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CALMET
Smart Calibration Devices

Calmet Calibration Laboratory

Unique Laboratory

Calmet Calibration Laboratory is Unique Laboratory of Power Network Parameters and Power Quality, which offers calibration (checking, testing) of measuring instruments and calibrators of electro-energetic values such as: DC and AC voltage and current, phase angle, frequency, power, energy and resistance.

There are many accredited and non-accredited laboratories to offer these services, but Calmet Calibration Laboratory offers calibration service in the field:

- highest accuracy 0.007% for voltage, current, power and energy up to 3x120A AC,
- distorted signals as harmonic of voltage and current, interharmonics,
- time-varying signals as flicker.

What means, that **we specialize in:**

- **highest accuracy power network parameters,**
- **power quality parameters.**

Who needs us?

Power engineering and industries associated with it, where are used voltmeters, ammeters, clamp meters, frequency meters, phase meters, meters of power network parameters, watt-meters, electricity meters, power quality analysers, calibrators of voltage, current and power, reference meters and testers of electrical devices, protection relays, measurement transducers …

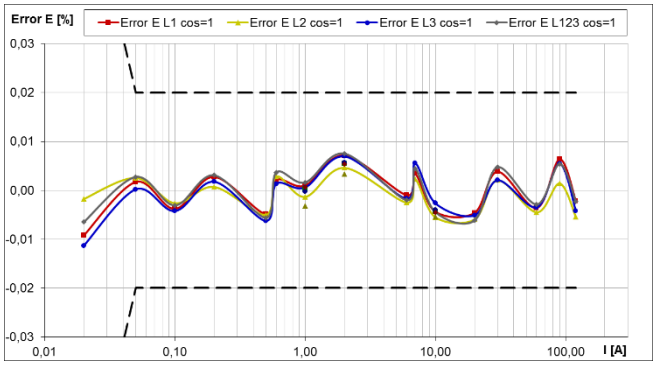
What we offer?

1. Increasing energy prices resulted in need to use of electricity meter testers with high accuracy classes from 0.5% to 0.02% inclusive. These testers are working under difficult conditions on site and the measurement results can have financial consequences, so there is a need of periodical checking these testers. We offer calibration of testers (reference meters) of all accuracy classes in the scope of accreditation No. AP 216, with the CMC at the level 0.007%.
2. For more than 30 years we have manufactured several thousand of electrical standards that determine the Calibration and Measurement Capability (CMC) of many domestic and foreign laboratories, and which for many years we regularly calibrated and maintain. During this time our staff has acquired a lot of experience, which is the basis of our measurement abilities.
3. Standardization of power quality parameters acc. to EN 61000-4-7, EN 61000-4-15, EN 61000-4-30 and EN 50160 made it possible to assess the power quality of energy with using the power quality analyzers, which should be tested periodically. Since 2002, we produced and calibrated measuring instruments and calibrators with measurement and generation functions of power quality parameters.

Hardware base

It is obvious, that for calibration is required in addition to the competence the necessary equipment.

As a producer, we have automatic measuring stations for calibration manufactured by us Three Phase Power Calibrators and Reference Meters, including 0.02% accuracy class. In the serial production of these standards we have obtained such high level of automation that it is possible to use these systems for calibrating instruments from other manufacturers. *The diagram shows an example of the error characteristics of the Energy as a function of current (50mA-120A) of the C300B Calibrator for balanced and unbalanced loads, which was obtained in fully automatic way.*



We have semi-automatic measuring stations for calibration the manufactured by us Multifunction Calibrators and Multiproduct Calibrators accuracy classes up to 0.002% inclusive.

In the adjustment and calibration on the design, production and maintenance process we meet the requirements of PN-EN ISO/IEC 17025:2018-02 with traceability to the standards maintained at Polish Central Office of Measures (GUM), PTB or NIST.

Scope of laboratory activities, for which Calmet Calibration Laboratory declares compliance with the requirements of the standard PN-EN ISO/IEC 17025:2018-02, including activities covered by the scope of accreditation No. AP 216 (yellow color)

