



- AC/DC voltage 1000Vrms, current 20Arms
- Optional 1000A test coil for current transformers
- Power Calibrator to 2400 W (+1.0 to -1.0 PF)
- Built in multimeter
- Deviation control along with measurement uncertainty readout
- 0.003% basic dc accuracy
- 0.025% basic ac accuracy
- 10 step memory and pass fail output
- Supplied with RS232 and IEEE-488 interfaces
- UKAS/NIST Traceable

About the MC140 calibrator

The Multifunction Calibrator MC140 functions as a Voltage Calibrator, Current Calibrator, Power Calibrator, Resistance Calibrator, Capacitance Calibrator and a Thermocouple Calibrator. Having very low uncertainties, it is ideal as a standard of these electric quantities in calibration laboratories. It also has the feature of supplying several different waveshapes in addition to the traditional sinusoidal output. This feature makes it ideal for testing meters which are true rms reading or crest factor sensitive. These signals are also suitable for the basic calibration of oscilloscopes. The calibrator has the capability of measuring temperature with TC and RTD temperature sensors. A built-in multimeter can be used independently or in simultaneous operation with the calibrator output.

Basic Functions

In the Voltage Calibrator mode, the Multifunction Calibrator generates DC/AC voltages up to 1000 V and in the Current Calibrator mode it generates DC/AC currents up to 20 A . Using a 50-turn transformer, the AC current range can be extended to 1000 A. The best accuracy of the calibrator on DC voltage ranges is 0.0035%, on AC voltage ranges 0.03%, on DC current ranges 0.013% and on AC current ranges 0.055%. The frequency range is from 20 Hz to 50 kHz. The calibrator can generate periodic non-harmonic signals with a defined crest factor. Such signals can be used to test the sensitivity of multimeters to distorted signals. The Multifunction Calibrator simulates both resistance and capacitance. The resistance range extends to 50 MOhm and the capacitance range is from 1 nF to 50 μ F. The precision of both quantities is sufficient for the calibration of commonly used hand-held multimeters. The basic accuracy of the resistance ranges and capacitance ranges is 0.03%, and 0.5% respectively. The resistance calibration may be used with both DC and AC signals up to 1 kHz.

Operation

The operation of the MC140 display, front panel keyboard and front panel terminals can be seen illustrated by clicking on the links below.

Display	Front panel keyboard	Front panel terminals
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Specifications

DC voltage

range	% of value + % of range
0 μ V - 20 mV	0.05 + 0.0 + 10 μ V
20 mV - 200 mV	0.01 + 0.0 + 10 μ V
200 mV - 2 V	0.003 + 0.0008
2 V - 20 V	0.003 + 0.0005
20 V - 240 V	0.003 + 0.0005
240 V - 1000 V	0.005 + 0.005

AC voltage

range	% of value + % of range	% of value + % of range
	20 Hz - 10 kHz	10 kHz - 50 kHz
1 mV - 20 mV	0.20 + 0.05 + 20 μ V	0.20 + 0.10 + 20 μ V
20mV - 200mV	0.1 + 0.03 + 20 μ V	0.15 + 0.05 + 20 μ V
200 mV - 2 V	0.025 + 0.005	0.05 + 0.01
2 V - 20 V	0.025 + 0.005	0.05 + 0.03
20 V - 240 V	0.025 + 0.010	- -
240 V - 1000 V	0.03 + 0.02 *	- -

* valid for $f < 1000$ Hz

DC current

range	% of value + % of range
1 μ A - 200 μ A	0.05 + 0.0 + 20 nA
200 μ A - 2 mA	0.02 + 0.005
2 mA - 20 mA	0.01 + 0.003
20 mA - 200 mA	0.01 + 0.003
200 mA - 2 A	0.015 + 0.005
2 A - 20 A	0.02 + 0.010

AC current

range	% of value + % of range	% of value + % of range
	20 Hz - 1 kHz	1 kHz - 5 kHz
1 μ A - 200 μ A	0.15 + 0.0 + 20 nA	0.30 + 0.10 + 20 nA
200 μ A - 2 mA	0.07 + 0.01	0.20 + 0.05
2 mA - 20 mA	0.05 + 0.005	0.20 + 0.05
20 mA - 200 mA	0.05 + 0.005	0.20 + 0.05
200 mA - 2 A	0.05 + 0.005	- -
2 A - 20 A	0.10 + 0.03	- -

When option 130-50 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.

