



Multifunction Calibrator

15ppm / Year OCM-142

- ✓ DC and AC Voltages up to 1000V
- ✓ DC and AC Currents up to 30A
- ✓ Power and Energy Calibration
- ✓ $\cos \varphi$ free selectable
- ✓ Digital Camera automatic Calibration
- ✓ RTD, Ni and Thermocouples
- ✓ Resistors and Capacitors
- ✓ Frequency generation
- ✓ IEEE 488, RS232



OCM-142 is mainly dedicated for laboratory calibration of precision Instruments for measurement of electrical values.

Model OCM-142 is a bus compatible Multifunction Calibrator for accurate generation of electric units. The instrument is mainly dedicated for calibration laboratories and permits generation of voltages from 0 to 1000V DC and AC and currents from 0mA to 30A. By using a current transformer 140-50 with 50 winding also Clamp Meters can be calibrated up to 1000A.

The highest precision is 15ppm at DC, 250ppm at AC Voltages and 130ppm at DC, 550ppm at AC Currents.

OCM142 permits also the generation of electric DC and AC Power with a variable $\cos \varphi$ from -1 to +1. This permits calibration of Wattmeters and Watt Transmitters up to 240V and 20A.

RTD Thermometers Pt and Ni as well as DIN Thermocouple R, S, B, J, T, E, K, N can be simulated. The cold junction can be set from the keyboard. By using the Option 140-01 is the ambient temperature automatically measured and the junction compensated. The accuracy is 0.04°C to 0.5°C for RTD- Simulation and 0.4°C to 4.3°C for T/C. The RTD Simulation contains all Pt and Ni Types.

The build-in Multimeter can measure signals from Transmitters under test supplied by signals from the calibrator.

Non harmonic signals for testing of instruments with Non-Zero Distortion measurements are available with variable frequency, amplitude and PWM ratio.

The calibrator contains further functions which facilitate the operation during the calibration such as the setting of the relative Deviation of the set value, Displaying of the momentary Accuracy, state of the automatic Calibration, Calibration steps and other.

The Display shows the most important information. The function can be controlled from the keyboard or via RS232 or GPIB Data Bus.

VOLTAGE and CURRENT

The basic function is the generation of DC and AC voltages from 0mV to 1000V and DC and AC Currents from 0 μ A to 30A. By using a current transformer 140-50 with 50 winding also Clamp Meters can be calibrated up to 1000A.

The voltage is adjustable in a frequency range DC to 100 kHz.

POWER and ENERGY

Energetic packages for calibration of instrument for Energy measurements with separated voltage and current inputs, such as Wattmeter, Electrometer and Transmitter can be set from 0.2V to 240V and from 2mA to 20A DC, 40Hz up to 400Hz. The time is adjustable from 1.1 sec. To 1999 seconds.

The Phase is programmable from -1 to +1 with a resolution of 0, 1% and a frequency range from 40Hz to 400Hz.

The voltage output can be loaded with up to 30mA. This permits the calibration of analogue Wattmeters.

DIGITAL CAMERA

For calibration of multimeters with LCD display a digital camera is available. The LCD display of the multimeter is scanned by the camera and the measurements directly incorporated into the calibration software. By using WinQbase and Caliber Software an automatic calibration system with generation of calibration protocols can be achieved.

OTHER FUNCTIONS

Non-harmonic periodical signals with defined crest factor can be generated and used for the calibration of multimeters, considering accuracy during measurements of distorted AC signals.

Resistors and capacitors are be simulated between 0 Ohm and 1000 MOhm and 700 pF to 100 μ F.

Also the simulation of RTD Thermometers and DIN Thermocouples R, S, B, J, K, T, E, and N is a standard function.

The cold junction can be set with the keyboard directly as temperature or can be compensated automatically at the input terminals.

Precision frequency output 0.1Hz to 20MHz with adjustable amplitude 1mV to 10V is suitable for calibration of input characteristics of instruments, analogue circuits, signal conditioners etc.

SPECIFICATIONS

The stated errors are defined for an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and after a warm-up time of 60 minutes. They contain the long time stability, the temperature coefficient, the load characteristics, the mains stability and the traceability to the national standards. The parameters are valid for 12 month.

Voltage Range: 0 – 1000V
Frequency Range: 20Hz – 100 kHz
Resolution: 6½ Digits

DC and AC VOLTAGE sine wave				
RANGE	% from value + μV	% from value + μV	% from value + μV	% from value + μV
	DC	20Hz – 10kHz	10kHz – 50kHz	50kHz – 100kHz
0 μV - 20mV	0.005+6	0.2+30	0.20 + 0.10 + 20 μV	1.0 + 0.10 + 20 μV
20mV - 200mV	0.0015+8	0.1+80	0.15 + 0.05 + 20 μV	0.3 + 0.05 + 20 μV
200mV - 2V	0.0012+10	0.018+100	0.05 + 0.01	0.2 + 0.05
2V - 20V	0.001+50	0.018+1000	0.05 + 0.03	0.2 + 0.05
20V - 240V	0.0015+500	0.018+10 000	---	---
240V - 1000V	0.005+20000	0.03+200 000 (*)	---	---

(*) Max. Frequency 1000 Hz

By using the Current Transformer (Option 140-50) the corresponding ranges have to be multiplied by 50 and 0.3% has to be added to the value.

