



## CALIBRATION CERTIFICATE

Date of issue: 25 October 2023

Certificate No: XXXX/2023 (XXXXXXXXXX)

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<b>OBJECT OF CALIBRATION</b>	Power network analyzer type ND45 - serial number:	19120099
<b>APPLICANT</b>	LUMEL S.A., ul. Słubicka 4, 65-127 Zielona Góra	
<b>USER</b>	Laboratorium Badawcze LUMEL S.A., ul. Słubicka 4, 65-127 Zielona Góra	
<b>CALIBRATION METHOD</b>	Calibration manual for digital instruments for measuring electrical quantities No. LB-002/00.	
<b>ENVIRONMENTAL CONDITIONS</b>	The measurements were made at the temperature of $23\pm 1^{\circ}\text{C}$ and relative air humidity of $50\pm 5\%$	
<b>DATE OF CALIBRATION</b>	25 October 2023	
<b>TRACEABILITY</b>	This certificate provides traceability of measurement results to the International System of Units (SI) through the use of: CALMET C300B Calibrator No 27247.	
<b>CALIBRATION RESULTS</b>	Given on pages 2-4 of this certificate along with the measurement uncertainty values. The results apply only to the calibrated object.	
<b>UNCERTAINTY OF MEASUREMENT</b>	Uncertainty of measurement has been evaluated in compliance with EA-4/02 M:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor $k = 2$	
<b>CONFORMITY WITH REQUIREMENTS</b>	On the basis of calibration results, it has been found that measuring instrument meets metrological requirements specified in user manual.	

Signature of Head of Laboratory  
LABORATORIUM  
BADAWCZEGO

*Marek Floryszak*

## Power network analyzer type ND45 - serial number: 191200 19120099

## Voltage U L-N, range: 11,5V - 70V 50Hz

Parameter	Ur [V]	Um [V]	Measurement error U [V]	IA dopl [V]	Measurement uncertainty ±U[V]	*Statement of Conformity
U1	11,500	11,499	-0,0012	0,058	0,0042	PASS
U2	11,500	11,501	0,0012	0,058	0,0042	PASS
U3	11,500	11,501	0,00096	0,058	0,0042	PASS
U1	18,000	18,000	-0,00017	0,058	0,0042	PASS
U2	18,000	18,002	0,002	0,058	0,0042	PASS
U3	18,000	18,004	0,0038	0,058	0,0042	PASS
U1	25,000	25,002	0,0017	0,058	0,005	PASS
U2	25,000	25,001	0,00096	0,058	0,005	PASS
U3	25,000	25,008	0,0076	0,058	0,005	PASS
U1	31,000	31,004	0,0037	0,058	0,0062	PASS
U2	31,000	31,003	0,0035	0,058	0,0062	PASS
U3	31,000	31,010	0,01	0,058	0,0062	PASS
U1	38,000	38,008	0,0076	0,058	0,0076	PASS
U2	38,000	38,004	0,004	0,058	0,0076	PASS
U3	38,000	38,013	0,013	0,058	0,0076	PASS
U1	44,000	44,006	0,0062	0,058	0,0088	PASS
U2	44,000	44,005	0,0047	0,058	0,0088	PASS
U3	44,000	44,016	0,016	0,058	0,0088	PASS
U1	51,000	51,012	0,012	0,058	0,01	PASS
U2	51,000	51,008	0,008	0,058	0,01	PASS
U3	51,000	51,018	0,018	0,058	0,01	PASS
U1	57,000	57,013	0,013	0,058	0,011	PASS
U2	57,000	57,010	0,0098	0,058	0,011	PASS
U3	57,000	57,023	0,023	0,058	0,011	PASS
U1	64,000	64,012	0,012	0,058	0,013	PASS
U2	64,000	64,010	0,0097	0,058	0,013	PASS
U3	64,000	64,022	0,022	0,058	0,013	PASS
U1	70,000	70,012	0,012	0,058	0,014	PASS
U2	70,000	70,009	0,0092	0,058	0,014	PASS
U3	70,000	70,025	0,025	0,058	0,014	PASS

