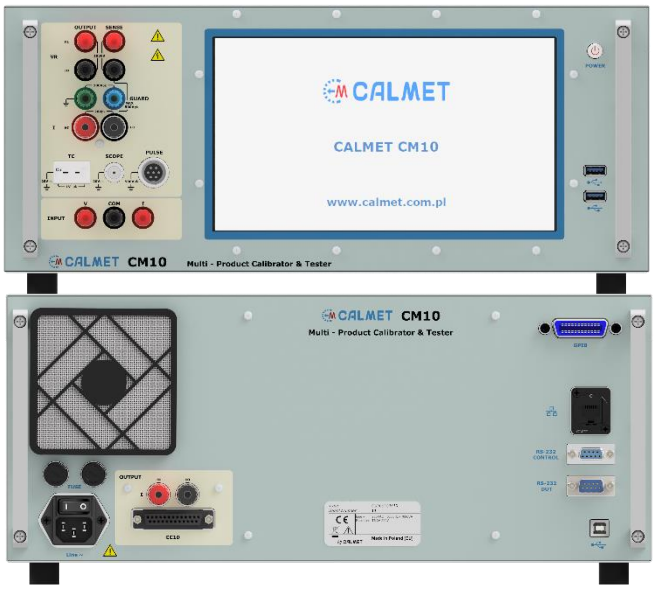
CALMET CM10

Data Sheet

Multi-Product Calibrator and Tester

Calmet CM10
• Highest accuracy for calibrating the most demanding modern instruments including 6.5 D multimeters
• Simultaneous generation of voltage and current to 20.5A with setable phase shift can be extended up to 200A@DC and 120A@AC using the CC10 Transconductance Amplifier allows e-mobility market instruments testing as electricity meters
• The high possibility load of current output with the use 50 turn coil allows to calibrate clamp meters up to 6000A
• The high possibility load of voltage output allows to calibrate of analog meters and instruments powered from the measuring circuit such as electricity meters
• The built-in multimeter and external USB camera (for 7 segments display) will enable automatic calibration of instruments without the need to manualy read and write the results by operator
• Automatic calculation of the mean value and standard deviation of the DUT error from *n* repeated measurements
• The expanded uncertainty of measurement according to EA-4-02 is calculated in fully automatic way
• Possibility of 4-wire load connection to the calibrator's voltage outputs to compensate voltage drops on connecting cables



The CM10 Calibrator and Tester is used for calibration a wide range of measuring instruments used in power engineering and enables testing:

DC/AC voltmeters, DC/AC ammeters, frequency meters, phase angle meters, power factor meters, wattmeters, VARmeters, VAmeters, clamps meters and much more,

power harmonics analyzers, recorders IEC 61000-4-30 for EN 50160 compatibility or individual requirements of user,

electricity meters EN 50470 with accuracy relative to an internal reference of the CM10 including: measure the basic error and influence of frequency, voltage, distortion,

electrical measuring transducers for converting electrical quantities EN 60688 (voltage, current, active power, reactive power, frequency, phase angle, power factor),

current instrument transformers EN 60044 including measure the accuracy of current and phase angle,

current clamps with AC & DC voltage and current output including measure the accuracy of current and phase angle,

oscilloscopes with using the PWM Pulse Width Modulation and HSO High Frequency Square Oscillator functions,

AC/DC power supplies and generators with voltage, current and power outputs with using the built-in multimeter functions.

Absolute expanded uncertainty is defined under the confidence level of 95 % which contains uncertainty of the external standards, the uncertainty within last 12 months, changes: the ambient temperature in the range of +20…+26°C, humidity, power supply voltage as well as frequency and burden.