Object of calibration/measurement	Measuring range	Uncertainty of measurement for CMC [1)]	Conditions
7.01.DC Voltage			
Meters Calibrators	0 V to 1050 V 0 V to 1.2 V 1.2 V to 12 V 12 V to 120 V 120 V to 1050 V	 0.0005% + 0.3 µV 0.0004% + 0.5 µV 0.0006% + 32 µV 0.0007%	Except p.7.7.2 PT/ILC
7.02. DC Current			
Meters Calibrators	0 mA to 200 A 0 mA to 0.12 mA 0.12 mA to 1.2 mA 1.2 mA to 12 mA 12 mA to 200 mA 0.2 A to 2 A 2 A to 200 A	 0.0018% + 1 nA 0.0018% + 6 nA 0.0018% + 0.06 µA 0.0027% 0.0026% 0.0074%	Except p.7.7.2 PT/ILC
7.03. AC Voltage			
Meters Calibrators	0.001 V to 1050 V **45 Hz to 65 Hz** **10 V to 30 V** **30 V to 525 V** 0.01 kHz to 0.02 kHz 0.001 V to 0.0022 V 0.0022 V to 0.007 V 0.007 V to 0.022 V 0.022 V to 0.07 V 0.07 V to 0.22 V 0.22 V to 0.7 V 0.7 V to 22 V 0.02 kHz to 0.04 kHz 0.001 V to 0.0022 V 0.0022 V to 0.007 V 0.007 V to 0.022 V 0.022 V to 0.07 V 0.07 V to 0.22 V 0.22 V to 0.7 V 0.7 V to 22 V 0.04 kHz to 20 kHz 0.001 V to 0.0022 V 0.0022 V to 0.007 V 0.007 V to 0.022 V 0.022 V to 0.07 V 0.07 V to 0.22 V 0.22 V to 0.7 V 0.7 V to 22 V 22 V to 1050 V 20 kHz to 50 kHz 0.001 V to 0.0022 V 0.0022 V to 0.007 V 0.007 V to 0.022 V 0.022 V to 0.07 V 0.07 V to 0.22 V 0.22 V to 0.7 V 0.7 V to 22 V	 **0.015%** **0.006%** 0.1317% + 1.0 µV 0.0660% + 1.0 µV 0.0226% + 1.0 µV 0.0195% + 1.0 µV 0.0163% + 1.2 µV 0.0163% + 1.1 µV 0.0155% 0.0573% + 1.0 µV 0.0289% + 1.0 µV 0.0149% + 1.0 µV 0.0116% + 0.9 µV 0.0067% + 1.3 µV 0.0061% + 1.1 µV 0.0055% 0.0325% + 1.0 µV 0.0166% + 1.0 µV 0.0088% + 1.0 µV 0.0078% + 0.7 µV 0.0033% + 1.3 µV 0.0031% + 1.0 µV 0.0025% 0.0040% 0.0635% + 1.6 µV 0.0320% + 1.6 µV 0.0164% + 1.6 µV 0.0116% + 1.3 µV 0.0057% + 1.6 µV 0.0031% + 1.0 µV 0.0042%	

Object of calibration/measurement	Measuring range	Uncertainty of measurement for CMC [1)]	Conditions
	50 kHz to 100 kHz 0.001 V to 0.0022 V 0.0022 V to 0.007 V 0.007 V to 0.022 V 0.022 V to 0.07 V 0.07 V to 0.22 V 0.22 V to 0.7 V 0.7 V to 22 V	 0.0930% + 1.9 µV 0.0474% + 1.9 µV 0.0241% + 1.9 µV 0.0210% + 1.8 µV 0.0124% + 2.0 µV 0.0066% + 1.9 µV 0.0069%	
Power quality analyzers Power quality calibrators	50 Hz and 60 Hz 30 V to 525 V		
- Voltage harmonics	0% to 100% 0° to 360°	0.014% [2)] 0.05° [3)]	Harmonics up to 64th
- Voltage THD	0% to 100%	0.014% [2)]	Harmonics up to 64th
- Voltage interharmonics	0% to 30%	0.05% [4)]	Interharmonics 50 Hz to 3840 Hz
- Flicker Pst	0.2 to 40	1%	Rectangular modulation 0.1 CPM to 4000 CPM

Object of calibration/measurement	Measuring range	Uncertainty of measurement for CMC [1)]	Conditions
7.04. AC Current			
Meters Calibrators	0.00001 A to 120 A **45 Hz to 65 Hz** **0.01 A to 0.25 A** **0.25 A to 120 A** 0.01 kHz to 0.02 kHz 0.01 mA to 0.1 mA 0.1 mA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 0.2 A to 2 A 2 A to 12 A 0.02 kHz to 0.04 kHz 0.01 mA to 0.1 mA 0.1 mA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 0.2 A to 2 A 2 A to 12 A 0.04 kHz to 20 kHz 0.01 mA to 0.1 mA 0.1 mA to 2 mA 2 mA to 20 mA 20 mA to 200 mA 0.2 A to 2 A 0.04 kHz to 1 kHz 2 A to 120 A 1 kHz to 5 kHz 2 A to 20 A 20 kHz to 30 kHz 0.01 mA to 0.1 mA 0.1 mA to 2 mA 2 mA to 20 mA 20 mA to 200 mA	 **0.01%** **0.007%** 0.0176% + 0.002 µA 0.0172% + 0.002 µA 0.0180% + 0.031 µA 0.0171% + 0.4 µA 0.0171% + 4 µA 0.0200% 0.0095% + 0.002 µA 0.0094% + 0.002 µA 0.0098% + 0.035 µA 0.0094% + 0.4 µA 0.0094% + 4 µA 0.0130% 0.0077% + 0.0016 µA 0.0081% + 0.001 µA 0.0083% + 0.02 µA 0.0081% + 0.2 µA 0.0081% + 2 µA 0.0212% 0.0422% 0.0474% 0.0469% + 0.001 µA 0.0468% + 0.012 µA 0.0086% + 0.41 µA	
Clamp meters	0.001 A to 3000 A **45 Hz to 65 Hz** **0.25 A to 120 A** 0.001 A to 3000 A	 **0.05%** 0.05%	
Power quality analyzers Power quality calibrators - Current harmonics - Current THD - Current interharmonics	50 Hz and 60 Hz 0.02 A to 120 A 0% to 100% 0° to 360° 0% to 100% 0% to 30%	 0.014% [2)] 0.05° [3)] 0.014% [2)] 0.05% [4)]	 Harmonics up to 64th Harmonics up to 64th Interharmonics 50 Hz to 3840 Hz

