LUMEL

METER OF NETWORK PARAMETERS

# ND20LITE




INSTRUKCJA OBSŁUGI

CE

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# 1. APPLICATION

The ND20LITE meter is a digital programmable panel meter destined for the measurement of single-phase power network parameters (2-wire network) and 3-phase, 3,4-wire network in balanced and unbalanced systems with the simultaneous display of measured quantities on a LCD display. The meter enables the control and optimization of power electronics devices, systems and industrial installation operations.

The meter ensures the measurement of: rms values of voltage and current, active, reactive and apparent power, active, reactive energy, power factors, frequency, 15, 30, 60 minutes' mean active power, THD. Additionally, the current value in the neutral wire is calculated. Voltages and currents are multiplied by given voltage and current ratios of measuring transformers. Indications of power and energy take into consideration values of programmed ratios. The value of each measured quantity can be transmitted to the master system through the RS-485 interface. The relay output signals the overflow of the chosen quantity, and the pulse output can be used for the consumption check of 3-phase active and reactive energy.

The meter has a galvanic separation between respective blocks:

- supply,
- measuring inputs,
- voltage and current inputs,
- RS-485 output,
- impulse output.

# 2. METER SET

The set of the ND20LITE meter is composed of:

1. ND20LITE meter..... 1 pc.
2. seal..... 1 pc.
3. holders to fix the meter in the panel... 4 pcs

# 3. BASIC REQUIREMENTS AND OPERATIONAL SAFETY

In the safety service scope, the ND20LITE meter meets to requirements of the EN 61010 -1 standard.



**Observations Concerning the Operational Safety:**

- All operations concerning transport, installation, and commissioning as well as maintenance, must be carried out by qualified, skilled per sonnel, and national regulations for the prevention of accidents must be observed.
- Before switching the meter on, one must check the correctness of connection to the network.
- Before removing the meter housing, one must switch the supply off and disconnect measuring circuits
- The removal of the meter housing during the guarantee contract period may cause its cancellation.
- The ND20 meter is destined to be installed and used in industrial electromagnetic environment conditions.
- One must remember that in the building installation, a switch or a circuit-breaker should be installed. This switch should be located near the device, easy accessible by the operator, and suitably marked.

# 4. INSTALLATION

The ND20LITE meter is adapted to be fixed on a panel by means of holders. The fitting way is presented on the fig.1.

Housing overall dimensions: 96 x 96 x 77 mm. At the rear side of the meter, there are screw terminal strips which enable the connection of external wires with a cross-section up to 2.5 $mm^2$.

One must prepare a $92.5^{+0.6}$ x $92.5^{+0.6}$ mm cut-out in the panel. The material thickness which the panel is made from should not exceed 15 mm. Insert the meter from the frontal panel side with the disconnected supply voltage. After the insertion into the hole, fix the meter by means of holders.

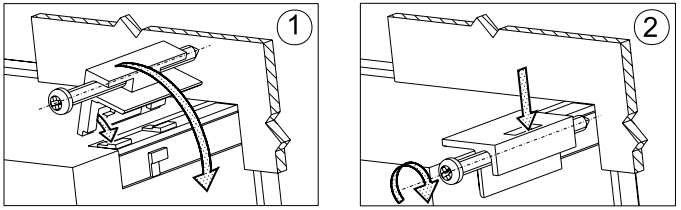



*Fig. 1. Meter fitting*

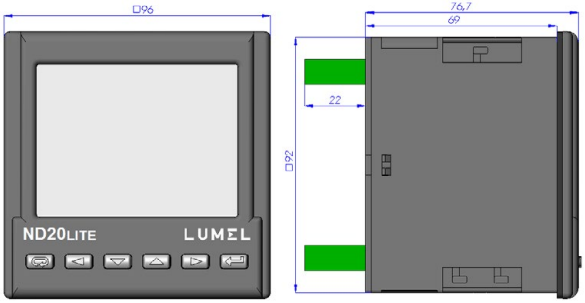



*Fig. 2 Meter overall dimensions*

# 5. METER DESCRIPTION

## 5.1 Current Inputs

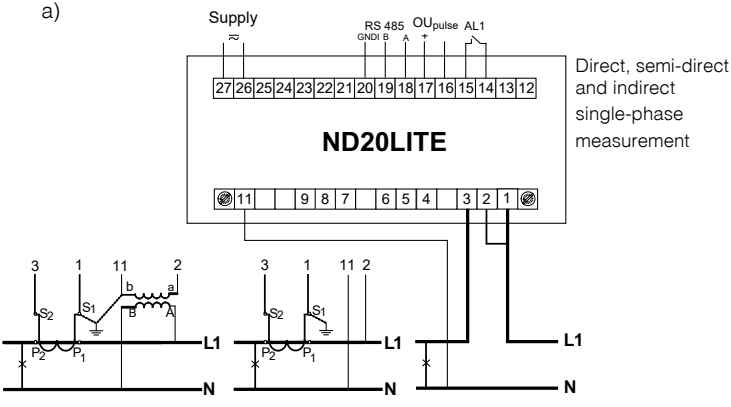
All current inputs are galvanically isolated (internal current transformers). The meter is adapted to co-operate with external measuring current transformers. Displayed current values and derivative quantities are automatically recoun in relation to the introduced external current transformer ratio. Current inputs have programmable ranges:1 A or 5 A.

## 5.2 Voltage Inputs

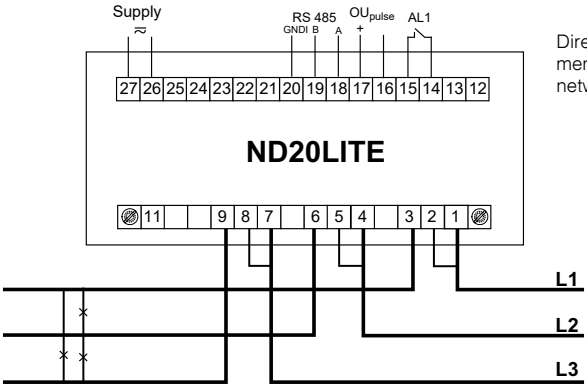
Quantities on voltage inputs are automatically converted acc. to the introduced ratio of the external voltage transformer. Voltage inputs have programmable ranges: 3 x 57.7/100 V, 3 x 230/400 V.

## 5.3 Connection Diagrams

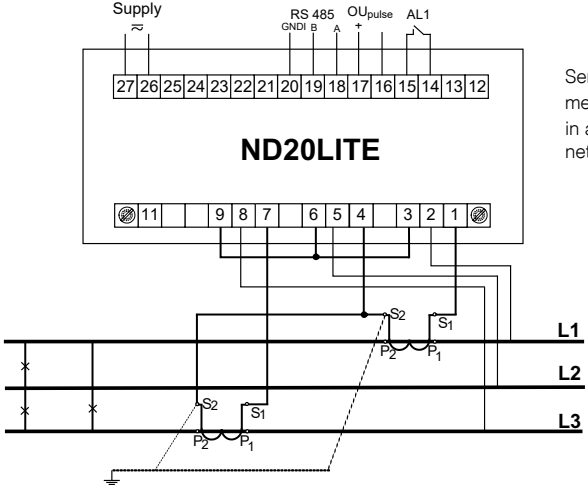
a)



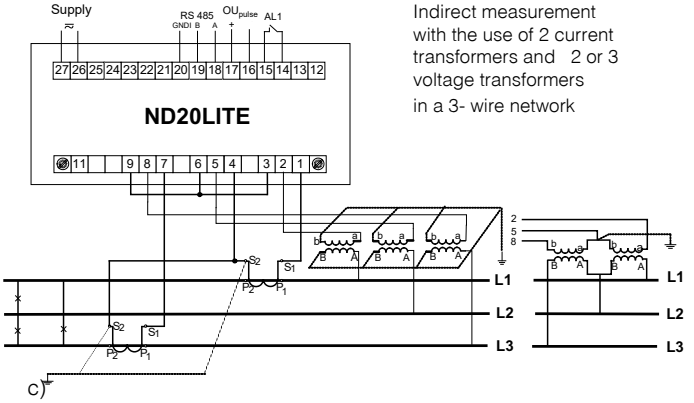
*b)*



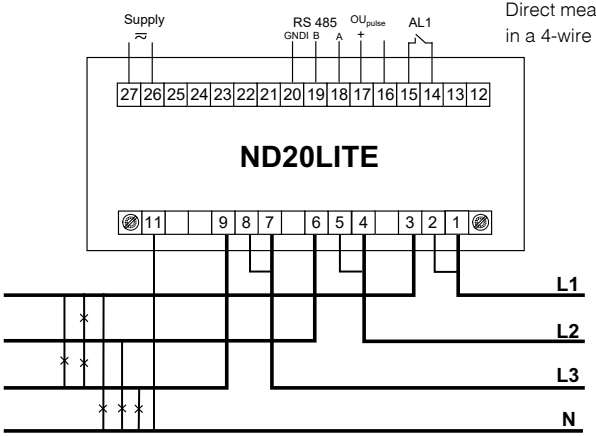

Direct measurement in a 3-wire network



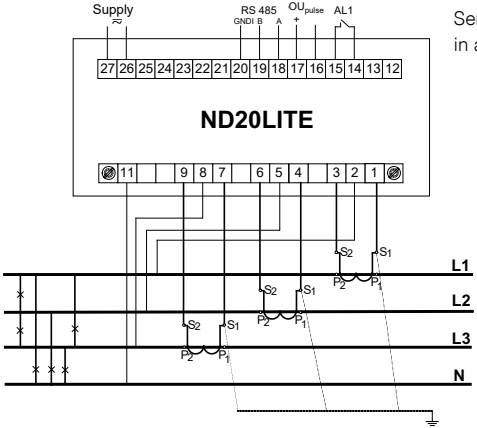

Semi-indirect measurement in a 3-wire network



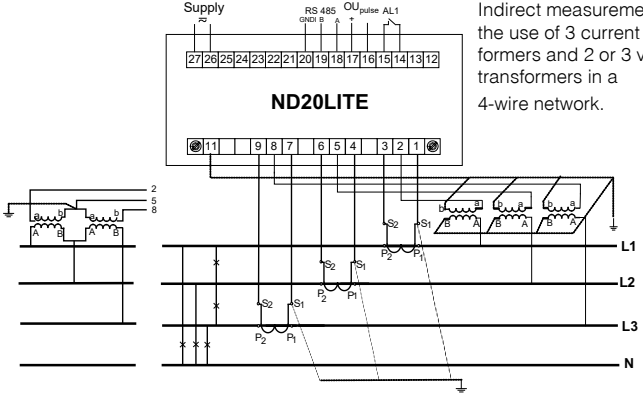

Indirect measurement with the use of 2 current transformers and 2 or 3 voltage transformers in a 3- wire network




Direct measurement in a 4-wire network.




Semi-indirect measurement in a 4-wire network.




Indirect measurement with the use of 3 current transformers and 2 or 3 voltage transformers in a 4-wire network.

