 280 V
5 mA - 5 A	0.044 %	0.044 %	0.044 %	0.044 %	0.044 %
5 A - 10 A	0.05 %	0.05 %	0.05 %	0.05 %	0.05 %
10 A - 30 A	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %

\*Best accuracy is shown.

## AC electric power \*

Total range: 3x (0.005 VA to 18 kVA (900 kVA with current coil option 140-50))  
Frequency range: 15 Hz to 1000 Hz  
Quantity: W, VA, VAR

PF = 1.0 f = 40 - 70 Hz		Voltage range				
Current range	1 V - 10 V	10 V - 30 V	30 V - 70 V	70 V - 140 V	140 V - 280 V	280 V - 600 V
5 mA - 100mA	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %
100 mA - 5 A	0.04 %	0.04 %	0.04 %	0.04 %	0.04 %	0.05 %
5 A - 10 A	0.05 %	0.05 %	0.05 %	0.05 %	0.05 %	0.06 %
10 A - 30 A	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %
PF = 0.8 f = 40 - 70 Hz		Voltage range				
Current range	1 V - 10 V	10 V - 30 V	30 V - 70 V	70 V - 140 V	140 V - 280 V	280 V - 600 V
5 mA - 100 mA	0.09 %	0.09 %	0.09 %	0.09 %	0.09 %	0.09 %
100 mA - 5 A	0.05 %	0.05 %	0.05 %	0.05 %	0.05 %	0.05 %
5 A - 10 A	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %	0.06 %
10 A - 30 A	0.09 %	0.09 %	0.09 %	0.09 %	0.09 %	0.09 %
PF = 0.5 f = 40 - 70 Hz		Voltage range				
Current range	1 V - 10 V	10 V - 30 V	30 V - 70 V	70 V - 140 V	140 V - 280 V	280 V - 600 V
5 mA - 100 mA	0.16 %	0.16 %	0.16 %	0.16 %	0.16 %	0.16 %
100 mA - 5 A	0.08 %	0.08 %	0.08 %	0.08 %	0.08 %	0.08 %
5 A - 10 A	0.08 %	0.08 %	0.08 %	0.08 %	0.08 %	0.08 %
10 A - 30 A	0.16 %	0.16 %	0.16 %	0.16 %	0.16 %	0.16 %

\*Best accuracy for active power.

Electric power accuracy is calculated according to formula:  $dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.012)} (\%)$

## DC/AC electric energy

Voltage range: 1 V to 280 Vdc (600 Vac)  
Current range: 0.005 A to 30 A  
Power factor range: -1 to +1  
Time interval setting: 1 s to 10 000 s  
Time interval resolution: 0.1 s  
Time interval accuracy: 0.01% + 0.1s



## NON-HARMONIC SIGNALS (M133C ONLY) MODULATION, FLICKER

Fundamental harmonic frequency range:	15 Hz to 1 kHz
Single harmonic (2-50) frequency range:	30 Hz to 5 kHz
Modulation frequency range:	0.001 Hz to 50 Hz
Modulation depth:	0 to 30 %
Modulation depth resolution:	0.001 %
RMS amplitude uncertainty:	0.2 % of range
Waveform of modulation signal:	sinus, rectangular
Duty cycle ratio of rectangular signal:	1 % to 99 %
Modulation depth accuracy:	0.2 %

## Harmonic and interharmonic distortion (H/I products)

Fundamental harmonic frequency range:	15 Hz to 1 kHz
Fundamental harmonic uncertainty:	0.2 % of range
Frequency range of harmonic products:	30 Hz to 5 kHz
Frequency range of interharmonic product:	15 Hz to 1 kHz
Max. number of harmonic products:	50
Number of interharmonic products:	1
Frequency uncertainty:	0.005 %
H/I products amplitude range:	max. 30 % of RMS output value
Amplitude resolution of H/I products:	0.001 %
Noise & distortion:	- 60 dB

### Accuracy of H/I products amplitude

Ranges	% of range	
	30 - 3000 Hz	3000 - 5000 Hz
1.0000 - 10.0000 V		
10.0001 - 30.0000 V		
30.001 - 70.000 V	0.1	0.2
70.001 - 140.000 V		
140.001 - 280.000 V		
0.008000 - 0.300000 A		
0.30001 - 1.00000 A	0.1	0.2
1.00001 - 2.00000 A		
2.00001 - 5.00000 A	0.2	0.4
5.0001 - 10.0000 A		
10.0001 - 30.0000 A	0.2	0.8

## Dip/Swell

AC voltage range:	0.1 V ... 280 V
AC current range:	1 mA ... 30 A
Amplitude accuracy:	0.2 % of range *1
Frequency range:	15 Hz ... 1 kHz

## Timing \*2

t1 range:	0 s ... 60 s
t2 range:	0.1 ms ... 60 s
t3 range:	2 ms ... 60 s
t4 range:	0.1 ms ... 60 s
t5 range:	0 s ... 60 s

\*1 Range is defined according to the highest level of generated signal. \*2  $t_1 + t_5 > 2$  ms

## Built in process multimeter

Function	Range	Accuracy	Resolution
DC voltage	0 to $\pm 12$ V	0.01 % + 0.01 %	100 $\mu$ V
DC current	0 to $\pm 25$ mA	0.01 % + 0.01 %	100 nA
Frequency	1 Hz to 15 kHz	0.005 %	10 $\mu$ Hz - 0.1 Hz

## GENERAL DATA

Warm up time:	60 min
Operating temperature:	23 ± 10 °C
Storage temperature:	-10 to 55 °C, humidity < 90 %
Reference temperature:	23 ± 2 °C
Power supply:	115/230V – 50/60 Hz
Safety class:	I, according EN 1010
Dimensions:	500 x 520 x 430 mm
Weight:	59 kg
Power consumption:	max. 1875 VA

Specification includes long-term stability, temperature coefficient, linearity, load and line regulation and the traceability of factory and National calibration standards. Specified accuracy is valid after one hour warm up in temperature range 23 ± 2 °C. Specified accuracy is one year accuracy.

## APPLICATION

### Calibration of different transducers

INPUT	OUTPUT
power	0...10 V
voltage	0...20mA
current	0...10 kHz
phase	
frequency	



### Calibration of power quality meters (M133C only)

power  
voltage  
current  
phase  
frequency  
harmonic 1...50  
interharmonic  
modulation  
flicker  
dip/swell



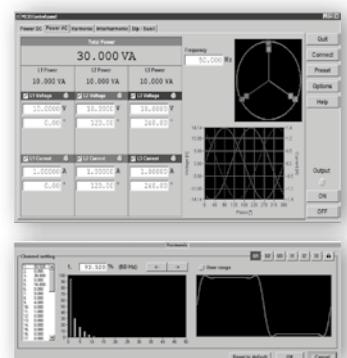
### High current adapter Option M133C-01

AC/DC current up to 90 A and up to 2250 A using 151-25 Current Coil. Comes as standards with three phase systems



### M133 control panel (freeware)

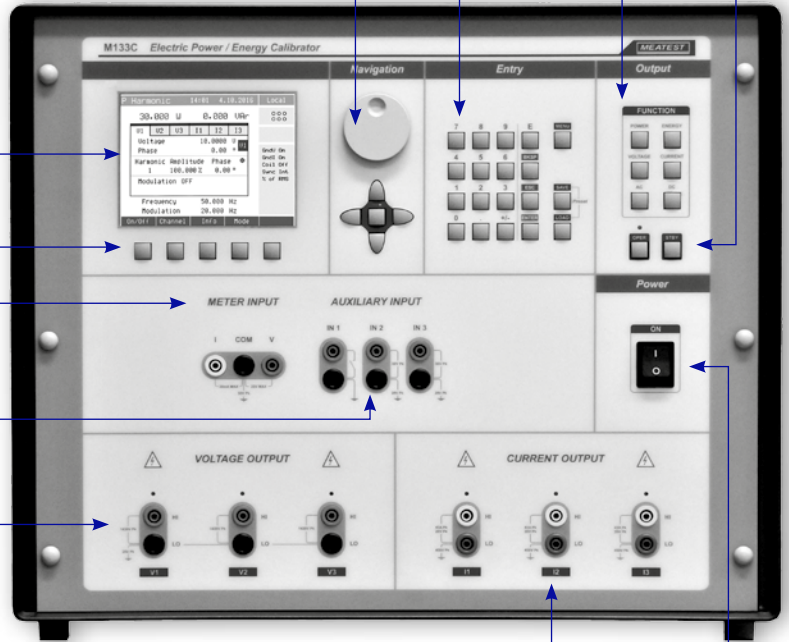
Program can be used with all M133C models to display and change output over remote control interface. Settings can be saved into a PC in file format. Program displays vector diagram and shapes of individual signals.



