

NETWORK PARAMETERS METER
ND25LITE



USER MANUAL



1 INTENDED USE

The ND25LITE meter is a programmable, panel-mount digital device designed to measure single-phase (2-wire) and three-phase 3- and 4-wire power network parameters in balanced and unbalanced systems. Measured values are displayed on a dedicated LCD display. It makes possible to control and optimize the use of power electronic devices, systems, and industrial installations.

It performs measurements of: effective voltage and current, active, reactive, and apparent power, active and reactive energy, power factors, frequency, 15-, 30-, and 60-minute average active power, THD, and harmonics. Additionally, the neutral current value is calculated. Voltages and currents are multiplied by the preset voltage and current ratios of the measuring transformers. Power and energy readings take into account the programmed ratios. The value of each measured quantity can be transmitted to a master system via the RS-485 interface. The meter has two potential-free binary inputs that do not require additional power. They can be used to determine, for example, the status of contacts in relays and contactors.

The meter detects and signals incorrect phase sequence.

The meter has galvanic isolation between the following individual blocks:

- power supply,
- measurement inputs,
- binary inputs,
- voltage and current inputs,
- RS-485 output,
- pulse output.

2 METER SET

The set is composed of the following elements:

- | | |
|---------------------------|--------|
| - ND25LITE meter | 1 pc. |
| - user's manual | 1 pc. |
| - gasket | 1 pc. |
| - panel mounting brackets | 4 pcs. |

3 Basic requirements, safety of use

The device complies with the requirements of the PN-EN 61010-1 standard with respect to the safety demand.

Safety instructions:

- The meter should be installed and connected by qualified personnel. All available protection requirements must be taken into consideration.
- Before turning on the meter, the correctness of all connections should be verified.
- Before removing the meter's housing, the power should be turned off and the measuring circuits disconnected.
- Removing the meter's housing during the warranty period will cause the warranty to be invalidated.
- The meter meets the requirements for electromagnetic compatibility in industrial environments.
- The building installation should have a switch or circuit breaker located near the device, easily accessible to the operator, and appropriately labeled.

4 Installation

The meter is designed for mounting in a panel using the brackets shown in Figure 1. The meter housing is made of plastic.

The housing dimensions are 96 x 96 x 77 mm. The meter's exterior features removable screw terminal blocks that allow for the connection of external wires with a cross-section of up to 2.5 mm².

In the panel a hole measuring 92.5 + 0.6 x 92.5 + 0.6 mm should be prepared. The thickness of the panel material should not exceed 6 mm. The meter should be inserted from the front of the panel with the power supply disconnected. After inserting the meter into the hole, secure it with the brackets.

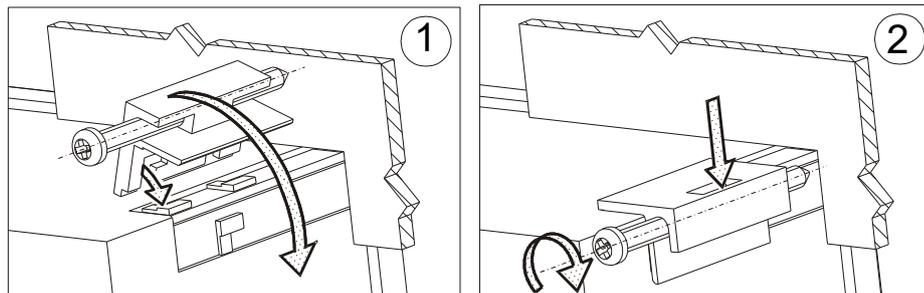


Fig. 1. Meter fixing

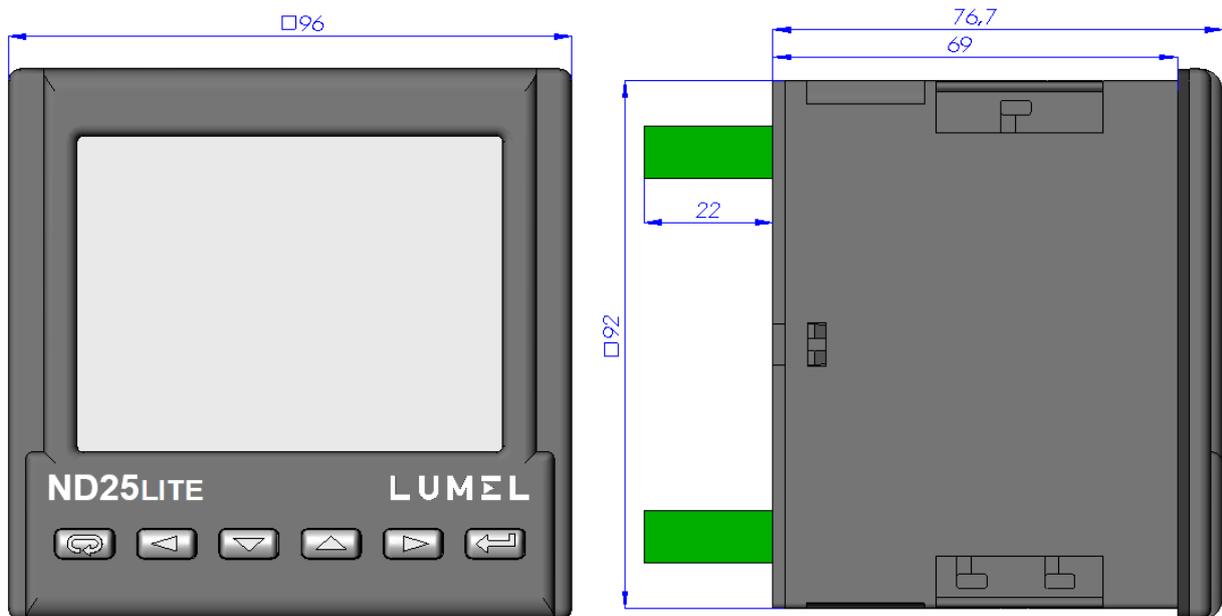


Fig. 2. Meter dimensions

5 Device Description

5.1 Current inputs

All current inputs are galvanically isolated (internal current transformers). The meter is designed to work with external current transformers. Displayed current and derivative values are automatically recalculated based on the entered external current transformer ratio. Current inputs have programmable ranges: 1 A or 5 A.

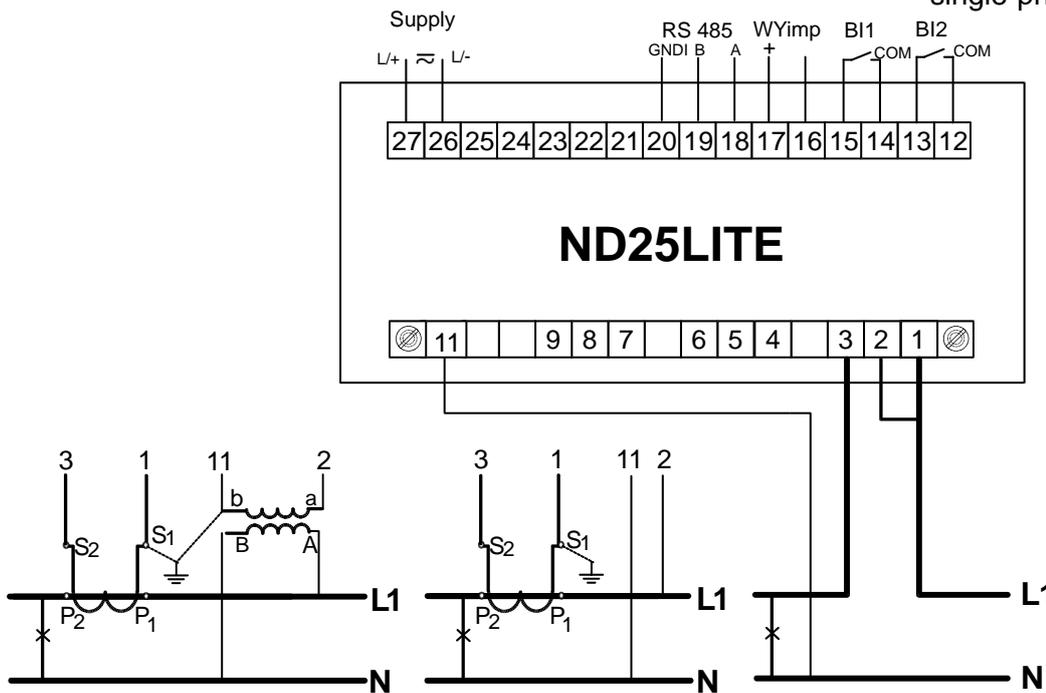
5.2 Voltage inputs

Voltage input values are automatically recalculated based on the entered external voltage transformer ratio. Voltage inputs have programmable ranges of: 3 x 57.7/100 V , 3 x 69,3/120 V, 3 x 230/400 V.