*Fig 3. Meter connection diagrams in a:*
*a) single-phase network, b) 3-phase - 3 wire network,*
*c) 3-phase - 4-wire network*

# 6. ND20LITE PROGRAMMING

## 6.1 Frontal Panel



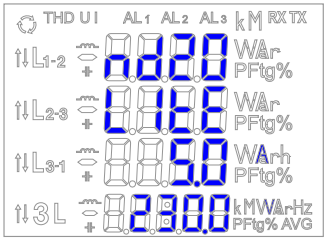

*Fig 4. Frontal panel*

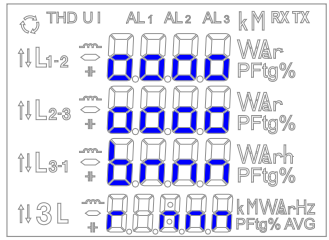
Description of the frontal panel:

1 – abandon push-button – ESC
2 – push-button to displace to the left
3 – push-button to decrease the value
4 – push-button to increase the value
5 – push-button to displace to the right
6 – acceptance push-button - ENTER
7 – symbol of displayed value of averaged active power
8 – display field of mean values, frequency, time, power guard
9 – display field of basic quantities, energy, THD,
10 – symbols indicating the display of power factor PF, tgφ factor and THD (row 4)
11 – units of displayed values
12 – symbols of digital data transmission
13 – multipliers of basic values
14 – symbols of alarm switching on/occurrence
15 – symbols of THD display
16 – symbols of energy flow
17 – symbols of min / max quantities
18 – symbols of quantity affiliation to respective phase
19 – symbols of power, energy character
20 – symbol of 3-phase quantity display

## 6.2 Messages after Switching the Supply on

After switching the supply on, the meter performs the display test and display the ND20LITE meter name, meter version, serial number and the current program version.




where:
oooooooo - is the serial number
r n.nn - is the number of the current program version or the number of the custom-made version.
bnnn - is the number of boatloader version.

*Fig. 5. Message after starting the meter*

**Caution! If on displays the message Err Cal or Err EE appears, one must contact the service shop.**

## 6.3 Monitoring of Parameters

In the measuring mode, quantities are displayed acc. to settled tables. The pressure of the ◄ push-button (left) or ► push-button (right) causes the transition between displayed quantities. The pressure of the ↵ push-button (Enter) causes the transition between mean and additional displayed values. The pressure of the ▼ push-button (down) causes the monitoring of the minimum value, however the pressure of the ▲ push-button (up) causes the monitoring of the maximum value. The pressure of the ESC (ESC) push-button during the monitoring of these values, erases suitably minimum or maximum values. Through the RS-485 interface one can set up the values, that would be visualized.

The error display is described in the chapter 8.

When displaying the reactive power, a marker indicating the load character is displayed, capacitive (⫫) or inductive (∿)

Displayed quantities in the field 9 (fig. 4.) for 3-phase 4-wire measurement mode 3Ph/4W and single-phase 1Ph/2W are presented in the table 1a and 1b.

Table 1a

| Backlit symbols | | $L_1$, V<br>$L_2$, V<br>$L_3$, V | $L_{1-2}$, V<br>$L_{2-3}$, V<br>$L_{3-1}$, V | $L_1$, A<br>$L_2$, A<br>$L_3$, A | $L_1$, W<br>$L_2$, W<br>$L_3$, W | $L_1$, Var<br>$L_2$, Var<br>$L_3$, Var | $L_1$, VA<br>$L_2$, VA<br>$L_3$, VA | $L_1$, PF<br>$L_2$, PF<br>$L_3$, PF | $L_1$, tg<br>$L_2$, tg<br>$L_3$, tg | kWh |
|---|---|---|---|---|---|---|---|---|---|---|
| Displayed values | row 1 | U1 | U12 [1] | I1 | P1 | Q1 | S1 | PF1 | tg1 | Imported active energy 2 |
| | row 2 | U2 [1] | U23 [1] | I2 [1] | P2 [1] | Q2 [1] | S2 [1] | PF2 [1] | tg2 [1] | |
| | row 3 | U3 [1] | U31 [1] | I3 [1] | P3 [1] | Q3 [1] | S3 [1] | PF3 [1] | tg3 [1] | |
| Displaying | | optional | | | | | | | | |

| Backlit symbols | | -, kWh | ∿ kVarh | ⫫ kVarh | kVAh | $L_1$,%<br>$L_2$,%<br>$L_3$,% , THD U |
|---|---|---|---|---|---|---|
| Displayed values | row 1 | Exported active energy [2] | reactive inductive energy / reactive positive energy [2] | reactive capacitive energy / reactive negative energy [2] | apparent energy [2] | THD U1 % [1] |
| | row 2 | | | | | THD U2 % [1] |
| | row 3 | | | | | THD U3 % [1] |
| Displaying | | optional | | | | |

| Backlit symbols | | $L_1$, %<br>$L_2$, %<br>$L_3$, %,<br>THD I | c | W<br>var<br>VA |
|---|---|---|---|---|
| Displayed values | row 1 | THD I1 % [1] | cosinusφ1 | $P_{3phase}$ [1] |
| | row 2 | THD I2 % [1] | cosinusφ2 [1] | $Q_{3phase}$ [1] |
| | row 3 | THD I3 % [1] | cosinusφ3 [1] | $S_{3phase}$ [1] |
| Displaying | | optional | | |

Displayed quantities in the field 8 (fig. 4.)

Table 1b

| Displayed symbols | 3L, A | A | 3L, W | 3L, var | 3L, VA | 3L, PF | 3L, tg | 3L, $W_{AVG}$ |
|---|---|---|---|---|---|---|---|---|
| Displayed values in the row 4 | $I_{mean}$ 3phase[1] | I(N)[1] | P 3phase[1] | Q 3phase[1] | S 3phase[1] | $PF_{mean}$ 3phase[1] | $tg_{mean}$ 3phase[1] | $P_{3phase}$ (15, 30 or 60 min)[2] |
| Displaying | optional | | | | | | | |

| Backlit symbols | 3L, c | | Hz | % | 3L, THD U | 3L, THD I |
|---|---|---|---|---|---|---|
| Displayed values in the row 4 | cosinus(φ) 3phase [1] | hour : minutes | frequency | Consumption of ordered power (in 15, 30 or 60 minutes' time)[2] | THD $U_{mean}$ %[1] | THD $I_{mean}$ %[1] |
| Displaying | optional | | | | | |

In 1Ph/2W measurement mode:

[1] - values are not calculated and not displayed,

[2] - values calculated as corresponding values of first phase

Displayed quantities in the field 9 (fig. 4.) for 3-phase 3-wire measurement mode 3Ph/3W and single-phase 1Ph/2W are presented in the table 2a and 2b.

Tablica 2a

| Backlit symbols | | $L_{1\text{-}2}$, V<br>$L_{2\text{-}3}$, V<br>$L_{3\text{-}1}$, V | $L_1$, A<br>$L_2$, A<br>$L_3$, A | kWh | -, kWh | kvar | kvar |
|---|---|---|---|---|---|---|---|
| Displayed values | row 1 | U12 | I1 | imported active energy | exported active energy | reactive inductive energy / reactive positive energy | reactive capacitive energy / reactive negative energy |
| | row 2 | U23 | I2 | | | | |
| | row 3 | U31 | I3 | | | | |
| Displaying | | optional | | | | | |

| Displayed symbols | | kVAh | W<br>var<br>VA |
|---|---|---|---|
| Displayed values | row 1 | apparent energy | $P_{3phase}$ |
| | row 2 | | $Q_{3phase}$ |
| | row 3 | | $S_{3phase}$ |
| Displaying | | optional | |

Displayed quantities in the field 8 (fig. 4.)

Table 2b

| Displayed symbols | 3L, A | 3L, W | 3L, var | 3L, VA | 3L, PF | 3L, tg | 3L, $W_{AVG}$ |
|---|---|---|---|---|---|---|---|
| Displayed values in the row 4 | $I_{maen\ 3phase}$ | $P_{3phase}$ | $Q_{3phase}$ | $S_{3phase}$ | $PF_{mean\ 3phase}$ | $tg_{mean\ 3phase}$ | $P_{3phase}$ (15, 30 or 60 min) |
| Displaying | optional | | | | | | |

| Backlit symbols | 3L, c | | Hz | % |
|---|---|---|---|---|
| Displayed values in the row 4 | $cosinus(\varphi)_{3phase}$ | hour : minutes | frequency | Consumption of ordered power (in 15, 30 or 60 minutes' time) |
| Displaying | optional | | | |

Performed calculations:
Reactive power (the calculation method configured):

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

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

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

Power factor PF: $PF = P / S$

Tangens power: $tg\varphi = Q / P$

Cosinus: cosinus between *U* and *I*

The exceeding of the upper indication range is signaled on the display by upper horizontal lines, however the exceeding of the lower range is signaled by lower horizontal lines.
In case of averaged power measurement $P_{3\text{-phase}}$, single measurements are carried out with a 15 seconds' quantum. Suitably to the 15 min, 30 min, 60 min selection, 60, 120 or 240 measurements are averaged. After starting the meter or the power erasing, the first value will be calculated after 15 seconds since the meter switching on or erasing. Till the time to obtain all active power samples, the value of averaged power is calculated from already measured samples.
The current in the neutral wire $I_{(N)}$ is calculated from phase current vectors
The value of consumed ordered power can be used for a previous warning against the exceeding of ordered power and to escape of fines related with it. The consumption of ordered power is calculated on the base of time interval set for the synchronization of the mean active power and the value of ordered power (section 6.5.1). The consumption example is presented in the section 6.5.3.

The alarm switching on is signaled by the lighting of the AL1 inscription (in the mode A3non, A3nof, A3_on, A3_of: of AL1, AL2, AL3 inscriptions). The end of alarm duration at the alarm signaling support switched on, is indicated by the pulsation of the AL1 inscription (in the mode A3non, A3nof, A3_on, A3_of: of AL1, AL2, AL3 inscriptions).

## 6.4 Operating modes

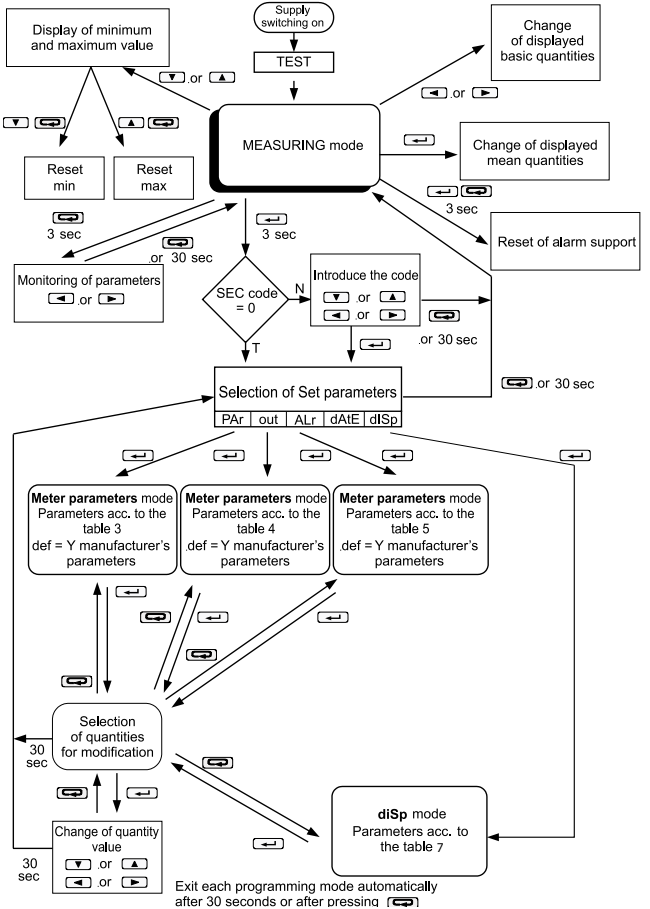



*Fig. 6. Operating modes of the ND20LITE meter.*

## 6.5. Parameter Settings

To configure the ND20LITE meter is free eCon software available on the www.lumel.com.pl.