Free download from [www.meatest.com](http://www.meatest.com)

# M133C FRONT PANEL

- Output On/Off**  
Operate/Standby with LED indicator
- Function keys** - Direct function selection
- Numeric keys** - Direct value setting
- Adjustment controls**  
Multifunction rotary knob Cursor keys
- Multifunction display**  
Generated and measured values  
Accuracy of generated value  
Warnings and error messages  
Status of the calibrator  
Output terminals configuration
- Soft keys**
- Meter inputs**  
DC voltage, DC current, Frequency
- Auxiliary inputs** - Pulse counting,  
Synchronization, Triggering
- Output voltage terminals**  
Channels L1, L2, L3, Common LO  
terminals floating up to 20 Vpk
- Output current terminals**  
Channels L1, L2, L3, Independent LO  
terminals floating up to 450 Vpk
- Power line switch**

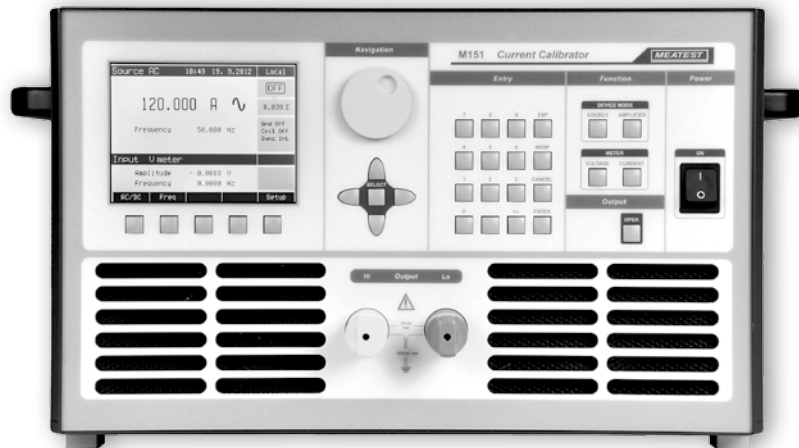


- Remote control state** - Remote/Local
- Information line**
- Output state**  
Voltage over 50 V, Output On/Off
- Main parameter** - Value, Unit, AC/DC
- Specification** - Main value accuracy
- Auxiliary parameters**  
Voltage, Current, Phase, Frequency
- Auxiliary information** - Grounding,  
Sense, Current coil, Synchronization,  
Active channels
- Process meter**  
Voltage Current Frequency
- Soft keys** - Function depends  
on actual display mode

Pac Basic	17:11	15. 3.2011	Local
21.600 kW			⚡ U I
0.051 %			
Voltage	240.000 V		
Current	30.000 A		
Phase	0.00 °		
Frequency	50.000 Hz		
Input	0.0001 V		
	Units	Mode	

# M151

# CURRENT CALIBRATOR



## HIGHLIGHTS

- AC/DC current 8 mA...120 A, 15-1000 Hz
- Total accuracy 275-400 ppm in all ranges
- Floating output up to 450 Vpk, compliance voltage 8 Vpk
- Calibration of clamp meters up to 3000 A
- Real and simulated transconductance amplifier
- GPIB and RS-232 come as standard

## DESCRIPTION

Model M151 is a stable high current calibrator up to 120 A. Basic accuracy is 275 ppm. Instrument can be controlled via RS232 or GPIB interface. Calibrator can work in a simulated amplifier mode to increase current ranges of any multifunction calibrator. It is suitable for power meter's calibration because M151 can be synchronized with the input signal not only in amplitude but also in frequency and phase. Current terminals are isolated up to 450 Vpk against case (protective earth). M151 is a sophisticated instrument with its own recalibration procedure. The procedure enables to adjust any deviation directly from the front panel. Calibrator is designed for checking parameters of amp meters. With current coil it can be used for calibration of clamp meters.

### M151 Specification (1 year accuracy, reference temperature)

Range	% of value + % of range			Compliance voltage		
	DC	40 - 70 Hz	15 - 40 Hz 70 - 1000 Hz	DC	15 - 400 Hz	400 - 1000 Hz
0.008000 - 0.300000 A	0.0175 + 0.01	0.0175 + 0.01	0.025 + 0.02	8 V	5.5 V	3.5 V
0.300001 - 1.000000 A	0.0175 + 0.01	0.0175 + 0.01	0.025 + 0.02	8 V	5.5 V	3.5 V
1.000001 - 2.000000 A	0.0175 + 0.01	0.0175 + 0.01	0.025 + 0.02	8 V	5.5 V	3.5 V
2.000001 - 5.000000 A	0.0175 + 0.01	0.0175 + 0.01	0.025 + 0.02	5 V	3.5 V	3.5 V
5.00001 - 10.0000 A	0.021 + 0.015	0.021 + 0.015	0.04 + 0.02	5 V	3.5 V	3.5 V
10.0001 - 30.0000 A	0.025 + 0.015	0.025 + 0.015	0.05 + 0.02	5 V	3.5 V	3.5 V
30.0001 - 60.0000 A	0.025 + 0.015	0.025 + 0.015	0.05 + 0.02	5 V	3.5 V	3.5 V
60.0001 - 120.000 A	0.025 + 0.015	0.025 + 0.015	0.05 + 0.02	5 V	3.5 V	3.5 V

# SPECIFICATION

## Built in process multimeter

Function	Range	% of value + % of range
AC voltage < 1 kHz	0 – 20 V	0.02 % + 0.02 %
AC voltage > 1 kHz	0 – 20 V	0.05 % + 0.05 %
DC voltage	±20 V	0.01 % + 0.01 %
AC current < 1 kHz	0 – 200 mA	0.02 % + 0.02 %
AC current > 1 kHz	0 – 200 mA	0.05 % + 0.05 %
DC Current	±200 mA	0.01 % + 0.01 %
Frequency	1 Hz - 10 kHz	0.005 % + 0.00 %

## GENERAL DATA

Warm-up time:	15 min
Output terminals isolation:	up to 450 Vpk against GND (protective earth)
Distortion of output signal:	< 0.1 %
Frequency accuracy:	0.005 %
Frequency resolution:	0.001, 0.01 Hz above 500 Hz
Frequency synchronization:	internal, external, power supply
Simulated amplifier gain:	0.5 ... 10 A/V (transconductance amplifier) 50 ... 1000 A/A (current amplifier)
Remote control:	RS232, IEEE488
Power supply:	115/230 VAC, 50/60 Hz
Reference temperatures:	+20 °C ... +26 °C
Working temperatures:	+5 °C ... +40 °C
Storage temperatures:	-10 °C ... +55 °C
Dimensions:	W 538 mm, H 283 mm, D 540 mm
Weight:	42 kg

## Option 151-25 Current Coil



Actively cooled 25-turn current coil for calibration of clamp ammeters up to 3000 A.

### AC current source

Source AC		14:35 21. 9.2012	Local
102.000 A		~	0.053 %
Frequency	50.000 Hz		Gnd Off Coil Off Sync Int
Input A meter			
Amplitude	99.990 mA		
Frequency	50.000 Hz		
AC/DC	Freq		Setup

### Simulated transconductance amplifier

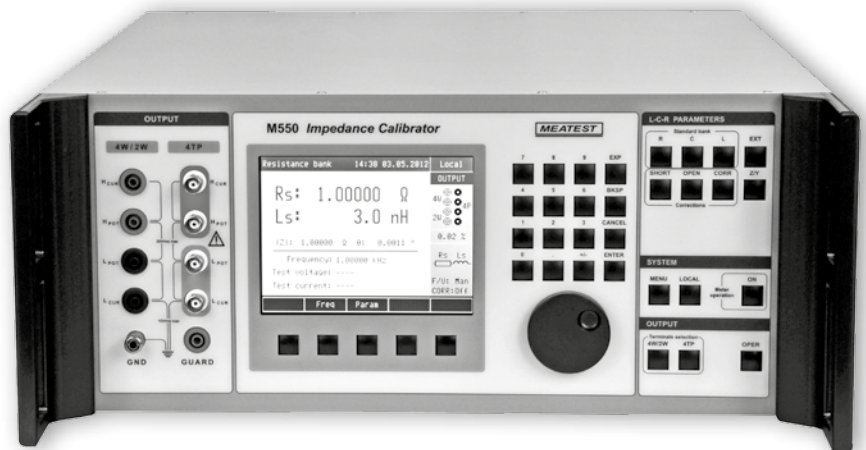
Amplifier AC		14:43 21. 9.2012	Local
• 117.000 A		~	0.053 %
Frequency	1000.00 Hz		Gnd Off Coil Off Sync Int
Gain	10.00 A/U		
Step	1.0 A		
Input U meter			
Amplitude	11.7069 V		
Frequency	1000.00 Hz		
AC/DC	Freq	Gain	Step
			Setup

### Recalibration

Current AC		Setup
Range 300mAac low (300mA)		
Range 300mAac high (300mA)		
Range 1Aac low (0.3A)		
Range 1Aac high (1A)		
Range 2Aac low (1A)		
Range 2Aac high (2A)		
Range 5Aac low (2A)		
Range 5Aac high (5A)		
Range 10Aac low (5A)		
Range 10Aac high (10A)		
Range 120Aac low 1 (10A)		
Range 120Aac high 1 (30A)		
Range 120Aac low 2 (10A)		
▼		
Select		Exit

# M550

# IMPEDANCE CALIBRATOR



## HIGHLIGHTS

- Calibration of LCR meters up to 1 MHz
- Resistance range 100 mΩ to 100 MΩ
- Capacitance range 10 pF to 100 μF
- Simulated inductance standards 10 μH to 10 H
- Best calibration uncertainty 0.02 % at 1 kHz
- GPIB and RS-232 come as standard
- Four pair coaxial terminal connection, four terminal connection, two terminal connection
- OPEN and SHORT reference functions

## DESCRIPTION

Idea behind M550 Impedance Calibrator is to replace countless single value RCL standards with one calibrator that can switch between the standards like a CD changer in your car. The calibrator contains stable and temperature independent resistance standards, partial capacitance standards and partial inductance standards, simulated by RC T-type passive network. Calibration values of both complex parameters of partial standards are displayed on large LCD screen in preselected pairs of parameters as well as voltage, current and frequency readouts from built-in test signal meter. OPEN and SHORT reference positions are available as well.