Object of calibration/measurement	Measuring range	Uncertainty of measurement for CMC [1)]	Conditions
7.5. Resistance DC			
Meters Calibrators	1 mΩ to 1.2 GΩ 1 Ω to 12 Ω 12 Ω to 120 Ω 0.12 kΩ to 1.2 kΩ 1.2 kΩ to 12 kΩ 12 kΩ to 120 kΩ 0.12 MΩ to 1.2 MΩ 1.2 MΩ to 12 MΩ 12 MΩ to 120 MΩ 0.12 GΩ to 1.2 GΩ	 0.0008% + 0.033 mΩ 0.0006% + 0.3 mΩ 0.0010% 0.0011% 0.0013% 0.0014% + 1.3 Ω 0.006% + 0.06 kΩ 0.058% + 1.1 kΩ 0.59%	
7.10. Phase angle			
Meters Calibrators	**0° to 360°** **45 Hz to 65 Hz** **30 V to 525 V** **0.25 A to 120 A** 0° to 360° 0.016 Hz to 10 kHz 0.0002 A to 120 A 0.1 V to 30 V 0.1 V to 120 V 0° to 360° 30 V to 1050 V 0.0002 A to 120 A 0.045 kHz to 0.2 kHz 0.2 kHz to 1 kHz 1 kHz to 2 kHz	**0.005°** 0.023° 0.033° 0.037° 0.12° 1.2°	
Clamp meters	**0° to 360°** **45 Hz to 65 Hz** **30 V to 525 V** **0.25 A to 120 A**	**0.04°**	
7.11. AC Energy			
Meters of power network parameters Electricity meters Devices for checking energy meters Calibrators	**45 Hz to 65 Hz** **30 V to 525 V** **0° to 360°** **cosφ or sinφ: 0.5 to 1** 0.001 A to 0.01 A **0.01 A to 0.25 A** **0.25 A to 120 A**	**CMC is applicable to active, reactive and apparent energy** 0.05% **0.015%** **0.007%**	
	45 Hz to 65 Hz **30 V to 525 V** **0° to 360°** **cosφ or sinφ: 0.5 to 1** **0.25 A to 120 A** 120 A to 3000 A	**CMC is applicable to active, reactive and apparent energy** **0.05%** 0.007%	

Object of calibration/measurement	Measuring range	Uncertainty of measurement for CMC [1)]	Conditions
7.13. AC Power			
Meters of power network parameters Electricity meters Devices for checking energy meters Calibrators	0.015 W to **0.15 W to 189 kW** 0.015 var to **0.15 var to 189 kvar** 0.03 VA to **0.3 VA to 189 kVA** **45 Hz to 65 Hz** **30 V to 525 V** **0° to 360°** **cosφ or sinφ: 0.5 to 1** 0.001 A to 0.01 A **0.01 A to 0.25 A** **0.25 A to 120 A**	 0.05% **0.015%** **0.007%**	
Clamp meters	**3.75 W to 189 kW** to 4.725 MW **3.75 var to 189 kvar** to 4.725 Mvar **7.5 VA to 189 kVA** to 4.725 MVA **45 Hz to 65 Hz** **30 V to 525 V** **0° to 360°** **cosφ or sinφ: 0.5 to 1** **0.25 A to 120 A** 120 A to 3000 A	 **0.05%** 0.07%	
7.15. Electrical simulation of quantity			
Calibrators - Temperature Symulators	-200 °C to +2316 °C	0.06 °C	Thermocouple simulation
10.01. Time (interval)			
Meters Calibrators	1 µs to 100 s	0.00007% + 0.5 ns	Except p.7.7.2 PT/ILC
Pulse Analysers Pulse Calibrators - Duty cycle	0.1 kHz to 10 kHz -30 V to +30 V 1% to 99%	 0.00022%	Except p.7.7.2 PT/ILC
10.02. Frequency			
Meters Calibrators	1 Hz to 10 MHz **45 Hz to 65 Hz**	0.00001% **0.0003%**	

[1)] Measurement uncertainty for CMC is the expanded uncertainty with a probability of expansion about 95%. The value expressed in percentages is the relative measurement uncertainty and concerns the percentage share in the measured value. In other cases, the measurement uncertainty for CMC is expressed in units of the measured value

[2)] 0.014% output value for the fundamental frequency of the first harmonic with linear rise up to 0.087% output value for the 64th harmonics

[3)] 0.05° for the fundamental frequency of the first harmonic with linear rise up to 4° for the 64th harmonics

[4)] 0.05% output value for the interharmonics frequency 50 Hz with linear rise up to 0.3% output value for interharmonics frequency 3840 Hz