Resistance (4-wire)

range	% of value
0 Ohm - 100 Ohm	0.03 + 10 mOhm
100 Ohm - 400 Ohm	0.015
400 Ohm - 2 kOhm	0.015
2 kOhm - 10 kOhm	0.015
10 kOhm - 40 kOhm	0.015
40 kOhm - 200 kOhm	0.015
200 kOhm - 1 MOhm	0.05
1 MOhm - 4 MOhm	0.1
4 MOhm - 20 MOhm	0.2
20 MOhm - 50 MOhm	0.5

Maximum allowed voltage on the load is 8 Vpk.

Capacitance (4-wire)

range	% of value
900 pF - 2.5 nF	0.5 + 15 pF
2.5 nF - 10 nF	0.5 + 5 pF
10 nF - 50 nF	0.5
50 nF - 250 nF	0.5
250 nF - 1 μ F	0.5
1 μ F - 3.5 μ F	1.0
3.5 μ F - 5 μ F	1.0
5 μ F - 10 μ F	1.5
10 μ F - 50 μ F	2.0

Maximum allowed voltage on the load is 8 Vpk.

Frequency

type	PWM (pos, neg, sym)	HF *
range	0.1 Hz - 100 kHz	0.1 Hz - 20 MHz
frequency unc. (%)	0.005	0.005
amplitude	1 mV - 10 V	2 V
amplitude unc. (%)	0.1	10
ratio	0.00 - 1.00	- -
ratio unc. (%)	0.05	- -

* Rise time < 5 ns

DC power, energy

quantity	range	% of value + % of range
voltage	200 mV - 240 V	see voltage table
current	2 mA - 10 A	0.05 + 0.01

AC power, energy

quantity	range	uncertainty
voltage	200 mV - 240 V	see voltage table
current	2 mA - 10 A	0.05 % + 0.01 %
frequency	40 Hz - 400 Hz	0.005
power factor	-1 - +1	0.005 - 0.0005
phase	0 - 360 °	0.15 ° - 0.25 °

Setting time in energy mode 10 s - 1999 s.

Uncertainty of AC power depends on set value of voltage, current, phase. The best uncertainty is 0.08 %. Uncertainty in energy mode depends on set value of voltage, current, phase and time. The best uncertainty is 0.09 %.

Resistance temperature sensor simulation

types	Pt 1.385, Pt 1.392, Ni
range of R0	20 Ohm - 2 kOhm
range of temperature	-200 °C - 850 °C
temperature uncertainty	0.04 °C - 0.5 °C
temperature scale	ITS 90, PTS 68

Thermocouple simulation

types	R, S, B, J, T, E, K, N
range of temperature	-250 °C - 1820 °C
temperature uncertainty	0.4 °C - 4.0 °C
temperature scale	ITS 90, PTS 68

Multimeter

quantity	range	uncertainty
VDC (DC voltage)	0 - ± 12 V	0.01 % + 100 µV
mVDC (DC voltage)	0 - ± 2000 mV	0.01 % + 10 µV
mADC (DC current)	0 - ± 25 mA	0.02 % + 1 µA
FREQ (Frequency)	1 Hz - 15 kHz	0.005 %
R4W (Resistance)	0 - 2 kOhm	0.02 % + 100 mOhm
TRTD (RTD sensors)	-150 - +600 °C	0.1 °C
TTC (TC sensors)	-250 - +1820 °C	0.4 - 4 °C
SGS (strain gauge sensor) *	depends on sensor	0.01 % + 10 µV + sensor unc.

* Supplying voltage 2 to 10 V DC, max. current 40 mA, input resistance > 100 MOhm
sensitivity 0.5 - 100 mV/V, displayed unit settable

Basic Functions

In the Voltage Calibrator mode, the Multifunction Calibrator generates DC/AC voltages up to 1000 V and in the Current Calibrator mode it generates DC/AC currents up to 20 A. Using a 50-turn transformer, the AC current range can be extended to 500 A. The best accuracy of the calibrator on DC voltage ranges is 0.0035%, on AC voltage ranges 0.03%, on DC current ranges 0.013% and on AC current ranges 0.055%. The frequency range is from 20 Hz to 50 kHz. The calibrator can generate periodic non-harmonic signals with a defined crest factor. Such signals can be used to test the sensitivity of multimeters to distorted signals. The Multifunction Calibrator simulates both resistance and capacitance. The resistance range extends to 50 MOhm and the capacitance range is from 1 nF to 50 µF. The precision of both quantities is sufficient for the calibration of commonly used hand-held multimeters. The basic accuracy of the resistance ranges and capacitance ranges is 0.03%, and 0.5% respectively. The resistance calibration may be used with both DC and AC signals up to 1 kHz.

