



Three Phase Power and Energy Calibrators **OCM133C** and **OCM133C-i**

- ✓ Three Phase Calibration to 280VDC and up to 600VAC
- ✓ Currents 30A DC/AC up to 90A DC/AC in one phase configuration
- ✓ Harmonic and Interharmonic Distortion
- ✓ Power VA, W or VAR
- ✓ $\cos \varphi$ selectable
- ✓ Energy kVAs, kW, kVAr
- ✓ Phase Adjustment 0 to 360°
- ✓ Frequency Range 15 to 1000 Hz
- ✓ IEEE 488, RS232, Ethernet
- ✓ Internal Own Calibration Constants
- ✓ Economical Single Phase Model



Model **OCM133C-i** does not permit Generation of Harmonic and Interharmonic Signals.

OCM 133C is a bus compatible three-phase calibrator for precise calibration of power and energy measuring electronic instruments, voltage and ampere meters, phase meters, integrators, power transmitters, mains analyzers and many other. It also finds its application at laboratories, design departments and service departments as well as at institutions, which have to frequently calibrate their equipment in accordance with their internal quality certification system.

The main function of the calibrator is the generation of AC and DC electric power in ranges to 280VDC (600VAV) and 30 A in each of the three phases. The accuracy of the power generation is 0.05%. For calibration of clamp Amperemeters up to 1500A an optional current coil is available. By using the cable adapter the three current outputs can be linked into one output adjustable from 0.1A to 90A.

OCM133C includes additional functions for calibration of Mains Analyzers. The settings contains the selection of Harmonic and Interharmonic Distortions, fluctuation of harmonic

signals, modulation with periodical signals, flicker signals, ramps, profiles and many others. Extensive software permits very simple and clear selection of values, menu parameters and test steps.

All parameters and signals can manually be entered from the keyboard or from IEEE488, RS232 or Ethernet Ports. The Parameters, Information, Test and Calibration Steps are clearly visible at a TFT color display.

The internal calibration software is locked with a password and permits the calibrator own recalibration with internal constants stored during the factory production.

OCM133C includes functions which simplify calibration and tests of three phase transducers with current or voltage signal outputs. Currents up to $\pm 25\text{mA}$ and voltage up to $\pm 12\text{V}$ can be measured with the internal Multimeter with accuracy of 0.015%. The deviation of the measured signal is simultaneously shown at the display.

For One Phase applications only one current and one voltage channel can be assembled. This more economical version can be enlarged at any later time for all three Phases.

SPECIFICATIONS

DC and AC VOLTAGE

The voltage setting has accuracy of 5.5 digits

Output: 1V to 280V DC, 1V to 600V AC
 Frequency Range: DC, AC from 15Hz to 1000Hz.
 Frequency Accuracy: 0.005%. (50/60Hz can be mains synchronized)
 Frequency Resolution: 0.001 Hz (< 40Hz), 0.01 Hz (> 40 Hz)
 Distortion: < 0.05% (Distortion of the output signal)

DC and AC Voltage (Sinewave)

Range	% of value % of range	Max. burden (mA)	% of value + % of range	Max. burden (mA)	% of value + % of range	Max. burden * (mA)
	DC		15 - 40 Hz 400 - 1000 Hz		40 - 70 Hz	
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
30.0001 - 70.0000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	300
70.0001 - 140.0000 V	0.015 + 0.01	200	0.02 + 0.01	200	0.015 + 0.01	300
140.0001 - 280.0000 V	0.015 + 0.01	150	0.02 + 0.01	150	0.015 + 0.01	200
280.0001 - 600.0000 V**	--	--	0.03 + 0.01	50	0.02 + 0.01	60

* the sum of all currents (three phases) is limited to 400mA

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

DC and AC CURRENTS (Sinewave)

The current setting has accuracy of 5.5 digits

Output: 5 mA to 30 A, max.
 Frequency Range: DC, AC from 15 Hz to 1000 Hz.
 Frequency Accuracy: 0.005 %. (50/60 Hz can be mains synchronized)
 Frequency Resolution: 0.001 Hz (< 40Hz), 0.01 Hz (> 40 Hz)
 Distortion: < 0.1 % (Distortion of the output signal)

DC and AC Current (Sine)

Range Current (A)	% of value + % of range	Max. Voltage (V)	% of value + % of range	% of value + % of range	Max. Voltage (V)	Max. Voltage (V)
	DC	DC	15 - 40 Hz 70 - 1000 Hz	40 - 70 Hz	15 - 400 Hz	400 - 1000 Hz
0.005000 - 0.300000	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
0.300001 - 1.000000	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
1.000001 - 2.000000	0.025 + 0.01	8	0.03 + 0.02	0.025 + 0.01	5.5	3.5
2.000001 - 5.000000	0.025 + 0.01	5	0.03 + 0.02	0.025 + 0.01	3.5	3.5
5.000001 - 10.000000	0.03 + 0.015	5	0.04 + 0.02	0.03 + 0.015	3.5	3.5
10.000001 - 30.000000	0.035 + 0.015	5	0.05 + 0.02	0.035 + 0.015	3.5	3.5

I* is the selected Current in A.

Additional inaccuracy of 0.3% has to be added when Current Coil Option 140-50 is used (Multiplication by 50).