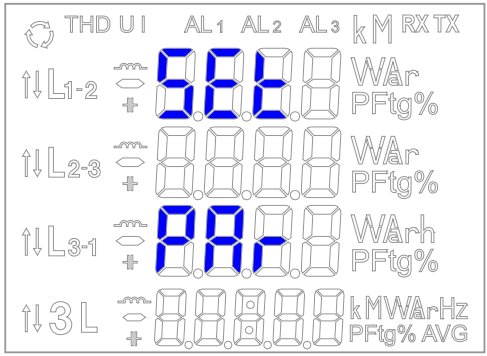



*Fig 7. Setup menu*

The entry in the programming mode is carried out through the pressure and holding down of the ↵ push-button during ca 3 sec. The entry in the programming mode is protected by the access code. If there is not such a code, the program transits into the programming option. The inscription SET is displayed (in the first row) and the first group of PAr parameters. The monitoring of parameters is always available through the pressure and holding down the ↵ push-button during ca 3 sec.

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PAr Meter parameters | SEc Access code | cn.I Current range | cn.U Voltage range | tr.I Current ratio | tr.U Voltage ratio | Syn Synchronizing of the active mean power | ErL.I Storage of the min/max value with errors | q.t Way to count reactive power | En.q Way to count reactive energy | LGHt Display backlight | En.d Erasing of watt-hour meters | PA.d Erasing of active mean power | PAor Ordered power | conn Type of system connection | t.H Hour, minute | dEF Manufacturer's parameters |
| oUt Output parameters | io.n Quantity of impulses | Addr Address in MODBUS network | tryb Transmission mode | bAUd Baud rate | dEF Manufacturer's parameters | | | | | | | | | | | |
| ALr Alarm parameters | AL.n Quantity on the alarm output (table 6 in the user's manual) | AL.t Alarm type | ALoF Lower value of the input range | ALon Higher value of the input range | ALdt Time delay of the switching reaction | AL.S Support of the alarm appearance signaling | AL.b Lock of alarm | dEF Manufacturer's parameters | | | | | | | | |
| di SP Displayed values | U.Ln Phase voltages L-N | U.LL Voltages L-L | I.Ln Phase currents | P Phase active powers | q Phase reactive powers | S Phase apparent powers | PF Power factors PF phase | tU Power phase Tangents tge | EnP Imported active energy | EnP- Exported active energy | Enq Reactive inductive energy | Enq- Reactive capacitive energy | EnS Apparent energy | tHdU THD of phase voltages | | |
| | tHdI THD of phase currents | CoS Phase Cosinuses φ | PQS Power P3phase, Q3phase, S3phase, | I.A Three-phase mean current | I.n Current in neutral wire | 3P Power SP3phase | 3q Power Q3phase | 3S Power Q3phase | PF.A Three-phase mean Power Factor PF | tU.A Three-phase mean Tangent | PAvL Power P3phase (15,30 or 60 minutes) | CoSA Three-phase mean Cosinus | HoUr Hour | FrEq Frequency | | |
| | P.or Three-phase ordered power | tH3U mean THD of phase voltages | tH3I mean THD of phase currents | on Display of parameters - ON | oFF Display of parameters - OFF | | | | | | | | | | | |

*Fig 8. Programming matrix.*

## 6.5.1 Setting of Meter Parameters

Select the **PAr** mode in options (by ▼ or ▲ push-buttons) and approve the choice by the ↵ push-button.

Table 3

| Item | Parameter name | Designation | Range | Notes/ description | Manufacturer's value |
|---|---|---|---|---|---|
| 1 | Introduction of the access code | SEc | oFF, 1 ... 60000 | 0 - without code | 0 |
| 2 | Current range | rn_I | 1A, 5A | 1A - current range 1A<br>5A - current range 5A | 5A * |
| 3 | Voltage range | rn_U | 57_7V, 69_3V, 230V | 57_7V – voltage range 57.7V<br>69,3V – voltage range 69.3V<br>230V – voltage range 230V | 230V * |
| 4 | Ratio of the current transformer | tr_I | 1 ... 10000 | | 1 |
| 5 | Ratio of the voltage transformer | tr_U | 0.1 ... 4000.0 | | 1 |
| 6 | Synchronization of mean active power | Syn | 15, c_15, c_30, c_60 | Synchronization of mean active power:<br>15 - 15 minutes' walking window (record synchronized with the clock every 15 minutes)<br>c_15 – measurement synchronize with the clock every 15 minutes.<br>c_30 – measurement synchronized with the clock every 30 minutes,<br>c_60 – measurement synchronized with the clock every 60 minutes, | 15 |
| 7 | Storage of minimum and maximum values with errors | erLI | oFF, on | oFF – storage of only correct values (from the measuring range).<br>on – storage of also error occurrences in measurements (values in registers 1e20 and 1e20) | on |

| | | | | | |
|---|---|---|---|---|---|
| 8 | Way to calculate reactive power | q_t | trGLE, SInUS | TrGle: $Q = \sqrt{S^2 - P^2}$<br>SInUS: $Q = \sum_{i=1}^{k} U_i * I_i * \sin(\angle U_i, I_i)$<br>k - harmonic number,<br>k = 21 for 50 Hz,<br>k = 18 for 60 Hz | trGLE |
| 9 | Way to calculate reactive energy | En_q | cAP, SIGn | cAP – inductive and capacitive energy<br>SIGn – positive and negative energy | cAP |
| 11 | Display backlit | LGHt | oFF, 1 .. 60, on | off – disabled,<br>on – enabled,<br>1..60 – time in seconds of backlit support since the push-button pressure. | on |
| 12 | Erasing of watt-hour meters | En_0 | no, EnP, Enq, EnH, ALL | no – lack of actions,<br>EnP – erasing of active energy,<br>Enq – erasing of reactive energy,<br>EnH – erasing of harmonic energy.<br>ALL – erasing of all energy | no |
| 13 | Erasing of mean active power | PA_0 | no, yES | yES -erasing of power | no |
| 14 | Reset of mean active power archive | PAr0 | no, yES | yES - erasing of archive | no |
| 15 | Ordered power | PAor | 0...144.0 | Ordered power for forecasting the power consumption in % of the rated value | 100.0 |
| 16 | Measure-ment mode | conn | 3Ph-4, 3Ph-3, 1Ph-2 | Meter connection way | 3Ph-4 |
| 17 | Manu-facturer's parameters | dEf | no, yES | Restoration of manufacturer's parameters of the group. | no |

* rated value for the values calculated in% of the rated value

The automatic erasing of energy is carried out:
- for active energy when changing: voltage or current ratio;
- for reactive energy when changing: voltage or current ratio, the way of reactive power calculation.

Values are set by means of ▼ and ▲ push-buttons, however the position of the set digit is selected by means of ◄ and ► push-buttons. The active position is signaled by the cursor. The value is accepted by ↵ the push-button and resigned by the pressure of the ↵ push-button. During the acceptation, the value insertion possibility in the range is checked. In case when the value is set beyond the range, the meter remains in the parameter edition mode, however the value is set on the maximum value (when the value is too higher) or on the minimum value (when the value is too lower).

## 6.5.2. Setting of Output Parameters

Select the **out** mode in options and approve the choice by the ↵ push-button.

Table 4

| Item | Parameter name | Designation | Range | Notes/ description | Manufacturer's value |
|---|---|---|---|---|---|
| 1 | Number of impulses | Io_n | 1000 ... 20000 | Number of impulses for 1 kWh | 5000 |
| 2 | Address in MODBUS network | Addr | 1 ... 247 | | 1 |
| 3 | Transmission mode | trYb | r8n2, r8E1, r8o1, r8n1 | | 8n2 |
| 4 | Baud rate | bAUd | 4.8 k, 9.6 k, 19.2 k, 38.4 k | | 9,6 k |
| 5 | Manufacturer's parameters | dEf | no, yES | Restoration of manufacturer's parameters of the group | no |

## 6.5.3. Setting of Alarm Parameters

Select the **ALr** mode in options and approve the choice by the push-button.

Table 5

| Item | Parameter name | Designation | Range | Notes/ description | Manufacturer's value |
|---|---|---|---|---|---|
| 1 | Quantity in the alarm output | AL_n | table 6 | (code acc. to the table 6) | P |
| 2 | Alarm type | AL_t | n-on, n-oFF, on, oFF, H-on, H-oFF, A3non, A3nof, A3_on, A3_of | Fig. 9 | n-on |
| 3 | Lower value of the input range | ALoF | -144.0 ... 144.0 | in % of the rated quantity value | 99,0 |
| 4 | Upper value of the input range | ALon | -144.0 ... 144.0 | in % of the rated quantity value | 101,0 |
| 5 | Time delay of the switching reaction | ALdt | 0 ... 900 | in seconds (for quantities AL_n =P_ord the delay occurs only when switching the alarm on) | 0 |
| 6 | Support of the alarm occurrence signaling | AL_S | oFF, on | In the situation when the support function is enabled, after the retreat of the alarm state the alarm symbol is not blanked but begins to pulsate. The signaling exists till the moment of blanking it by means of the ⇦ and ↵ push-buttons combination (during 3 seconds). The function concerns only and exclusively the alarm signaling, then relay contacts will be active without support, acc. to the selected type of alarm. | oFF |
| 7 | Interlocking of a renewed alarm switching on | AL_b | 0...900 | in seconds | 0 |
| 8 | Manufacturer's parameters | dEF | no, yES | Restoration of manufacturer's parameters of the group. | no |

The write of the value ALon lower than ALoF switches the alarm off.