The philosophy of M550 is based on remote control and automated calibration. For this reason, the calibrator is equipped with RS-232 and GPIB interfaces and of course, supported in CALIBER/WinQbase calibration software. Easy recalibration systems offers either full recalibration in all spot frequency points or simplified offset calibration.

## SPECIFICATION

Modes:	4TP four pair terminal, 4 W four terminal 2 W two terminal
Output terminals:	4x BNC connectors for coaxial output (4TP) 4x banana terminal for non-coaxial output (2 W/4 W)
Frequency range:	20 Hz to 1 MHz
Reference correction positions:	SHORT, OPEN

## Resistance

Range:	0.1 $\Omega$ to 100 M $\Omega$ (fix decimal values)
Deviation to nominal value:	0.10 % to 10 % depending on value and mode
Calibration uncertainty:	0.02 % to 1 % at 1 kHz depending on value and mode
Temperature coefficient:	2 to 25 ppm/°C

## Capacitance

Range:	10 pF to 100 $\mu$ F (fix decimal values)
Deviation to nominal value:	< 5 %
Calibration uncertainty:	0.05 % to 5 % at 1 kHz depending on value and mode
Temperature coefficient:	30 to 100 ppm/°C

## Inductance (simulated in 4TP mode)

Range:	10 $\mu$ H to 10 H (fix decimal values)
Deviation to nominal value:	< 15 %
Calibration uncertainty:	0.1 % to 4 % at 1 kHz depending on value and mode
Temperature coefficient:	50 ppm/°C max.

## Test level meter

Frequency range:	20 Hz to 100 kHz
Voltage range:	200 mV to 10 V rms
Test voltage accuracy:	2 to 5 %

## GENERAL DATA

Interface:	RS232, GPIB
Operating temperature:	15 ... 30 °C
Storage temperature:	-10 ... +40 °C
Dimension:	W 450 mm, H 150 mm, D 430 mm
Net weight:	12 kg
Power line:	115/230 VAC, 50/60 Hz
Consumption:	45 VA

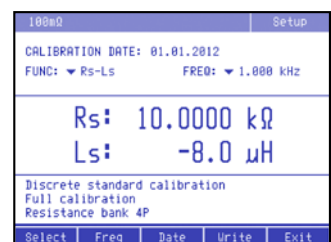
## Automation of LCR meter calibration



M550 Impedance calibrator application combines precise and frequency independent partial standards of electric resistance, capacitance and inductance in one instrument. Both manual and remote control is available making the M550 an effective tool for manual or automatic adjustments, verifications and calibrations of various types of LCR meters. In 4TP mode the calibrator enables verification of LCR meter in frequency range up to 1 MHz. Calibration values either with or without test cable length correction are selectable.

## Recalibration procedure

M550 calibration menu offers comfortable recalibration of calibration data. Two basic methods are implemented to make the recalibration easier. Full recalibration enables access to all stored complex calibration values of all partial standards in spot frequencies. Modification of frequency characteristics is fully accessible in this method. Offset recalibration simplifies the process of recalibration to modification of main parameter at 1 kHz only. Difference from the previous calibration value is automatically projected to all spot frequencies.



# LF IMPEDANCE STANDARDS



## HIGHLIGHTS

- Traceability of electric quantities, calibration of meters
- Low time constant, calibration uncertainty 0.005 %
- Three/four terminal or four pair terminal connection

## DESCRIPTION

Resistance/Capacitance standards of series MTE are designed for calibration of ohmmeters, RCL meters, insulation testers calibration. They can be applied as a mean of traceability of electric resistance between primary and secondary laboratories. DC modification of the standards is equipped with 4 mm terminal socket. Resistance standards up to 1 MΩ are in four-terminal connection while standards over 10 MΩ have two terminal connection with additional insulation washer and with grounding terminal connected to the housing. AC resistance versions and capacitance/inductance standards are delivered with four BNC connectors enabling application in three-terminal, four-terminal, four-pair terminal configuration. As a part of MTE set for AC applications the reference positions OPEN and SHORT terminals can be delivered. Both components serve typically for zero calibration of RCL meters. Other type of connectors can be installed on request. Other nominal values can be delivered on request.

## Inductance standards

Connection	Four pair terminal
Type of terminals	BNC coaxial connectors
Frequency range	100 Hz – 20 kHz

Model	Nominal value	Accuracy	1 kHz calibration uncertainty	Temperature coefficient	Min. quality factor for f=1 kHz	Type
LP - 100m *	100 mH	0.5 %	0.05 %	50 ppm/°C	≥ 3 ***	T-network
LP - 1 **	1 H	0.5 %	0.05 %	50 ppm/°C	≥ 3	T-network
LP - 10	10 H	0.5 %	0.05 %	50 ppm/°C	≥ 10	T-network
LP - 100	100 H	0.5 %	0.05 %	50 ppm/°C	≥ 10	T-network
LP - 1000	1000 H	0.5 %	0.05 %	50 ppm/°C	≥ 10	T-network

T network is composed from two resistors and one capacitor. The network can simulate inductance parameter L21 with Q factor over 3 in recommended frequency area. The standard can be applied for calibration of those RCL meters which measure test current in Low input terminal. The standard cannot be applied for calibration of classic transformer bridges.

\*Applicable frequency range from 10 to 20 kHz; \*\*Applicable frequency range from 1 kHz to 20 kHz; \*\*\*Q factor for frequency 10 kHz



## Resistance standards

Connection	4-terminals or 4 pair-terminals, 3-terminals (above 10 MΩ)
Type of terminals	BNC coaxial connectors for AC applications (0.1 Ω to 10 MΩ) Gold plated term. for DC applications (0.1 Ω to 10 MΩ) Standard terminals with additional ertallyte isolation (above 10 MΩ)
Frequency range	DC to 20 kHz for nominal value 0.1 Ω to 10 MΩ (with BNC connectors)

Model	Nominal Value	Accuracy	DC calibration uncertainty	Temperature coefficient *	Power rating ** (maximum voltage)	Type
RP - 0.1	100 mΩ	0.1 %	0.05 %	10 ppm/°C	3 W	Foil resistor
RP - 1.0	1 Ω	0.05 %	0.01 %	10 ppm/°C	3 W	Foil resistor
RP - 1.0	1 Ω	0.05 %	0.01 %	1 ppm/°C	3 W	Foil resistor
RP - 10	10 Ω	0.01 %	0.005 %	1 ppm/°C	0.3 W	Foil resistor
RP - 100	100 Ω	0.01 %	0.005 %	1 ppm/°C	0.3 W	Foil resistor
RP - 1k	1 kΩ	0.01 %	0.005 %	1 ppm/°C	0.3 W	Foil resistor
RP - 10k	10 kΩ	0.01 %	0.005 %	1 ppm/°C	50 V	Foil resistor
RP - 100k	100 kΩ	0.01 %	0.005 %	1 ppm/°C	150 V	Foil resistor
RP - 1M	1 MΩ	0.01 %	0.005 %	1 ppm/°C	500 V	Foil resistor
RP - 10M	10 MΩ	0.05 %	0.01 %	100 ppm/°C	2 500 V	Ceramic resistor
RP - 100M	100 MΩ	0.5 %	0.1 %	100 ppm/°C	2 500 V	Ceramic resistor
RP - 1G	1 GΩ	1 %	0.3 %	100 ppm/°C	5 000 V	Ceramic resistor
RP - 10G	10 GΩ	3 %	0.5 %	100 ppm/°C	5 000 V	Ceramic resistor

\*in temperature range 0-50 °C; \*\*for ambient temperature 23 °C;

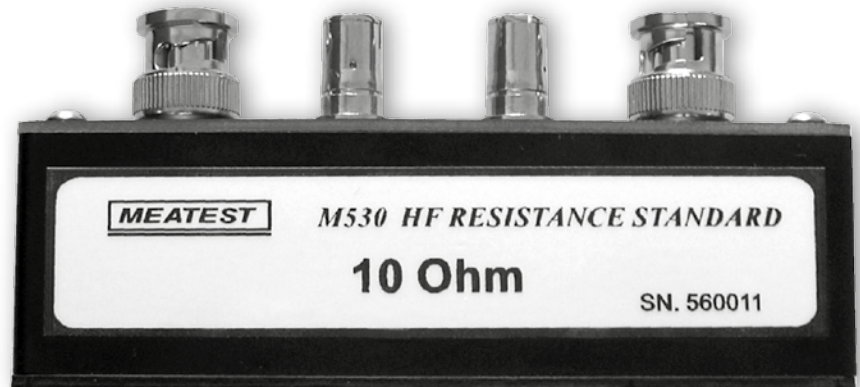
## Capacitance standards

Connection	Four pair terminal
Type of terminals	BNC coaxial connectors for AC applications
Frequency range	20 Hz-20 kHz to 1 nF, 20 Hz - 10 kHz to 100 μF