Current Range: 0 – 30A
Frequency Range: 20Hz – 10 kHz
Resolution: 6½ Digits

DC and AC CURRENT sine wave				
RANGE	% from value + μA	% from value + μA	% from value + μA	% from value + μA
	DC	20Hz - 1kHz	1kHz - 5kHz	5kHz - 10kHz
1 μA - 200 μA	0.05+0.02	0.15+0.02	0.30+0.22	---
200 μA -2mA	0.02+0.1	0.07+0.2	0.20+1	0.5+1.4
2mA-20mA	0.01+0.6	0.05+1	0.20+10	0.5+14
20mA-200mA	0.01+6	0.05+10	0.20+100	0.5+140
200mA-2A	0.015+100	0.05+100	---	---
2A-20A	0.02+2000	0.10+6000	---	---
20A-30A	$[0.02+0.003 \cdot (I-20)]+2000$	$[0.1+0.003 \cdot (I-20)]+6000$	---	---

(*) I is the current value set.

FUNCTION SHAPE (non harmonic Signals)

Voltage Range: 1mV to 200V
Current Range: 100 μA to 2A
Output Shape: Square positive, negative, symmetrical, Saw, Triangle, disturbed Sine wave $k=13,45\%$.
Amplitude Accuracy: 0.3%
Display: Peak value, calculated true RMS value
Frequency Range: 1000Hz for AC Voltage, 120Hz for AC Current

The lowest frequency value for square wave signals is 0.1Hz. For other waveforms 20Hz.

RESISTORS (Resolution 4 Digits)

Ranges: 0 Ohm - 1000 MOhm

CAPACITY (Resolution 4 Digits)

Ranges: 700 pF - 100 μ F

RESISTORS and CAPACITORS				
RANGE	ACCURACY %from value + m Ω	CURRENT RANGE **	KAPACITY RANGE *	ACCURACY %from value + pF
0 Ω -10 Ω	0.03 + 5	400 μ A - 100 mA	700 pF – 1 nF	0.5 + 15
10 Ω -33 Ω	0.015 + 5	400 μ A - 100 mA	1 nF – 3.3 nF	0.5 + 5
33 Ω -100 Ω	0.010 + 5	400 μ A - 100 mA	3.3 nF - 10 nF	0.5
100 Ω -330 Ω	0.010 + 5	400 μ A – 40 mA	10 nF – 33 nF	0.5
330 Ω -1 k Ω	0.010	400 μ A – 11 mA	33 nF – 100 nF	0.5
1 k Ω -3.3 k Ω	0.010	100 μ A – 6 mA	100 nF – 330 nF	1
3.3 k Ω -10 k Ω	0.010	20 μ A – 2 mA	330 nF - 1 μ F	1
10 k Ω -33 k Ω	0.010	4 μ A – 600 μ A	1 μ F – 3.3 μ F	1.5
33 k Ω -100 k Ω	0.010	1 μ A – 200 μ A	3.3 μ F – 10 μ F	1.5
100 k Ω -330 k Ω	0.010	1 μ A – 60 μ A	10 μ F - 100 μ F	2.0
330 k Ω -1 M Ω	0.010	0.2 μ A – 20 μ A		
1 M Ω -3.3 M Ω	0.020	40 nA – 6 μ A		
3.3 M Ω -10M Ω	0.05	10 nA – 2 μ A		
10 M Ω -33 M Ω	0.1	10 nA – 600 nA		
33 M Ω -100M Ω	0.2	10 nA – 180 nA		
100 M Ω -1000 M Ω	0.5	4 nA – 20 nA		

* Maximum permitted voltage 5.5V RMS.

** Maximum permitted voltage at the terminals 20V RMS.

FREQUENCY

Frequency Range:

0.1Hz to 20MHz

Resolution:

6 Digits

Accuracy:

0.005%

Functions:

- PWM Square wave with calibrated Ratio, Frequency and Amplitude.
- HF Square wave with calibrated Frequency and Amplitude.

