



Innovative-Developing Enterprise Calmet Ltd.
Laboratory of Measurement
Poland, 65-472 Zielona Gora, Kukulcza Street 18
Phone +48 68 324-04-56, Fax:+48 68 324-04-57
mail@calmet.com.pl www.calmet.com.pl

CERTIFICATE OF CALIBRATION

Date of issue: 14 September 2017

Certificate Number: CT/607/2017

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|----------------------------------|--|
| CALIBRATION OBJECT | Name: Three Phase Power Calibrator and Power Engineering Apparatus Tester Model: C300B class 0.02 Serial No.: 26008 Manufacturer: Innovative-Developing Enterprise Calmet Ltd. Poland, 65-472 Zielona Gora, Kukulcza Street 18 |
| APPLICANT | PK elektronik Poppe GmbH Velten Business Park Ameisenweg 6, D-16727 Velten b. Berlin, Germany |
| CALIBRATION METHOD | Method of Direct Comparison - according to a procedure CT-PW-02-04 |
| ENVIRONMENTAL CONDITIONS | Calibration was performed in $+23^{\circ}\text{C}\pm 2^{\circ}\text{C}$ ambient temperature and 35...60% relative humidity |
| CALIBRATION DATE | 12 September 2017 |
| TRACEABILITY | This instrument was calibrated by a Three-phase Electricity Standard Radian RD-33-223 SN 301589, which is traceable to the National Institute of Standards and Technology (NIST). For calibration was also used Keysight 3458A Multimeter SN MY45051722 |
| CALIBRATION RESULTS | The calibration results are presented on the next pages of this certificate including uncertainty of measurement |
| UNCERTAINTY OF MEASUREMENT | Uncertainty of measurement has been evaluated in compliance with EA-4/02. The expanded uncertainty assigned corresponds to a coverage probability of 95% and the coverage factor $k=2$ |
| COMPLIANCE WITH THE REQUIREMENTS | As a result of calibration, it has been found, that the instrument listed above meets metrological requirements specified in manufacturer documentation |
| DECLARATION | This is to confirm, that Calmet's Laboratory of Measurement meets requirements of the EN ISO/IEC 17025:2005 standard |

Przedsiębiorstwo Innowacyjno Wdrożeniowe
CALMET Spółka z o.o.
ul. Kukulcza 18, tel. +48 68 324 04 56
65-472 ZIELONA GÓRA

Kierownik Produkcji i Serwisu
Jacek Szumański
mgr inż. Jacek Szumański

.....
Stamp and signature

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CALIBRATION RESULTS

The results are presented below

| ID. | Function symbol Range | Results of test for voltage, current, angle and frequency accuracy. | | | | | | | | Uncertainty of measurement | |
|-----|--------------------------|---|-----------|---------|-----------|---------------------------|---------------------|------------|------------|----------------------------|--------|
| | | Setting | | | | Uncertainty of calibrator | Measurement results | | | | |
| | | U | I | f | φ | | Errors in phase | | | | |
| | | [V] | [A] | [Hz] | [°] | | L1 | L2 | L3 | | |
| 1 | U 70V | 3.0 | 50 | 50 | | ±0.0042V | +0.0005V | +0.0007V | +0.0005V | 0.0040V | |
| 2 | | 20.0 | | | | ±0.0042V | -0.0004V | -0.0002V | -0.0001V | 0.0046V | |
| 3 | | 65.0 | | | | ±0.0130V | -0.0007V | -0.0002V | +0.0003V | 0.0038V | |
| 4 | | 40 | | | | ±0.008V | -0.001V | -0.001V | -0.001V | 0.003V | |
| 5 | | 140V | | | | 130 | ±0.026V | -0.002V | -0.001V | -0.001V | 0.008V |
| 6 | | U | | | | 85 | ±0.017V | -0.002V | -0.002V | -0.002V | 0.005V |
| 7 | | 280V | | | | 260 | ±0.052V | -0.005V | -0.002V | -0.005V | 0.015V |
| 8 | | U | | | | 170 | ±0.034V | -0.005V | -0.002V | -0.004V | 0.010V |
| 9 | | 560V | | | | 510 | ±0.102V | -0.007V | -0.005V | -0.011V | 0.029V |
| 10 | I 0,5A | 50 | 0.020 | 50 | | ±0.00010A | -0.000001A | +0.000000A | -0.000003A | 0.000002A | |
| 11 | | | 0.125 | | | ±0.000025A | -0.000001A | +0.000000A | +0.000003A | 0.000007A | |
| 12 | | | 0.480 | | | ±0.000096A | -0.000022A | -0.000018A | -0.000018A | 0.000028A | |
| 13 | 0.5 | | ±0.00012A | | | +0.00002A | +0.00003A | -0.00001A | 0.00003A | | |
| 14 | I 6A | | 1.5 | | | ±0.00030A | +0.00003A | +0.00004A | +0.00006A | 0.00009A | |
| 15 | | | 5.8 | | | ±0.00116A | -0.00024A | -0.00025A | -0.00020A | 0.00034A | |
| 16 | | | 5 | | | ±0.0010A | -0.0001A | +0.0000A | +0.0000A | 0.0003A | |
| 17 | I 20A | | 10 | | | ±0.0020A | -0.0006A | -0.0004A | -0.0004A | 0.0006A | |
| 18 | | | 19 | | | ±0.0038A | -0.0007A | -0.0004A | -0.0005A | 0.0011A | |
| 19 | | 30 | ±0.006A | +0.001A | +0.001A | +0.001A | 0.001A | | | | |
| 20 | I 120A | 60 | ±0.012A | -0.003A | -0.003A | -0.001A | 0.004A | | | | |
| 21 | | 115 | ±0.023A | -0.004A | -0.002A | -0.003A | 0.007A | | | | |
| 22 | | f | | 50 | | ±0.0020Hz | -0.0001Hz | - | - | 0.0031Hz | |
| 23 | | | 60 | | ±0.0020Hz | +0.0001Hz | - | - | 0.0037Hz | | |
| 24 | φ | 230 | 5 | 50 | 0 | ±0.05° | +0.01° | +0.00° | -0.01° | 0.02° | |
| 25 | | | | | +90 | ±0.05° | +0.01° | -0.01° | +0.02° | 0.02° | |
| 26 | | | | | -90 | ±0.05° | -0.02° | -0.01° | -0.01° | 0.02° | |

