



- DC/AC voltage to 1000 V, accuracy 10ppm/year
- DC/AC current to 30A
- Resistance to 1000 M Ω Capacitance to 100 μ F
- TC/RTD Temperature sensor simulation
- Frequency output to 20MHz
- Electric power/energy to 240V/20A
- Built-in process multimeter
- GPIB & RS232 interface

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 multimeter

Built-in process multimeter, standard part of both M142 and M142i, 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.

User comfort

M142 calibrator is focused on user friendliness making calibrations simple and straightforward. Each function has its dedicated chunky button and all relevant details including total relative accuracy are shown on large LCD. Range of adapters for easier terminal connection and automation possibilities, relative deviation feature that can help you with UUT error calculation and easy keyboard-controlled adjustment procedure are just a few examples to prove the point.

GPIB and RS-232 interfaces are present in both versions so the calibrator can be operated via remote control or used in WinQbase/Caliber software calibration systems including the CamOCR module for automated optical UUT readouts.

DC/AC voltage sin

Voltage range: 0 to 1000 V Frequency uncertainty: 0.005

%

Frequency voltage: 20 Hz to 100 kHz

Resolution: 6½ dig.

Range	% of value + uV	% of value + uV	% of value + uV	% of value + uV
	DC	20 Hz - 10 kHz	10 kHz - 50 kHz	50 kHz - 100 kHz
0 mV - 20 mV	0.005 + 6	0.2 + 30	0.20 + 30	1.0 + 30
20mV - 200mV	0.0015 + 8	0.1 + 80	0.15 + 120	0.3 + 120
200 mV - 2 V	0.0012 + 10	0.018 + 100	0.05 + 200	0.2 + 1 000
2 V - 20 V	0.0010 + 50	0.018 + 1 000	0.05 + 6 000	0.2 + 10 000
20 V - 240 V	0.0015 + 500	0.018 + 10 000	--	--
240 V - 1000 V	0.005 + 20 000	0.03 + 200 000 *	--	--

* Maximal frequency 1000 Hz

DC/AC current sin

Current range: 0 to 30 ADC, 1uA to 30 AAC Frequency uncertainty: 0.005

%

Frequency range: 20 Hz to 10 kHz

Resolution: 6½ dig.

Range	% of value+ µA	% of value+ µA	% of value+ µA	% of value+ µA
	DC	20 Hz - 1 kHz	1 kHz - 5 kHz	5 kHz - 10 kHz
1 µA - 200 µA	0.05 + 0.02	0.15 + 0.02	0.30 + 0.22	--
200 µA - 2 mA	0.02 + 0.1	0.07 + 0.2	0.20 + 1	0.50 + 1.4
2 mA - 20 mA	0.01 + 0.6	0.05 + 1	0.20 + 10	0.50 + 14
20 mA - 200 mA	0.01 + 6	0.05 + 10	0.20 + 100	0.50 + 140
200 mA - 2 A	0.015 + 100	0.05 + 100	--	--
2 A - 20 A	0.02 + 2 000	0.10 + 6 000	--	--
20 A - 30 A *	[0.02 + 0.003* (I-20)] + 2000	[0.1 + 0.003* (I-20)] + 6 000	--	--

* I is set current value in A

Additional uncertainty when current coil Option 140-50 applied is 0.3 %. Output current is multiplied by factor 25 or 50.

Shape function (non-harmonic signal)

Voltage range: 1 mV to 200 V

Current range: 100uA to 2 A

Output signal waveform: square positive, negative, symmetrical, saw A, saw B, triangle limited sin with defined distortion k=13,45 %

Peak value accuracy: 0.3 % + 50 uV

Displayed values: peak, calculated rms

Frequency range: 1000 Hz for AC voltage, 120 Hz for AC current

The lowest settable frequency for squarewave signal is 0.1 Hz, pro other waveforms 20 Hz.

Resistance and Capacitance

Resistance range: 0 to 1000 MΩ Resolution: 4 dig.