DC Voltage Source				
Range	Settings span	Resolution	Uncertainty [ppm of setting + µV]	Maximum load [1]
200 mV	0…205 mV	0.1 µV	20 + 4	R_O= 40 Ω
2 V	0…0.205001…2.05 V	1 µV	15 + 2	50 mA
20 V	0…2.05001…20.5 V	10 µV	15 + 20	50 mA
300 V	20.5001…300 V	100 µV	20 + 500	30 mA
1000 V	300.001…1050 V	1 mV	20 + 1000	10 mA
[1] R_O – output resistance R<0.5 Ω (for 2-wire mode). External sensing (4-wire mode) is also available				

DC Current Source				
Range	Settings span	Resolution	Uncertainty [ppm of setting + µA]	Maximum load
200 µA	0…205 µA	100 pA	60 + 0.005	8 V
2 mA	0…0.205001…2.05 mA	1 nA	60 + 0.03	8 V
20 mA	0…2.05001…20.5 mA	10 nA	60 + 0.2	8 V
200 mA	0…20.5001…205 mA	100 nA	60 + 3	8 V
2 A	0…0.205001…2.05 A	1 µA	150 + 30	8 V
20 A	0…2.05001…20.5 A	10 µA	200 + 400	3.5 V
200 A [1]	2.0000…200 A	100 µA	500 + 10 000	2 V
[1] 200 A range is optional				

AC Voltage Source					
Range	Settings span	Resolution	Uncertainty [ppm of setting + µV]	Frequency	Maximum load
200 mV	20.5001…205 mV	0.1 µV	200 + 80	10 Hz…45 Hz	40 mA
			200 + 80	45 Hz…1 kHz	
			200 + 80	1 kHz…10 kHz	
			300 + 80	10 kHz…20 kHz	
			No specifications	20 kHz…100 kHz	
2 V	0.205001…2.05 V	1 µV	150 + 20	10 Hz…45 Hz	50 mA
			150 + 20	45 Hz…1 kHz	
			150 + 20	1 kHz…10 kHz	
			200 + 50	10 kHz…20 kHz	
			No specifications	20 kHz…100 kHz	
20 V	2.05001…20.5 V	10 µV	150 + 200	10 Hz…45 Hz	50 mA
			150 + 200	45 Hz…1 kHz	
			150 + 200	1 kHz…10 kHz	
			300 + 500	10 kHz…20 kHz	
			No specifications	20 kHz…100 kHz	
300 V	20.5001…300 V	100 µV	150 + 2000	40 Hz…1 kHz	50 mA
			300 + 2000	1 kHz…2 kHz	20 mA
1000 V	300.001…1050 V	1 mV	150 + 6000	45 Hz…1 kHz	10 mA
			300 + 6000	1 kHz…2 kHz	5 mA

AC Current Source					
Range	Settings span	Resolution	Uncertainty [% of setting + µA]	Frequency	Maximum load
200 µA	20…205 µA	1 nA	0.05 + 0.1	10 Hz…20 Hz	6 V
			0.05 + 0.1	20 Hz…45 Hz	
			0.05 + 0.1	45 Hz…1 kHz	
			0.05 + 0.2	1 kHz…5 kHz	
			0.5 + 0.2	5 kHz…10 kHz	
			No specifications	10 kHz…30 kHz	
2 mA	0.205001…2.05 mA	1 nA	0.03 + 0.1	10 Hz…20 Hz	6 V
			0.03 + 0.1	20 Hz…45 Hz	
			0.03 + 0.1	45 Hz…1 kHz	
			0.03 + 0.1	1 kHz…5 kHz	
			0.03 + 0.1	5 kHz…10 kHz	
			No specifications	10 kHz…30 kHz	
20 mA	2.05001…20.5 mA	10 nA	0.03 + 1	10 Hz…20 Hz	6 V
			0.03 + 1	20 Hz…45 Hz	
			0.03 + 1	45 Hz…1 kHz	
			0.03 + 1	1 kHz…5 kHz	
			0.03 + 1	5 kHz…10 kHz	
			No specifications	10 kHz…30 kHz	
200 mA	20.5001…205 mA	100 nA	0.03 + 10	10 Hz…20 Hz	6 V
			0.03 + 10	20 Hz…45 Hz	
			0.03 + 10	45 Hz…1 kHz	
			0.03 + 10	1 kHz…5 kHz	
			0.03 + 10	5 kHz…10 kHz	
			No specifications	10 kHz…30 kHz	
2 A	0.205001…2.05 A	1 µA	0.03 + 100	10 Hz…20 Hz	3.5 V
			0.03 + 100	20 Hz…45 Hz	
			0.03 + 100	45 Hz…1 kHz	
			0.03 + 100	1 kHz…5 kHz	
			No specifications	5 kHz…10 kHz	
20 A	2.05001…20.5 A	10 µA	0.05+ 1000	10 Hz…20 Hz	2.5 V
			0.05 + 1000	20 Hz…45 Hz	
			0.05 + 1000	45 Hz…1 kHz	
			0.2 + 1000	1 kHz…5 kHz	
120 A [1)]	20.5001…120 A	1 mA	0.1 + 20000	40 Hz…100 Hz	2 V @ 60 A
			0.2 + 50000	100 Hz…500 Hz	1 V @ 120 A
[1)] 120 A range is optional					