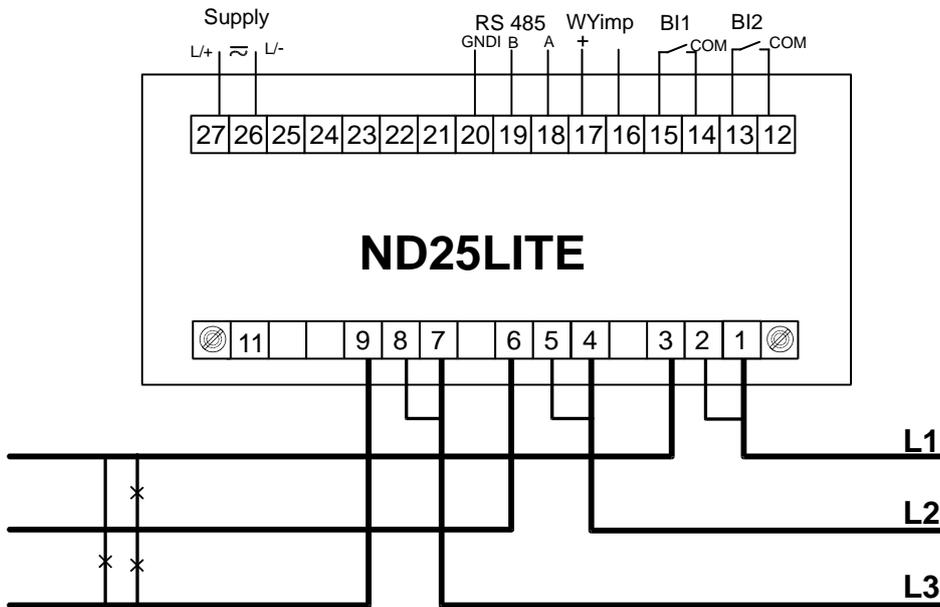
5.3 Connections diagrams

a)

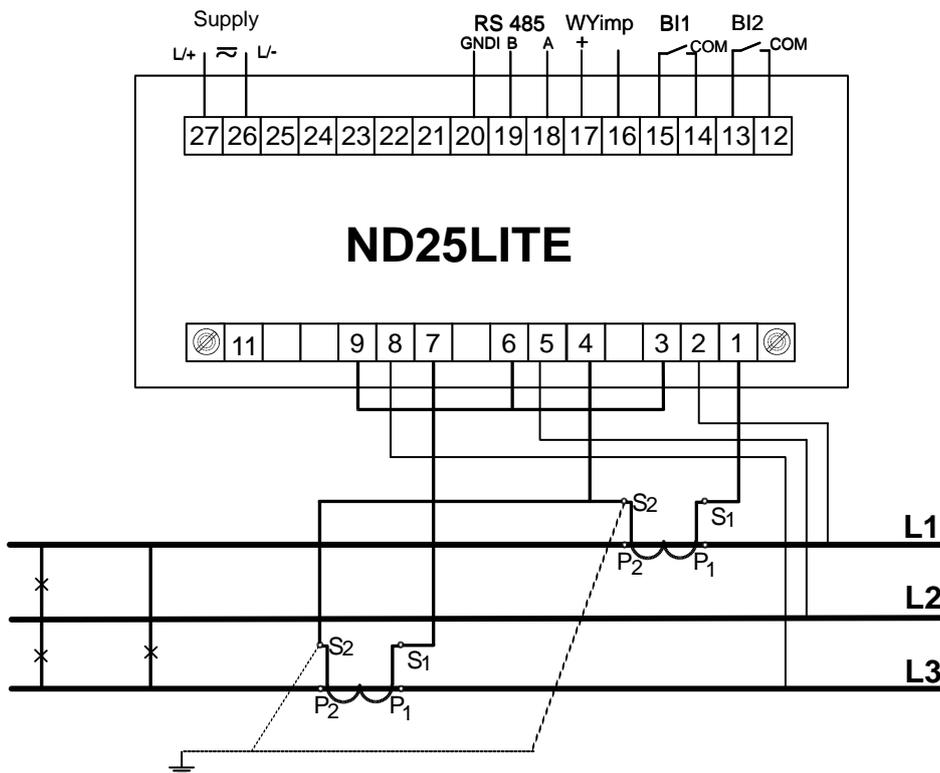
Direct, semi-indirect, and single-phase indirect measurement



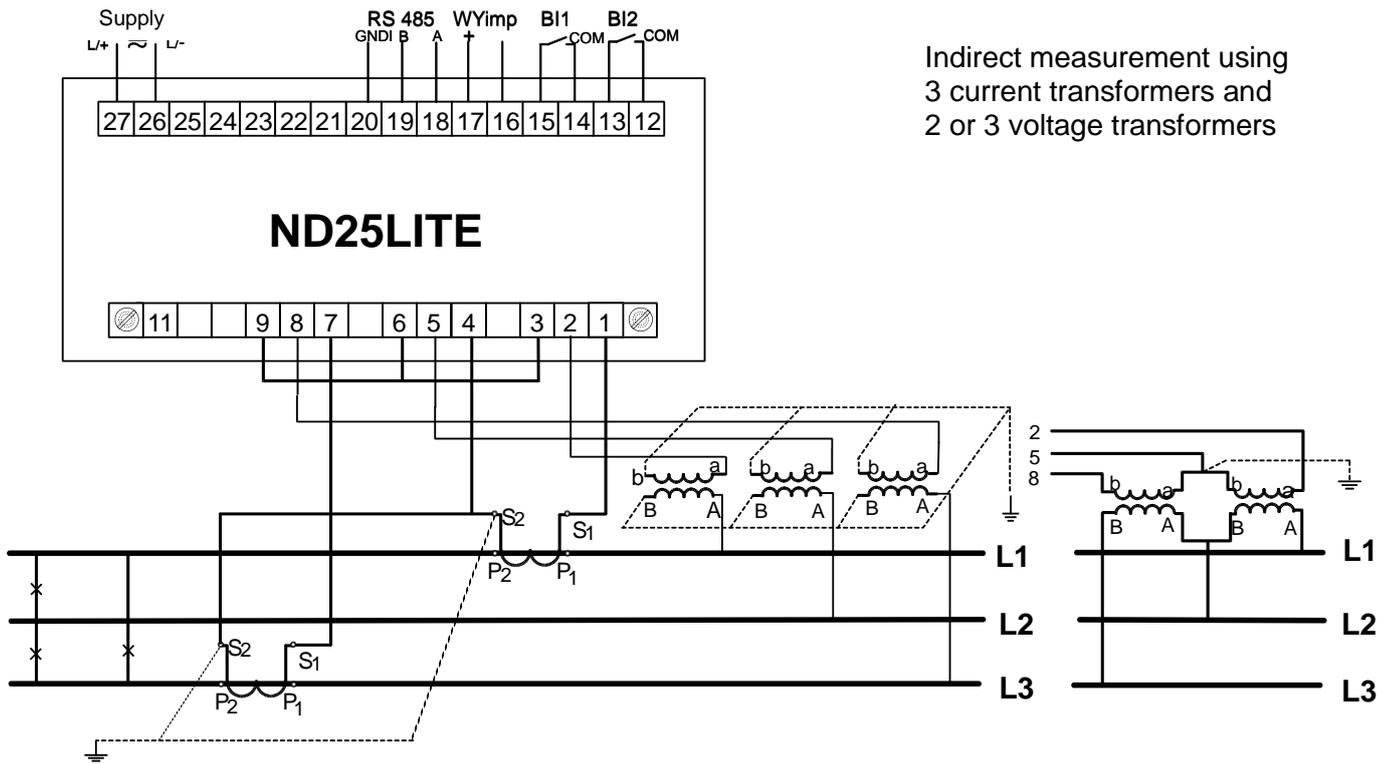
b)



Direct measurement in a three-wire network

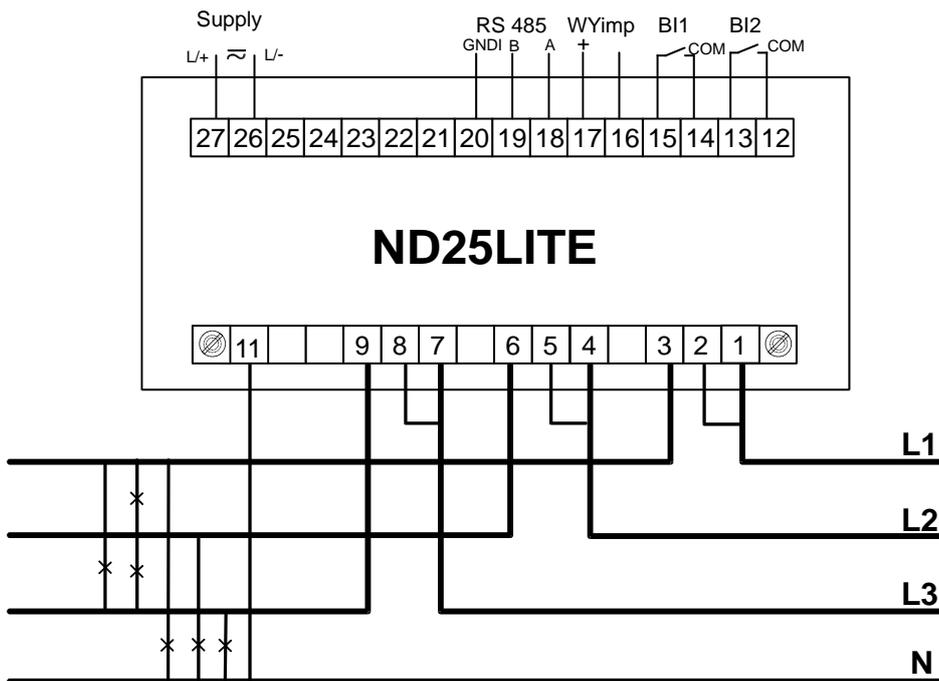


Semi-indirect measurement in a three-wire network



Indirect measurement using 3 current transformers and 2 or 3 voltage transformers

c)