The frequency function of the calibrator makes it possible to generate a square wave signal with adjustable and calibrated duty cycle, frequency and amplitude in the range from 1 mV to 10 V in the frequency band up to 10 kHz. In the HF mode a square wave signal up to 20 MHz with a very low risetime can be generated. The frequency function is suitable for the calibrations of corresponding frequency ranges of multimeters, and for calibration of the channel sensitivities and time bases of the oscilloscopes.

In the Power Calibration mode, the MC140 can be used as a source to calibrate DC and single-phase AC watt meters, power analyzers, and energy meters. In this mode, the output voltage can be set up to 240 V, the output current up to 10A, and the power factor in range from -1 to +1 in the frequency band from 20 Hz to 400 Hz. The current capability of the voltage output is 30 mA so that analog watt meters, which usually have lower input impedances at their voltage input, may be calibrated.. For calibration of thermometers and temperature regulators, the temperature function is simulated by the Multifunction Calibrator. It is able to simulate all commonly used Pt and Ni resistance sensors as well as TC sensors of the R, S, B, J, T, E, K and N types. Compensation of the TC cold junction is made either by entering a value from the keyboard, or automatically by measuring the ambient temperature with a Pt-100 sensor. The precision of the simulated resistance and TC sensors depends on set value and type of the sensor. For resistance sensors the uncertainty band is in the range from 0.04 °C to 0.5 °C, for TC sensors from 0.4°C to 4.0 °C.

Calibrator - Tester

The Multifunction Calibrator can be used both as a precision signal source for a device under test and as a meter to measure the resultant voltages generated by the device. Programmable capability of the calibrator enables the user to set 10 steps of a testing procedure. The testing can run automatically, and after it is completed, PASS/FAIL status is displayed. With the testing function, isolated relay contacts activated by the FAIL indicator, make it possible to control other equipment.

Built-in multimeter

An internal multimeter with basic ranges of 20 mA, 200 mV, 10 V and 2 kOhm is a standard feature off the Multifunction Calibrator. With an accuracy of 0.01%, it enables the user to measure the output signals of various types of transducers. With external strain gauge sensors, pressure, torsion, strength, etc. can be measured and displayed.

User friendly

The MC140 Calibrator is equipped with a number of other functions which make it extremely easy to use. Among them, are the capability to set relative deviations from the actual value of the selected output signal, the continuous displaying of the output signal uncertainty, and the internal calibration procedure. The large, easy to read, comprehensive luminescent display contains all of the necessary information to set up any of the Multifunction Calibrator's functions. In addition, frequently used functions have specific keys assigned to them. The calibrator is equipped with the IEEE-488.2 interface and with the RS-232 serial interface.

Accessories included

Power line cable	1 pc
Operation manual	1 pc
Option 10/11 Test cable	2 pcs
Option 40	1 pc

Test cable for built-in multimeter, 2 banana terminals for DC voltage and current measurement.



Option 60	1 pc
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Test cable for built-in multimeter, 4 banana terminals for resistance measurement as well as Pt/Ni sensor temperature measurement.



Option 70	1 pc
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4-wire resistance adapter. The adapter provides a four wire return to the calibrator for making resistance measurements.



Optional Accessories

Option 140-50	Current coil 25/50 turns, simulating 1000Arms. Suitable for clamp-on current transformer testing.
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Option 140-01	Cable adapter for multimeters. The adapter provides support for the meter
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under test as well as a simple cable connection to the calibrator front panel terminals.

The Adapter is equipped with a built-in Pt-100 temperature sensor. The internal meter can measure ambient temperature and display it on the screen and automatically make cold junction compensation when the TC temperature sensor simulation is selected.

Option 140-41 Cable adapter for simultaneous applications.

Cable adapter is designed for low-voltage/current applications to 20 VDC and 200 mADC. There are two fields on the adapter. The first contains terminals with the calibrator output signals, the second contains internal multimeter input terminals. Various calibration tasks can be fulfilled with the adapter, especially measurements where simultaneous generation of the calibrated signal and response of unit under test are required.

With the adapter, temperatures of external TC temperature sensors can be measured and displayed.



Option 140-02 Set of cables and adapters. It includes Option 140-01, Option 140-41, Option 10 2pcs, Option 11 2pcs, Option 20, Option 30, Option 40, Option 60, Option 70

Option 10 Test cable 20A/1000V (black)

Option 11 Test cable 20A/1000V (red)

Option 20 Test cable BNC/BNC 1m

Option 30 Test cable BNC/banana 1m

Cable GPIB IEEE-488, 2m

Cable RS-232 RS-232, 2m