DC Power Source					
Voltage range	Current range				
	0.205…2.05 mA	2.05001… 205 mA	205.001 mA…2.05 A	2.05001…20.5 A	20.5…200 A
	Uncertainty [% of power setting]				
20 mV…205 mV	0.030	0.028	0.031	0.037	0.103
205.001 mV…1050 V	0.022	0.017	0.022	0.030	0.100

AC Power Source			
Voltage range	Current range		
	0.205 mA…2.05 A	2.05001… 20.5 A	20.5001…120 A
	Uncertainty [1)] [% of power setting]		
20 mV…205 mV	0.43	0.44	0.47
205.001 mV…1050 V	0.09	0.11	0.21
[1)] the power uncertainty values are the maximum values in the given voltage and current ranges for power factor PF=1 @ P (sinφ=1 @ Q) in frequency range 45…65 Hz			

Phase Source				
Frequency	16…45 Hz	45…200 Hz	200 Hz…1 kHz	1…10 kHz
Uncertainty	0.1°	0.1°	0.5°	5°

Frequency Source			
Range of frequencies	Resolution	Uncertainty	Jitter
10…100 Hz	0.01 Hz	2.5 ppm + 5 µHz	100 ns
100.1…1000 Hz	0.1 Hz		
1.001…10 kHz	1 Hz		
10.01…100 kHz	10 Hz		

Harmonic Source		
Fundamental frequency range		10 Hz…5 kHz
Harmonic frequency range		2^{nd}…63^{rd} @ f_{max}=10 kHz
Harmonic amplitude range		0…50% of fundamental
Harmonic phase range		0…360°
Number of harmonics in a user-defined polyharmonic shape		≤ 15
Uncertainty	Amplitude	0.1% of fundamental
	Phase	Same as the phase uncertainty for phase source function

Resistance Source			
Resistance nominal value [2]	Resolution [1]	Uncertainty [ppm of setting + Ω]	Maximum load
0 Ω	10 µΩ	0 + 0.005 Ω	0.5 A
10 Ω	10 µΩ	0 + 0.005 Ω	0.15 A
100 Ω	100 µΩ	30 + 0.005 Ω	0.05 A
1 kΩ	1 mΩ	30 + 0.005 Ω	10 V
10 kΩ	10 mΩ	20 + 0.05 Ω	20 V
100 kΩ	100 mΩ	30 + 0 Ω	100 V
1 MΩ	1 Ω	30 + 0 Ω	100 V
10 MΩ	10 Ω	250 + 0 Ω	100 V
100 MΩ	100 Ω	3000 + 0 Ω	100 V
1 GΩ	1 kΩ	15000 + 0 Ω	100 V

[1] 2-wire and 4-wire connected resistor is calibrated together with terminals. For attaining maximum accuracy, resistance value is displayed with provided resolution

[2] There is available 2-wire mode for resistance 0…1 GΩ and 4-wire mode for resistance 0…100 kΩ

Thermocouple Source					
Type [1]	Range [ºC] [3]	Uncertainty [ºC] [2]	Type [1]	Range [ºC] [3]	Uncertainty [ºC] [2]
B	600…800	0.44	N	-200…0	0.40
	800…1820	0.34		0…600	0.15
				600…1300	0.20
C	0…1000	0,30	R	0…250	0.57
	1000…1800	0.50		250…1000	0.35
	1800…2316	0.84		1000…1767	0.40
E	-200…0	0.20	S	0…250	0.47
	0…1000	0.15		250..1400	0.35
				1400…1767	0.46
J	-200…-50	0.15	T	-200…100	0.20
	-50…1200	0.20		100…400	0.15
K	-200…-100	0.25	U	-200…0	0.56
	-100…1372	0.18		0…600	0.27
L	-200…-100	0.37			
	-100…900	0.26			