Direct measurement in a four-wire network

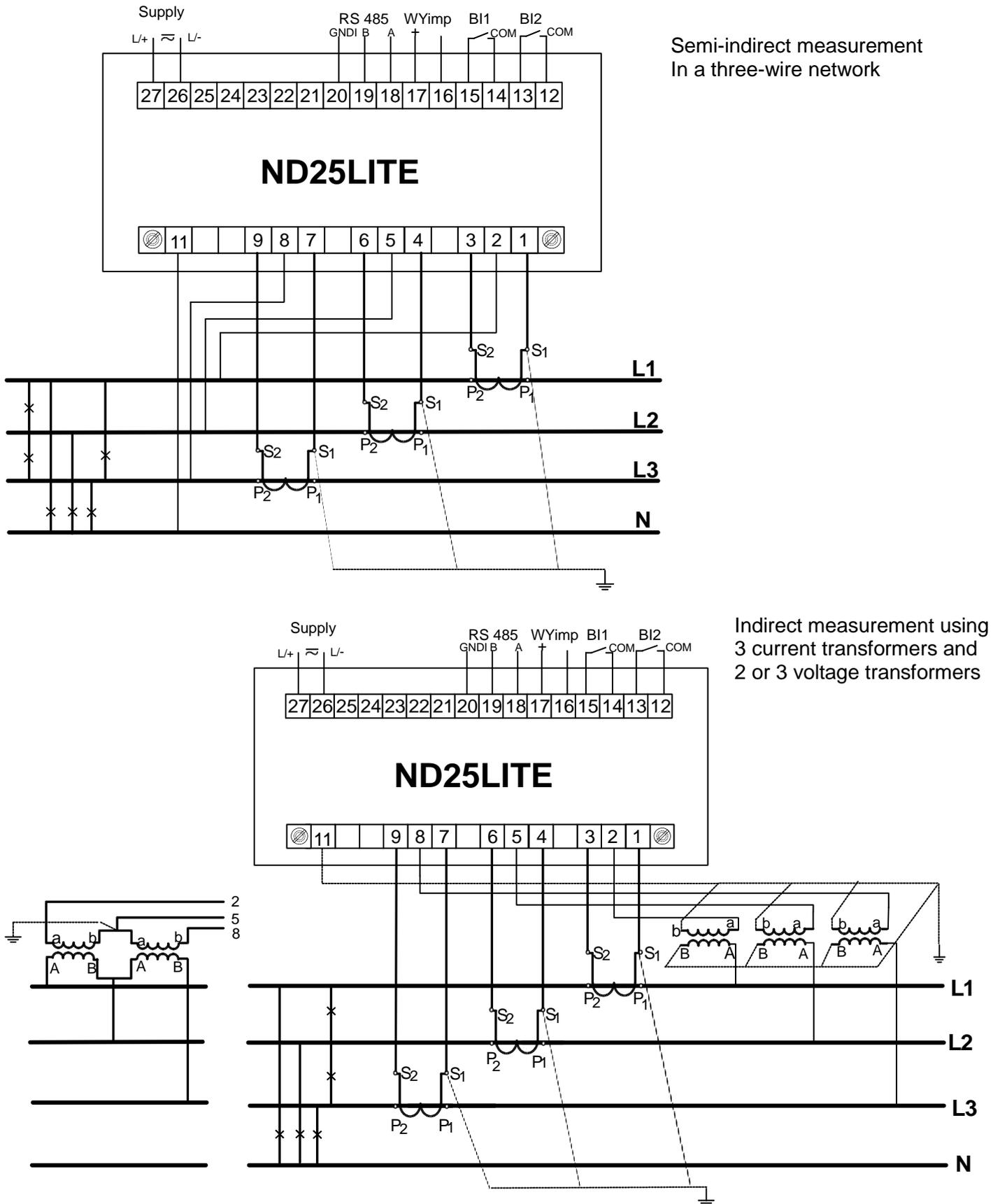


Fig. 4. Meter connection diagrams in the following networks: a) single-phase, b) three-phase three-wire, c) three-phase four-wire

6 ND25LITE Programming

6.1 Front Panel



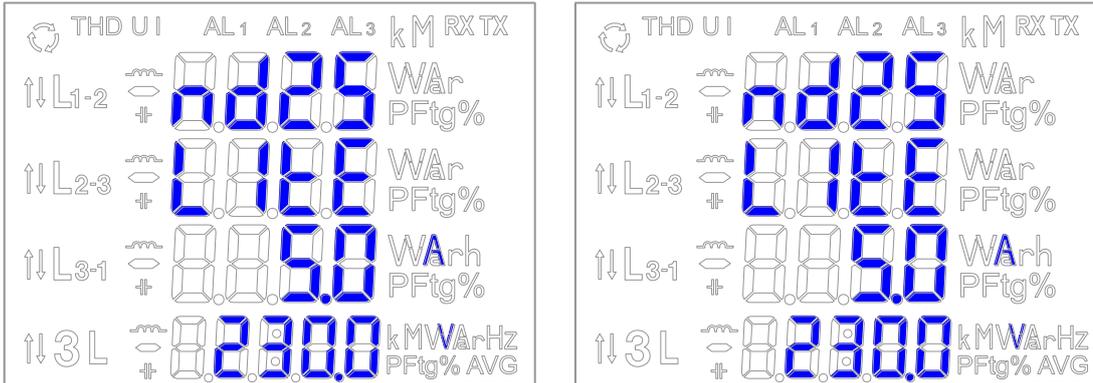
Fig 5. Front Panel

Description of the front panel:

1 – ESC cancel button	11 – Displayed value units
2 – left shift button	12 – Digital data transmission symbols
3 – decrease value button	13 – Basic value multipliers
4 – increase value button	14 – Binary input symbols AL1->BI1, AL2->BI2
5 – right shift button	15 – Harmonics and THD display symbols
6 – ENTER accept button	16 – Energy flow symbols
7 – average active power display symbol	17 – Min/Max quantity symbols
8 – display field for average values, frequency, time, power guard	18 – Phase assignment symbols
9 – display field for basic quantities, energy, THD, harmonics, date (lines 1, 2, 3)	19 – Power and energy character symbols
10 – symbols indicating the display of power factor (PF), tangent factor (tgφ), and THD (line 4)	20 – 3-phase quantity display symbol

6.2 Messages after turning on the power

After turning on the power, the meter performs a display test and displays the ND25LITE meter name, version, and current software version.



where: oooooooo is the serial number, r.n.nn is the current software version number or the special version number, and bnnn is the bootloader version number.

Figure 6. Messages after turning on the power

Note! If the display shows "Err Cal" or "Err EE," contact service.

6.3 Viewing parameters

In measurement mode, quantities are displayed according to predefined tables. Pressing the  button (left) or the  button (right) toggles between the displayed quantities. Pressing the  button (Enter) toggles between the displayed average and additional values. Pressing the  button (down) displays the minimum value, while pressing the (up)  button displays the maximum value. While viewing these values, pressing the  button (ESC) clears the minimum or maximum values, respectively.

When the all harmonics measurement mode is set (ALL – Table 3), the percentage values of the harmonics are displayed instead of the harmonic energy. Use of the  and  buttons allows to toggle between the subsequent harmonics. The harmonic number is displayed alternately with the value. The values to be displayed in the view can be configured via the RS-485 interface.

Error display is described in section 8.

When displaying reactive power, a marker indicating the load's capacitive () or inductive () type is displayed.

The values displayed in field 9 (Fig. 5) for the three-phase, four-wire 3Ph/4W and single-phase 1Ph/2W measurement modes are presented in tables 1a and 1b.

Table 1a

Displayed Symbols		L ₁ ,V	L ₁₋₂ ,V	L ₁ ,A	L ₁ ,W	L ₁ ,var	L ₁ ,VA	L ₁ ,PF	L ₁ ,tg	kWh
		L ₂ ,V	L ₂₋₃ ,V	L ₂ ,A	L ₂ ,W	L ₂ ,var	L ₂ ,VA	L ₂ ,PF	L ₂ ,tg	
		L ₃ ,V	L ₃₋₁ ,V	L ₃ ,A	L ₃ ,W	L ₃ ,var	L ₃ ,VA	L ₃ ,PF	L ₃ ,tg	
Displayed Values	line 1	U1	U12 ¹	I1	P1	Q1	S1	PF1	tg1	Active energy consumed ²
	line 2	U2 ¹	U23 ¹	I2 ¹	P2 ¹	Q2 ¹	S2 ¹	PF2 ¹	tg2 ¹	
	line 3	U3 ¹	U31 ¹	I3 ¹	P3 ¹	Q3 ¹	S3 ¹	PF3 ¹	tg3 ¹	
Displaying		option	option	option	option	option	option	option	option	option

Displayed Symbols	- , kWh			L ₁ , U / THD U	L ₁ , I / THD I
		kvarh	kvarh	L ₂ , U / THD U	L ₂ , I / THD I
				L ₃ , U / THD U	L ₃ , I / THD I

Displayed Values	line 1	Active energy exported ²	Inductive reactive energy / Positive reactive energy ²	Capacitive reactive energy / Negative reactive energy ²	Uh1 V / THD1 %	Ih1 A / THD1 %
	line 2				Uh2 V / THD2 % ¹	Ih2 A / THD2 % ¹
	line 3				Uh3 V / THD3 % ¹	Ih3 A / THD3 % ¹
Displaying		option	option	option	option	option

Displayed Symbols		kWh UI	L ₁ , U L ₂ , U L ₃ , U	kWh UI	L ₁ , I L ₂ , I L ₃ , I	c		W var VA
Displayed Values	line 1	Harmonic active energy consumed ¹	Uh1n* %	Harmonic active energy exported ¹	Ih1n* %	cosinus φ ₁	year	P _{3phas} ¹
	line 2		Uh2n* % ¹		Ih2n* % ¹	cosinus φ ₂ ¹	month	Q _{3phas} ¹
	line 3		Uh3n* % ¹		Ih3n* % ¹	cosinus φ ₃ ¹	day	S _{3phas} ¹
Displaying		option	option	option	option	option	option	option

* harmonic voltage (current) of phase L1, L2, L3 for the nth harmonic

Values displayed in field 8 (Fig. 5.)

Table 1b

Displayed Symbols	3L, A	A	3L, W	3L, var	3L, VA	3L, PF	3L, tg	3L, W _{AVG}
Displayed Values in line 4	I _{av} ¹ _{3phas}	I _(N) ¹	P _{3phas} ¹	Q _{3phas} ¹	S _{3phas} ¹	PF _{av} ¹ _{3phas}	tg _{av} ¹ _{3phas}	P _{3phas} (15, 30 or 60 minutes) ²
Displaying	option	option	option	option	option	option	option	option

Displayed Symbols	3L, c		Hz	%	3L, THD U	3L, THD I
Displayed Values in line 4	cosinus (φ) _{3phas} ¹	hour: minutes	frequency	Use of ordered power (in 15, 30 or 60 minutes) ²	U _{av} V / THD U _{av} % ¹	I _{av} A / THD I _{av} % ¹
Displaying	option	option	option	option	option	option

In the 1Ph/2W measurement mode:

¹ – values not calculated or displayed,

² – values calculated as the corresponding values of the first phase,

The values displayed in field 9 (Fig. 5) for the three-phase, three-wire 3Ph/3W measurement mode are presented in Tables 2a and 2b.