Voltage Range	% from value + μ V	Frequency Range:	0.1 Hz - 20 MHz
1 mV - 20 mV	0.2 + 5 0	Output Impedance:	50 Ω
20 mV - 200 mV	0.1 + 5 0	Function of Output Signal:	Square wave symmetrical
200 mV - 2 V	0.1	Amplitude of Output Signal:	4 V p-p
2 V - 10 V	0.1	Output Range:	0, -10, -20 dB, -30 dB +/- 1 dB
		Amplitude Range:	10 %
		Rise Time:	< 3 ns

ELECTRIC POWER and ENERGY

Voltage Range: 0.2V to 240V
 Current Range: 2mA to 20A
 Power Range: 0.0004 to 4.8kVA
 Time Setting Range: 1.1 to 1999 sec.
 Frequency Range: DC, 40Hz to 400Hz

CURRENT RANGE	% from value+ μ A	FREQUENCY RANGE	PHASE ERROR $d\phi$ [°]
2 mA - 20 mA	0.05 + 2	40 – 200 Hz	0.15
20 mA - 200 mA	0.05 + 10	200 – 400 Hz	0.25
200 mA - 2 A	0.05 + 100		
2 A – 20 A	0.05 + 2000		

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

TEMPERATURE SENSORS (according to IST 90, PTS 68)

RTD: Pt 1.385, Pt 1.392, Ni Temperate Range: -200 to +850 °C
 Range of RO: 20 Ω to 2 k Ω Temperature Accuracy: 0.07 °C to 0.4 °C

RTD			
TYP	-200 to 250 °C	250 to 850 °C	Sensor Types: DIN, US/JS, Ni Range of RO: 20 Ω to 2 k Ω
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	--	

Thermocouples: Types, Ranges and Accuracy

THERMOCOUPLES					
R	RANGE (°C)	-50.0 – 0.0	0.1 – 400.0	400.1 – 1000.0	1000.1 – 1770.0
	MAX. ERROR (°C)	1.8	1.4	0.7	0.6
S	RANGE (°C)	-50.0 – 0.0	0.1 – 250.0	250.1 – 1400.0	1400.1 – 1767.0
	MAX. ERROR (°C)	1.6	1.3	0.8	0.7
B	RANGE (°C)	400.0 – 800.0	800.1 – 1000.0	1000.1 – 1500.0	1500.1 – 1820.0
	MAX. ERROR (°C)	1.7	0.9	0.8	0.7
J	RANGE (°C)	-210.0 – -100.0	-100.1 – 150.0	150.1 – 700.0	700.1 – 1200.0
	MAX. ERROR (°C)	0.3	0.2	0.2	0.2
T	RANGE (°C)	-200.0 – -100.0	-100.1 – 0.0	0.1 – 100.0	100.1 – 400.0
	MAX. ERROR (°C)	0.4	0.2	0.2	0.1
E	RANGE (°C)	-250.0 – -100.0	-100.1 – 280.0	280.1 – 600.0	600.1 – 1000.0
	MAX. ERROR (°C)	0.7	0.2	0.1	0.1
K	RANGE (°C)	-200.0 – -100.0	-100.1 – 480.0	480.1 – 1000.0	1000.1 – 1372.0
	MAX. ERROR (°C)	0.5	0.2	0.3	0.3
N	RANGE (°C)	-200.0 – -100.0	-100.1 – 0.0	0.1 – 580.0	580.1 – 1300.0
	MAX. ERROR (°C)	0.7	0.3	0.2	0.2

BUILD - IN MULTIMETER

MULTIMETER			
TYP	RANGE	ACCURACY	RESOLUTION
DC – Voltage (V)	0 ... $\pm 20V$	0.01% + 300 μV	100 μV / 20V
DC – Voltage (mV)	0 ... $\pm 2V$	0.02% + 7 μV	100 nA/20mA
DC – Current	0 ... $\pm 25mA$	0.015% + 300 nA	20mV / 100nV, 200mV / 1 μV , 2V / 10 μV
Frequency	1 Hz - 15 kHz	0.005%	20 Ω / 1m Ω , 200 Ω / 1m Ω , 2k Ω / 10m Ω
Resistor	0 ... 2.5 k Ω	0.02% + 10 m Ω	10 μ Hz - 0.1 Hz
Temperature (Pt Sensor)	-200 ... +850 $^{\circ}C$	0.1 $^{\circ}C$	0.01 $^{\circ}C$
Temperature (TC Sensor)	-250 ... +1820 $^{\circ}C$	0.4 to 2.5 $^{\circ}C$	0.1 $^{\circ}C$
Strain Gauges ^{*1}	Sensor depending	0.05%+10 μV +Sensor Error	100 μV / 10V

ADDITIONAL SPECIFICATIONS

Warm-up Time: 60 min.

Working Temperature: 23 \pm 10 $^{\circ}C$

Storing Temperature: 0 to 40 $^{\circ}C$ @ max. 80 % r.h.

Reference Temperature: 23 $^{\circ}C \pm 2^{\circ}C$

Ambient Pressure: 860 to 1060 hPa

Dimensions: 450 x 480 x 150 mm, Weight 22 kg

Supply: 230V, $\pm 10\%$, 50-60Hz,
250 VA at maximum load.

AUTOMATIC CALIBRATION with DIGITAL CAMERA



Automatic Calibration of Multimeters by using optional Digital Camera and WinQbase Software.

For calibration of multimeters with LCD display a digital camera is available. The LCD display of the multimeter is scanned by the camera and the measurements directly incorporated into the calibration software. By using *WinQbase* and *Caliber* Software an automatic calibration system with generation of calibration protocols can be achieved.