## Voltage U L-L, range: 19,92V - 121,24V 50Hz

Parameter	Ur [V]	Um [V]	Measurement error U [V]	IA dopl [V]	Measurement uncertainty ±U[V]	*Statement of Conformity
U1-2	19,919	19,909	-0,0091	0,5	0,0042	PASS
U2-3	19,919	19,915	-0,0037	0,5	0,0042	PASS
U3-1	19,919	19,963	0,044	0,5	0,0042	PASS
U1-2	31,177	31,181	0,0038	0,5	0,0062	PASS
U2-3	31,177	31,169	-0,0076	0,5	0,0062	PASS
U3-1	31,177	31,222	0,045	0,5	0,0062	PASS
U1-2	43,301	43,318	0,017	0,5	0,0087	PASS
U2-3	43,301	43,289	-0,012	0,5	0,0087	PASS
U3-1	43,301	43,348	0,046	0,5	0,0087	PASS
U1-2	53,694	53,723	0,029	0,5	0,011	PASS
U2-3	53,694	53,679	-0,015	0,5	0,011	PASS
U3-1	53,694	53,744	0,051	0,5	0,011	PASS
U1-2	65,818	65,865	0,047	0,5	0,013	PASS
U2-3	65,818	65,790	-0,028	0,5	0,013	PASS
U3-1	65,818	65,874	0,056	0,5	0,013	PASS
U1-2	76,210	76,264	0,054	0,5	0,015	PASS
U2-3	76,210	76,183	-0,027	0,5	0,015	PASS
U3-1	76,210	76,270	0,06	0,5	0,015	PASS
U1-2	88,335	88,403	0,069	0,5	0,018	PASS
U2-3	88,335	88,305	-0,03	0,5	0,018	PASS
U3-1	88,335	88,397	0,062	0,5	0,018	PASS
U1-2	98,727	98,808	0,082	0,5	0,02	PASS
U2-3	98,727	98,692	-0,035	0,5	0,02	PASS
U3-1	98,727	98,790	0,063	0,5	0,02	PASS
U1-2	110,851	110,903	0,052	0,5	0,022	PASS
U2-3	110,851	110,815	-0,036	0,5	0,022	PASS
U3-1	110,851	110,940	0,088	0,5	0,022	PASS
U1-2	121,244	121,308	0,064	0,5	0,024	PASS
U2-3	121,244	121,202	-0,041	0,5	0,024	PASS
U3-1	121,244	121,332	0,088	0,5	0,024	PASS

Authorized by:

Adam Siwa

Power network analyzer type ND45 - serial number: 19120099

Current I, zakres: 0,5A - 6A 50Hz

Parameter	I <sub>r</sub> [A]	I <sub>m</sub> [A]	Measurement error I [A]	ΔI dopł [A]	Measurement uncertainty ±[A]	*Statement of Conformity
I1	0,5000	0,5000	0,000011	0,005	0,0001	PASS
I2	0,5000	0,5001	0,000083	0,005	0,0001	PASS
I3	0,5000	0,5000	-0,0000012	0,005	0,0001	PASS
I1	1,1111	1,1111	0,000013	0,005	0,00022	PASS
I2	1,1111	1,1112	0,00011	0,005	0,00022	PASS
I3	1,1111	1,1110	-0,000069	0,005	0,00022	PASS
I1	1,7222	1,7223	0,00011	0,005	0,00034	PASS
I2	1,7222	1,7226	0,00035	0,005	0,00034	PASS
I3	1,7222	1,7223	0,000094	0,005	0,00034	PASS
I1	2,3333	2,3334	0,00012	0,005	0,00047	PASS
I2	2,3333	2,3337	0,0004	0,005	0,00047	PASS
I3	2,3333	2,3334	0,00006	0,005	0,00047	PASS
I1	2,9444	2,9445	0,000032	0,005	0,00059	PASS
I2	2,9444	2,9447	0,00027	0,005	0,00059	PASS
I3	2,9444	2,9443	-0,00013	0,005	0,00059	PASS
I1	3,5556	3,5558	0,00024	0,005	0,00071	PASS
I2	3,5556	3,5559	0,00032	0,005	0,00071	PASS
I3	3,5556	3,5557	0,00011	0,005	0,00071	PASS
I1	4,1667	4,1670	0,00029	0,005	0,00083	PASS
I2	4,1667	4,1669	0,0002	0,005	0,00083	PASS
I3	4,1667	4,1668	0,00015	0,005	0,00083	PASS
I1	4,7778	4,7780	0,00023	0,005	0,00096	PASS
I2	4,7778	4,7779	0,00009	0,005	0,00096	PASS
I3	4,7778	4,7778	0,000067	0,005	0,00096	PASS
I1	5,3889	5,3889	0,000057	0,005	0,0011	PASS
I2	5,3889	5,3888	-0,0001	0,005	0,0011	PASS
I3	5,3889	5,3887	-0,00018	0,005	0,0011	PASS
I1	6,0000	5,9998	-0,00016	0,005	0,0012	PASS
I2	6,0000	5,9997	-0,00025	0,005	0,0012	PASS
I3	6,0000	5,9995	-0,00046	0,005	0,0012	PASS