Table 2a

Displayed Symbols		L ₁₋₂ , V L ₂₋₃ , V L ₃₋₁ , V	L ₁ , A L ₂ , A L ₃ , A	kWh	-, kWh	$\overset{\sim}{\text{m}}$ kvarh	\oplus kvarh
Displayed Values	line 1	U12	I1	Active energy consumed	Active energy exported	Reactive energy inductive / Positive reactive energy	Capacitive reactive energy / Negative reactive energy
	line 2	U23	I2				
	line 3	U31	I3				
Displaying		option	option	option	option	option	option

Displayed Symbols			W var VA
Displayed	line 1	year	P _{3phas}

Values	line 2	month	Q _{3phas}
	line 3	day	S _{3phas}
Displaying		option	option

Values displayed in the field 8 (fig. 5.)

Table 2b

Displayed Symbols	3L, A	3L, W	3L, var	3L, VA	3L, PF	3L, tg	3L, W _{AVG}
Displayed Values in line 4	I _{av 3phas}	P _{3phas}	Q _{3phas}	S _{3phas}	Pf _{av 3phas}	tg _{av 3phas}	P _{3phas} (15, 30 or 60 minutes)
Displaying	option	option	option	option	option	option	option

Displayed Symbols	3L, c		Hz	%
Displayed Values in line 4	cosinus (φ) _{3phas}	hour: minutes	frequency	Use of ordered power (in 15, 30 or 60 minutes)
Displaying	option	option	option	option

Calculations performed: Reactive power (configured calculation method):

$$Q = \sqrt{S^2 - P^2}$$

or

$$Q = \sum_{i=1}^k U_i * I_i * \sin(\angle U_i, I_i)$$

where k – harmonic number (k = 21 for 50 Hz, k = 18 for 60 Hz)

Power Factor PF: $PF = P / S$

Tangent factor: $tg \varphi = Q / P$

Cosine: cosine of the angle between U and I

Exceeding the upper reading range is indicated on the display by upper horizontal lines, while exceeding the lower reading range is indicated by lower horizontal lines. For the three-phase average power measurement, individual measurements are taken with a 15-second time interval. Depending on the selection: 15 min, 30 min, or 60 min, 60, 120, or 240 measurements are averaged. After turning on the meter or deleting the power, the first value will be calculated 15 seconds after turning it on or deleting it. Until all active power samples have been obtained, the averaged power value is calculated from the samples already measured.

The neutral current I(N) is calculated from the phase current vectors.

The value of the ordered power consumption can be used to provide advance warning of exceeding the ordered power and avoid associated penalties. The consumption of ordered power is calculated based on the time interval set for the synchronization of averaged active power and the value of ordered power (section 6.5.1).

Entering programming mode is accomplished by pressing and holding the  button for approximately 3 seconds. Entering programming mode is protected by an access code. Without the code, the program enters the programming options. The **SET** message (on the first line) and the first group of parameters, **PAr**, are displayed. Parameter previews are always available by pressing and holding the  button for around 3 s.

6.5.1 Meter parameters setting

In options choose the mode **PAr** (with the  or  buttons) and confirm your selection with the  button.

Table 3

No.	Parameter Name	Description	Scope	Notes / Description	Factory parameters value
1	Entering Access Code	SEc	oFF, 0... 60000	0 – no code	0
2	Current Range	rn_I	1A, 5A	1A – 1A current range 5A – 5A current range	5A *
3	Voltage Range	rn_U	57_7V, 69_3V, 230V	57_7V – 57.7V voltage range 69.3V – 69.3V voltage range 230V – 230V voltage range	230V *
4	Current Transformer Ratio	tr_I	1 ... 10000		1
5	Voltage Transformer Ratio	tr_U	0,1...4600, 0		1
6	Average Active Power Synchronization	Syn	15, c_15, c_30, c_60	Average active power synchronization: 15 – 15-minute rolling window (recording synchronized with the clock every 15 minutes) c_15 – measurement synchronized with the clock every 15 minutes, c_30 – measurement synchronized with the clock every 30 minutes, c_60 – measurement synchronized with the clock with a clock every 60 minutes,	15
7	Measured Harmonic Number / THD	nHAr	tHd, ALL, 2...21,	tHd – THD ALL – subsequent harmonic calculations entered into registers 2...21 – harmonic number (in this mode, active harmonic energy is calculated),	tHd
8	Storing Minimum and Maximum Values with Errors	erLI	oFF, on	oFF – only correct values are saved (within the measurement range), on – measurement error occurrences are also saved (values in registers 1e20 and -1e20):	on
9	Reactive Power Calculation Method	q_t	trGLE, SInUS	trGLE: $Q = \sqrt{S^2 - P^2}$	trGLE

				$Q = \sum_{i=1}^k U_i * I_i * \sin(\angle U_i, I_i)$ SInUS: k – harmonic number, k = 21 for 50 Hz, k = 18 for 60 Hz	
10	Reactive Energy Calculation Method	En_q	cAP, SIGn	cAP – inductive and capacitive energy SIGn – positive and negative energy	cAP
11	Resetting Energy Meters	En_0	no, EnP, Enq, EnH, ALL	no – no activity, EnP – active energy reset, Enq – reactive energy reset, EnH – harmonic energy reset. ALL – Clear all energy	no
12	Resetting Average Active Power	PA_0	no, yES	yES – Clear power	no
13	Ordered Power	PAor	0...144,0	Power ordered for power consumption forecasting in % of the rated value	100,0
14	Measurement Mode	conn	3Ph-4, 3Ph-3, 1Ph-2	Meter connection method	3Ph-4
15	Factory Parameters	dEf	no, yES	Restore factory group parameters	no

* - Nominal value for quantities calculated as a percentage of the nominal value. Automatic energy reset is performed:

- for active energy when changing: the voltage or current ratio;
- for reactive energy when changing: the voltage or current ratio, the reactive power calculation method, the reactive energy calculation method;
- for harmonic energy when changing: the voltage or current ratio, the measured harmonic number;

The  and  buttons are used to set values, while the  and  buttons are used to select the position of the digit being set. The active position is indicated by a cursor. The value is accepted by pressing the  button or canceled by pressing the  button. During acceptance, the value is checked to see if it falls within the range. If a value is set outside the range, the meter remains in parameter edit mode, and the value is set to the maximum (if the value is too high) or the minimum (if the value is too low).

6.5.2 Setting output parameters

In the options, select the out mode and confirm your selection with the  button.

Table 4

No.	Name of parameter	Designation	Range	Notes/Description	Default value
1	Pulse count	lo_n	1000 ... 20000	Number of pulses per kWh	5000
2	MODBUS network address	Addr	1...247		1
3	Transmission mode	trYb	r8n2, r8E1, r8o1, r8n1		8n2
4	Transmission speed	bAUd	4.8 k, 9.6 k, 19.2 k, 38.4 k		9,6 k

5	Factory parameters	dEf	no, yES	Resetting the group to factory default parameters	no
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6.5.3 Setting date and time

In the options, select dAtE mode and confirm your selection with the  button.
The seconds are reset to zero after setting the hours and minutes.

Table 7

No	Name of parameter	Designation	Range	Default value
1	Hour, minutes	t_H	0...23, 0..59	00,00
2	Month, day	t_d	1...12, 1...31	1,01
3	Year	t_y	2026 ... 2100	2026

6.5.4 Setting the displayed values

In the options, select dISP mode and confirm your selection with the  button.

Table 8

No	Name of parameter	Designation	Range	Default value
Parameters displayed in lines 1 - 3				
1	Phase voltages	U_Ln	oFF, on	on
2	Phase-to-phase voltages	U_LL	oFF, on	on
3	Phase currents	I_Ln	oFF, on	on
4	Phase active power	P	oFF, on	on
5	Phase reactive power	q	oFF, on	on
6	Phase apparent power	S	oFF, on	on
7	Phase PF power factors	PF	oFF, on	on
8	Phase tan ϕ coefficients	tG	oFF, on	on
9	Input active energy	EnP	oFF, on	on
10	Output active energy	EnP-	oFF, on	on
11	Inductive reactive energy	Enq	oFF, on	on
12	Capacitive reactive energy	Enq-	oFF, on	on
13	Phase voltage THD	tHdu	oFF, on	on
14	Phase current THD	tHdl	oFF, on	on
15	Input harmonic energy	EnH	oFF, on	on
16	Output harmonic energy	EnH-	oFF, on	on
17	Phase cosine ϕ	cos	oFF, on	on
18	Data	date	oFF, on	on
19	Three-phase active, reactive, apparent power	PqS	oFF, on	on
Parameters displayed in line 4				
20	Average three-phase current	I_A	oFF, on	on
21	Neutral current	I_n	oFF, on	on
22	Three-phase active power	3P	oFF, on	on
23	Three-phase reactive power	3q	oFF, on	on
24	Three-phase apparent power	3S	oFF, on	on
25	Average three-phase PF	PF_A	oFF, on	on
26	Average three-phase tangent factor	tG_A	oFF, on	on
27	Average three-phase active power (15, 30, or 60 minutes)	PAvG	oFF, on	on
28	Average three-phase cosine ϕ	coSA	oFF, on	on
29	Time	HoUr	oFF, on	on

30	Frequency	Freq	oFF, on	on
31	Ordered three-phase power	p_or	oFF, on	on
32	Average phase voltage THD	tH3u	oFF, on	on
33	Average phase current THD	tH3I	oFF, on	on
34	Enable display of all parameters	on	no, YES	no
35	Disable display of all parameters	off	no, YES	no

Note! When all parameters are disabled, the phase current values and the average three-phase current are displayed.