Phase

Range: 0 ... 360° settable in 0.01° Steps
 Frequency Range: 15-1000Hz
 Resolution: 0.01°

cos φ

Range: -1.00...+1.00
 Resolution: 0.001
 Error: $dPF = (1 - \cos(\varphi + d\varphi)) / \cos(\varphi)$ (-)

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 – 0.029999	0.05
15.000 – 70.000	0.030 - 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
15.000 - 400.000	0.005 - 0.007999	0.4
400.001 - 1000.00	0.005 - 0.007999	1.0

DC and AC POWER

The accuracy of the Power is calculated from the Voltage, the Current and the Phase:

Active Power [W] $dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.01^2)}$ [%]
 Reactive Power [VAr] $dP = \sqrt{(dU^2 + dI^2 + dPF^2 + 0.01^2)}$ [%]
 Apparent Power [VA] $dP = \sqrt{(dU^2 + dI^2 + 0.01^2)}$ [%]

Whereas:

dP Uncertainty of Power [%]
 dU Uncertainty of Voltage setting [%]
 dI Uncertainty of Current setting [%]
 dPF Uncertainty of Phase setting (cos φ) [%]

DC Power

Range: 0.005 W to 8400 W (280 kW with current coil option 140-50)
 Units: 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	0 V – 280 V
5 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

* The Table shows the best accuracies.

AC Power

Total range: 3x (0.005 VA to 18 kVA (900 kVA with current coil option 140-50))
Frequency: 15-1000 Hz
Units: 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
5mA –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
5mA –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
5mA –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

DC and AC ENERGY

Range: 1V to 280V DC (600V AC)
5mA to 30A
cos φ: -1.00 ... +1.00

Time Setting: 1 sec. to 10 000 sec.
Resolution: 0.1 sec.
Accuracy: 0.01% + 0.1 sec.

HARMONIC and INTERHARMONIC SIGNALS (H/I Mode) - only OCM133C

Harmonic and Interharmonic Distortion *1 H/I)

Carrier – First Harmonic (FA): 15 Hz to 1000 Hz
FA Amplitude Accuracy: 0.2% from Range
Range of Harmonic Products: 30 Hz to 5 kHz
Range of Interharmonic Products: 15 Hz to 1 kHz
Max. Number of Harmonics: 50
Max. Number of Interharmonic: 1
Frequency Accuracy: 0.005%
Amplitude Range of H/I: max. 30% from RMS Output
Amplitude Resolution of H/I: 0.001%
Noise and Distortion: < - 60 dB

Amplitude Accuracy of H/I products

Ranges	% of range	
	30 - 3000 Hz	3000 - 5000 Hz
1.0000 - 10.0000 V 10.0001 - 30.0000 V 30.001 - 70.000 V 70.001 - 140.000 V 140.001 - 280.000 V	0.1	0.2
0.008000 - 0.300000 A 0.30001 - 1.00000 A 1.00001 - 2.00000 A	0.1	0.2
2.00001 - 5.00000 A 5.0001 - 10.0000 A	0.2	0.4
10.0001 - 30.0000 A	0.2	0.8

Modulation, Flicker ^{*1}

Carrier Frequency Range:	15 Hz to 1000 Hz
Range of Harmonic Products:	30 Hz to 5 kHz
Frequency Range of Modulation:	0.001 Hz to 50 Hz
Modulation Depth:	0 to 30%
Accuracy of the Modulation Depth:	0.001%
Accuracy of Signal RMS Value:	0.2% from Range
Form of the Modulation Signal:	Sine, Rectangle
Ratio:	1 to 99%
Accuracy of the Modulation Depth:	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

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 OCM133C.

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

^{*3} t1 + t5 > 2 ms

MULTIMETER

Function	Range	Accuracy	Resolution
DC voltage	0 to ±12V	0.01% Value + 0.01% Range	100µV
DC current	0 to ±25 mA	0.01% Value + 0.01% Range	100 nA
Frequency	1 Hz to 15 kHz	0.005 %	10 µHz - 0.1 Hz

INPUTS

Input IN1 (energy pulses, synchronization)

Max frequency 400 Hz (filter, debounced input)
Internal pull-up values 18.8 kΩ to +15V

Input IN2 (energy pulses, synchronization)

Max frequency 10 kHz
Input low level max 0.8 V
Input low level min 3.5 V

Input IN3 (trigger, synchronization)

Min pulse width 10 us
Input low level max 0.8 V
Input low level min 3.5 V

ADDITIONAL SPECIFICATIONS

Warm Up Time: 60 min.
Operating Temperature: 23 ± 10 °C
Storage Temperature: -10 to 55 °C @ r.H. < 90 %
Reference Temperature: 23 ± 2 °C
Temperature Coefficient: 10% of Specs/°C above Ref. Temperature
Dimensions: 500x520x430mm
Net weight 59kg three phase model
37kg one phase model
Supply: 115/230V - 50/60 Hz
Power requirement: max. 1500 VA
Security Class: I according to EN 61010-1

Options (upon extra order)

- 140-50 Current coil 25 and 50 turns
- Option 10 Test lead 32A/1000V (black)
- Option 11 Test lead 32A/1000V (red)
- Option 12 Test lead 32A/1000V (blue)
- Option 13 Test lead 32A/1000V (yellow)
- IEEE488/IEEE488 GPIB cable, 2m
- Power Application SW for transducers calibration.

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