

M-133C Three phase Electric Power/Energy Calibrator



- **Voltage “phase-neutral”**
1V to 280Vdc / 300mA,
1V to 600Vac
- **AC voltage “phase – phase”**
2V to 1200V
- **DC/AC current 8mA to 30A / 5V**
- **DC/AC current 90A in one phase configuration**
- **Power factor setting -1 to +1**
- **Floating current outputs to 450Vpk**
- **Harmonic, interharmonic distortion, modulation**
- **Frequency range 15Hz to 1kHz**
- **Simulated electric power to 54 kVA (2.7 MVA with option M140-50)**
- **Built-in process multimeter**
- **GPIB & RS232 interface**

Basic feature of the device is precise simulation of DC and AC electric power and energy in voltage range to 280Vdc (600Vac) 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 0.02°. 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 1500 A.

M-133C calibrator is equipped with special functions for power line voltage analyzers testing (qualimeters). 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.

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

Technical data

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 bellow 40 Hz, 0.01 Hz above 40 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 * (mA)
	<i>DC</i>		<i>15 - 40 Hz 400 - 1000 Hz</i>		<i>40 - 70 Hz</i>	
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) is limited to 400mA

** only fundamental harmonic in range over 280Vac, frequency range 20 – 1000 Hz

DC/AC current sinus

Current range:	0.008 A to 30 A
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 bellow 40 Hz, 0.01 Hz above 40 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)
	<i>DC</i>	<i>DC</i>	<i>15 - 40 Hz 70 - 1000 Hz</i>	<i>40 - 70 Hz</i>	<i>15 - 400 Hz</i>	<i>400 - 1000 Hz</i>
0.008000 - 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)	Current (A)	Accuracy dφ (°)
15.000 - 70.000	0.1 - 10	0.02
15.000 - 70.000	0.008 - 0.099999 10.0001 - 30	0.05
70.001 - 400.000	0.008 - 30	0.1
400.001 - 1000.00	0.008 - 30	0.4

DC electric power

Total range:	0.008 W to 8400 W (420 kW with current coil option 140-50)
Quantity:	W

DC electric power accuracy (%)*					
Current range	Voltage range				
	1 V - 10 V	10 V - 30 V	30 V - 70 V	70 V - 140 V	140 V - 280 V
8 mA - 5 A	0.044	0.044	0.044	0.044	0.044
5 A - 10 A	0,052	0,052	0,052	0,052	0,052
10 A - 30 A	0,057	0,057	0,057	0,057	0,057

* Best accuracy is shown.

AC electric power *

Total range: 3x (0.008 VA to 18 kVA (900 kVA with current coil option 140-50))
 Frequency range: 15Hz to 1000 Hz
 Quantity: W, VA, VAr

AC electric power accuracy (%) for PF = 1.0 f = 40 – 70 Hz						
Current range	Voltage 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
8mA – 100mA	0,061	0,061	0,061	0,061	0,061	0,063
100mA – 5 A	0,044	0,044	0,044	0,044	0,044	0,047
5 A – 10 A	0,052	0,052	0,052	0,052	0,052	0,055
10 A - 30 A	0,057	0,057	0,057	0,057	0,057	0,059

AC electric power accuracy (%) for PF = 0.8 f = 40 – 70 Hz						
Current range	Voltage 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
8mA – 100mA	0,091	0,091	0,091	0,091	0,091	0,090
100mA – 5 A	0,051	0,051	0,051	0,051	0,051	0,054
5 A – 10 A	0,059	0,059	0,059	0,059	0,059	0,061
10 A - 30 A	0,087	0,087	0,087	0,087	0,087	0,088

AC electric power accuracy (%) for PF = 0.5 f = 40 – 70 Hz						
Current range	Voltage range					
	1 V - 10 V	10 V - 30 V	30 V - 70 V	70 V - 140 V	1 V - 10 V	280 V - 600 V
8mA – 100mA	0,160	0,160	0,160	0,160	0,160	0,160
100mA – 5 A	0,075	0,075	0,075	0,075	0,075	0,077
5 A – 10 A	0,080	0,080	0,080	0,080	0,080	0,082
10 A - 30 A	0,160	0,160	0,160	0,160	0,160	0,160

* Best accuracy is shown.

Electric power accuracy is calculated according to formula: $dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.01^2)} (\%)$

DC/AC electric energy

Voltage range: 1 V to 280 Vdc (600 Vac) Time interval setting: 1 s to 10 000 s
 Current range: 0.008 A to 30 A Time interval resolution: 0.1 s
 Power factor range: - 1 to + 1 Time interval accuracy: 0.01% + 0.1s

Non-harmonic signals (model M-133C only)

Harmonic and interharmonic distortion *1 (H/I products)

Fundamental harmonic frequency range: 15 Hz to 1 kHz
 Fundamental harmonic amplitude 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	0.1	0.2
10.0001 - 30.0000 V		
30.0001 - 70.0000 V		
70.0001 - 140.0000 V		
140.0001 - 280.0000 V		
0.008000 - 0.300000 A	0.1	0.2
0.300001 - 1.000000 A		
1.000001 - 2.000000 A		
2.000001 - 5.000000 A	0.2	0.4
5.000001 - 10.000000 A	0.2	0.8
10.000001 - 30.000000 A		

Modulation, Flicker *1

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 %

Dip/Swell *1

AC voltage range:	0.1 V ... 280 V
AC current range:	1 mA ... 30 A
Amplitude uncertainty:	0.2 % of range *2
Frequency range:	15 Hz ... 1 kHz

Timing *3

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 available only for M-133C.

*2 range is defined according to the highest level of generated signal

*3 t1 + t5 > 2 ms

Built in process multimeter

Function	Range	Accuracy	Resolution
DC voltage	0 to ±12 V	0.01 % + 0.01 %	100µV
DC current	0 to ±25 mA	0.01 % + 0.01 %	100 nA
Frequency	1 Hz to 15 kHz	0.005 %	10 µHz – 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
Dimensions:	500 x 520 x 430 mm
Net weight:	59 kg
Power supply:	115/230V – 50/60 Hz
Power consumption:	max. 1500 VA
Safety class:	I according EN 61010

Accessory (included)

Power supply cable	1 pc	
Operation manual, CD	1 pc	
Option 10 Test cable banana-banana 1000V - 32 A, black	3 pcs	Length 1m
Option 11 Test cable banana-banana 1000V - 32 A, red	3 pcs	Length 1m
Option 12 Test cable banana-banana 1000V - 32 A, blue	3 pcs	Length 1m
Option 13 Test cable banana-banana 1000V - 32 A, yellow	3 pcs	Length 1m
Spare fuse	1 pc	
RS 232 cable	1 pc	Length 1.5m
M133C-01 High Current Adapter	1 pc	

Options (extra ordered)

Option 140-50	Current coil 25/50 turns	For clamp ammeters
Option 10	Test cable banana-banana 1000V - 32 A, black	Length 1m
Option 11	Test cable banana-banana 1000V - 32 A, red	Length 1m
Option 12	Test cable banana-banana 1000V - 32 A, blue	Length 1m
Option 13	Test cable banana-banana 1000V - 32 A, yellow	Length 1m
GPIB cable	GPIB interface cable	Length 1 m
RS-232 cable	RS-232 interface cable	Length 1.5 m
POWER	Application SW. Transducers calibration.	

Manufacturer:

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