6.6 Configuring THD, Harmonics, and Harmonic Energy Measurement

The meter has three operating modes related to calculating THD and harmonics. When the harmonic number parameter is set:

- tHd – the meter measures only the THD value for currents and voltages every second, with the result displayed and expressed as a percentage in the registers. Harmonic energy is zeroed, and individual harmonics include an error value (1e20);
- ALL – the meter measures harmonics 2 to 21 for 50 Hz (2 to 18 for 60 Hz) every 80 seconds. Harmonic energy is zeroed;
- 2 – 21 – measures the selected harmonic every second, with the result displayed and expressed in the registers in basic units (V, A). The energy for a given harmonic is calculated.

Switching the harmonic number or changing the voltage or current ratio resets the energy for the harmonics.

6.7 Active Power Profile

Automatic reset of the averaged power is performed when the voltage or current ratio changes.

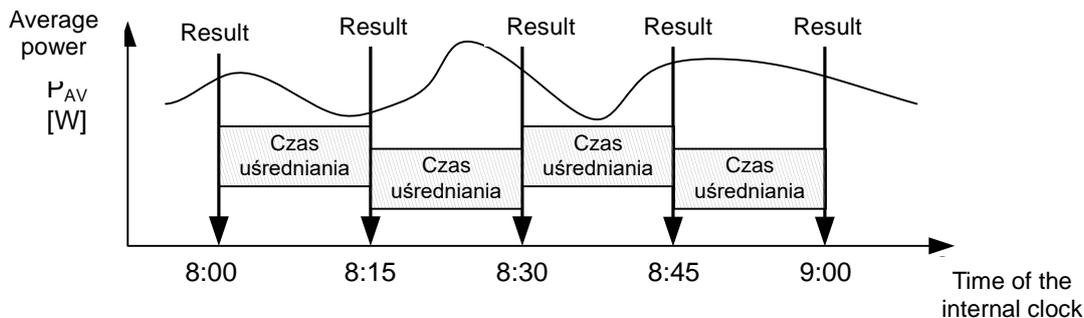


Fig. 12. Measurement of 15-minute average active power synchronized with the clock

7 Software upgrade

ND25LITE meters have a feature that allows software upgrades from a PC running eCon software. Free eCon software and update files are available at www.lumel.com.pl. The upgrade can be performed directly via the RS485 interface using an RS485 to USB converter, e.g., the PD10 converter.

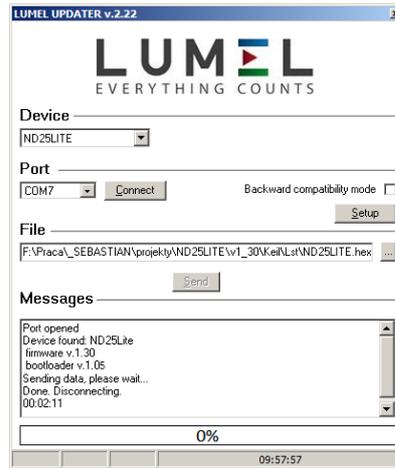


Fig. 13. Software upgrade window

Note: After updating the software, the meter must be reset to its factory settings. Therefore, it is recommended to save the meter parameters before upgrading using the eCon software.

After launching the eCon program, select the "Update Firmware" option (in the upper right corner of the screen), the Lumel Updater (LU) window will open – Fig. 13. Set the same transmission parameters (address, mode, speed) as those set in the device, select the firmware file, and press Connect. The "Messages" information window displays information about the update process. If the port is properly opened, the message "Port opened" will be displayed. The meter can be entered into update mode in two ways: remotely via LU (based on the settings in eCon – address, mode, speed, COM port) and by

powering on the meter while holding down the  button ((when entering bootloader mode with the button, the update is performed using the settings – baud rate 9600, RTU8N2, address 1). The display will show "boot" with the bootloader version, while the LU program will display the message "Device found" along with the name and software version of the connected device. Press the ... button and select the meter update file. If the file is properly opened, the message "File opened" will be displayed. Press the Send button. After the update is successfully completed, the meter resumes normal operation, and the information window displays "Done" and the update duration. If the update is unsuccessful, another update

can only be performed by powering on the meter while holding down the  button. After closing the LU window, go to the "Restore Factory Settings" parameter group, select the option, and press the "Apply" button. Then, press the "Save" icon to save the previously set parameters. You can also check the current software version by reading the meter's welcome messages after powering on.

Note! Turning off the power during the software update may result in permanent damage to the meter!

8 RS-485 interface

The implemented protocol complies with the Modicon PI-MBUS-300 Rev G specification. The ND25LITE meter's serial link parameters are:

- identifier 0xF5
- meter address 1..247
- baud rate 4.8, 9.6, 19.2, 38.4 kbit/s
- operating mode Modbus RTU
- information unit 8N2, 8E1, 8O1, 8N1
- maximum response time 600 ms
- Maximum number of registers read in a single query:
 - 38 registers – 4 bytes,
 - 76 registers – 2 bytes,

01	03	08	41	20	00	00	42	C8	00	00	E4 6F
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Writing a single register (code 06h)

Example 4. Writing the value 543 (0x021F) to register 4000 (0x0FA0)

Request:

Device address	Function	Register address		Value of register		Checksum CRC
		B1	B0	B1	B0	
01	06	0F	A0	02	1F	CA 54

Response:

Device address	Function	Register address		Value of register		Checksum CRC
		B1	B0	B1	B0	
01	06	0F	A0	02	1F	CA 54

Writing to n-registers (code 10h)

Example 5. Writing 2 registers starting from register address 0FA3h (4003)

Written values: 20, 2000.

Request:

Device address	Function	Hi register address	Lo register address	Number of Hi register	Number of Lo register	Number of bytes	Value for the register 0FA3 (4003)		Value for the register 0FA4 (4004)		Checksum CRC
							B1	B0	B1	B0	
01	10	0F	A3	00	02	04	00	14	07	D0	BB 9A

Response:

Device address	Function	Register address		Number of registers		Checksum CRC
		B1	B0	B1	B0	
01	10	0F	A3	00	02	B2 FE

Device Identification Report (Code 11h)

Example 6. Device Identification

Request:

Table 28

Device address	Function	Checksum
01	11	C0 2C

Response:

Address	Function	Number of Bytes	Identifier	Device status	Information field about the device software version (e.g., "ND25LITE-1.30 b-1.05" - ND25LITE device with software version 1.30 and bootloader version 1.05)	Checksum (CRC)
01	11	1D	F5	FF	4E 44 32 35 4C 49 54 45 2D 31 2E 33 30 20 20 20 20 20 20 20 62 2D 31 2E 30 35 20	FCA8

ND25LITE Meter Register Map

In the ND25LITE meter, data is stored in 16- and 32-bit registers. Process variables and meter parameters are stored in the register address space depending on the variable's value type. Bits in

the 16-bit register are numbered from least significant to most significant (b0-b15). 32-bit registers contain IEEE-754 float numbers.

Table 9

Range of addresses	Value Type	Description
4000 – 4070	Integer (16 bits)	The value is placed in a single 16-bit register. The registers are described in Table 10. Read and write registers.
7000 – 7319	Float (2x16 bits)	The value is placed in two consecutive 16-bit registers. These registers contain the same data as the 32-bit registers from the range 7500–7659. Read registers. Byte order (3-2-1-0).
7500 – 7659	Float (32 bits)	The value is placed in a single 32-bit register. The registers are described in Table 11. Read registers.
7660 – 7786	Float (32 bits)	The value is placed in one 32-bit register. The registers are described in Table 11. Read registers.
7800 – 8052	Float (2x16 bits)	The value is placed in two consecutive 16-bit registers. These registers contain the same data as the 32-bit registers from the range 7660–7786. Read registers. Byte order (3-2-1-0).
40001 – 43761	Float (2x16 bits)	The value is placed in two consecutive 16-bit registers.

Table 10

Register address	Operations	Range	Description	Default
4000	RW	0...60000	Protection - password	0
4001	RW	0...900 [s]	Relay output reconnection lockout time	0
4002	RW	0...1440 [% _∞]	Average ordered power *10 of nominal signals	1000
4003	RW	1...10000	Current transformer ratio	1
4004	RW	1...46000	Voltage transformer ratio *10	10
4005	RW	0..3	Average active power synchronization: 0 - 15-minute rolling window (recording synchronized with the clock every 15 minutes) 1 - measurement synchronized with the clock every 15 minutes, 2 - measurement synchronized with the clock every 30 minutes, 3 - measurement synchronized with the clock every 60 minutes,	0
4006	RW	0...21	Measured harmonic number / THD 0 - THD, 1 - all harmonics measured sequentially and stored in registers 7660-7780, 2...21 - harmonic number with energy,	0
4007	RW	0,1	Method of storing minimum and maximum values: 0 - no errors, 1 - with errors	0
4008	RW	0,1	Method of calculating reactive power: 0 - $Q = \sqrt{S^2 - P^2}$ 1 - $Q = \sum_{i=1}^k U_i * I_i * \sin(\angle U_i, I_i)$ k – harmonic number, k = 21 for 50 Hz, k = 18 for 60 Hz	0
4009	RW	0,1	Reactive energy calculation method: 0 – inductive and capacitive energy 1 – positive and negative energy	0
4010	RW		reserved	