Model	Nominal value	Accuracy	1 kHz calibration uncertainty	Temperature coefficient	Dissipation factor	Type
CP - 10p	10 pF	1 %	0.01 %	15 ppm/°C	≤0.001	Ceramic multilayer Silver mica
CP - 100p	1 00 pF	0.1 %	0.01 %	15 ppm/°C	≤0.001	Ceramic multilayer Silver mica
CP - 1n	1 000 pF	0.1 %	0.01 %	15 ppm/°C	≤0.0005	Silver mica
CP - 10n	10 000 pF	0.1 %	0.01 %	15 ppm/°C	≤0.0005	Silver mica
CP - 100n	100 000 pF	0.1 %	0.01 %	15 ppm/°C	≤0.0005	Silver mica
CP - 1μ	1 μF	0.1 %	0.01 %	50 ppm/°C	≤0.0005	Polypropylen
CP - 10μ	10 μF	0.2 %	0.1 %	50 ppm/°C	≤0.005	Polypropylen
CP - 100μ	100 μF	0.2 %	0.1 %	50 ppm/°C	≤0.005	Polypropylen

# M530

# HF RESISTANCE STANDARDS



## HIGHLIGHTS

- Resistance range 10  $\Omega$  to 1000  $\Omega$
- Very low frequency dependency
- Applicable frequency range to 100 MHz
- Calibration of wide frequency range
- LCR meters

## DESCRIPTION

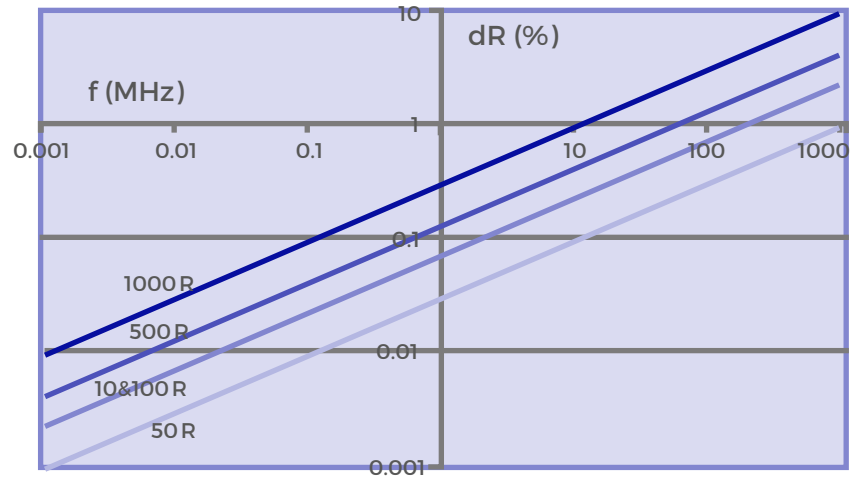
The resistance standard set is designed especially for calibration of LCR meters in frequency range from DC to 100 MHz. The standards are equipped with four coaxial BNC connectors. Wide frequency range is achieved by applied HF design using strip line technology. Four-pair terminal connection with 22 mm distance between them enables direct connection to the UUTs without need to apply test leads.

The standards are available with nominal value 10, 50, 100, 500, 1000  $\Omega$  in 1% tolerance. Reference positions OPEN and SHORT for easy "zero" compensation are available as well.

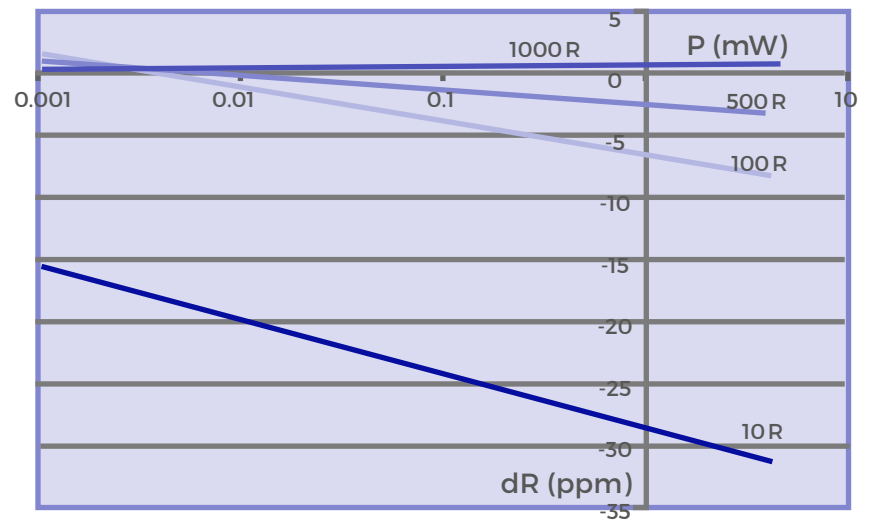
## Technical specification

Model	Nominal value	Maximal frequency for 0.1% deviation	Maximal frequency for 1% deviation	Time constant	Temperature coefficient	Maximal test current
M530-10R	10 $\Omega$	2 MHz	200 MHz	< 2.10-10 s	< 1 ppm/ $^{\circ}$ C	40 mA
M530-50R	50 $\Omega$	10 MHz	> 500 MHz	< 2.10-10 s	< 1 ppm/ $^{\circ}$ C	20 mA
M530-100R	100 $\Omega$	2 MHz	200 MHz	< 5.10-11 s	< 1 ppm/ $^{\circ}$ C	12 mA
M530-500R	500 $\Omega$	0.5 MHz	50 MHz	< 2.10-10 s	< 25 ppm/ $^{\circ}$ C	6 mA
M530-1000R	1000 $\Omega$	0.1 MHz	10 MHz	< 2.10-10 s	< 25 ppm/ $^{\circ}$ C	4 mA
OPEN	–	2 MHz	200 MHz	–	–	–
SHORT	0 $\Omega$	2 MHz	200 MHz	–	–	100 mA

## Frequency dependency



## Load dependency



## GENERAL DATA

Self-inductance:	< 0.08 $\mu$ H
Connection:	4 x BNC male connector
Distance between connectors:	22 mm
Dimensions:	105 x 34 x 50 mm (including connectors)
Housing:	aluminum
Range of working temperatures:	15–30 °C

## APPLICATION

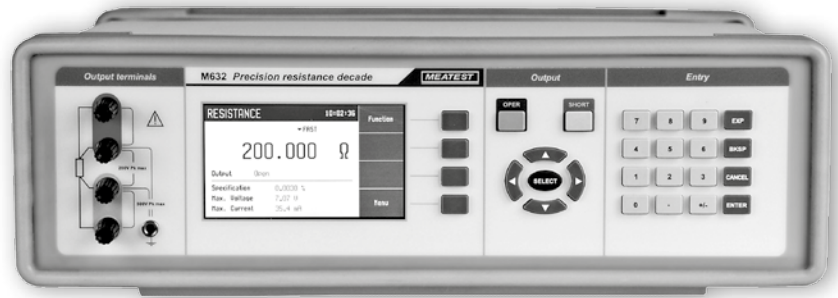
### Calibration of LCR meters



The standards are equipped with BNC connectors with the same spacing as input terminals of most frequently used LCR meters. Calibration in this way excludes the most significant uncertainties related to cables.

**M 63x**  
**M 64x**

# REAL-RESISTANCE DECADES



## HIGHLIGHTS

- Real resistors switched by relays
- Ranges as wide as 14 decades, resolution from 1  $\mu\Omega$
- No parasitic resistances
- 20 ppm accuracy / 5 W load capacity
- Six different languages, custom units

## DESCRIPTION

The M6xx series programmable resistance decades and RTD simulators offer an exceptional accuracy, resolution and stability of real resistance simulation. Both M63x decades contain stable foil resistors with low temperature coefficient switched by low thermal voltage relays. Built-in software has also a function of RTD temperature sensor simulation with parameters according to IEC (DIN) or US standards and temperature setting in degree of Celsius or Fahrenheit. Instrument can be controlled via RS232, USB, LAN or GPIB interface.

M6xx series programmable decades are sophisticated instruments with their own recalibration procedures. The procedure lets the user to correct any deviation in resistance without any mechanical adjusting.

Model	Usage	Range	Resolution	Max. load	Interfaces (RS232 std.)	Accuracy
M632	Resistance Decade	1 $\Omega$ – 1.2 M $\Omega$	10 $\mu\Omega$	0.25 W	USB, GPIB, LAN	0.003 %
M642	Resistance Decade	0.1 $\Omega$ – 22 M $\Omega$	1 $\mu\Omega$	5 W	USB, GPIB, LAN	0.02 %
M631	RTD Simulator	16 $\Omega$ – 400 k $\Omega$	0.001 $^{\circ}\text{C}$	0.25 W	USB, GPIB, LAN	0.01 $^{\circ}\text{C}$
M641	RTD Simulator	10 $\Omega$ – 300 k $\Omega$	0.01 $^{\circ}\text{C}$	5 W	USB, GPIB, LAN	0.1 $^{\circ}\text{C}$

## SPECIFICATION

### M632 Resistance accuracy

Range/Resolution	Accuracy
1.000 00 Ω–2.000 00 Ω	0.002 % + 2 mΩ
2.000 1 Ω–20.000 0 Ω	0.002 % + 2 mΩ
20.001 Ω–200.000 Ω	0.002 % + 2 mΩ
200.01 Ω–2000.00 Ω	0.003 %
2.000 1 kΩ–20.000 0 kΩ	0.003 %
20.001 kΩ–200.000 kΩ	0.003 %
200.01 kΩ–1200.00 kΩ	0.005 %