Active Power P, range: 4,6W - 336W 50Hz cosifi=0,8

Parameter	P <sub>r</sub> [W]	P <sub>m</sub> [W]	Measurement error P [W]	ΔI dopł [W]	Measurement uncertainty ±P[W]	*Statement of Conformity
P1	4,600	4,595	-0,0051	5,3	0,00092	PASS
P2	4,600	4,599	-0,00069	5,3	0,00092	PASS
P3	4,600	4,596	-0,0045	5,3	0,00092	PASS
P1	16,000	15,993	-0,0074	5,3	0,0032	PASS
P2	16,000	16,004	0,0041	5,3	0,0032	PASS
P3	16,000	15,988	-0,012	5,3	0,0032	PASS
P1	34,444	34,434	-0,01	5,3	0,0069	PASS
P2	34,444	34,456	0,012	5,3	0,0069	PASS
P3	34,444	34,416	-0,028	5,3	0,0069	PASS
P1	57,867	57,845	-0,022	5,3	0,012	PASS
P2	57,867	57,891	0,025	5,3	0,012	PASS
P3	57,867	57,827	-0,04	5,3	0,012	PASS
P1	89,511	89,503	-0,0082	5,3	0,018	PASS
P2	89,511	89,528	0,017	5,3	0,018	PASS
P3	89,511	89,448	-0,063	5,3	0,018	PASS
P1	125,156	125,141	-0,015	5,3	0,025	PASS
P2	125,156	125,186	0,031	5,3	0,025	PASS
P3	125,156	125,085	-0,071	5,3	0,025	PASS
P1	170,000	169,973	-0,027	5,3	0,034	PASS
P2	170,000	170,053	0,053	5,3	0,034	PASS
P3	170,000	169,915	-0,085	5,3	0,034	PASS
P1	217,866	217,882	0,015	5,3	0,044	PASS
P2	217,866	217,901	0,035	5,3	0,044	PASS
P3	217,866	217,721	-0,15	5,3	0,044	PASS
P1	275,911	275,899	-0,012	5,3	0,055	PASS
P2	275,911	275,920	0,0087	5,3	0,055	PASS
P3	275,911	275,751	-0,16	5,3	0,055	PASS
P1	336,000	336,007	0,0076	5,3	0,067	PASS
P2	336,000	336,111	0,11	5,3	0,067	PASS
P3	336,000	335,740	-0,26	5,3	0,067	PASS

Authorized by:

Adam Siwa

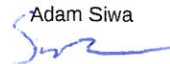
Power network analyzer type ND45 - serial number: 19120099

Frequency  $f$ , range: 46Hz - 53Hz  $U_n=57,7V$   $I_n=5A$

$f_r$ [Hz]	$f_m$ [Hz]	Measurement error $f$ [Hz]	$\Delta$ dopl [Hz]	Measurement uncertainty $\pm f$ [Hz]	*Statement of Conformity
46,000	46,00	0,00	0,05	0,0023	PASS
47,000	47,00	0,00	0,05	0,0024	PASS
48,000	48,00	0,00	0,05	0,0024	PASS
49,000	49,00	0,00	0,05	0,0025	PASS
50,000	50,00	0,00	0,05	0,0025	PASS
51,000	51,00	0,00	0,05	0,0026	PASS
52,000	52,00	0,00	0,05	0,0026	PASS
53,000	53,00	0,00	0,05	0,0027	PASS

Authorized by:

Adam Siwa



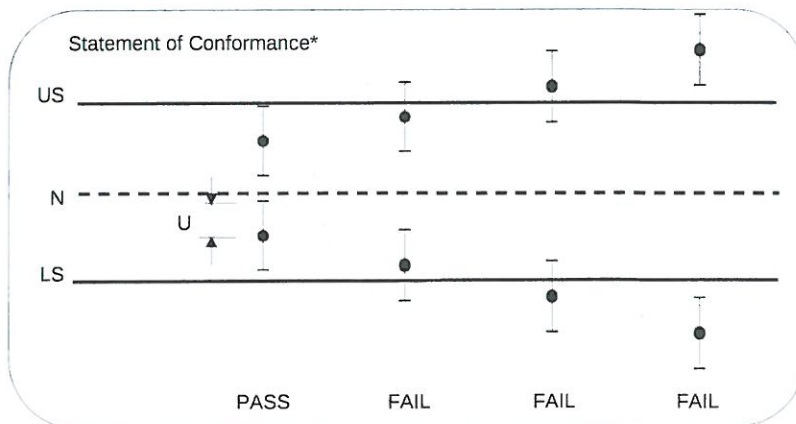
$U_r, I_r, P_r, f_r$  - correct value of the measured quantity determined on the basis of indications of the measuring instrument used for calibration

$U_m, I_m, P_m, f_m$  - value of the measured quantity indicated by the measuring instrument being checked

$\Delta$ dopl - permissible absolute error.

Software version number: 3,17

Card/bootloader version number: 0,18



US – Upper Specification, N- Nominal, LS- Lower Specification

U = 95% extended measurement uncertainty

\* Statement of conformity made based on ILAC-G8:09/2019 - binary statement of conformity with the applied protection band, the guard band is equal to the measurement uncertainty.