4011	RW	0...4	Resetting energy counters: 0 – no change, 1 – reset active energy, 2 – reset reactive energy, 3 – reset harmonic energy, 4 – reset all energy	0
4012	RW	0,1	Resetting average active power (PAV)	0
4014	RW	0,1	Resetting min and max	0
4015..4028			reserved	
4029	RW	1000...20000	Number of pulses for the pulse output	5000
4030	RW	1..247	MODBUS network address	1
4031	RW	0..3	Transmission mode: 0->r8n2, 1->r8E1, 2->r8o1,	0
4032	RW	0..3	3->r8n1	1
4033	RW	0,1	Transmission speed: 0->4800, 1->9600	0
4034	RW	0...2359	2->19200, 3->38400	0
4035	RW	101...1231	Update change Transmission parameters	101
4036	RW	2009...2100	Hour * 100 + Minutes	2009
4037	RW	0,1	Month * 100 + Day	0
4038	R	0..15258	Year	0
4039	R	0..65535	Recording of standard parameters (with resetting energy and min, max, and average power)	0
4040	R	0..15258	Active energy input, two older bytes	0
4041	R	0..65535	Active energy input, two younger bytes	0
4042	R	0..15258	Active energy output, two older bytes	
4043	R	0..65535	Active energy output, two younger bytes	
4044	R	0..15258	Inductive reactive energy, two older bytes	0
4045	R	0..65535	Inductive reactive energy, two younger bytes	0
4046	R	0..15258	Capacitive reactive energy, two older bytes	0
4047	R	0..65535	Harmonic active energy consumed, two lower bytes	0
4048	R	0..15258	Harmonic active energy exported, two higher bytes	0
4049	R	0..65535	Harmonic active energy exported, two lower bytes	0
4050	R	0..65535	Status register – description below	0
4051	R	0..65535	Serial number, two higher bytes	-
4052	R	0..65535	Serial number, two lower bytes	-
4053	R	0..65535	Program version (*100)	-
4054	RW	0..65535	Displayed parameters of basic quantities	0xFFFF
4055	RW	0..65535	Displayed parameters of average quantities	0xFFFF
4056 *	RW	0..65535	Displayed parameters of basic quantities 2	0xFFFF
4057 *	RW	0..2	Measurement mode: 0->3Ph / 4W, 1->3Ph / 3W 2-> 1Ph/2W	0
4058 *	R	0..65535	Rated voltage x10	577, 693, ② 2300
4059 *	R	0..65535	Rated current x100	100, 500 ②
4060 *	R	0..65535	Reserved	0
4061 *	R	0..65535	Status register 2 – description below	0
4062 - 4068	R	0..65535	Reserved	0 ②
4069	RW	0..1	Current range 0 -1A, 1 - 5A	1 ②
4070	RW	0..2	Voltage range 0 - 57.7V, 1 - 69.3V, 2 - 230V	2 ②

The resolution or unit is placed in brackets [], respectively.

* from program version 1.09

Energy is provided in hundreds of watt-hours (var-hours) in dual 16-bit registers, so when converting individual energy values from registers, divide them by 10, i.e.:

Active energy input = (register value 4038 x 65536 + register value 4039) / 10 [kWh]

Active energy output = (register value 4040 x 65536 + register value 4041) / 10 [kWh]

Inductive reactive energy = (register value 4042 x 65536 + register value 4043) / 10 [kvarh]

Capacitive reactive energy = (register value 4044 x 65536 + register value 4045) / 10 [kvarh]

Harmonized active energy consumed = (registered value 4046 x 65536 + registered value 4047) / 10 [kWh]

Harmonized active energy exported = (registered value 4048 x 65536 + registered value 4049) / 10 [kWh]

Device Status Register (Address 4050, R):

Bit 15 – “1” – non-volatile memory failure

Bit 14 – “1” – no calibration or incorrect calibration

Bit 13 – “1” – parameter value error

Bit 12 – “1” – energy value error

Bit 11 – “1” – phase sequence error

Bit 10 – current range “0” – 1 A~; “1” – 5 A~

Bit 9	Bit 8	voltage range
0	0	57.7 V~
0	1	230 V~

Bit 7 – “1” – power averaging interval has not elapsed

Bit 6 – “1” – frequency for THD calculation outside the following ranges:

- 48 – 52 for 50 Hz,

- 58 – 62 for 60 Hz

Bit 5 – “1” – voltage too low for frequency measurement

Bit 4 – “1” – phase L3 voltage too low

Bit 3 – “1” – phase L2 voltage too low

Bit 2 – “1” – phase L1 voltage too low

Bit 1 – “1” – RTC battery exhausted

Bit 0 – reserved

Status Register 2 – reactive power nature (address 4061, R):

Bit 15 - Reserved

Bit 14 - Reserved

Bit 13 - Reserved

Bit 12 - Reserved

Bit 11 - "1" - 3L maximum capacity

Bit 10 – “1” – 3L capacitance minimum

Bit 9 – “1” – 3L capacitance

Bit 8 – “1” – L3 capacitance maximum

Bit 7 – “1” – L3 capacitance minimum

Bit 6 – “1” – L3 capacitance

Bit 5 – “1” – L2 capacitance maximum

Bit 4 – “1” – L2 capacitance minimum

Bit 3 – “1” – L2 capacitance

Bit 2 – “1” – L1 capacitance maximum

Bit 1 – “1” – L1 capacitance minimum

Bit 0 – “1” – L1 capacitance

Configuration register of displayed parameters of basic quantities (address 4054, R/W):

Bits 15 ... 13 - reserved

Bit 12 – “1” – Displaying the date

Bit 11 – “1” – Displaying the cosine \square value

Bit 10 – “1” – Displaying the active harmonic energy exported / current harmonic value

Bit 9 – “1” – Displaying the active harmonic energy imported / voltage harmonic value

Bit 8 – “1” – Displaying the current THD / current harmonic value

Bit 7 – “1” – Displaying the voltage THD / voltage harmonic value

Bit 6 – “1” – Display of capacitive reactive energy

Bit 5 – “1” – Display of inductive reactive energy

Bit 4 – “1” – Display of exported active energy

Bit 3 – “1” – Display of imported active energy

Bit 2 – “1” – Display of tg

Bit 1 – “1” – Display of PF

Bit 0 – “1” – Display of phase-to-phase voltages

Configuration register for displaying basic quantity parameters 2 (address 4056, R/W):

Bits 15 ... 6 - reserved
 Bit 5 – "1" – Displaying power $\Sigma P, \Sigma Q, \Sigma S$
 Bit 4 – "1" – Displaying apparent phase power

Bit 3 – "1" – Displaying reactive phase power
 Bit 2 – "1" – Displaying active phase power
 Bit 1 – "1" – Displaying phase currents
 Bit 0 – "1" – Displaying phase voltages

Configuration register for displaying average quantity parameters (address 4055, R/W):

Bits 15 ... 14 - Reserved
 Bit 13 – "1" – Displays the average current THD
 Bit 12 – "1" – Displays the average voltage THD
 Bit 11 – "1" – Displays the power ΣS
 Bit 10 – "1" – Displays the power ΣQ
 Bit 9 – "1" – Displays the power ΣP
 Bit 8 – "1" – Displays the average current

Bit 7 – "1" – Displays the ordered power utilization
 Bit 6 – "1" – Displays the frequency
 Bit 5 – "1" – Displays the time
 Bit 4 – "1" – Displays the average cosine φ
 Bit 3 – "1" – Displays the average active power
 Bit 2 – "1" – Displays the average tangent
 Bit 1 – "1" – Displays the average PF
 Bit 0 – "1" – Displaying the current in the neutral wire

Table 11

16-bit register address	32-bit register address	Operations	Description	Unit	3Ph / 4W	3Ph / 3W	1Ph / 2W
7000	7500	R	Phase L1 Voltage	V	√	x	√
7002	7501	R	Phase L1 Current	A	√	√	√
7004	7502	R	Phase L1 Active Power	W	√	x	√
7006	7503	R	Phase L1 Reactive Power	var	√	x	√
7008	7504	R	Phase L1 Apparent Power	VA	√	x	√
7010	7505	R	Phase L1 Power Factor (PF)	-	√	x	√
7012	7506	R	Phase L1 Tan φ Factor	-	√	x	√
7014	7507	R	Phase L2 Voltage	V	√	x	x
7016	7508	R	Phase L2 Current	A	√	√	x
7018	7509	R	Phase L2 Active Power	W	√	x	x
7020	7510	R	Phase L2 Reactive Power	var	√	x	x
7022	7511	R	Phase L2 Apparent Power	VA	√	x	x
7024	7512	R	Phase L2 Power Factor (PF)	-	√	x	x
7026	7513	R	Phase L2 Tan φ Factor	-	√	x	x
7028	7514	R	Phase L3 Voltage	V	√	x	x
7030	7515	R	Phase L3 Current	A	√	√	x
7032	7516	R	Phase L3 Active Power	W	√	x	x
7034	7517	R	Phase L3 Reactive Power	var	√	x	x
7036	7518	R	Phase L3 Apparent Power	VA	√	x	x
7038	7519	R	Phase L3 Power Factor (PF)	-	√	x	x
7040	7520	R	Phase L3 Tan φ Factor	-	√	x	x
7042	7521	R	Average 3-Phase Voltage	V	√	x	x
7044	7522	R	Average 3-Phase Current	A	√	√	x
7046	7523	R	3-Phase Active Power (P1+P2+P3)	W	√	√	x
7048	7524	R	Power 3-Phase Reactive Power (Q1+Q2+Q3)	var	√	√	x
7050	7525	R	3-Phase Apparent Power (S1+S2+S3)	VA	√	√	x
7052	7526	R	Average Power Factor (PF)	-	√	√	x
7054	7527	R	Average Tangent Factor (Tg \square)	-	√	√	x
7056	7528	R	Frequency	Hz	√	√	√
7058	7529	R	Phase-to-Phase Voltage L1-2	V	√	√	x
7060	7530	R	Phase-to-Phase Voltage L2-3	V	√	√	x