### M642 Resistance accuracy

Range/Resolution	Accuracy
100.000 mΩ–200.000 mΩ	0.05 % + 15 mΩ
200.01 mΩ–2.00000 Ω	0.05 % + 15 mΩ
2.0001 Ω–20.0000 Ω	0.05 % + 15 mΩ
20.001 Ω–200.000 Ω	0.05 % + 15 mΩ
200.01 Ω–2000.00 Ω	0.02 %
2.0001 kΩ–20.0000 kΩ	0.02 %
20.001 kΩ–200.000 kΩ	0.02 %
0.20001 MΩ–2.00000 MΩ	0.02 %
2.0001 MΩ–20.0000 MΩ	0.05 %

### M631 Resistance accuracy

Range/Resolution	Accuracy
16.000 0 Ω–20.000 0 Ω	0.002 % + 2 mΩ
20.001 Ω–200.000 Ω	0.002 % + 2 mΩ
200.01 Ω–1000.00 Ω	0.003 %
1000.1 Ω–3000.0 Ω	0.005 %
3001 Ω–10000 Ω	0.015 %
10.01 kΩ–30.00 kΩ	0.03 %
30.1 kΩ–100.0 kΩ	0.1 %
101 kΩ–400 kΩ	0.4 %

### M641 Resistance accuracy

Range/Resolution	Accuracy
10.000 0 Ω–20.000 0 Ω	0.05 % + 15 mΩ
20.001 Ω–200.000 Ω	0.05 % + 15 mΩ
200.01 Ω–1000.00 Ω	0.02 %
1.0001 kΩ–3.0000 kΩ	0.02 %
3.001 kΩ–10.000 kΩ	0.02 %
10.01 kΩ–30.00 kΩ	0.05 %
30.1 kΩ–100.0 kΩ	0.1 %
101 kΩ–300 kΩ	0.5 %

### M63x Pt simulation accuracy

Temperature	M632		M631	
	Pt10 ... Pt99	Pt100 ... Pt20000	Pt100 ... Pt500	Pt501... Pt1000
-200.000... 0.000 °C	0.05 °C	0.01 °C	0.01 °C	0.01 °C
0.001... 200.000 °C	0.06 °C	0.015 °C	0.015 °C	0.02 °C
200.001... 500.000 °C	0.08 °C	0.03 °C	0.03 °C	0.04 °C
500.001... 850.000 °C	0.1 °C	0.04 °C	0.04 °C	0.1 °C

### M63x Ni simulation accuracy

Temperature	M632		M631	
	Ni10 ... Ni99	Ni100 ... Ni20000	Ni100 ... Ni500	Ni501... Ni1000
-60.000... 0.000 °C	0.05 °C	0.01 °C	0.01 °C	0.01 °C
0.001... 300.000 °C	0.05 °C	0.01 °C	0.01 °C	0.02 °C

### M64x Ni simulation accuracy

Temperature	M642		M641
	Ni10 ... Ni99	Ni100 ... Ni20000	Ni100 ... Ni1000
-60.000... 300.000 °C	0.4 °C	0.1 °C	0.1 °C

### M64x Pt simulation accuracy

Temperature	M642		M641
	Pt10 ... Pt99	Pt100 ... Pt20000	Pt100 ... Pt1000
-200.00 ... 0.000 °C	0.5 °C	0.15 °C	0.15 °C
-0.001 ... 850.000 °C	1.0 °C	0.2 °C	0.2 °C

## M63x Frequency response

AC/DC difference	M632						M631				
	1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ	16 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ
100 Hz	0.01 %	0.01 %	0.01 %	0.05 %	0.50 %	5.00 %	0.01 %	0.01 %	0.03 %	0.30 %	3.00 %
1 kHz	0.02 %	0.01 %	0.05 %	0.50 %	5.00 %		0.01 %	0.03 %	0.30 %	3.00 %	
10 kHz	0.20 %	0.04 %	0.50 %	5.00 %			0.04 %	0.30 %	3.00 %		

## M64x Frequency response

AC/DC difference	M642							M641				
	100 mΩ	1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ
100 Hz	0.05 %	0.02 %	0.01 %	0.01 %	0.06 %	0.60 %	6.00 %	0.01 %	0.01 %	0.04 %	0.40 %	4.00 %
1 kHz	0.20 %	0.1 %	0.02 %	0.01 %	0.60 %	6.00 %		0.01 %	0.05 %	0.40 %	4.00 %	
10 kHz	5.00 %	0.50 %	0.10 %	0.60 %	6.00 %			0.05 %	0.50 %	4.00 %		

## GENERAL DATA

Maximum voltage:	200 V pk
Maximum current:	500 mA
Total power dissipation:	0.25 W (M63x), 5 W (M64x)
Temperature coefficient:	10 % of specification per °C outside the reference temp. range
Reaction time:	6 ms
Switching method:	Fast/Smooth/Via short/Via open
Terminals:	gold plated terminals 4 mm
Remote control:	RS232 interface (optionally USB, LAN, IEEE488)
Power supply:	115/230 VAC, 50/60 Hz
Reference temperatures:	+20 °C ... +26 °C
Working temperatures:	+5 °C ... +40 °C
Storage temperatures:	-10 °C ... +50 °C
Dimensions:	W 390 mm, H 128 mm, D 310 mm
Weight:	5.2 kg (M63x), 4.0 kg (M64x)

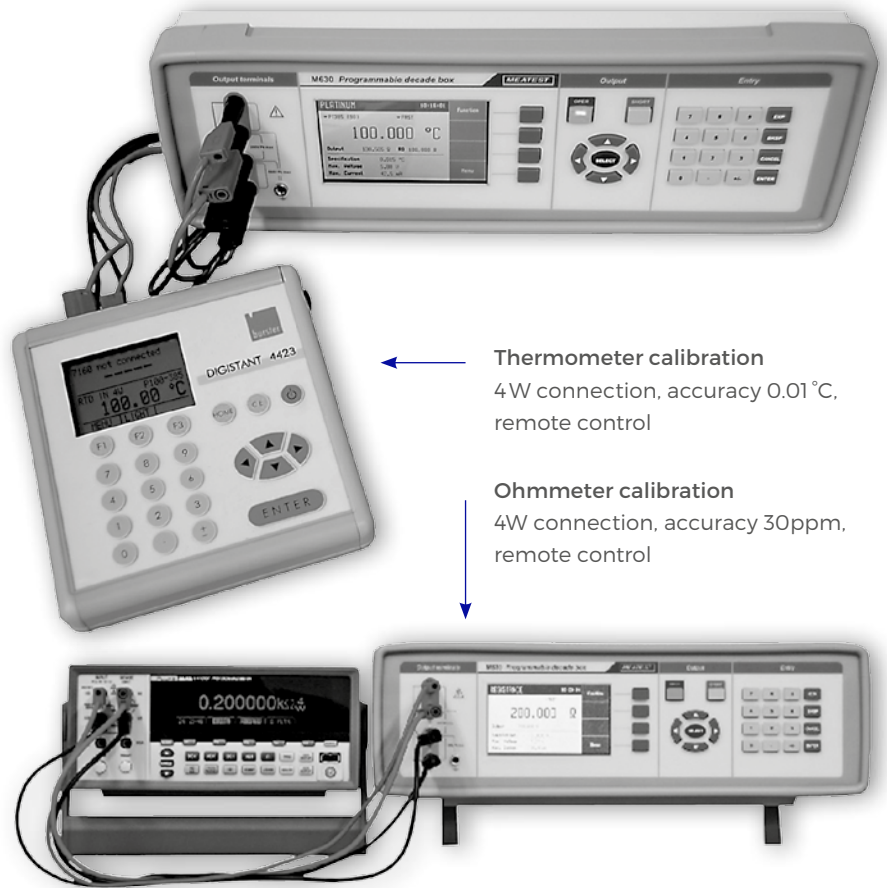
## Ordering codes

Bus	M6xx-V1xxx - RS232
	M6xx-V2xxx - RS232, USB, LAN, GPIB
Housing	M6xx-Vxx0x - table version
	M6xx-Vxx1x - module 19", 3HE
Other	M642-Vx2xx - 22 MΩ extension for M642

## 19" rack module



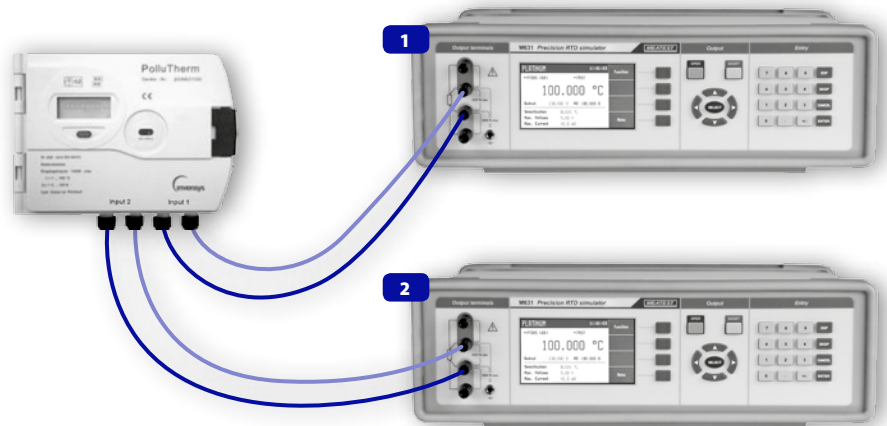
## Calibration of resistance meters and evaluation units



Thermometer calibration  
4W connection, accuracy 0.01 °C, remote control

Ohmmeter calibration  
4W connection, accuracy 30ppm, remote control

## Calibration of heat meters using two M631 RTD simulators



RTD simulators here simulate the temperatures of input and output water of the system.