Capacitance range: 900pF to 100 µF

Resistance range	% of value + mΩ	Current range **	Capacitance range *	% of value+ pF
0 Ω - 10 Ω	0.03 + 5	400 uA - 100 mA	700 pF - 1 nF	0.5 + 15
10 Ω - 33 Ω	0.015 + 5	400 µA - 100 mA	1 nF - 3.3 nF	0.5 + 5
33 Ω - 100 Ω	0.010 + 5	400 µA - 100 mA	3.3 nF - 10 nF	0.5
100 Ω - 330 Ω	0.010 + 5	400 µA - 40 mA	10 nF - 33 nF	0.5
330 Ω - 1 kΩ	0.010	400 µA - 11 mA	33 nF - 100 nF	0.5
1 kΩ - 3.3 kΩ	0.010	100 µA - 6 mA	100 nF - 330 nF	1
3.3 kΩ - 10 kΩ	0.010	20 µA - 2 mA	330 nF - 1 µF	1
10 kΩ - 33 kΩ	0.010	4 µA - 600 µA	1 µF - 3.3 µF	1.5
33 kΩ - 100 kΩ	0.010	1 µA - 200 µA	3.3 µF - 10 µF	1.5
100 kΩ - 330 kΩ	0.010	1 µA - 60 µA	10 µF - 100 µF	2.0
330 kΩ - 1 MΩ	0.010	0.2 µA - 20 µA		
1 MΩ - 3.3 MΩ	0.020	40 nA - 6 µA		
3.3 MΩ - 10MΩ	0.050	10 nA - 2 µA		
10 MΩ - 33 MΩ	0.1	10 nA - 600 nA		
33 MΩ - 100MΩ	0.2	10 nA - 180 nA		
100 MΩ - 1000 MΩ	0.5	4 nA - 20 nA		

* Maximal applicable test voltage on output terminals is 2 to 5.5Vrms.

** Maximum applicable voltage on output terminals is 20Vrms.

DC/AC electric power and energy

Voltage range:	0.2 V to 240 V
Current range:	2 mA to 20 A
Electric power range:	0.0004 to 2.4 kVA
Time setting:	1.1 s to 1999 s
Frequency range:	DC, 40 Hz to 400 Hz
Frequency accuracy:	0.005 %

AC/DC current accuracy

Phase shift accuracy

Current range	% of value + uA	Frequency range	Phase shift accuracy dφ [°]
2 mA - 20 mA	0.05 + 2	40 – 200 Hz	0.15
20 mA - 200 mA	0.05 + 10	200 – 400 Hz	0.25
200 mA - 2 A	0.05 + 100		
2 A - 20 A	0.05 + 2000		

AC power accuracy:

$$dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.03^2)} \quad [\%]$$

DC power accuracy:

$$P = \sqrt{(dU^2 + dI^2 + 0.01^2)} \quad [\%]$$

Power factor accuracy:

$$dPF = (1 - \cos(\varphi+d\varphi)/\cos\varphi) * 100 \quad [\%]$$

Frequency function

Total frequency range:	0.1 Hz to 20 MHz
Resolution:	6 dig.
Accuracy of frequency:	0.005 %
Mode:	PWM, square wave signal with calibrated duty cycle ratio, frequency and amplitude HF, square wave signal with calibrated frequency and amplitude

PWM mode

HF mode

Voltage range	% of value + mV	Frequency range:	0.1 Hz to 20 MHz
1 mV - 20 mV	0.2 + 0.1	Output impedance:	50 Ω
20 mV - 200 mV	0.1 + 0.1	Output signal shape:	square, symmetrical
200 - 2 V	0.1 + 0.1	Output signal amplitude:	4 V _{pk-pk}
2 V - 10 V	0.1 + 0.1	Output amplitude:	0, -10, -20 dB, -30 dB +/- 1 dB
		Amplitude accuracy:	10 %
		Rise and fall time slope:	< 3 ns

RTD temperature sensor simulation

Type	Range -200 - +250 °C	Range 250 – 850 °C	Sensor standard:	DIN, US/JS, Ni
Pt100	0.1 °C	0.3 °C	R0 constant setting:	20 Ω to 2 kΩ
Pt200	0.1 °C	0.2 °C		
Pt1000	0.2 °C	0.4 °C		
Ni100	0.07 °C	--		