Selection of the monitored value:

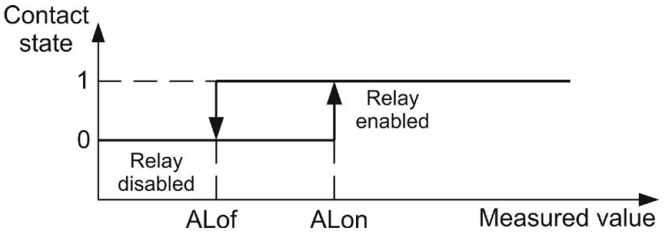
Table 6

| Item/ value in register 4015 | Displayed parameter | Kind of quantity | Value for the percentage conversion of alarm values and outputs (100%) |
|---|---|---|---|
| 00 | off | lack of quantity /alarm disabled/ | none |
| 01 | U_1 | voltage of phase L1 | Un [V] * |
| 02 | I_1 | current in the phase wire L1 | In [A] * |
| 03 | P_1 | active power of phase L1 | Un x In x cos(0°) [W] * |
| 04 | q_1 | reactive power of phase L1 | Un x In x sin(90°) [var] * |
| 05 | S_1 | apparent power of phase L1 | Un x In [VA] * |
| 06 | PF1 | active power factor PF of phase L1 | 1 |
| 07 | tg1 | tgφ coefficient of phase L1 | 1 |
| 08 | U_2 | voltage of phase L2 | Un [V] * |
| 09 | I_2 | current in the phase wire L2 | In [A] * |
| 10 | P_2 | active power of phase L2 | Un x In x cos(0°) [W] * |
| 11 | q_2 | reactive power of phase L2 | Un x In x sin(90°) [var] * |
| 12 | S_2 | apparent power of phase L2 | Un x In [VA] * |
| 13 | PF2 | active power factor PF of phase L2 | 1 |
| 14 | tg2 | tgφ coefficient of phase L2 | 1 |
| 15 | U_3 | voltage of phase L3 | Un [V] * |
| 16 | I_3 | current in the phase wire L3 | In [A] * |
| 17 | P_3 | active power of phase L3 | Un x In x cos(0°) [W] * |
| 18 | q_3 | reactive power of phase L3 | Un x In x sin(90°) [var] * |
| 19 | S_3 | apparent power of phase L3 | Un x In [VA] * |
| 20 | PF3 | active power factor PF of phase L3 | 1 |

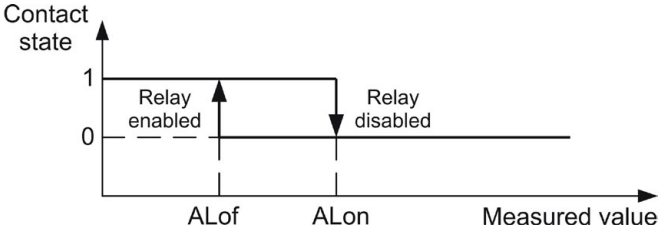
| | | | |
|---|---|---|---|
| 21 | tg3 | tgφ coefficient of phase L3 | 1 |
| 22 | U_A | mean 3-phase voltage | Un [V] * |
| 23 | I_A | mean 3-phase current | In [A] * |
| 24 | P | 3-phase active power<br>(P1 + P2+ P3) | 3 x Un x In x cos(0°)<br>[W] * |
| 25 | q | 3-phase reactive Power<br>(Q1 + Q2 + Q3) | 3 x Un x In x sin(90°)<br>[var] * |
| 26 | S | 3-phase apparent Power<br>(S1 + S2 + S3 ) | 3 x Un x In [VA] * |
| 27 | PF_A | 3-phase active power factor PF | 1 |
| 28 | Tg_A | 3-phase tgφ coefficient | 1 |
| 29 | FrEq | frequency | 100 [Hz] |
| 30 | U12 | phase-to-phase voltage L1-L2 | $\sqrt{3}$ Un [V] * |
| 31 | U23 | phase-to-phase voltage L2-L3 | $\sqrt{3}$ Un [V] * |
| 32 | U31 | phase-to-phase voltage L3-L1 | $\sqrt{3}$ Un [V] * |
| 33 | U4_A | mean phase-to-phase voltage | $\sqrt{3}$ Un [V] * |
| 34 | P_At | mean active power | 3 x Un x In x cos(0°)<br>[W] * |
| 35 | P_ord | Used percentage of the ordered active power (consumed energy) | 100% |

*Un, In – rated values of voltages and currents

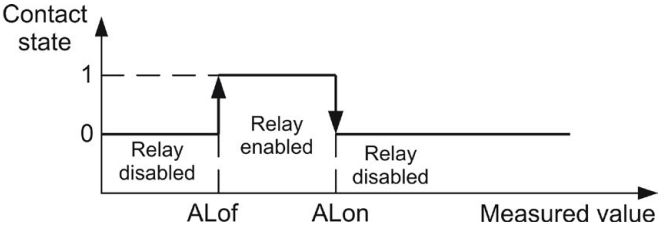
**a) n-on**


Contact
state
1
0
Relay
enabled
Relay
disabled
ALof
ALon
Measured value

**b) n-off**


Contact
state
1
0
Relay
enabled
Relay
disabled
ALof
ALon
Measured value

**c) On**




**d) OFF**

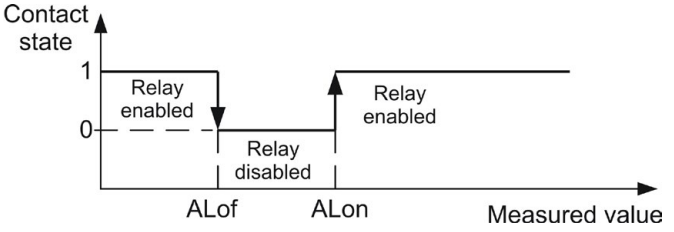



*Fig. 9. Alarm types: a),b) normal c) enabled d) disabled*

Remaining types of the alarm:

- H-on – always enabled;
- H-oFF – always disabled,
- A3non – when the "n-on" alarm type occurs on any of the phases – the relay switches on and the corresponding symbol is illuminated (AL1 – phase 1, AL2 – phase 2, AL3 – phase 3). When all alarms fade away, the relay switches off.
- A3nof – when the "n-off" alarm type occurs on any of the phases – the relay switches on and the corresponding symbol is illuminated (AL1 – phase 1, AL2 – phase 2, AL3 – phase 3). When all alarms fade away, the relay switches off.

– A3_on – when the “on” alarm type occurs on any of the phases – the relay switches on and the corresponding symbol is illuminated (AL1 – phase 1, AL2 – phase 2, AL3 – phase 3). When all alarms fade away, the relay switches off.
– A3_of – when the “off” alarm type occurs on any of the phases – the relay switches on and the corresponding symbol is illuminated (AL1 – phase 1, AL2 – phase 2, AL3 – phase 3). When all alarms fade away, the relay switches off

In the “A3” alarm series, the alarm value must range from 0-7. They work with equal ALof and ALon hysteresis thresholds for all of the phases. Signaling sustainment can be switched off by pressing together ESC and ENTER buttons (for 3 seconds).

Example no 1 of alarm setting:

Set the alarm of n-on type for the monitored quantity P – 3-phase active power,

Set ranges 5 A, 230V. Switching the alarm on, after exceeding 3800 W, switching the alarm off after decreasing 3100 W.

**Calculate**: rated 3-phase active power: P = 3 x 230 V x 5 A = 3450 W

3450 W – 100 %  3450 W – 100 %

3800 W – ALon %  3100 W – ALoF %

It appears:  ALon = 110 %  ALoF = 90 %

Set: Monitored quantity: P; Kind of alarm: n-on, ALon 110, ALoF 90.0.

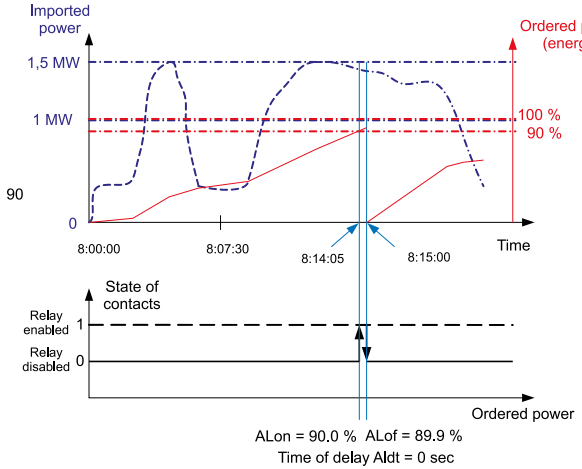
Example no 2 of alarm setting:

Set the alarm of earliest warning about the possibility to exceed the ordered 1 MW power on the level 90% at the one hour accounting. Measuring current transformer 2500/5 A, voltage :230 V, Instantaneous maximum import of power: 1.5 MW.

**Calculate:** rated 3-phase active power of the ND20LITE meter: P = 3 x 230 V x 2500 A (500 * 5 A) = 1.725 MW (500 * 3450 W) – 100%; 90% of ordered power / rated power = 90.0% * 1 MW / 1.725 MW = 52.1 % of the rated meter value (rounding down).

The’ ordered hourly power (energy for consumption): 1 MWh / 4 quarters = 900 MWs,

90% - 810 MWs. Remaining 10% at maximum power import would be used in time: 900 MWs / 1.5 MW = 60 s




An example of the parameter value utilization of ordered active power to switch the alarm on is presented on the fig. 10. The time delay is set on 0 sec. In the calculated example, for remaining 10% of ordered power, at the maximum power consumption, devices could still work during 60 sec without exposing customers to fines. when setting the time delay ALdt on 60 sec, the alarm would not be enabled.

*Fig 10. Measurement of 60 minutes' active power consumption synchronized with the clock, with alarm set on a 90% consumption.*

**Set:** Monitored quantity: P_ord, Kind of alarm: n-on, ALon = 90.0, ALoF = 89.9, Tr_1 = 500, Syn = c_60, Time delay ALdt = 0 or 240 s.

## 6.5.4. Setting of displayed values

Select the **dISP** mode in options and approve the choice by the ↵ push-button.

Table 7

| No. | Parameter name | Designation | Range | Manufacturer's value |
|---|---|---|---|---|
| Displayed parameters in the row 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 | Active phase powers | P | oFF, on | on |
| 5 | Reactive phase powers | q | oFF, on | on |
| 6 | Apparent phase powers | S | oFF, on | on |
| 7 | Phase PF power factors | PF | oFF, on | on |
| 8 | Phase Tangents φ factors | 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 | Capacity reactive energy | Enq- | oFF, on | on |
| 13 | THD of phase voltage | tHdu | oFF, on | on |
| 14 | THD of phase current | tHdI | oFF, on | on |
| 15 | Harmonic input active energy | EnH | oFF, on | on |
| 16 | Harmonic output active energy | EnH- | oFF, on | on |
| 17 | Phase Cosinus φ | cos | oFF, on | on |
| 18 | 3-phase active, reactive, apparent power | PqS | oFF, on | on |

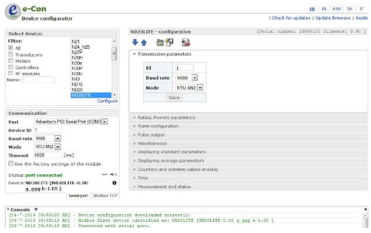
| Displayed parameters in the row 4 | | | | |
|---|---|---|---|---|
| 19 | Three-phase mean current | I_A | oFF, on | on |
| 20 | Current in neutral wire | I_n | oFF, on | on |
| 21 | Three-phase active power | 3P | oFF, on | on |
| 22 | Three-phase reactive power | 3q | oFF, on | on |
| 23 | Three-phase apparent power | 3S | oFF, on | on |
| 24 | Three-phase mean power factor PF | PF_A | oFF, on | on |
| 25 | Three-phase mean Tangent φ factor | tG_A | oFF, on | on |
| 26 | Three-phase mean active power (15,30 or 60 minutes) | PAvG | oFF, on | on |
| 27 | Three-phase mean Cosinus φ | coSA | oFF, on | on |
| 28 | Hour | HoUr | oFF, on | on |
| 29 | Frequency | Freq | oFF, on | on |
| 30 | Three-phase ordered power | p_or | oFF, on | on |
| 31 | Mean THD of phase voltages | tH3U | oFF, on | on |
| 32 | Mean THD of phase currents | tH3I | oFF, on | on |
| 33 | Diplay of parameters - ON | on | no, YES | no |
| 34 | Display of parameters - OFF | off | no, YES | no |

**Note!** When you turn off the display of all parameters, the phase current values and frequency are displayed.

# 7. UPDATING OF SOFTWARE

Function enabling updating of software from the computer of the PC with software eCon was implemented in meter ND20LITE. Free software eCon and update files are accessible on the site *www.lumel.com.pl*. The connected to the computer converter RS485 is required on USB to the updating, e.g.: the converter PD10.

a)




b)

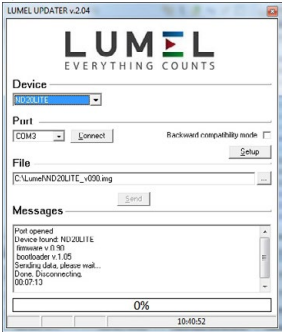



*Fig. 13. Program view: a) eCon, b) updating of software*

**Note!** After updating the software, the manufacturer's settings of the meter should be set, so it is recommended to save the meter parameters before updating using the software eCon.

