



HIGHLIGHTS

- **Power quality and energy functions**
- **Three and single phase versions**
- **Phase accuracy 0.01°, frequency range 15 - 1000 Hz**
- **AC power up to 3x 18 kVA, DC up to 25.2 kW**
- **Optical scanning head, built-in multimeter**
- **Floating current outputs for 3-wire power meters**
- **Current coil for clamp meters up to 2250 A**

DESCRIPTION

M133C is electric AC/DC power and energy calibrator for calibration of power meters, power transducers, power quality analyzers 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 to allow for 3-wire power meter calibration. One calibrator, many applications – saving your time, space and costs.

SPECIFICATION

Specifications below describe 1-year absolute accuracy, including long-term stability, linearity, load and line regulation and reference standard measurement uncertainty as well as ambient conditions within specified limits.

DC/AC Voltage

Voltage range summary	DC: 1 V – 280 V AC sine: 1 V _{rms} – 600 V _{rms}
Internal ranges	10 V, 30 V, 70 V, 140 V, 280 V, 600 V
Frequency range and accuracy	15 Hz – 1000 Hz, 50 ppm
Frequency resolution	≤ 500 Hz: 1 mHz > 500 Hz: 10 mHz
Total harmonic distortion	< 0.05 %

Ranges, resolution, 1 year accuracy [% of value + % of range]

Range	DC	40 Hz – 70 Hz	15 Hz – 40 Hz 70 Hz – 1 kHz	Maximum burden current ^{*1}
1.0000 – 10.0000 V	0.015 + 0.01	0.012 + 0.01	0.016 + 0.01	100 mA
10.0001 – 30.0000 V	0.015 + 0.01	0.012 + 0.01	0.016 + 0.01	200 mA
30.001 – 70.000 V	0.015 + 0.01	0.012 + 0.01	0.016 + 0.01	300 / 200 mA
70.001 – 140.000 V	0.015 + 0.01	0.012 + 0.01	0.016 + 0.01	300 / 200 mA
140.001 – 280.000 V	0.015 + 0.01	0.012 + 0.01	0.016 + 0.01	200 / 150 mA
280.001 – 600.000 V ^{*2}	N/A	0.016 + 0.01	0.024 + 0.01	60 / 50 mA

*1 In 40 – 70 Hz AC / otherwise. Sum of all currents from three phases is limited to 400 mA.

*2 Frequency is limited to 20 – 1 kHz.

DC/AC Current

Current range summary	DC: 5.000 mA – 30.0000 A AC Sine: 5.000 mA _{rms} – 30.0000 A _{rms}
Internal ranges	300 mA, 1 A, 2 A, 5 A, 10 A, 30 A
Frequency range and accuracy	15 Hz – 1000 Hz, 50 ppm
Frequency resolution	≤ 500 Hz: 1 mHz > 500 Hz: 10 mHz
Current output isolation	Up to 450 V _{pk} against GND
Total harmonic distortion	< 0.1 %

Ranges, resolution, 1 year accuracy [% of value + % of range]

Range	DC	40 Hz – 70 Hz	15 Hz – 40 Hz 70 Hz – 1 kHz	Compliance voltage ^{*3}
0.005000 – 0.300000 A	0.0175 + 0.01	0.0175 + 0.01	0.021 + 0.02	8 V _{pk} / 5 V _{pk}
0.30001 – 1.00000 A	0.0175 + 0.01	0.0175 + 0.01	0.021 + 0.02	8 V _{pk} / 5 V _{pk}
1.00001 – 2.00000 A	0.0175 + 0.01	0.0175 + 0.01	0.021 + 0.02	8 V _{pk} / 5 V _{pk}
2.00001 – 5.00000 A	0.0175 + 0.01	0.0175 + 0.01	0.021 + 0.02	5 V _{pk}
5.0001 – 10.0000 A	0.021 + 0.015	0.021 + 0.015	0.028 + 0.02	5 V _{pk}
10.0001 – 30.0000 A	0.0245 + 0.015	0.0245 + 0.015	0.035 + 0.02	5 V _{pk}

*3 In DC or 40 – 70 Hz AC / otherwise.

Current coil (option 151-25)

Applicable multiplier	25 or 50
Max. simulated current	multiplier · 90 A (2250 A with 151-25 Current Coil)
Frequency range	DC, 15 – 100 Hz
Additional accuracy	0.3 %

DC/AC Power & Energy

Power range summary	DC: 5 mW – 25.2 kW AC: (3×) 5 mVA – 18 kVA
Total accuracy	based on voltage, current, phase shift and energy period specifications.
Phase shift accuracy (I _x to U _x and U _x to U _i)	≤ 70 Hz, 0.1 – 10 A: 0.01 ° ≤ 70 Hz, V channels: 0.01 ° ≤ 70 Hz, otherwise: 0.05 ° 70 – 400 Hz: 0.1 ° > 400 Hz: 0.4 °
Energy period range and accuracy	1 s – 100 Ms, 0.01 % of value + 0.1 s

Total 1 year power accuracy in common applications [% of value]

Set current	EU grid power (230 V, 50 Hz)	US grid power (115 V, 60 Hz)	Aircraft onboard power (115 V, 400 Hz)	Ship onboard power (440 V, 60 Hz)
100 mA	0.054 %	0.054 %	0.086 %	0.057 %
1 A	0.038 %	0.038 %	0.051 %	0.042 %
10 A	0.045 %	0.045 %	0.057 %	0.048 %
30 A	0.047 %	0.047 %	0.063 %	0.050 %

Voltage from current

Voltage range	1.000 mV – 5.00000 V
Waveform	DC, 15.000 Hz – 400.00 Hz pure sine
Amplitude accuracy	0.05 % + (0.02 – 0.1) % of range
Distortion	< 0.1 %
Source impedance	1 or 18 Ω

Harmonic distortion

Max. number of products	63 harmonic or 1 interharmonic
Harmonic product frequency range	30 – 5000 Hz
Interharmonic product frequency range	15 – 1000 Hz
Product amplitude accuracy	≤ 3 kHz: 0.1 – 0.2 % of range > 3 kHz: 0.2 – 0.8 % of range

Modulation (Flicker)

Modulation envelope shapes	Sine, squarewave
Modulation frequency range	1 mHz – 50 Hz
Amplitude accuracy	0.2 % of range

Dip/Swell

Amplitude range	100 mV – 280 V, 1 mA – 30 A
Amplitude accuracy	0.2 % of range
Time period ranges	transition: 0.1 ms – 60 s other states: 2 ms – 60 s

Multimeter

Measurement function	Range	Accuracy
DC voltage	0.0000 – 12.0000 V	100 ppm + 1 mV
DC current	0.0000 – 25.0000 mA	100 ppm + 2.5 μA
Frequency	1.00000 Hz – 15.0000 kHz	50 ppm

GENERAL DATA

Warm-up time	60 minutes
Reference temperature	+21 °C – +25 °C
Operating temperature	+13 °C – +33 °C
Storage temperature	-10 °C – +55 °C
Temperature coefficient	10 % of accuracy / °C outside T _{REF}
Max storage humidity	90 %
Power supply	115/230V - 50/60 Hz, 1875 VA max
Dimensions (W x H x D)	520 x 430 x 500 mm
Weight	59 kg
Interfaces	RS232, IEEE488, Ethernet

Power analyzer calibration (application)



Clampmeter calibration with 151-25 Current Coil (application)



Power transducer calibration (application)