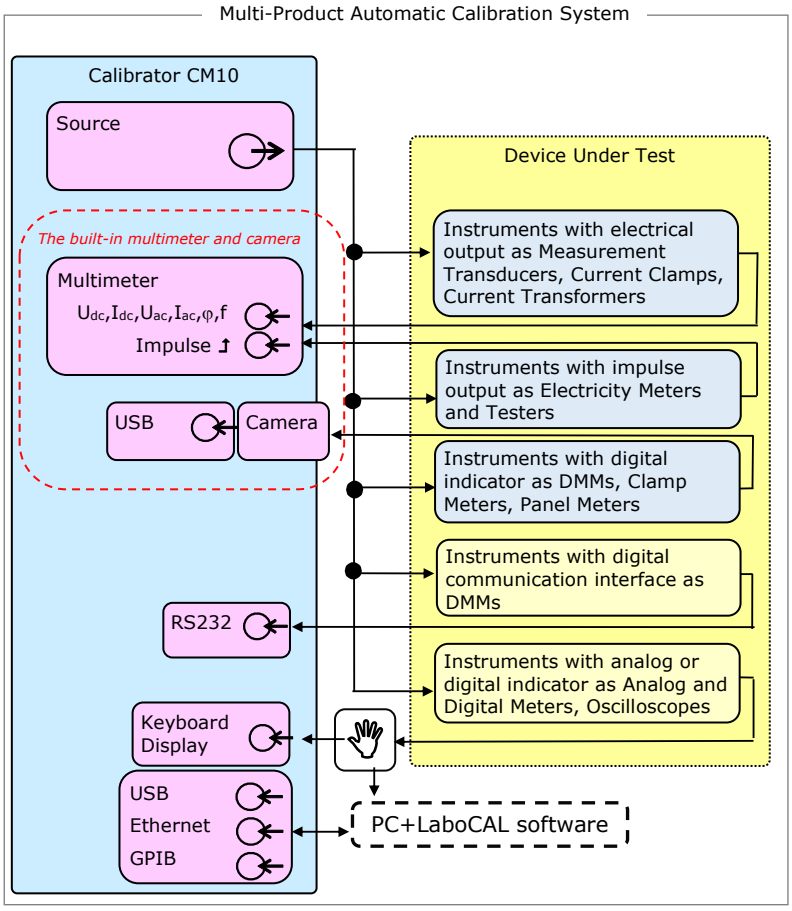
[1] Temperature scale ITS-90 or IPTS-68 is selected

[2] For the function of the automatic internal reference junction temperature compensation, additional error ±0.5ºC

[3] The resolution is 0.01ºC

PWM (Pulse Width Modulation) Source						
Shape / polarization	Frequency		Amplitude		Duty Cycle	
	Range	Uncertainty	Range	Uncertainty	Range	Uncertainty
Rectangular / positive, negative, symmetrical	0.1 … 10 kHz	0.5 ppm	0.001 … 10 V_{p-p}	0.1%	5 - 95%	0.001%

HSO (High frequency Square Oscillator) Source					
Shape	Frequency		Amplitude		Rise Time
	Range	Uncertainty	Value	Uncertainty	
Square	0.1 … 10 MHz	0.5 ppm	5 V	10%	≤ 5 ns



The CM10 as a tester will enable automatic calibration practically all equipment in your laboratory, including instruments:

✓ With electrical output as Measurement Transducers, Current Clamps or Current Transformers,

✓ With impulse output as Electricity Meters,

✓ With digital indicator as DMMs, Clamp Meters or Panel Meters,

✓ With digital interface as DMMs.