### Resistance

RESISTANCE		14:33:45	Function
100.000 Ω		FAST	
Output	100.000 Ω		
Specification	0.0040 %		
Max. Voltage	5.00 V		
Max. Current	50.0 mA		Menu

### Temperature

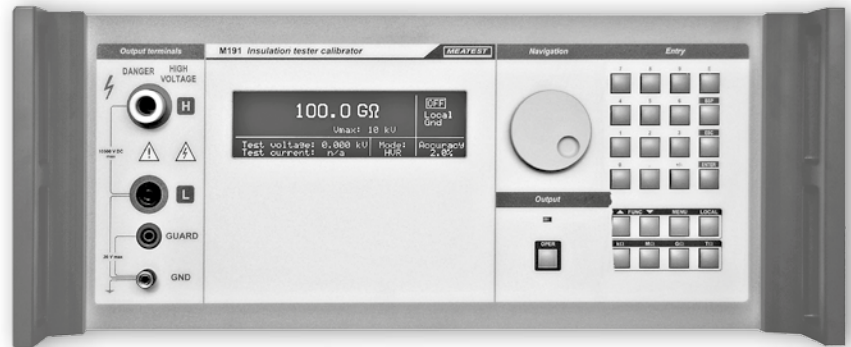
PLATINUM		10:18:59	Function
100.000 °C		FAST	
Output	138.505 Ω RO 100.000 Ω		
Specification	0.015 °C		
Max. Voltage	5.88 V		
Max. Current	42.5 mA		Menu

### Recalibration

CALIBRATION		Previous
Resistance	1 / 37	Next
Nominal resistance	1.95 Ω	Save
Requested accuracy	1 mΩ	
Last calibrated	07/02/2012	
1.9443810 Ω		Close

# M191

# INSULATION TESTER CALIBRATOR



## HIGHLIGHTS

- Resistance range 10 kΩ to 1 TΩ, voltage up to 10 kV
- Based on Real-Resistance Decade technology
- High voltage capacitance, dielectric parameter testing
- Test voltage and current indication
- Short and timer functions
- GPIB and RS-232 come as standard

## DESCRIPTION

M191 Insulation Tester Calibrator is based on 1 TΩ programmable high resistance decade with 10 kV DC compliance, coupled with test voltage meter. This setup allows for calibration of UUT's test voltage, short current verification, timer function verification and calibration of dielectric parameters measurement including polarization index (PI), dielectric absorption ratio (DAR) and polarization ratio (PR).

M191 is designed for thorough calibration of insulation testers, megaohmmeters, HIPOT testers or any other DC high resistance meters and safety testers with test voltage up to 10 kV. With M191's palette of functions you'll no longer need multiple instruments and complex setups for high resistance applications.

## SPECIFICATION

### High voltage resistance

Resistance range:	10.00 kΩ to 1000.0 GΩ
Test voltage range:	10 000 VDC + 5 % over range
Hot switching:	up to 3000 VDC

### SHORT function (short current testing)

Current range:	0.000 – 5.000 mA DC
Input resistance:	2700 Ω nom.

### High voltage capacitance

Range of capacitance:	10, 50, 100 nF fix values
Tolerance:	±10 %
Calibration value uncertainty:	0.3 % + 200 pF
Max. test voltage:	5 000 VDC + 5 % over range



## Accuracy in grounded mode (G) and floating mode (F):

Resistance range	Accuracy in G mode*	Accuracy in F mode*	Maximum DC test voltage***	Typical voltage dependency	Test voltage accuracy	Test current range	Test current accuracy
10.00 kΩ–99.99 kΩ	0.2 %	0.2 %	65 V	< 0.05 ppm/V	0.5 % + 10 V	10 mA	0.7 % + 100 μA
100.0 kΩ–999.9 kΩ	0.1 %	0.1 %	315 V	< 0.05 ppm/V	0.5 % + 10 V	2.5 mA	0.7 % + 10 μA
1.000 MΩ–9.999 MΩ	0.1 %	0.1 %	1 250 V	< 0.05 ppm/V	0.5 % + 10 V	1 mA	0.7 % + 1 μA
10.00 MΩ–99.99 MΩ	0.1 %	0.1 %	5 000 V	< 0.05 ppm/V	0.5 % + 10 V	500 μA	0.7 % + 100 nA
100.0 MΩ–499.9 MΩ	0.2 %	0.2 %	10 000 V	< 0.05 ppm/V	0.5 % + 10 V	100 μA	0.7 % + 20 nA
500.0 MΩ–999.9 MΩ	0.2 %	0.2 %	10 000 V	< 0.07 ppm/V	0.5 % + 10 V	20 μA	1 % + 10 nA
1.000 GΩ–9.999 GΩ	0.5 %	0.5 %	10 000 V	< 0.15 ppm/V	0.5 % + 10 V	10 μA	1.5 % + 1 nA
10.00 GΩ–19.99 GΩ	1 %	1.0 %	10 000 V	< 0.15 ppm/V	0.5 % + 10 V	1 μA	1.5 % + 500 pA
20.00 GΩ–99.99 GΩ	1 %	2 %	10 000 V	< 0.20 ppm/V	0.5 % + 10 V	500 nA	2 % + 100 pA
100.0 GΩ–299.9 GΩ	2 %	3 %	10 000 V	< 0.20 ppm/V	0.5 % + 10 V	100 nA	5 % + 20 pA
299.9 GΩ–1000.0 GΩ	5 %	6 %	10 000 V	< 0.20 ppm/V	N/A**	N/A**	N/A**

\* Accuracy is valid in reference temperature range 23+/-2 °C with RH < 50 %.

\*\* Test voltage voltmeter function is not available in resistance range from 299.9 GΩ to 1 000 GΩ.

\*\*\* Maximum measured DC test voltage is 5 % over the specified range

## Test signal meter

Function	Range	Accuracy	Resolution
DC voltage	50–10500 V	0.5 % + 10 V	4 digits
DC current	0.01 pA–100 mA	Based on voltage meas	4 digits
SHORT current	0–5 mA	0.2 % + 5 μA	1 μA

## GENERAL DATA

Warm up time:	15 minutes
Reference temperature:	21...25 °C
Operating temperature:	13...33 °C
Storage temperatures:	-10 °C...55 °C
Temperature coefficient:	10 % of specification per °C out side the reference temp. range
Reference humidity:	< 70 % RH; < 50 % RH above 10 GΩ
Humidity coefficient:	5 % of specification per % RH, 15 % above 10 GΩ, 2 % below 100 MΩ
Dimensions:	W 450 mm, H 150 mm, D 430 mm
Weight:	12 kg
Power supply:	115/230 V, 50/60 Hz
Consumption:	40 VA

## MAIN DISPLAY

Selected resistance value in Ω.

Maximum safe test voltage in selected point

Measured test voltage & current

Accuracy in selected point

100.0 GΩ	OFF
Umax: 10 kV	Local Gnd
Test voltage: 0.000 kV	Mode: ACCURACY
Test current: n/a	HVR
	2.0%

# M194

# HIGH RESISTANCE DECADE



## HIGHLIGHTS

- Resistance range 10.00 kΩ - 100.0 GΩ
- Resistance accuracy 0.1 to 1 %
- Operating voltage to 6 kVDC
- Short current mA - meter
- Hot switching
- Timing function
- RS232 (optionally USB, IEEE488, Ethernet)

## DESCRIPTION

M194 High Resistance Decade is based on M6xx Series Real-Resistance Programmable Decades, providing cutting-edge performance, user-friendly calibration of resistance ranges as well as test meter ranges, timer and short current testing of UUTs. Main feature of M194 is adjustable high resistance decade in continuous range from 10 kΩ to 100 GΩ with 4 digit resolution. Designed for maximum operating voltages of up to 6 kVDC this decade is great for calibration of meggers, megaohmmeters and insulation testers. Accuracy from 0.1%.

Full remote control and automated calibration support is a standard for all Meatest instruments. On top of that, M194 comes with 4 interfaces (RS232, USB, LAN and GPIB) to match your system more easily.

## Accuracy & limits

Resistance range	Accuracy*	Maximum DC test voltage**	Test voltage accuracy
10.00 kΩ-99.99 kΩ	0.1 %	65 V	0.5 % + 2 V
100.0 kΩ-999.9 kΩ	0.1 %	315 V	0.5 % + 2 V
1.00 MΩ-1.99 MΩ	0.1 %	1 250 V	0.5 % + 2 V
2.00 MΩ-9.999 MΩ	0.1 %	2 500 V	0.5 % + 2 V
10.00 MΩ-99.99 MΩ	0.1 %	6 000 V	0.5 % + 2 V
100.0 MΩ-999.9 MΩ	0.2 %	6 000 V	0.5 % + 2 V
1.000 GΩ-9.999 GΩ	0.5 %	6 000 V	0.5 % + 2 V
10.00 GΩ-100.0 GΩ***	1.0 %	6 000 V	0.5 % + 2 V

\* Accuracy is valid within reference temperature range 23 ± 2 °C with RH < 50%.

\*\* Maximum measured DC test voltage is 5% over the specified range.

\*\*\* 1 minute settling time for full accuracy.