7062	7531	R	Phase-to-Phase Voltage L3-1	V	√	√	x
7064	7532	R	Average Phase-to-Phase Voltage	V	√	√	x
7066	7533	R	Three-Phase Active Power 15, 30, 60 Minutes (P1+P2+P3)	W	√	√	√
7068	7534	R	Harmonic U1 / THD U1	V / %	√	x	√
7070	7535	R	Harmonic U2 / THD U2	V / %	√	x	x
7072	7536	R	Harmonic U3 / THD U3	V / %	√	x	x
7074	7537	R	Harmonic I1 / THD I1	A / %	√	x	√
7076	7538	R	Harmonic I2 / THD I2	A / %	√	x	x
7078	7539	R	Harmonic I3 / THD I3	A / %	√	x	x
7080	7540	R	Cosine of the angle between U1 and I1	-	√	x	√
7082	7541	R	Cosine of the angle between U2 and I2	-	√	x	x
7084	7542	R	Cosine of the angle between U3 and I3	-	√	x	x
7086	7543	R	3-phase mean cosine	-	√	√	x
7088	7544	R	Angle between U1 and I1	°	√	x	√
7090	7545	R	Angle between U2 and I2	°	√	x	x
7092	7546	R	Angle between U3 and I3	°	√	x	x
7094	7547	R	Neutral current (calculated from vectors)	A	√	x	x
7096	7548	R	3-phase active energy input (number of register overflows: 7549, reset after exceeding 99999999.9 kWh)	100 MWh	√	√	P1
7098	7549	R	3-phase active energy input (counter counting up to 99999.9 kWh)	kWh	√	√	P1
7100	7550	R	3-phase active energy output (number of register overflows: 7551, reset after exceeding 99999999.9 kWh)	100 MWh	√	√	P1
7102	7551	R	3-phase active energy output (counter counting up to 99999.9 kWh)	kWh	√	√	P1
7104	7552	R	3-phase inductive reactive energy (number of register overflows: 7553, reset after exceeding 99999999.9 kVarh)	100 Mvarh	√	√	Q1
7106	7553	R	3-phase inductive reactive energy (counter counting up to 99999.9 kVarh)	kvarh	√	√	Q1
7108	7554	R	3-phase capacitive reactive energy (number of register overflows 7555, reset after exceeding 99999999.9 kVarh)	100 Mvarh	√	√	Q1
7110	7555	R	3-phase capacitive reactive energy (counter counting up to 99999.9 kVarh)	kvarh	√	√	Q1
7112	7556	R	3-phase active harmonic energy consumed (number of register overflows 7557, reset after exceeding 99999999.9 kWh)	100 MWh	√	x	x
7114	7557	R	3-phase active harmonic energy consumed (counter counting up to 99999.9 kWh)	kWh	√	x	x
7116	7558	R	3-phase active harmonic energy exported (number of register overflows 7559, reset after exceeding 99999999.9 kWh)	100 MWh	√	x	x
7118	7559	R	Energy Active harmonic output 3-phase (counter counts up to 99999.9 kWh)	kWh	√	x	x
7120	7560	R	Time – hours, minutes	-	√	√	√
7122	7561	R	Time – month, day	-	√	√	√
7124	7562	R	Time – year	-	√	√	√
7126	7563		Reserved				
7128	7564	R	Voltage L1 min	V	√	x	√
7130	7565	R	Voltage L1 max	V	√	x	√

7132	7566	R	Voltage L2 min	V	√	x	x
7134	7567	R	Voltage L2 max	V	√	x	x
7136	7568	R	Voltage L3 min	V	√	x	x
7138	7569	R	Voltage L3 max	V	√	x	x
7140	7570	R	Current L1 min	A	√	√	√
7142	7571	R	Current L1 max	A	√	√	√
7144	7572	R	Current L2 min	A	√	√	x
7146	7573	R	Current L2 max	A	√	√	x
7148	7574	R	Current L3 min	A	√	√	x
7150	7575	R	Current L3 max	A	√	√	x
7152	7576	R	Active power L1 min	W	√	x	√
7154	7577	R	Active power L1 max	W	√	x	√
7156	7578	R	Active power L2 min	W	√	x	x
7158	7579	R	Active power L2 max	W	√	x	x
7160	7580	R	Active power L3 min	W	√	x	x
7162	7581	R	Active power L3 max	W	√	x	x
7164	7582	R	Reactive power L1 min	var	√	x	√
7166	7583	R	Reactive power L1 max	var	√	x	√
7168	7584	R	Reactive power L2 min	var	√	x	x
7170	7585	R	Reactive power L2 max	var	√	x	x
7172	7586	R	Reactive power L3 min	var	√	x	x
7174	7587	R	Reactive power L3 max	var	√	x	x
7176	7588	R	Apparent power L1 min	VA	√	x	√
7178	7589	R	Apparent power L1 max	VA	√	x	√
7180	7590	R	Apparent power L2 min	VA	√	x	x
7182	7591	R	Apparent power L2 max	VA	√	x	x
7184	7592	R	Apparent power L3 min	VA	√	x	x
7186	7593	R	Apparent power L3 max	VA	√	x	x
7188	7594	R	Power factor (PF) of phase L1 min	-	√	x	√
7190	7595	R	Power factor (PF) of phase L1 max	-	√	x	√
7192	7596	R	Power factor (PF) of phase L2 min	-	√	x	x
7194	7597	R	Power factor (PF) of phase L2 max	-	√	x	x
7196	7598	R	Power factor (PF) of phase L3 min	-	√	x	x
7198	7599	R	Power factor (PF) of phase L3 max	-	√	x	x
7200	7600	R	Tgφ factor of phase L1 min	-	√	x	√
7202	7601	R	Tgφ factor of phase L1 max	-	√	x	√
7204	7602	R	Tgφ factor of phase L2 min	-	√	x	x
7206	7603	R	Tgφ factor of phase L2 max	-	√	x	x
7208	7604	R	Tgφ factor of phase L3 min	-	√	x	x
7210	7605	R	Tgφ factor of phase L3 max	-	√	x	x
7212	7606	R	Phase-to-phase voltage L1-2 min	V	√	√	x
7214	7607	R	Phase-to-phase voltage L1-2 max	V	√	√	x
7216	7608	R	Phase-to-phase voltage L2-3 min	V	√	√	x
7218	7609	R	Phase-to-phase voltage L2-3 max	V	√	√	x
7220	7610	R	Phase-to-phase voltage L3-1 min	V	√	√	x
7222	7611	R	Phase-to-phase voltage L3-1 max	V	√	√	x
7224	7612	R	Average 3-phase voltage min	V	√	√	x
7226	7613	R	Average 3-phase voltage max	V	√	√	x
7228	7614	R	Average 3-phase current min	A	√	√	x
7230	7615	R	Average 3-phase current max	A	√	√	x
7232	7616	R	3-phase active power min	W	√	√	x

7234	7617	R	3-phase active power max	W	√	√	x
7236	7618	R	3-phase reactive power min	var	√	√	x
7238	7619	R	3-phase reactive power max	var	√	√	x
7240	7620	R	3-phase apparent power min	VA	√	√	x
7242	7621	R	Apparent power 3-phase max	VA	√	√	x
7244	7622	R	Power factor (PF) average min	-	√	√	x
7246	7623	R	Power factor (PF) average max	-	√	√	x
7248	7624	R	Tgφ factor average min	-	√	√	x
7250	7625	R	Tgφ factor average max	-	√	√	x
7252	7626	R	Frequency min	Hz	√	√	√
7254	7627	R	Frequency max	Hz	√	√	√
7256	7628	R	Mean phase-to-phase voltage min	V	√	√	x
7258	7629	R	Mean phase-to-phase voltage max	V	√	√	x
7260	7630	R	Three-phase active power 15, 30, 60 minutes min	W	√	√	√
7262	7631	R	Three-phase active power 15, 30, 60 minutes max	W	√	√	√
7264	7632	R	Harmonic U1 / THD U1 min	V / %	√	x	√
7266	7633	R	Harmonic U1 / THD U1 max	V / %	√	x	√
7268	7634	R	Harmonic U2 / THD U2 min	V / %	√	x	x
7270	7635	R	Harmonic U2 / THD U2 max	V / %	√	x	x
7272	7636	R	Harmonic U3 / THD U3 min	V / %	√	x	x
7274	7637	R	Harmonic U3 / THD U3 max	V / %	√	x	x
7276	7638	R	Harmonic I1 / THD I1 min	A / %	√	x	√
7278	7639	R	Harmonic I1 / THD I1 max	A / %	√	x	√
7280	7640	R	Harmonic I2 / THD I2 min	A / %	√	x	x
7282	7641	R	Harmonic I2 / THD I2 max	A / %	√	x	x
7284	7642	R	Harmonic I3 / THD I3 min	A / %	√	x	x
7286	7643	R	Harmonic I3 / THD I3 max	A / %	√	x	x
7288	7644	R	Cosine of the angle between U1 and I1 min	-	√	x	√
7290	7645	R	Cosine of the angle between U1 and I1 max		√	x	√
7292	7646	R	Cosine of the angle between U2 and I2 min	-	√	x	x
7294	7647	R	Cosine of the angle between U2 and I2 max	-	√	x	x
7296	7648	R	Cosine of the angle between U3 and I3 min	-	√	x	x
7298	7649	R	Cosine of the angle between U3 and I3 max	-	√	x	x
7300	7650	R	3-phase mean cosine min	-	√	√	x
7302	7651	R	3-phase mean cosine max	-	√	√	x
7304	7652	R	Angle between U1 and I1 min	°	√	x	√
7306	7653	R	Angle between U1 and I1 max	°	√	x	√
7308	7654	R	Angle between U2 and I2 min	°	√	x	x
7310	7655	R	Angle between U2 and I2 max	°	√	x	x
7312	7656	R	Angle between U3 and I3 min	°	√	x	x
7314	7657	R	Angle between U3 and I3 max	°	√	x	x
7316	7658	R	Neutral current min	A	√	x	x
7318	7659	R	Neutral current max	A	√	x	x
7800	7660	R	U1 - harmonic 2	%	√	x	√
...			
7838	7679	R	U1 - harmonic 21	%	√	x	√
7840	7680	R	U2 - harmonic 2	%	√	x	x

...			
7878	7699	R	U2 - harmonic 21	%	√	x	x
7880	7700	R	U3 - harmonic 2	%	√	x	x
...			
7918	7719	R	U3 - harmonic 21	%	√	x	x
7920	7720	R	I1 - harmonic 2	%	√	x	√
...			
7958	7739	R	I1 - harmonic 21	%	√	x	√
7960	7740	R	I2 - Harmonic 2	%	√	x	x
...			
7998	7759	R	I2 - Harmonic 21	%	√	x	x
8000	7760	R	I3 - Harmonic 2	%	√	x	x
...			
8038	7779	R	I3 - Harmonic 21	%	√	x	x
8040	7780	R	Ordered power used	%	√	x	P1
8042	7781	R	3-phase harmonic U / THD U mean	V / %	√	x	x
8044	7782	R	3-phase harmonic I / THD I mean	A / %	√	x	x
8046	7783	R	3-phase harmonic U / THD U mean min	V / %	√	x	x
8048	7784	R	3-phase harmonic U / THD U mean max	V / %	√	x	x
8050	7785	R	3-phase harmonic I / THD I mean min	A / %	√	x	x
8052	7786	R	3-phase harmonic I / THD I mean max	A / %	√	x	x
8054	7787	R	Binary input BI1 status	-	√	√	√
8056	7788	R	0 - open, 1 - closed	-	√	√	√

In case of a lower limit exceedance, the value -1e20 is entered, while in case of an upper limit exceedance or an error, the value 1e20 is entered.