The mean value *M* and standard deviation *s* of the DUT error from *n* repeated measurements are displayed as the calibration result, without need to manually entering readings from DUT by operator. Additionally, the expanded uncertainty of measurement *U* according to EA-04-02 is displayed, which is calculated in fully automatic way.

The operator can also enter readings from DUT manually using the calibrator's keyboard in the calibration of instruments with analog or digital indicator as Analog and Digital Meters or Oscilloscopes.

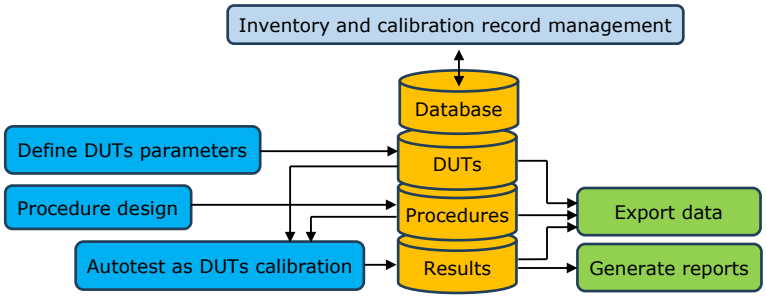
Specifications for the Multimeter

Function	Range	Resolution	Uncertainty
DC voltage	0...±14 V	10 uV	0.015% + 30 uV
DC current	0...±6 A	0,001% @ I≥20 mA 200 nA @ I<20 mA	0.015% + 100 nA
AC voltage	0...10 V	10 uV	0.03% + 50 uV [1)]
AC current	0...6 A	0,001% @ I≥20 mA 200 nA @ I<20 mA	0.03% + 1uA [1)]
Phase shift angle	0...360°	0.001°	0.1° [1)2)]
Frequency	0.001 Hz...210 kHz	0.0001%	0.001% [2)]
Impulse	0.001 Hz...210 kHz and 0...2 V / 4...27 V	0.0001% @ t≥1 s	0.001%

[1)] in frequency range 45...65 Hz
[2)] for AC voltages and currents from 2% of voltage and current range

Automatic calibration of the 7-segment display DMM by using USB Camera

General specifications	
Temperature	Operating +10…+40°C / Calibration +15…+35°C / Storage -20…+50°C
Humidity	Operating <80% to +30°C and <70% to +40°C / Storage <95% to +50°C
Safety	IEC 61010-1: Electric shock class 1 / Installation category II / Level of pollution 2
Degree of case protection	EN 60529: IP30
EMC	EN 61326: class A acc. to EN 55022 / level 2 acc. to EN 61000-4-2…6 / level 0 acc. to EN 61000-4-11
Power supply	207…258 V / 47…63 Hz / 300 VA
Dimensions (D x W x H)	(550x345x600) mm
Weight	28 kg



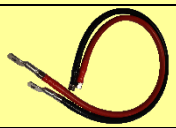
LaboCAL software is an smart application that enables CM10 remote control, define DUTs parameters, procedure design, autotest realised, record management, data export and generate reporting as full calibration certificates.

Calmet CM10

All completed Calmet CM10 Calibrator's set consists of:

- CM10 calibrator,
- power cord,
- fuse T6A, 250V, 5x20 (2units),
- C091A T3475-001 plug Amphenol for Calibrator inputs,
- CM10 PC-Soft with intarface cable,
- operation manual calibrator and software (2units),
- warranty card,
- manufacturer calibration certificate.

Optionally for Calmet CM10 Calibrator are available:

• LaboCAL software with operation manual and a USB B / USB A cable,		• EA41 set of 200A current cables (2units) with ring tip,	
• CC10 Transconductance Amplifier 200 A DC and 120 A AC with operation manual,		• EA13 2m safety cables (4units),	
• CF106H photo head with holder for inductive meter and meter with LED,		• EA22 additional accessories for the safety cables: banana plug (8units) and copper wire (4units),	
• TC Thermocouple connector,		• EA25 shorting jumpers for the terminals (2units),	
• USB Camera,		• ET32 transport case for the additional accessories,	
		• Calibration Certificate issued by ISO 17025 accredited laboratory.	

*) All images are for illustrative purposes only and are subject to change

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