## SPECIFICATION

### SHORT function (short current testing)

Current range: 0.00–10.00 mA DC  
Input resistance: 100  $\Omega$  nom.  
Current meter accuracy: 0.2 % + 25  $\mu$ A

## GENERAL DATA

Reference temperature: 21...25 °C  
Operating temperature: 5...40 °C  
Storage temperatures: -10 °C...50 °C  
Temperature coefficient: 10 % of specification per °C outside the reference temp. range  
Reference humidity: < 70 % RH, < 50 % RH above 10 G $\Omega$   
Humidity coefficient: 2 % of specification per % RH, 5 % above 10 G $\Omega$   
Terminals: Gold plated terminals 4 mm  
Remote control: RS232 interface (optionally USB, LAN, IEEE488)  
Dimensions: W 390 mm, H 128mm, D 310 mm  
Weight: 4.5 kg  
Power supply: 115/230 V, 50/60 Hz

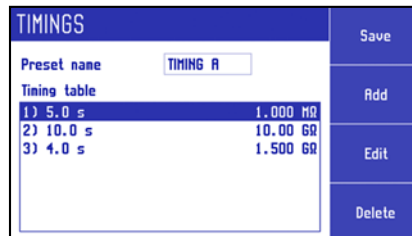
## Ordering codes

Bus: M194-V1xxx – RS232  
M194-V2xxx – RS232, USB, LAN, GPIB  
Housing: M194-Vxx0x – table version  
M194-Vxx1x – module 19", 3HE

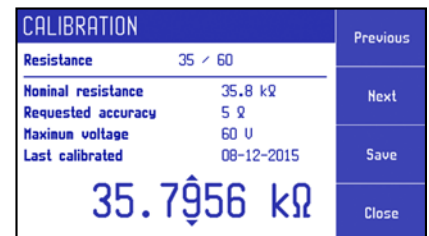
### Resistance



### Time sequence



### Recalibration



# M109R

# HIGH RESISTANCE DECADE



## HIGHLIGHTS

- Calibration of megaohmmeters
- 12 GΩ range, resolution 1 MΩ
- Maximum test voltage 5 kV
- Floating Lo terminal
- Battery backup
- RS-232 as standard

## DESCRIPTION

High resistance decade box is designed for calibrating of insulation meters and megaohmmeters. It is suitable for calibration laboratories and service centres, where can be used also for testing or setting of high resistance meters. High voltage relays with extremely high insulation resistance are used for switching of resistance components.

M109R is equipped with indication of maximum voltage limit. Instrument is supplied from accumulator or power line adapter. Control is possible manually or remotely via serial interface RS-232.

## GENERAL DATA

Range of resistance:	1 MΩ – 12.221 GΩ
Maximum voltage:	5kV DC between terminals H-L, H-GND, L-GND
Connection:	2W, 3W (GUARD)
Type of terminals:	high voltage terminals with ERTALYTE isolation
Remote control:	RS-232
Supply:	internal accumulator, power line supply adapter 15 V (100-240 V/50-60 Hz)
Temperature range:	23 °C ± 5 °C
Relative humidity:	10 – 50 %
Dimensions:	364 mm x 111 mm x 316 mm
Weight:	4 kg

## Accuracy

Decade	Nominal value accuracy	Voltage coefficient	Temperature coefficient	Maximum voltage
1 M $\Omega$ -11 M $\Omega$	0.1 %	1 ppm/V	< 100 ppm/ $^{\circ}$ C	1000 VDC
10 M $\Omega$ -110 M $\Omega$	0.2 %	1 ppm/V	< 100 ppm/ $^{\circ}$ C	2500 VDC
100 M $\Omega$ -1.1 G $\Omega$	0.5 %	2 ppm/V	< 100 ppm/ $^{\circ}$ C	5000 VDC
1 G $\Omega$ -12 G $\Omega$	1.0 %	2 ppm/V	< 100 ppm/ $^{\circ}$ C	5000 VDC

## APPLICATION



Calibration and verification of resistance meters with test voltage up to 5 kVDC - insulation testers, safety testers, megaohmmeters, ...

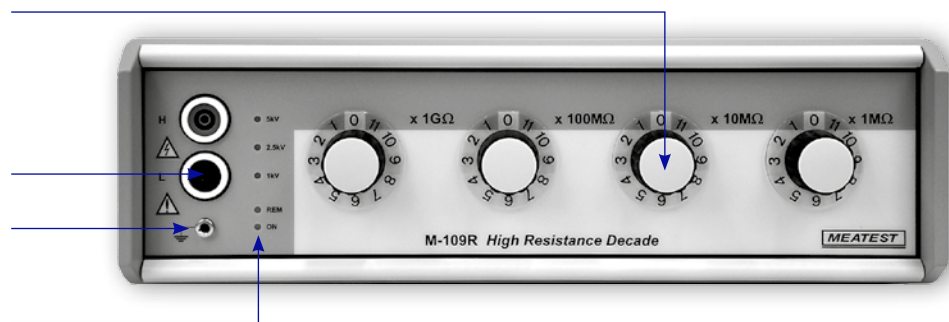
## FRONT PANEL

Mechanical rotary knobs

Floating terminals,  
protected up to 5 kV

GND terminal (protection earth)

LED indication (max. allowed  
voltage, remote control, on/off)



# M525

# CAPACITANCE DECADE



## HIGHLIGHTS

- Designed for capacitance meter calibration
- Capacitance range 100 pF - 100 μF based on real-resistance decade technology
- Capacitance accuracy 0.25 % open correction
- Operating voltage 50 V
- GPIB, USB, RS-232 and ethernet interfaces

## DESCRIPTION

Model M525 is a precise capacitance decade box with range from 100 pF to 100 μF. Basic accuracy is 0.25 %. Best resolution on the lowest range is 1 pF. Capacitors are switched using special relays designed for high currents. Comfortable user interface offers direct setting of capacity value, OPEN correction, grounding L terminal, user conversion curves setting and others. Decade can be remotely controlled by a computer using standard RS232 interface. LAN, USB and GPIB interfaces are optional.

M525 is equipped with an internal calibration menu that allows correcting any deviation of capacity value without opening the instrument. Decade is designed for checking multimeters and simple RLC meter. It is suitable also for repair, adjustment and calibration of measuring instruments.

## SPECIFICATION

Range	Accuracy	Loss coefficient	Accuracy	Loss coefficient	Temperature coefficient
	1 kHz	1 kHz	40 Hz - 1 kHz	10 Hz - 1 kHz	
0.100 nF - 10.000 nF	0.25 % ± 3pF	< 0.05	0.5 % ± 3pF	< 0.05	< 270
10.001 nF - 100.00 nF	0.25 %	< 0.005	0.5 %	< 0.005	< 270
100.01 nF - 1.0000 μF	0.25 %	< 0.005	0.5 %	< 0.005	< 270
1.0001 μF - 10.000 μF	0.25 %	< 0.05	0.5 %	< 0.05	< 270
10.001 μF - 100.00 μF	0.25 %*	< 0.2 *	0.5 %	< 0.2 **	< 270

Note:

\* For frequency 100 Hz

\*\* For frequency range 40-100 Hz

Capacity value is defined in the output terminals level.

Correction Open OFF - capacity value is defined relative to the OPEN value.

Correction Open ON - capacity value is defined absolutely.

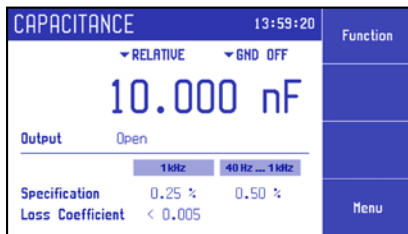
## GENERAL DATA

Maximal voltage:	50 Vpk
Temperature coefficient:	< 270 ppm/ °C
Reaction time:	< 200 ms
Terminals:	gold plated terminals 4 mm
Remote control:	RS232 interface (optionally USB, LAN, IEEE488)
Power supply:	85-260 VAC, 45-65 Hz
Reference temperatures:	+21 °C ... + 25 °C
Working temperatures:	+5 °C ... +40 °C
Storage temperatures:	-10 °C ... +50 °C
Dimensions:	W 390 mm, H 128 mm, D 310 mm
Weight:	4 kg

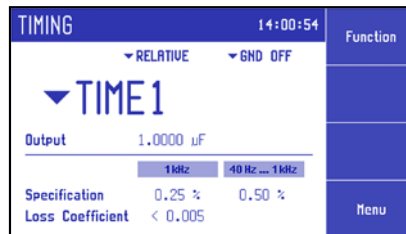
## Ordering codes

Bus	M525-V1xxx-RS232 M525-V2xxx-RS232, USB, LAN, GPIB
Housing	M525-Vxx0x-table version M525-Vxx1x-module 19", 3 HE