After starting eCon's software COM port, baudrate, transmission mode and adress should be set. It can be done in *Options*. Then, ND20LITE meter should be selected from *Device*. Push icon *Load* to read and save current settings. Open window *Lumel Updater* (LU) – figure 13b from *Updating->Updating of devices firmware*. Push *Connect*. Update progress is shown in *Messages* section. Text *Port opened* appear after correctly opened port. Putting meter in update's mode can be done in two ways: remote from LU (with settings from eCon – port, baudrate, transmission mode and adress) or by turning power on while ↵ button pressed. Meter display shows the „*boot*" inscription with bootloader version, LU shows message „*Device found*" with name and current version of firmware. Using button ... browse to the meter upgrade file. If the file is opened correctly, a *File opened* message is displayed. Press the Send button. When upgrade is successfully completed, meter reverts to the default settings and begins normal operation while the information window displays *Done* message and upgrade elapsed time. Close LU and go to *Restoration of default parameters*. Select checkbox and press *Apply* button. After the LU window is closed, press the *Save* icon to save all initially read parameters. Current firmware version can be checked when meter is power on.

**Warning!** Turning the meter off during upgrade process may result in permanent damage!

# 8. RS-485 INTERFACE

The implemented protocol is compliant with the PI-MBUS-300 Rev G, Modicon. Parameter set of the serial ND20LITE meter link:

- identifier 0xDC
- meter address: 1..247
- baud rate 4.8, 9.6, 19.2, 38.4 kbit/s,
- working mode Modbus RTU,
- information unit 8N2, 8E1, 8O1, 8N1,
- maximum time to response start 600 ms.
- maximum quantity of read out registers in one request
  41registers – 4 byte registers,
  82 registers – 2 byte registers,
- implemented functions 03, 04, 06, 16, 17,
  - 03, 04 - readout of registers,
  - 06 - write of one register,
  - 16 - write of n-registers,
  - 17 - device identification,

Manufacturer's settings: address 1, baud rate: 9600 baud, RTU 8N2 mode,

**Readout of n-registers (code 03h)**

**Example 1 .** Readout of 2 registers 16-bit of integer type, starting with the register with the 0FA0h (4000) address - register values 10, 100.

**Request:**

| Device address | Function | Register address | | Number of registers | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 03 | 0F | A0 | 00 | 02 | C7 3D |

**Response:**

| Device address | Function | Number of bytes | Register address 0FA0 (4000) | | Number of registers 0FA1 (4001) | | CRC Control sum |
|---|---|---|---|---|---|---|---|
| | | | B1 | B0 | B1 | B0 | |
| 01 | 03 | 04 | 00 | 0A | 00 | 64 | E4 6F |

**Example 2 .** Readout of 2 registers 32-bit of float type as 2 registers 16-bits, starting with the register with the 1B58h (7000) address - register values 10, 100.

**Request:**

| Device address | Function | Register address | | Number of registers | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 03 | 1B | 58 | 00 | 04 | C3 3E |

**Response:**

| Device address | Function | Number of baytes | Value from register 1B58 (7000) | | Value from register 1B59 (7001) | | Value from register 1B5A (7002) | | Value from register 1B5B (7003) | | CRC Control sum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | B3 | B2 | B1 | B0 | B3 | B2 | B1 | B0 | |
| 01 | 03 | 08 | 41 | 20 | 00 | 00 | 42 | C8 | 00 | 00 | E4 6F |

**Example 3 .** Readout of 2 registers 32-bit of float type as 2 registers 16-bit, starting with the register with the 1770h (6000) address - register values 10, 100.

**Request**

| Device address | Function | Register address | | Number of registers | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 03 | 17 | 70 | 00 | 04 | 4066 |

**Response:**

| Device address | Function | Number of bytes | Value from register 1770h (6000) | | Value from register 1770h (6000) | | Value from register 1772h (6002) | | Value from register 1772h (6002) | | CRC Control sum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | B1 | B0 | B3 | B2 | B1 | B0 | B3 | B2 | |
| 01 | 03 | 08 | 00 | 00 | 41 | 20 | 00 | 00 | 42 | C8 | E4 6F |

**Example 4 .** Readout of 2 registers 32-bit of float type, starting with the register with the 1D4Ch (7500) address - register values 10, 100.

**Request:**

| Device address | Function | Register address | | Number of registers | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 03 | 1D | 4C | 00 | 02 | 03 B0 |

**Response:**

| Device address | Function | Number of bytes | Value from register 1D4C (7500) | | | | Value from register 1D4D (7501) | | | | CRC Control sum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | B3 | B2 | B1 | B0 | B3 | B2 | B1 | B0 | |
| 01 | 03 | 08 | 41 | 20 | 00 | 00 | 42 | C8 | 00 | 00 | E4 6F |

**Recording a single register (code 06h)**

**Example 5 .** Recording the value 543 (0x021F) in the register 4000 (0x0FA0)

**Request:**

| Device address | Function | Register address | | Number of registers | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 06 | 0F | A0 | 02 | 1F | CA 54 |

**Response:**

| Device address | Function | Register address | | Number of registers | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 06 | 0F | A0 | 02 | 1F | CA 54 |

**Recording to n-registers (code 10h)**

**Example 6 .** Recording 2 registers starting with the register with the 0FA3h (4003) address recorded values 20, 2000.

**Request:**

| Device address | Function | Register addr. Hi | Register addr. Lo | Register addr. Hi | Register addr. Lo | Number of bytes | Value for register 0FA3 (4003) | | Value for register 0FA4 (4004) | | CRC Control sum |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 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 | | CRC Control sum |
|---|---|---|---|---|---|---|
| | | B1 | B0 | B1 | B0 | |
| 01 | 10 | 0F | A3 | 00 | 02 | B2 FE |

**Report identifying the device (code 11h)**

**Example 7 .** Device identification

**Request:** Table 8

| Device address | Function | CRC Control sum |
|---|---|---|
| 01 | 11 | C0 2C |

**Response:**

| Device address | Function | Number of bytes | Identifier | Device status | Information field of the device software version (eg, „ND20LITE-0.09 b-1.05" - ND20 device with software version 0.09 and bootloader version 1.05) | CRC Control sum |
|---|---|---|---|---|---|---|
| 01 | 11 | 1D | DC | FF | 4E 44 32 30 4C 49 54 45 2D 30 2E 39 20 20 20 20 20 20 20 62 2D 31 2E 30 35 20 | DB 84 |

**Map of ND20 meter registers**

In the ND20LITE meter, data are placed in 16 and 32-bit registers. Process variables and meter parameters are placed in the address area of registers in a way depended on the variable value type. Bits in 16-bit registers are numbered from the youngest to the oldest (b0-b15). 32-bit registers include numbers of float type in IEEE-754 standard.

Table 8

| Address range | Type of value | Description |
|---|---|---|
| 4000 – 4070 | Integer (16 bits) | The value is placed in one 16-bit register. The table 11 includes the register description. Registers for write and readout. |
| 6000 – 6319 | Float (2x16 bits) | Value placed in two successive 16-bit registers. Registers include the same data as 32-bit registers from the area 7500 – 7659. Registers for readout. Sequence of bytes (1-0-3-2). |
| 6320 – 6573 | Float (2x16 bits) | Value placed in two successive 16-bit registers. Registers include the same data as 32-bit registers from the area 7660 – 7786. Registers for readout. Sequence of bytes (1-0-3-2). |
| 7000 – 7319 | Float (2x16 bits) | Value placed in two successive 16-bit registers. Registers include the same data as 32-bit registers from the area 7500 – 7659. Registers for readout. Sequence of bytes (3-2-1-0). |

| | | |
|---|---|---|
| 7500 – 7659 | Float (32 bits) | Value placed in one 32-bit register. The table 10 includes the register description. Registers for readout. |
| 7660 – 7786 | Float (32 bits) | Value placed in one 32-bit register. The table 10 includes the register description. Registers for readout. |
| 7800 – 8052 | Float (2x16 bits) | Value placed in two successive 16-bit registers. Registers include the same data as 32-bit registers from the area 7660 – 7786. Registers for readout. Sequence of bytes (3-2-1-0). |