TC temperature sensor simulation

R	Range [°C]	-50 - 0	0 - 400	400 - 1000	1000 - 1767
	Accuracy [°C]	2.0	1.5	0.9	1.0
S	Range [°C]	-50 - 0	0 - 250	250 - 1400	1400 - 1767
	Accuracy [°C]	1.8	1.5	1.0	1.0
B	Range [°C]	400 - 800	800 - 1000	1000 - 1500	1500 - 1820
	Accuracy [°C]	1.9	1.1	1.0	0.9
J	Range [°C]	-210 - -100	-100 - 150	150 - 700	700 - 1200
	Accuracy [°C]	0.6	0.4	0.3	0.4
T	Range [°C]	-200 - -100	-100 - 0	0 - 100	100 - 400
	Accuracy [°C]	0.6	0.4	0.3	0.4
E	Range [°C]	-250 - -100	-100 - 280	280 - 600	600 - 1000
	Accuracy [°C]	0.9	0.3	0.2	0.2
K	Range [°C]	-200 - -100	-100 - 480	480 - 1000	1000 - 1372
	Accuracy [°C]	0.7	0.4	0.4	0.5
N	Range [°C]	-200 - -100	-100 - 0	0 - 580	580 - 1300
	Accuracy [°C]	1.0	0.5	0.5	0.5

Built-in process multimeter

Function	Range	Accuracy (%)	Resolution / Range
DC voltage - DCV	0 to ± 20 V	0.01 % + 300 μ V	100 μ V / 20V
DC current	0 to ± 25 mA	0.015 % + 300 nA	100 nA/20mA
DC voltage - mVDC	0 to ± 2 V	0.02 % + 7 μ V	20mV / 100nV, 200mV / 1uV, 2V / 10uV
Resistance *	0 to 2.5 k Ω	0.02% + 10 m Ω	20 Ω / 1m Ω , 200 Ω / 1m Ω , 2k Ω / 10m Ω
Frequency	1 Hz to 15 kHz	0.005	10 μ Hz – 0.1 Hz
TC temperature sensor simulation	-250 to +1820 $^{\circ}$ C	0.4 to 2.5 $^{\circ}$ C	0.01 $^{\circ}$ C
RTD temperature sensor simulation	-200 to +850 $^{\circ}$ C *3	0.1 $^{\circ}$ C	0.1 $^{\circ}$ C

* Test current 1mA

General information

Warm up time:	60 min
Working temperature range:	23 \pm 10 $^{\circ}$ C
Storing temperature range:	0 to 40 $^{\circ}$ C at RH below 80 %
Reference temperature:	23 \pm 2 $^{\circ}$ C
Dimensions:	450 x 480 x 150 mm
Weight:	22 kg
Power supply voltage:	230V - 50Hz
Consumption:	max. 250 VA

Accessories (included)

Power line cable	1 pc	
Operation manual, CD	1 pc	
Option 10/11 Test lead 1000V - 20 A, black/red	2 pcs	Length 1m
Option 40, 60, 70, 80	1 pc	Length 1m
Spare fuse	1 pc	
RS 232 cable	1 pc	Length 1m

Options (extra ordered)

Option 140-50	Current coil 25/50 turns	For clamp ammeters calibration
Option 10	Test lead 20A/1000V (černý)	Length 1m
Option 11	Test lead 20A/1000V (červený)	Length 1m
Option 20	Test cable BNC – BNC	Length 1m
Option 30	Test cable BNC – banana	Length 1m
Option 40	Cable adapter Canon 25 / 2 x banana	For DC voltage/current
Option 60	Cable adapter Canon 25 / 4 x banana	Four wire resistance measurement
Option 70	Four wire cable adapter	Four wire resistance simulation
Option 80	Cable adapter Cannon 25 / 2 x banana	mVDC and TC measurement
Option 90	External sensor	RTD temperature sensor
Option 100	Adapter for $\frac{3}{4}$ " output terminals spacing	
Option 140-01	Cable adapter with metal pad for test unit	Contains Pt100 sensor for ambient temperature measurement and cold junction compensation.
Cable GPIB	GPIB cable	Length 1m
Cable RS-232	RS-232 cable	Length 1m
WinQbase	Database software for meter calibration	
CALIBER	Software for automatic calibration of meter	