MC-133c MC-133i Electric Power/Energy Calibrator

- **DC/AC voltage "phase-neutral" 1V to 280V / 300mA, accuracy 260 ppm**
- **AC voltage "phase – phase" in the 3phase system 2V to 480V**
- **DC/AC current 30mA to 30A / 5V, accuracy 310 ppm**
- **Power factor setting -1 to +1**
- **Harmonic, interharmonic distortion, modulation**
- **Frequency range 16Hz to 1kHz**
- **Simulated electric power to 8.4 kVA (420 kVA with option 140-50)**
- **Built-in process multimeter**
- **GPIB & RS232 interface**

MC-133 MC133i Power/energy calibrator is one phase calibrator of electric power and energy.

MC-133 contains option for generation of distorted signals with defined parameters. The option application field is focused to the field of calibration of quality of energy analyzers. One phase can be extended to three phase system using additional amplifiers MC-133f.

MC-133 is delivered without the option of harmonic/interharmonic functions.

Basic feature of the device is precise simulation of DC and AC electric power and energy in voltage range to 280V and in current range to 30 A. In AC electric power mode phase shift between voltage and current channel can be set in range 0° to 360°. Best accuracy of simulation is 0.05%. Calibrator offers high burden current of voltage output of several hundreds mA and compliance voltage of current output up to 5Vrms. Current range can be extended using Option 140-50 50 turns current coil up to 1000 A.

MC-133 calibrator is equipped with special functions for power line voltage analyzers testing. It can generate calibrated harmonic and interharmonic distortion, fluctuation harmonics, flickers, ramp signals and others. User interface offers simple and user convenient programming of output signal parameters.

The calibrator can be extended to four-wire three-phase system using two additional „slave" amplifiers MC-133f.

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Specification

DC/AC voltage sin

Voltage range: 0 to 1000 V
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 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
Capacitance range: 900pF to 100 μF
Resolution: 4 dig.

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

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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

Current range	% of value + uA
2 mA - 20 mA	0.05 + 2
20 mA - 200 mA	0.05 + 10
200 mA - 2 A	0.05 + 100
2 A – 20 A	0.05 + 2000

Phase shift accuracy

Frequency range	Phase shift accuracy dφ [°]
40 – 200 Hz	0.15
200 – 400 Hz	0.25

AC power accuracy:	$dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.03^2)}$ [%]
DC power accuracy:	$P = \sqrt{(dU^2 + dI^2 + 0.01^2)}$ [%]
Power factor accuracy:	$dPF = (1 - \cos(\varphi+d\varphi)/\cos\varphi) * 100$ [%]

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

Voltage range	% of value + uV
1 mV - 20 mV	0.2 + 5 0
20 mV - 200 mV	0.1 + 5 0
200 mV - 2 V	0.1
2 V - 10 V	0.1

HF mode

Frequency range:	0.1 Hz to 20 MHz
Output impedance:	50 Ω
Output signal shape:	square, symmetrical
Output signal amplitude:	4 V_{pk-pk}
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
Pt100	0.1 °C	0.3 °C
Pt200	0.1 °C	0.2 °C
Pt1000	0.2 °C	0.4 °C
Ni100	0.07 °C	- -

Sensor standard:	DIN, US/JS, Ni
R0 constant setting:	20 Ω to 2 kΩ

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

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

* Test current 1mA

General data

Warm up time:	60 min
Working temperature range:	23 ± 10 °C
Storing temperature range:	0 to 40 °C at RH bellow 80 %
Reference temperature :	23 ± 2 °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 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	

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