Table 9

| Register address | Operation | Range | Description | By default |
|---|---|---|---|---|
| 4000 | RW | 0...60000 | Protection - password | 0 |
| 4001 | RW | 0...900 [s] | Interlocking time of the renewed switching of the relay output on | 0 |
| 4002 | RW | 0...1440 [‰] | Ordered mean power *10 | 1000 |
| 4003 | RW | 1..10000 | Current transformer ratio | 1 |
| 4004 | RW | 1..40000 | Voltage transformer ratio *10 | 10 |

| | | | | |
|---|---|---|---|---|
| 4005 | RW | 0..3 | Synchronization of mean active power:<br>0 – 15 minutes' walking window (record synchronized every 15 minutes with the clock)<br>1 – measurement synchronized every 15 minutes with the clock<br>2 – measurement synchronized every 30 minutes with the clock<br>3 – measurement synchronized every 60minutes with the clock | 0 |
| 4006 | RW | 0 | reserved | 0 |
| 4007 | RW | 0,1 | Storage way of minimum and maximum values<br>0 – without errors,<br>1 – with errors | 0 |
| 4008 | RW | 0,1 | Way to calculate reactive power:<br>0: $Q = \sqrt{S^2 - P^2}$<br>1: $Q = \sum_{i=1}^{k} U_i * I_i * \sin(\angle U_i, I_i)$<br>k – harmonic number,<br>k = 21 for 50 Hz,<br>k = 18 for 60 Hz | 0 |
| 4009 | RW | 0,1 | Way to calculate reactive energy:<br>0 – inductive and capacitive energy<br>1 – positive and negative energy | 0 |
| 4010 | RW | 0...61 | Display backlit:<br>0 – disabled,<br>1-60 – backlit time in seconds since the push-button pressure,<br>61 – always enabled | 61 |

| | | | | |
|---|---|---|---|---|
| 4011 | RW | 0...4 | Erasing of watt-hour meters:<br>0 – without changes,<br>1- erase active energy,<br>2 – erase reactive energy,<br>3 – erase energy of harmonics,<br>4 – erase all energy. | 0 |
| 4012 | RW | 0,1 | Erasing of mean active power $P_{AV}$ | 0 |
| 4013 | RW | 0 | reserved | 0 |
| 4014 | RW | 0,1 | Erase min and max | 0 |
| 4015 | RW | 0,1 .. 35 | Quantity on the alarm relay output (code acc. to the table 6) | 24 |
| 4016 | RW | 0 ... 9 | Output type: 0 – n-on, 1– n-oFF,<br>2 – on, 3 - oFF, 4 – H-on,<br>5 – H-oFF, 6 - A3non, 7 - A3nof,<br>8 - A3_on, 9 - A3_of | 0 |
| 4017 | RW | -1440..0..<br>1440 [‰] | Lower alarm switching value | 990 |
| 4018 | RW | -1440..0..<br>1440 [‰] | Upper alarm switching value | 1010 |
| 4019 | RW | 0...900 s | Delay of the alarm switching ( for quantity AL_n = P_ord – rgister 4015 =35, the delay occurs only when the alarm is switched on. | 0 |
| 4020 | RW | 1..2000<br>[10uA] | Alarm signaling support | 0 |
| 4021 | RW | 0 | reserved | 0 |
| 4022 | RW | 0 | reserved | 0 |
| 4023 | RW | 0 | reserved | 0 |
| 4024 | RW | 0 | reserved | 0 |
| 4025 | RW | 0 | reserved | 0 |

| | | | | |
|---|---|---|---|---|
| 4026 | RW | 0 | reserved | 0 |
| 4027 | RW | 0 | reserved | 0 |
| 4028 | RW | 0 | reserved | 0 |
| 4029 | RW | 1000.. 20000 | Number of impulses for the impulse output | 5000 |
| 4030 | RW | 1..247 | Address in the MODBUS network | 1 |
| 4031 | RW | 0..3 | Transmission mode: : 0->r8n2, 1->r8E1, 2->r8o1, 3->r8n1 | 0 |
| 4032 | RW | 0..3 | Baud rate: 0->4800, 1->9600 2->19200, 3->38400 | 1 |
| 4033 | RW | 0.1 | Bring up to date the transmission parameter change | 0 |
| 4034 | RW | 0..2359 | Hour *100 + Minutes | 0 |
| 4035 | RW | 0 | reserved | 0 |
| 4036 | RW | 0 | reserved | 0 |
| 4037 | RW | 0,1 | Record of standard parameters (together with the reset of energy and min, max, averaged power) | 0 |
| 4038 | R | 0..15258 | Imported active energy, two older bytes | 0 |
| 4039 | R | 0.. 65535 | Imported active energy, two younger bytes | 0 |
| 4040 | R | 0..15258 | Exportedactive energy, two older bytes | 0 |
| 4041 | R | 0..65535 | exported active energy, two younger bytes | 0 |
| 4042 | R | 0..15258 | Reactive inductive energy, two older bytes | 0 |
| 4043 | R | 0..65535 | Reactive inductive energy, two younger bytes | 0 |

| | | | | |
|---|---|---|---|---|
| 4044 | R | 0..15258 | Reactive capacitive energy, two older bytes | 0 |
| 4045 | R | 0..65535 | Reactive capacitive energy, two younger bytes | 0 |
| 4046 | R | 0..15258 | Apparent energy, two older bytes | 0 |
| 4047 | R | 0..65535 | Apparent energy, two younger bytes | 0 |
| 4048 | R | 0 | reserved | 0 |
| 4049 | R | 0 | reserved | 0 |
| 4050 | R | 0..65535 | Status register – description below | 0 |
| 4051 | R | 0..65535 | Serial number, two older bytes | - |
| 4052 | R | 0..65535 | Serial number, two younger bytes | - |
| 4053 | R | 0..65535 | Program version (*100) | - |
| 4054 | RW | 0..65535 | Displayed parameters of standard values | 0xFFFF |
| 4055 | RW | 0..65535 | Displayed parameters of average values | 0xFFFF |
| 4056 | RW | 0..65535 | Displayed parameters of standard values 2 | 0xFFFF |
| 4057 | RW | 0...2 | Measurement mode: 0->3Ph / 4W, 1->3Ph / 4W 2-> 1Ph/2W | 0 |
| 4058 | R | 0..65535 | nominal voltage x10 | 577, 693, 2300 |
| 4059 | R | 0..65535 | nominal current x10 | 100, 500 |
| 4060 | R | 0 | reserved | 0 |
| 4061 | R | 0..65535 | Register of status 2 - description below | 0 |
| 4062 - 4068 | R | 0..65535 | reserved | 0 |
| 4069 | RW | 0..1 | Current range 0 -1A, 1 - 5A | 1 |
| 4070 | RW | 0..2 | Voltage range 0 – 57.7V, 1 – 69.3V, 2 - 230V | 2 |

In parenthesis [ ], suitably is placed: resolution or unit.

Energy is made available in hundreds of watt-hours (var-hours) in double 16-bit register, and for this reason, one must divide them by 10 when calculating values of particular energy from registers, ie:

Imported active energy = (register 4038 value x 65536 + register 4039 value) /10 [kWh]
Exported active energy = (register 4040 value x 65536 + register 4041 value) /10 [kWh]
Reactive inductive energy = (register 4042 value x 65536 + register 4043 value) /10 [kVarh]
Reactive capacitive energy = (register 4044 value x 65536 + register 4045 value) /10 [kVarh]
Apparent energy = (register 4046 value x 65536 + register 4047 value)/ 10 [kVAh]

Device status register (address 4050, R):

| | |
|---|---|
| Bit 15 – „1" – damage of the non-volatile memory | Bit 7 – „1" – the interval of averaged power is not elapsed |
| Bit 14 – „1" – lack of calibration or erroneous calibration | Bit 6 – „1" – frequency for THD calculation beyond intervals<br>- 48 – 52 for frequency 50 Hz,<br>- 58 – 62 for frequency 60 Hz |
| Bit 13 – „1" – error of parameter values | Bit 5 – „1" – voltage too low for frequency measurements |
| Bit 12 – „1" – error of energy values | Bit 4 – „1" – too low voltage of phase L3 |
| Bit 11 – „1" – error of phase sequence | Bit 3 – „1" – too low voltage of phase L2 |
| Bit 10 – current range „0" – 1 A~; 1" – 5 A~ | Bit 2 – „1" – too low voltage of phase L1 |

| Bit 9 | Bit 8 | Voltage range | Bit 1 – reserved |
|---|---|---|---|
| 0 | 0 | 57.7 V~ | Bit 0 – state of relay output „1" – On, „0" - off |
| 0 | 1 | 230 V~ | |
| 1 | 1 | 69.3 V~ | |

Register of status 2 - nature of the reactive power (address 4061, R):

Bit 15 – reserved

Bit 14 – „1" – alarm indication in phase L3 (only for alarm type: A3non, A3nof, A3_on, A3_of)

Bit 13 – „1" – alarm indication in phase L2 (only for alarm type: A3non, A3nof, A3_on, A3_of

Bit 12 – „1" – alarm indication in phase L1 (only for alarm type: n-on, n-off, on, off)

Bit 11 – „1" – capacitive 3L maximum

Bit 10 – „1" – capacitive 3L minimum

Bit 9 – „1" – capacitive 3L

Bit 8 – „1" – capacitive L3 maximum

Bit 7 – „1" – capacitive L3 minimum

Bit 6 – „1" – capacitive L3

Bit 5 – „1" – capacitive L2 maximum

Bit 4 – „1" – capacitive L2 minimum

Bit 3 – „1" – capacitive L2

Bit 2 – „1" – capacitive L1 maximum

Bit 1 – „1" – capacitive L1 minimum

Bit 0 – „1" – capacitive L1

Configuration register of displayed parameters of standard values (address 4054, R/W):

Bit 15 ..."1" – displaying of cosinus φ

Bit 14 – „1" – displaying of THD current

Bit 13 – „1" – displaying of THD voltage

Bit 12 – „1" – displaying of apparent energy

Bit 11 – „1" – displaying of capacitve reactive energy

Bit 10 – „1" – displaying of inducvtie reactive energy

Bit 9 – „1" – displaying of exported active energy

Bit 8 – „1" – displaying of imported active energy

Bit 7 – „1" – displaying of tg

Bit 6 – „1" – displaying of PF

Bit 5 – „1" – displaying of phase apparent powers

Bit 4 – „1" – displaying of phase reactive powers

Bit 3 – „1" – displaying of phase active powers

Bit 2 – „1" – displaying of phase currents

Bit 1 – „1" – displaying of phase-to--phase voltages

Bit 0 – „1" – displaying of phase voltages

Configuration register of displayed parameters of standard values 2 (address 4056, R/W):

Bit 15 ...1 – reserved

Bit 0 – „1" – displaying of power ΣP,ΣQ,ΣS

Register of status 2 - nature of the reactive power (address 4055, R/W):