Tablica 12

32-bit register address	Operation	Description	Unit	3Ph / 4W	3Ph / 3W	1Ph / 2W
40001	R	Phase L1 Voltage	V	√	x	√
40003	R	Phase L2 Voltage	V	√	x	x
40005	R	Phase L3 Voltage	V	√	x	x
40007	R	Phase L1 Current	A	√	√	√
40009	R	Phase L2 Current	A	√	√	x
40011	R	Phase L3 Current	A	√	√	x
40031	R	Phase L1 Power Factor (PF)	-	√	x	√
40033	R	Phase L2 Power Factor (PF)	-	√	x	x
40035	R	Phase L3 Power Factor (PF)	-	√	x	x
40043	R	Average Phase-to-Phase Voltage	V	√	√	x
40047	R	Average 3-Phase Current	A	√	√	x
40063	R	Average Power Factor (PF)	-	√	√	x
40065	R	Power Factor (PF1+PF2+PF3)	-	√	√	x
40071	R	Frequency	Hz	√	√	√
40085	R	Three-Phase Active Power 15, 30, 60 Minutes (P1+P2+P3)	W	√	√	√
40093	R	reserved				
40101	R	reserved				
40201	R	Phase-to-Phase Voltage L1-2	V	√	√	x
40203	R	Phase-to-Phase Voltage L2-3	V	√	√	x
40205	R	Phase-to-Phase Voltage L3-1	V	√	√	x
40225	R	Neutral Current (calculated from vectors)	A	√	x	x
40249	R	reserved				

40801	R	3-Phase Active Energy Consumed	kWh	√	√	P1
40807	R	Reactive Energy 3-phase inductive	kvarh	√	√	Q1
43759		Binal input BI1 contact state	-	√	√	√
43761		0 – open, 1 – closed	-	√	√	√
43763		Typical meter error	-	√	√	√

9 ERROR CODES

Error messages may appear during meter operation. The causes of errors are listed below.

- **Err1** – when the voltage or current is too low during measurement:
 - PF_i , $tg\varphi_i$, \cos , THD, Harm below 10% U_n ,
 - PF_i , $tg\varphi_i$, \cos below 1% I_n ,
 - THD, Harm below 10% I_n ,
 - f below 10% U_n ,
 - $I_{(N)}$ below 10% I_n ;
- **bAd Freq** – when measuring harmonics and THD, when the frequency value is outside the range of 48 – 52 Hz for 50 Hz and 58 – 62 Hz for 60 Hz;
- **Err bat** – displayed when the internal RTC clock battery is low. The measurement is performed after power-up and daily at midnight. The message can be turned off by pressing the  button. Once disabled, the message will remain inactive until the meter is turned on again;
- **Err CAL, Err EE** – displayed when the meter's memory has been corrupted. The meter should be returned to the manufacturer.
- **Err PAr** – displayed when the meter's operating parameters are incorrect. Factory settings should be restored (from the menu or via RS-485). The message can be turned off by pressing the  button.
- **Err Enrg** – displayed when the meter's operating parameters are incorrect. Factory settings should be restored (from the menu or via RS-485). The message can be turned off by pressing the  button. Incorrect energy values are reset to zero.
- **Err L3 L2** – phase sequence error; phase 2 and phase 3 connections should be reversed. The message can be turned off by pressing the  button. The message will be displayed again each time the power is turned on.
- _____ or _____ – lower limit. The measured value is lower than the lower measurement range.
- _____ or _____ – upper limit. The measured value is higher than the upper measurement range or a measurement error.

10 TECHNICAL DATA

Measuring ranges and permissible basic errors

Table 13

Measured value	Indication range *	Measurement range	L1	L2	L3	Σ	Class
Current In 1 A	0.00 .. 12 kA	0.001 .. 1.200 A~	•	•	•		0.2 (PN-EN 61557-12)
5 A	0.00 .. 60 kA	0.005 .. 6.000 A~					
Voltage L-N							0.2 (PN-EN 61557-12)
57.7 V	0.0 .. 318.0 kV	2.8 .. 70.0 V~	•	•	•		
69.3 V	0.0 .. 382.5 kV	3.4 .. 84 V~					
230 V	0.0 .. 1.269 MV	11.5 .. 276 V~					
Voltage L-L							0.5 (PN-EN 61557-12)
100 V	0.0 .. 552.0 kV	5 .. 120 V~	•	•	•		

120 V 400 V	0.0 .. 662.0 kV 0.0 .. 2.20 MV	6.0 .. 144 V~ 20 .. 480 V~					
Frequency	47.0 .. 63.0 Hz	47.0 .. 63.0 Hz	•	•	•		0.1 (PN-EN 61557-12)
Active power	-9999 MW ..0.00 W .. 9999 MW	-1.65 kW ..-0.1 W; 0.1W.. 1.65 kW	•	•	•	•	0.5 (PN-EN 61557-12)
Reactive power	-9999 Mvar ..0.00 var .. 9999 Mvar	-1.65 kvar ..-0.1 var; 0.1var.. 1.65 kvar	•	•	•	•	0.5 (PN-EN 61557-12)
Apparent power	0.00 VA .. 9999 MVA	0.1 VA .. 1.65 kVA	•	•	•	•	0.5 (PN-EN 61557-12)
Power factor (PF)	-1 .. 0 .. 1	-1 .. 0 .. 1	•	•	•	•	1 (PN-EN 61557-12)
Tgφ factor	-10.2 .. 0 .. 10.2	-10.2 .. 0 .. 10.2	•	•	•	•	1 (PN-EN 61557-12)
Cosine φ	-1 ... 1	-1 ... 1	•	•	•	•	1 (PN-EN 61557-12)
φ	-180 ... 180	-180 ... 180	•	•	•		1 (PN-EN 61557-12)
Input active energy	0 ..99 999 999.9 kWh					•	0.2S (PN-EN 62053-22)
Output active energy	0 ..99 999 999.9 kWh					•	0.2S (PN-EN 62053-22)
Inductive reactive energy	0 ..99 999 999.9 kVarh					•	0.5 (PN-EN 61557-12)
Capacitive reactive energy	0 ..99 999 999.9 kVarh					•	0.5 (PN-EN 61557-12)
THD	0...100%	0...100 %	•	•	•		5 (PN-EN 61557-12)

* Depending on the set tr_U (voltage transformer ratio: 0.1 .. 4600.0)
and tr_I (current transformer ratio: 1 .. 10000) φ

Note! Correct current measurement requires a voltage greater than 0.05 VA on at least one phase.

Power consumption:

- in the power supply circuit: ≤ 6 VA
- in the voltage circuit ≤ 0.05 VA
- in the current circuit ≤ 0.05 VA

Display

BI1, BI2 pulses inputs

RS485 serial interface:

dedicated LCD 3.5" display,
potential-free and do not require additional power supply,
address 1..247
mode: 8N2, 8E1, 8O1,8N1

speed: 4.8, 9.6, 19.2, 38,4 kbit/s

Transmission protocol: Modbus RTU

Response time: 600 ms:

Pulse energy output

Open-circuit (NPN), passive Class A according to

PN-EN 62053-31; supply voltage 18...27V, current 10...27mA

Open-circuit output pulse constant:

1000 - 20000 pulses/kWh

independent of the tr_U, tr_I ratio settings

The degree of protection provided by the housing

from the front side	IP 65
from the back-panel part	IP 20

Weight

0.3 kg

Dimensions

96 x 96 x 77 mm

Reference and rated operating conditions.

- supply voltage 85..253 V a.c. (40...400) Hz or 90..300 V d.c.
20..40 V a.c. (40...400) Hz or 20..60 V d.c.
- input signal: 0 .. 0.001..1.2I_n; 0.05..1.2U_n for current, voltage
0 .. 0.001..1.2I_n; 0..0.1..1.2U_n; for PF_i, tgφ_i coefficients
frequency 47..63 Hz; sinusoidal (THD ≤ 8%)
- power factor -1...0...1
- Ambient temperature -25...23...+55°C
- Storage temperature -30...+70°C
- Humidity 25...95% (condensation not permitted)
- Permissible crest factor:
 - Current 2
 - Voltage 2
- External magnetic field 0...40...400 A/m
- Short-term overload (5 s)
 - Voltage inputs 2 Un (max. 1000 V)
 - Current inputs 10 In
- Operating position any
- Warm-up time 5 min.

- from input signal frequency < 50%
- from ambient temperature changes < 50 % / 10 °C
- for THD > 8% < 100 %

The meter complies with the following standards:

Electromagnetic compatibility:

- Interference immunity according to PN-EN 61326-1 Class A: Industrial environment
- Interference emission according to PN-EN 61000-6-4

Safety requirements:

according to PN-EN 61010-1

- Insulation between circuits: basic,

Installation category III,

Insulation degree 2,

Maximum operating voltage to ground:

- for power supply and measurement circuits: 300 V
- for other circuits: 50 V • Altitude above sea level < 2000 m

11 ORDER CODE

The meter is available in one variant: ND25LITE.

ORDER EXAMPLE: ND25LITE code - with programmable input current ranges: 1 A or 5 A, programmable input voltage ranges: 3 x 57.7/100 V, 3 x 69.3/120 V, 3 x 230/400 V, with two binary inputs, with a power supply of 85...253 V a.c./90...300 V d.c. in a standard version, Polish/English language version, with a technical inspection certificate.



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