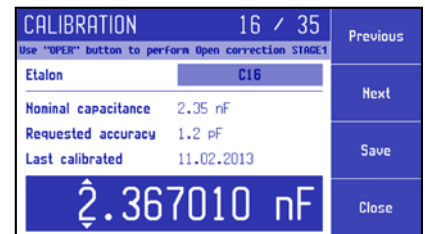
### Capacitance



### Time sequence

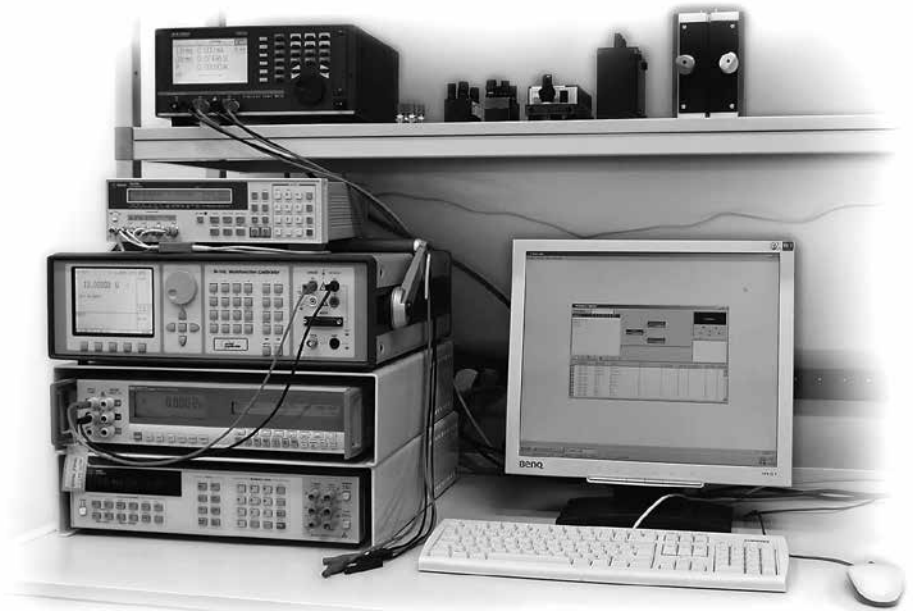


### Calibration



# CALIBER

# AUTOMATED CALIBRATION SOFTWARE



## HIGHLIGHTS

- Saves times, costs and prevents human errors
- Instrument control via RS232, GPIB, USB, RS485 or VISA ethernet
- Camera readout module
- Fully flexible, works with all kinds of instruments, any brand
- Uncertainty calculation according to metrology standards (EA 4/02)
- Easy creation of new procedures using Procedure wizzard
- Up to 20 instruments per calibration point
- Runs on all Windows versions from 2000 to Windows 10
- EN, DE, RU, HU, SK an CZ language

## DESCRIPTION

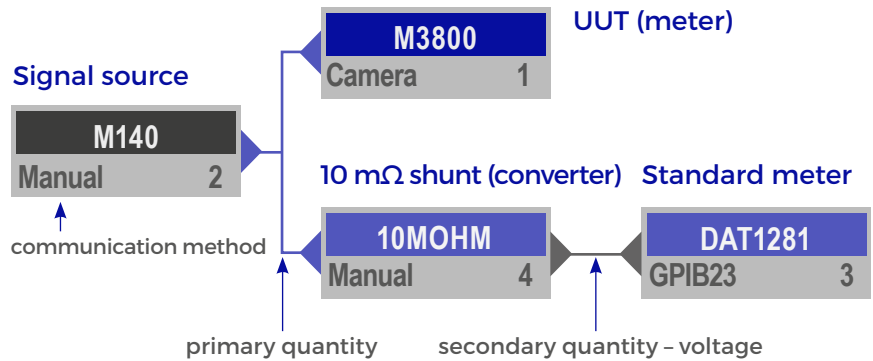
Caliber software is designed for automated calibration and reporting. It does the same thing as you would with Excel spreadsheet and manual calibration but much faster, cheaper, doing no errors and not bothering you even a minute.

Caliber controls calibration instruments using RS232, GPIB or VISA interface where possible. Instruments with no such interfaces can be read by optical readout module CamOCR or operated manually altogether.



## Instruments scheme

Program uses special symbols for displaying different types of instruments in the "Instruments scheme" diagram. Up to 20 instruments can be used in one calibration point. Diagram below shows calibration of current function with standard meter measuring voltage at current shunt.



## Caliber output

Registration number page 3

**Calibration certificate No.1**

**Measured values:**

Function	Range	Standard	UUT	Deviation	%spec	Allowed	Uncertainty
VDC-2W	200 mV	20.0 mV	20.0 mV	1.0 uV	51	200 uV	62 uV ok
VDC-2W	200 mV	180.0 mV	179.8 mV	-200 uV	-201	999 uV	66 uV ok
VDC-2W	200 mV	-180.0 mV	-180.2 mV	-200 uV	-201	1001 uV	66 uV ok
VDC-2W	2 V	0.200 V	0.200 V	0.30 mV	151	2.00 mV	0.58 mV ok
VDC-2W	2 V	1.800 V	1.800 V	0.10 mV	11	19.00 mV	0.58 mV ok
VDC-2W	2 V	-1.800 V	-1.800 V	0.00 mV	01	19.00 mV	0.58 mV ok
VDC-2W	20 V	2.00 V	2.00 V	2.0 mV	101	20.0 mV	5.8 mV ok
VDC-2W	20 V	10.00 V	10.30 V	300.0 mV	4881	61.5 mV	5.8 mV *

**Uncertainty of measurements:** Extended uncertainty is defined by coefficient k=2.

Output of the CALIBER program represents a physically performed calibration with a calibration record - a table with measured and evaluated data (the test report).

## MAIN WINDOW

Camera - Optional camera module for digital display scanning

User prompt window  
Clear instruction for calibration staff

Status line

Instruments scheme  
Instruments used in selected calibration point and their configuration

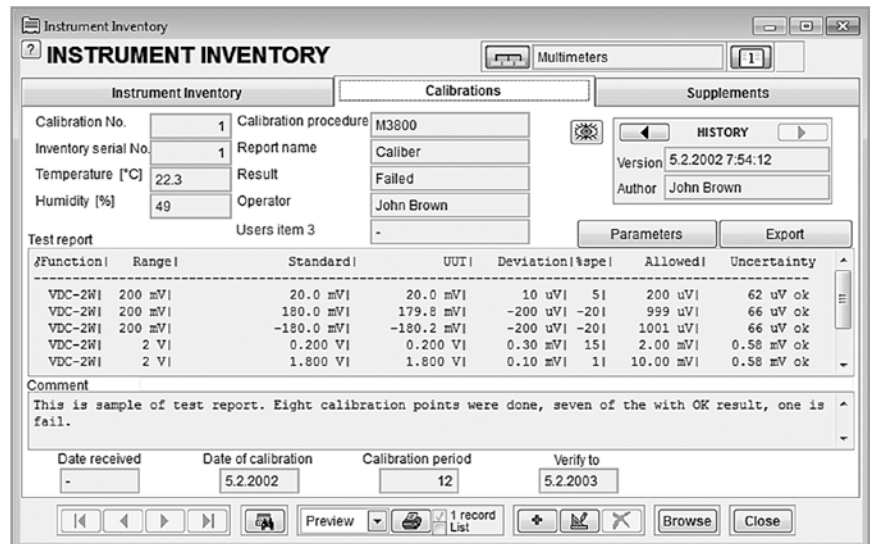
Procedure window  
Functions, Ranges, Points, Active terminals connection, Exceptions

Direct keys  
New/Open /Save, Reload Start, Calibration, Import/Export

Test report - Measured and evaluated values (measured deviation, maximum allowed deviation, measurement uncertainty...)

Readings - Instrument readouts

## WinQbase-Caliber



To keep things organized, you can employ database software WinQbase to work in tandem with Caliber. WinQbase is designed specifically for calibration labs to keep detailed information of both standard units and UUTs, such as instrument serial number, inventory data, owner identification, calibration dates and methods, etc.

Calibrations done by Caliber software are automatically stored in WinQbase when online or synchronized later when you're out on site without connection to the database. Database is automatically backed up, uses password protected user accounts and logs every operation within the system so you can't ever lose your calibration data.

## CamOCR (optional Camera module)



CamOcr camera module extends possibilities of MEATEST automatic calibration software Caliber. CamOcr is designed for scanning of 7 segment digital displays.

Instruments (UUT) without remote control interface can be "connected" using CamOcr to the computer. Instrument's display is scanned by digital video camera. It is very easy to do repeated measurements and calculate uncertainty type "A" for every calibration point.

## CERTIFIED BUSINESS

Our quality management system is certified to ISO 9001:2015 under UKAS certification rules. All new instruments are tested and calibrated with possibility of ISO 17025 certified calibration.

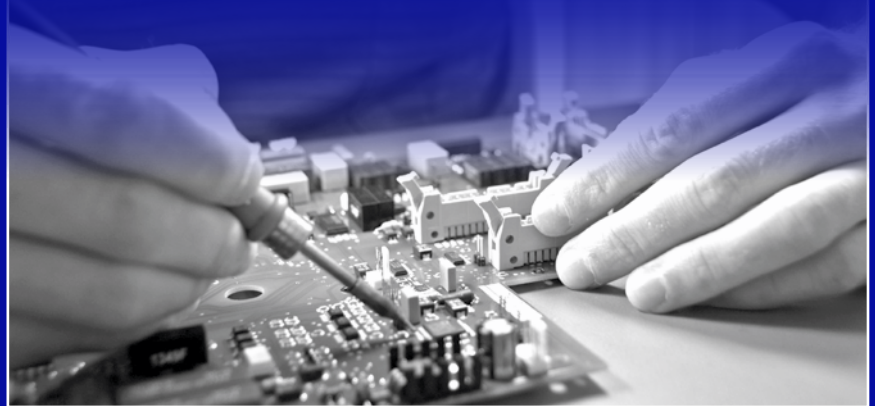


## INNOVATION FOCUS

Continuous development is taken very seriously in Meatest. That's why developers account for more than a quarter of all Meatest workforce.

## FLEXIBLE SOLUTIONS

Nothing on market to match your requirements? Or just missing critical feature in our instruments? Share with us and together we'll surely come up with solution.



## INSTRUMENTS FOR PEOPLE

Our representatives are at your service all over the world. Would you like to consult your solution with us? Get a quote? Training? Service? Calibration? Let us know.



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