Bit 15...14 – reserved

Bit 13 – „1" – displaying of mean THD current

Bit 12 – „1" – displaying of mean THD voltage

Bit 11 – „1" – displaying of ordered power utilization

Bit 10 – „1" – displaying of frequenz

Bit 9 – „1" – displaying of time

Bit 8 – „1" – displaying of mean φ cosinus

Bit 7 – „1" – displaying of mean active power

Bit 6 – „1" – displaying of mean tg

Bit 5 – „1" – displaying of mean PF

Bit 4 – „1" – displaying of power ΣS

Bit 3 – „1" – displaying of power ΣQ

Bit 2 – „1" – displaying of power ΣP

Bit 1 – „1" – displaying of current in neutral conductor

Bit 0 – „1" – displaying of mean current

Table 12

| Address of 16-bit registers | Address of 32-bit registers | Operation | Description | Unit | 3Ph/4W | 3Ph/3W | 3Ph/2W |
|---|---|---|---|---|---|---|---|
| 6000/7000 | 7500 | R | Voltage of phase L1 | V | √ | x | √ |
| 6002/7002 | 7501 | R | Current in phase L1 | A | √ | √ | √ |
| 6004/7004 | 7502 | R | Active power of phase L1 | W | √ | x | √ |
| 6006/7006 | 7503 | R | Reactive power of phase L1 | var | √ | x | √ |
| 6008/7008 | 7504 | R | Apparent power of phase L1 | VA | √ | x | √ |
| 6010/7010 | 7505 | R | Power factor (PF) of phase L1 | - | √ | x | √ |
| 6012/7012 | 7506 | R | Tg φ factor of phase L1 | - | √ | x | √ |
| 6014/7014 | 7507 | R | Voltage of phase L2 | V | √ | x | x |
| 6016/7016 | 7508 | R | Current in phase L2 | A | √ | √ | x |
| 6018/7018 | 7509 | R | Active power of phase L2 | W | √ | x | x |
| 6020/7020 | 7510 | R | Reactive power of phase L2 | var | √ | x | x |
| 6022/7022 | 7511 | R | Apparent power of phase L2 | VA | √ | x | x |
| 6024/7024 | 7512 | R | Power factor (PF) of phase L2 | - | √ | x | x |
| 6026/7026 | 7513 | R | Tg φ factor of phase L2 | - | √ | x | x |
| 6028/7028 | 7514 | R | Voltage of phase L3 | V | √ | x | x |
| 6030/7030 | 7515 | R | Current in phase L3 | A | √ | √ | x |
| 6032/7032 | 7516 | R | Active power of phase L3 | W | √ | x | x |
| 6034/7034 | 7517 | R | Reactive power of phase L3 | var | √ | x | x |
| 6036/7036 | 7518 | R | Apparent power of phase L3 | VA | √ | x | x |
| 6038/7038 | 7519 | R | Power factor (PF) of phase L3 | - | √ | x | x |
| 6040/7040 | 7520 | R | Tg φ factor of phase L3 | - | √ | x | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6042/7042 | 7521 | R | Mean 3-phase voltage | V | √ | x | x |
| 6044/7044 | 7522 | R | Mean 3-phase current | A | √ | √ | x |
| 6046/7046 | 7523 | R | 3-phase active power (P1+P2+P3) | W | √ | √ | x |
| 6048/7048 | 7524 | R | 3-phase reactive power (Q1+Q2+Q3) | var | √ | √ | x |
| 6050/7050 | 7525 | R | 3-phase apparent power (S1+S2+S3) | VA | √ | √ | x |
| 6052/7052 | 7526 | R | Mean power factor (PF) | - | √ | √ | x |
| 6054/7054 | 7527 | R | Mean Tg φ factor of phase L1 | - | √ | √ | x |
| 6056/7056 | 7528 | R | Frequency | Hz | √ | √ | x |
| 6058/7058 | 7529 | R | Phase-to-phase voltage L1-2 | V | √ | √ | x |
| 6060/7060 | 7530 | R | Phase-to-phase voltage L2-3 | V | √ | √ | x |
| 6062/7062 | 7531 | R | Phase-to-phase voltage L3-1 | V | √ | √ | x |
| 6064/7064 | 7532 | R | Mean phase-to-phase voltage | V | √ | √ | x |
| 6066/7066 | 7533 | R | 3-phase 15, 30, 60 minutes' active Power (P1 + P2 + P3) | W | √ | √ | √ |
| 6068/7068 | 7534 | R | THD U1 | % | √ | x | √ |
| 6070/7070 | 7535 | R | THD U2 | % | √ | x | x |
| 6072/7072 | 7536 | R | THD U3 | % | √ | x | x |
| 6074/7074 | 7537 | | THD U mean | % | √ | x | x |
| 6076/7076 | 7538 | R | THD I1 | % | √ | x | √ |
| 6078/7078 | 7539 | R | THD I2 | % | √ | x | x |
| 6080/7080 | 7540 | R | THD I3 | % | √ | x | x |
| 6082/7082 | 7541 | R | Cosinus of angle between U1 and I1 | - | √ | x | x |
| 6084/7084 | 7542 | R | Cosinus of angle between U2 and I2 | - | √ | x | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6088/7088 | 7544 | R | Cosinus of angle between U3 and I3 | - | √ | x | x |
| 6090/7090 | 7545 | R | 3-phase mean cosinus | - | √ | √ | x |
| 6092/7092 | 7546 | R | Angle between U1 and I1 | ° | √ | x | √ |
| 6094/7094 | 7547 | R | Angle between U2 i I2 | ° | √ | x | x |
| 6096/7096 | 7548 | R | Angle between U3 i I3 | ° | √ | x | x |
| 6098/7098 | 7549 | R | Current in neutral wire (calculated from vectors) | A | √ | x | x |
| 6100/7100 | 7550 | R | Imported 3-phase active energy (number of overflows in register 7551, reset after exceeding 99999999.9 kWh) | 100 MWh | √ | √ | P1 |
| 6102/7102 | 7551 | R | Imported 3-phase active energy (counter totting up to 99999.9 kWh) | kWh | √ | √ | P1 |
| 6104/7104 | 7552 | R | Exported 3-phase active energy (number of overflows in register 7553, reset after exceeding 99999999.9 kWh) | 100 MWh | √ | √ | P1 |
| 6106/7106 | 7553 | R | Exported 3-phase active energy (counter totting up to 99999.9 kWh) | kWh | √ | √ | P1 |
| 6108/7108 | 7554 | R | 3-phase reactive inductive energy (number of overflows in register 7555, reset after exceeding 99999999.9 kVarh) | 100 Mvarh | √ | √ | Q1 |
| 6110/7110 | 7555 | R | 3-phase reactive inductive energy (counter totting up to 99999.9 kVarh) | kvarh | √ | √ | Q1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6112/7112 | 7556 | R | 3-phase reactive capacitive energy (number of overflows in register 7557, reset after exceeding 99999999.9 kVarh) | 100 Mvarh | √ | √ | Q1 |
| 6114/7114 | 7557 | R | 3-phase reactive capacitive energy ( counter totting up to 99999.9 kVarh) | kvarh | √ | √ | Q1 |
| 6116/7116 | 7558 | R | Apparent 3-phase power (number of overflows in register 7559, reset after exceeding 99999999.9 kVAh) | 100 MVAh | √ | x | x |
| 6118/7118 | 7559 | R | Apparent 3-phase power (counter totting up to 99999.9 kVAh) | kVAh | √ | x | x |
| 6120/7120 | 7560 | R | reserved | - | - | - | - |
| 6122/7122 | 7561 | R | reserved | - | - | - | - |
| 6124/7124 | 7562 | R | Time – hours, minutes | - | √ | √ | √ |
| 6126/7126 | 7563 | R | reserved | - | - | - | - |
| 6128/7128 | 7564 | R | reserved | - | - | - | - |
| 6130/7130 | 7565 | R | reserved | - | - | - | - |
| 6132/7132 | 7566 | R | Utilized ordered power | V | √ | x | √ |
| 6134/7134 | 7567 | R | reserved | - | - | - | - |
| 6136/7136 | 7568 | R | reserved | - | - | - | - |
| 6138/7138 | 7569 | R | reserved | - | - | - | - |
| 6140/7140 | 7570 | R | Voltage L1 min | V | √ | x | √ |
| 6142/7142 | 7571 | R | Voltage L1 max | V | √ | x | √ |
| 6144/7144 | 7572 | R | Voltage L2 min | V | √ | x | x |
| 6146/7146 | 7573 | R | Voltage L2 max | V | √ | x | x |
| 6148/7148 | 7574 | R | Voltage L3 min | V | √ | x | x |
| 6150/7150 | 7575 | R | Voltage L3 max | V | √ | x | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6152/7152 | 7576 | R | Current L1 min | A | √ | √ | √ |
| 6154/7154 | 7577 | R | Current L1 max | A | √ | √ | √ |
| 6156/7156 | 7578 | R | Current L2 min | A | √ | √ | x |
| 6158/7158 | 7579 | R | Current L2 max | A | √ | √ | x |
| 6160/7160 | 7580 | R | Current L3 min | A | √ | √ | x |
| 6162/7162 | 7581 | R | Current L3 max | A | √ | √ | x |
| 6164/7164 | 7582 | R | Active power L1 min | W | √ | x | √ |
| 6166/7166 | 7583 | R | Active power L1 max | W | √ | x | √ |
| 6168/7168 | 7584 | R | Active power L2 min | W | √ | x | x |
| 6170/7170 | 7585 | R | Active power L2 max | W | √ | x | x |
| 6172/7172 | 7586 | R | Active power L3 min | W | √ | x | x |
| 6174/7174 | 7587 | R | Active power L3 max | W | √ | x | x |
| 6176/7176 | 7588 | R | Reactive power L1 min | var | √ | x | √ |
| 6178/7178 | 7589 | R | Reactive power L1 max | var | √ | x | √ |
| 6180/7180 | 7590 | R | Reactive power L2 min | var | √ | x | x |
| 6182/7182 | 7591 | R | Reactive power L2 max | var | √ | x | x |
| 6184/7184 | 7592 | R | Reactive power L3 min | var | √ | x | x |
| 6186/7186 | 7593 | R | Reactive power L3 max | var | √ | x | x |
| 6188/7188 | 7594 | R | Apparent power L1 min | VA | √ | x | √ |
| 6190/7190 | 7595 | R | Apparent power L1 max | VA | √ | x | √ |
| 6192/7192 | 7596 | R | Apparent power L2 min | VA | √ | x | x |
| 6194/7194 | 7597 | R | Apparent power L2 max | VA | √ | x | x |
| 6196/7196 | 7598 | R | Apparent power L3 min | VA | √ | x | x |
| 6198/7198 | 7599 | R | Apparent power L3 max | VA | √ | x | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6200/7200 | 7600 | R | Power factor (PF) of phase L1 min | - | √ | x | √ |
| 6202/7202 | 7601 | R | Power factor (PF) of phase L1 max | - | √ | x | √ |
| 6204/7204 | 7602 | R | Power factor (PF) of phase L2 min | - | √ | x | x |
| 6206/7206 | 7603 | R | Power factor (PF) of phase L2 max | - | √ | x | x |
| 6208/7208 | 7604 | R | Power factor (PF) of phase L3 min | - | √ | x | x |
| 6210/7210 | 7605 | R | Power factor (PF) of phase L3 max | - | √ | x | x |
| 6212/7212 | 7606 | R | tg φ factor of phase L1 min | - | √ | x | √ |
| 6214/7214 | 7607 | R | tg φ factor of phase L1 max | - | √ | x | √ |
| 6216/7216 | 7608 | R | tg φ factor of phase L2 min | - | √ | x | x |
| 6218/7218 | 7609 | R | tg φ factor of phase L2 max | - | √ | x | x |
| 6220/7220 | 7610 | R | tg φ factor of phase L3 min | - | √ | x | x |
| 6222/7222 | 7611 | R | tg φ factor of phase L3 max | - | √ | x | x |
| 6224/7224 | 7612 | R | Phase-to-phase voltage L1-2 min | V | √ | √ | x |
| 6226/7226 | 7613 | R | Phase-to-phase voltage L1-2 max | V | √ | √ | x |
| 6228/7228 | 7614 | R | Phase-to-phase voltage L2-3 min | V | √ | √ | x |
| 6230/7230 | 7615 | R | Phase-to-phase voltage L2-3 max | V | √ | √ | x |
| 6232/7232 | 7616 | R | Phase-to-phase voltage L3-1 min | V | √ | √ | x |
| 6234/7234 | 7617 | R | Phase-to-phase voltage L3-1 max | V | √ | √ | x |
| 6236/7236 | 7618 | R | 3-phase mean voltage min | V | √ | √ | x |
| 6238/7238 | 7619 | R | 3-phase mean voltage max | V | √ | √ | x |
| 6240/7240 | 7620 | R | 3-phase mean current min | A | √ | √ | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6242/7242 | 7621 | R | 3-phase mean current max | A | √ | √ | x |
| 6244/7244 | 7622 | R | 3-phase active power min | W | √ | √ | x |
| 6246/7246 | 7623 | R | 3-phase active power max | W | √ | √ | x |
| 6248/7248 | 7624 | R | 3-phase reactive power min | var | √ | √ | x |
| 6250/7250 | 7625 | R | 3-phase reactive power max | var | √ | √ | x |
| 6252/7252 | 7626 | R | 3-phase apparent power min | VA | √ | √ | x |
| 6254/7254 | 7627 | R | 3-phase apparent power max | VA | √ | √ | x |
| 6256/7256 | 7628 | R | mean power factor (PF) min | - | √ | √ | x |
| 6258/7258 | 7629 | R | mean power factor (PF) max | - | √ | √ | x |
| 6260/7260 | 7630 | R | Mean Tgφ factor min | - | √ | √ | x |
| 6262/7262 | 7631 | R | Mean Tgφ factor max | - | √ | √ | x |
| 6264/7264 | 7632 | R | Frequency min | Hz | √ | √ | √ |
| 6266/7266 | 7633 | R | Frequency max | Hz | √ | √ | √ |
| 6268/7268 | 7634 | R | Mean phase-to-phase voltage min | V | √ | √ | x |
| 6270/7270 | 7635 | R | Mean phase-to-phase voltage max | V | √ | √ | x |
| 6272/7272 | 7636 | R | 3-phase active power 15,30,60 minutes min | W | √ | √ | √ |
| 6274/7274 | 7637 | R | 3-phase active power 15,30,60 minutes min | W | √ | √ | √ |
| 6276/7276 | 7638 | R | THD U1 min | V / % | √ | x | √ |
| 6278/7278 | 7639 | R | THD U1 max | V / % | √ | x | √ |
| 6280/7280 | 7640 | R | THD U2 min | V / % | √ | x | x |
| 6282/7282 | 7641 | R | THD U2 max | V / % | √ | x | x |
| 6284/7284 | 7642 | R | THD U3 min | V / % | √ | x | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6286/7286 | 7643 | R | THD U3 max | V / % | √ | x | x |
| 6288/7288 | 7644 | R | mean THD U min | V / % | √ | x | x |
| 6290/7290 | 7645 | R | mean THD U max | V / % | √ | x | x |
| 6292/7292 | 7646 | R | THD I1 min | A / % | √ | x | √ |
| 6294/7294 | 7647 | R | THD I1 max | A / % | √ | x | √ |
| 6296/7296 | 7648 | R | THD I2 min | A / % | √ | x | x |
| 6298/7298 | 7649 | R | THD I2 max | A / % | √ | x | x |
| 6300/7300 | 7650 | R | THD I3 min | A / % | √ | x | x |
| 6302/7302 | 7651 | R | THD I3 max | A / % | √ | x | x |
| 6304/7304 | 7652 | R | mean THD I min | A / % | √ | x | x |
| 6306/7306 | 7653 | R | mean THD I max | A / % | √ | x | x |
| 6308/7308 | 7654 | R | cosinus of angle between U1 and I1 min | – | √ | x | √ |
| 6310/7310 | 7655 | R | cosinus of angle between U1 and I1 max | | √ | x | √ |
| 6312/7312 | 7656 | R | cosinus of angle between U2 and I2 min | – | √ | x | x |
| 6314/7314 | 7657 | R | cosinus of angle between U2 and I2 max | – | √ | x | x |
| 6316/7316 | 7658 | R | cosinus of angle between U3 and I3 min | – | √ | x | x |
| 6318/7318 | 7659 | R | cosinus of angle between U3 and I3 max | – | √ | x | x |
| 6320/7320 | 7660 | R | 3-phase mean cosinus min | - | √ | √ | x |
| 6322/7322 | 7661 | R | 3-phase mean cosinus max | - | √ | √ | x |
| 6324/7324 | 7662 | R | Angle between U1 and I1 min | ◦ | √ | x | √ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6326/7326 | 7663 | R | Angle between U1 and I1 max | ◦ | √ | x | √ |
| 6328/7328 | 7664 | R | Angle between U2 and I2 min | ◦ | √ | x | x |
| 6330/7330 | 7665 | R | Angle between U2 and I2 max | ◦ | √ | x | x |
| 6332/7332 | 7666 | R | Angle between U3 and I3 min | ◦ | √ | x | x |
| 6334/7334 | 7667 | R | Angle between U3 and I3 max | ◦ | √ | x | x |
| 6336/7336 | 7668 | R | current in neutral conductor min | A | √ | x | x |
| 6338/7338 | 7669 | R | current in neutral conductor max | A | √ | x | x |