| ID. | Function symbol [unit] | Results of test active, reactive and apparent power accuracy in four wire, star connection. | | | | | | | | Uncertainty of measurement | | |
|-----|---------------------------|---|---------|------|---------|---------------------------|---------------------|---------|---------|----------------------------|---------|--------|
| | | Setting | | | | Uncertainty of calibrator | Measurement results | | | | | |
| | | U | I | f | φ | | Errors in phase | | | | | |
| | | [V] | [A] | [Hz] | [°] | | L1 | L2 | L3 | | L123 | |
| 1 | P [W] | 100 | 1 | 50 | 0 | ±0.020% | +0.003% | +0.000% | -0.004% | +0.002% | 0.006% | |
| 2 | | | | | 60 | ±0.150% | +0.024% | +0.056% | -0.025% | +0.008% | 0.007% | |
| 3 | | | | | -60 | ±0.150% | -0.019% | -0.050% | -0.036% | -0.043% | 0.007% | |
| 4 | | | | | 0 | ±0.020% | +0.003% | +0.004% | +0.000% | +0.003% | 0.006% | |
| 5 | | | | | 60 | ±0.150% | +0.006% | +0.035% | -0.034% | +0.004% | 0.007% | |
| 6 | | | | | -60 | ±0.150% | -0.036% | -0.028% | -0.052% | -0.042% | 0.007% | |
| 7 | | 0 | ±0.020% | | -0.006% | -0.003% | -0.009% | -0.006% | 0.006% | | | |
| 8 | | 60 | ±0.150% | | +0.000% | +0.043% | -0.036% | +0.002% | 0.007% | | | |
| 9 | | -60 | ±0.150% | | -0.052% | -0.002% | -0.065% | -0.049% | 0.007% | | | |
| 10 | | Q [var] | 200 | | 2 | 90 | ±0.020% | +0.003% | +0.008% | +0.004% | +0.004% | 0.007% |
| 11 | | | | | | 150 | ±0.150% | -0.038% | +0.027% | -0.046% | -0.009% | 0.007% |
| 12 | | | | | | 30 | ±0.150% | +0.001% | -0.011% | -0.040% | -0.013% | 0.007% |
| 13 | | S [VA] | 100 | | 1 | 0 | ±0.020% | +0.004% | +0.003% | +0.001% | +0.003% | 0.006% |
| 14 | | | 200 | | 2 | 0 | ±0.020% | +0.003% | +0.005% | +0.004% | +0.005% | 0.006% |
| 15 | | | 400 | | 10 | 0 | ±0.020% | -0.006% | -0.002% | -0.005% | -0.004% | 0.006% |

Measured by:

Kuszyk

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CALIBRATION RESULTS

The results are presented below

| ID. | Function symbol [unit] | Setting | | | | Uncertainty of calibrator | Measurement results | | | | Uncertainty of measurement |
|-----|------------------------|---------|---------|------|---------|---------------------------|---------------------|---------|---------|---------|----------------------------|
| | | U | I | f | φ | | Errors in phase | | | | |
| | | [V] | [A] | [Hz] | [°] | | L1 | L2 | L3 | L123 | |
| 1 | EP [Wh] | 57 | 5 | 50 | 0 | ±0.020% | +0.003% | +0.002% | +0.001% | +0.002% | 0.006% |
| 2 | | | | | 60 | ±0.150% | -0.010% | +0.020% | -0.053% | -0.027% | 0.007% |
| 3 | | | | | -60 | ±0.150% | +0.018% | -0.015% | -0.028% | -0.014% | 0.007% |
| 4 | | | | | 0 | ±0.020% | +0.002% | +0.002% | +0.001% | +0.002% | 0.006% |
| 5 | | | | | 60 | ±0.150% | -0.002% | +0.028% | -0.041% | -0.020% | 0.007% |
| 6 | | | | | -60 | ±0.150% | +0.009% | +0.022% | -0.040% | -0.028% | 0.007% |
| 7 | | 110 | 5 | | 0 | ±0.020% | -0.001% | +0.003% | +0.004% | -0.001% | 0.006% |
| 8 | | | | | 0 | ±0.020% | -0.005% | -0.003% | -0.003% | -0.005% | 0.006% |
| 9 | | | | | 60 | ±0.150% | +0.005% | +0.045% | -0.043% | +0.003% | 0.007% |
| 10 | | | | | -60 | ±0.150% | -0.058% | -0.044% | -0.065% | -0.041% | 0.007% |
| 11 | | | | | 0 | ±0.020% | +0.000% | +0.001% | +0.003% | +0.001% | 0.006% |
| 12 | | | | | 0 | ±0.020% | -0.005% | -0.003% | -0.006% | -0.007% | 0.006% |
| 13 | | | | | 0 | ±0.020% | +0.001% | +0.001% | +0.001% | +0.000% | 0.006% |
| 14 | | | | | 0 | ±0.020% | +0.004% | +0.005% | +0.006% | +0.005% | 0.006% |
| 15 | | | | | 0 | ±0.020% | +0.002% | +0.002% | +0.000% | +0.001% | 0.006% |
| 16 | | | | | 60 | ±0.150% | -0.031% | +0.002% | -0.063% | -0.016% | 0.007% |
| 17 | | -60 | ±0.150% | | -0.008% | +0.002% | -0.063% | -0.023% | 0.007% | | |
| 18 | | 0 | ±0.020% | | -0.003% | -0.001% | -0.005% | -0.002% | 0.006% | | |
| 19 | | 0 | ±0.020% | | -0.004% | -0.001% | -0.005% | -0.006% | 0.006% | | |
| 20 | | 0 | ±0.020% | | -0.004% | -0.005% | -0.002% | -0.004% | 0.006% | | |
| 21 | | 0 | ±0.020% | | -0.002% | -0.004% | -0.003% | -0.003% | 0.006% | | |
| 22 | | 60 | ±0.150% | | -0.022% | +0.049% | -0.010% | -0.003% | 0.007% | | |
| 23 | | -60 | ±0.150% | | -0.024% | -0.011% | -0.028% | -0.010% | 0.007% | | |
| 24 | | 0 | ±0.020% | | +0.000% | +0.000% | -0.001% | +0.000% | 0.006% | | |
| 25 | | 60 | ±0.150% | | -0.051% | -0.017% | -0.038% | -0.021% | 0.007% | | |
| 26 | | -60 | ±0.150% | | -0.035% | +0.021% | -0.046% | -0.006% | 0.007% | | |
| 27 | EQ [varh] | 57 | 5 | 90 | ±0.020% | +0.004% | +0.004% | +0.003% | +0.003% | 0.007% | |
| 28 | | | | 150 | ±0.150% | +0.024% | -0.002% | -0.021% | +0.029% | 0.007% | |
| 29 | | | | 30 | ±0.150% | -0.015% | -0.034% | -0.065% | -0.049% | 0.007% | |
| 30 | | | | 90 | ±0.020% | +0.003% | +0.004% | +0.002% | +0.003% | 0.007% | |
| 31 | | | | 150 | ±0.150% | +0.041% | +0.013% | -0.013% | +0.014% | 0.007% | |
| 32 | | | | 30 | ±0.150% | -0.034% | -0.050% | -0.069% | -0.036% | 0.007% | |
| 33 | ES [VAh] | 230 | 5 | 57 | ±0.020% | +0.003% | +0.003% | +0.003% | +0.002% | 0.006% | |
| 34 | | | | 110 | ±0.020% | +0.003% | +0.003% | +0.002% | +0.003% | 0.006% | |
| 35 | | | | 0 | ±0.020% | +0.003% | +0.002% | +0.000% | +0.003% | 0.006% | |
| 36 | | | | 0 | ±0.020% | +0.001% | +0.001% | +0.000% | +0.001% | 0.006% | |
| 37 | | | | 0 | ±0.020% | -0.005% | -0.001% | -0.003% | -0.003% | 0.006% | |
| 38 | | | | 0 | ±0.020% | +0.000% | +0.003% | +0.002% | +0.003% | 0.006% | |
| 39 | | | | 0 | ±0.020% | +0.002% | +0.003% | +0.002% | +0.003% | 0.006% | |

Measured by:

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