In case of a lower exceeding the value -1e20 is written in, however after an upper exceeding or error occurrence, the value 1e20 is written.

# 9. ERROR CODES

During the meter operation, messages about errors can occur. Reasons of errors are presented below.

**Err1** -when the voltage or current is too small when measuring:
- PFi, tgφi, cos, THD below 10% Un,
- PFi, tgφi, cos, below 1% In,
- THD below 10% In ,
- f below 10% Un,
- $I_{(N)}$, below 10% In;

**bAd Freq** - When measuring harmonics and THD, if the frequency value is beyond the interval 48 – 52 Hz for 50Hz and 58 – 62 for 60 Hz;

**Err CAL, Err EE** - are displayed when the meter memory is damaged. The meter must be sent to the manufacturer.

**Err PAr** - are displayed when operating parameters in the meter are incorrect. One must restore manufacturer's parameters (from the menu level or through RS-485). One can disable the message by the ⏎ push-button.

**Err Enrg** - are displayed when energy values in the meter are incorrect.
One can disable the message by the ⏎ push-button. Incorrect energy values are reset.

**Err L2 L3** error of phase sequence, one must interchange the connection of phase 2 and phase 3. One can disable the message by the ⏎ push-button. Each time you power up, the message will be displayed again.

- - - - or - - - - - - lower overflow. The measured value is smaller than the lower measuring quantity range.

- - - - or - - - - - - upper overflow. The measured value is higher than the upper measuring quantity range or measurement error.

# 10. TECHNICAL DATA

**Measuring ranges and admissible basic errors**

Table 11

| Measured value | Indication range* | Measuring range | L1 | L2 | L3 | Σ | Basic error |
|---|---|---|---|---|---|---|---|
| Current In<br>1 A<br>5 A | <br>0.00 ... 12 kA<br>0.00 ... 60 kA | <br>0.002 ... 1.200 A~<br>0.010 ... 6.000 A~ | • | • | • | | ±0.2% r |
| Voltage L-N<br>57.7 V<br>69.3 V<br>230 V | <br>0.0 ... 280 kV<br>0.0 .. 333.0 kV<br>0.0 ... 1.104 MV | <br>2.8 ... 70.0 V~<br>3.4 .. 84 V~<br>11.5 ... 276 V~ | • | • | • | | ±0.2% r |
| Voltage L-L<br>100 V<br>400 V | <br>0.0 ... 480 kV<br>0.0 ... 1.92 MV | <br>5 ... 120 V~<br>20 ... 480 V~ | • | • | • | | ±0.5% r |
| Frequency | 47.0 .. 63.0 Hz | 47.0...63.0 Hz | • | • | • | | ±0.2%mv |
| Active power | -9999 MW .. 0.00 W .. 9999 MW | -1.65 kW...1.4 W...1.65 kW | • | • | • | • | ±0.5% r |
| Reactive power | -9999 Mvar .. 0.00 var ... 9999 Mvar | -1.65 kvar...1.4 var...1.65 kvar | • | • | • | • | ±0.5% r |
| Apparent power | 0.00 VA .. 9999 MVA | 1.4 VA...1.65 kVA | • | • | • | • | ±0.5% r |
| Power factor PF | -1 .. 0.. 1 | -1...0...1 | • | • | • | • | ±1% r |
| Tangent φ factor | -10.2...0...10.2 | -1.2...0...1.2 | • | • | • | • | ±1% r |
| Cosinus φ | -1... 1 | -1... 1 | • | • | • | • | ±1% r |
| φ | -180 ... 180 | -180 ... 180 | • | • | • | | ±0.5% r |
| Imported active energy | 0 .. 99 999 999.9 kWh | | | | | • | 0.5 S (PN-EN 62053-22) |
| Exported active energy | 0 .. 99 999 999,9 kWh | | | | | • | 0.5 S (PN-EN 62053-22) |
| Reactive inductive energy | 0 .. 99 999 999.9 kvarh | | | | | • | ±0.5% r |
| Reactive capacitive energy | 0 .. 99 999 999.9 kvarh | | | | | • | ±0.5% r |
| Apparent energy | 0 ..99 999 999.9 kVAh | | | | | • | ±0.5% r |
| THD | 0 .. 100% | 0 .. 100% | • | • | • | | ±5% r |

* Depending on the set tr_U ratio (ratio of the voltage transformer: 0.1...4000.0) and tr_I ratio (ratio of the current transformer: 1...10000)

r - of the range mv - of the measured value

**Caution!** For proper current measurement, a voltage greater than 0.05 Un is required at this phase. In the absence of voltage - current measurement from approximately 10% of the rated current)

| | |
|---|---|
| **Power input:** | |
| - in supply circuit | ≤ 6 VA |
| - in voltage circuit | ≤ 0.05 VA |
| - in current circuit | ≤ 0.05 VA |
| **Display field:** | dedicated display LCD 3.5'' |
| **Realay output:** | relay, voltageless NO contacts<br>load capacity 250 V~/ 0.5 A ~ |
| **Serial interface RS-485:** | address 1...247;<br>mode: 8N2,8E1, 8O1,8N1;<br>baud rate: 4.8, 9.6, 19.2, 38.4 kbit/s<br>transmission protocol: Modbus RTU<br>response time: 600 ms |
| **Energy impulse output** | output of OC type (NPN), passive<br>of class A , acc.to EN 62053-31<br>supply voltage18 .. 27 V,<br>current 10 .. 27 mA |
| **Constant of OC type output impulse:** | 1000 - 20000 imp./kWh<br>independently of set tr_U, tr_I ratios |
| **Protection grade ensured by the casing:** | |
| - from frontal side | IP 65 |
| - from terminal side | IP 20 |
| **Weight** | 0.3 kg |
| **Overall dimensions** | 96 x 96 x 77 mm |

**Reference and rated operating conditions**

| | |
|---|---|
| - supply voltage | 85..253 V a.c. (40...400) Hz or<br>90..300 V d.c. |
| - input signal: | 0...0.002...1.2 $I_n$; 0.05...1.2 $U_n$<br>for current, voltage |
| | 0...0.002...1.2 $I_n$; 0...0.1...1.2 $U_n$<br>for power factors $Pf_i$ ,$t\varphi_i$ |
| | frequency 47...63 Hz<br>sinusoidal (THD ≤ 8%) |
| - power factor | -1...0...1 |
| - ambient temperature | -25...23...+70°C |
| - storage temperature | -30...+70°C |
| - relative humidity | 25...95% (condensation inadmissible) |
| - admissible peak factor: | |
| - current intensity | 2 |
| - voltage | 2 |
| - external magnetic field | 0...40...400 A/m |
| - short duration overload (5 s) | |
| - voltage inputs | 2 Un (max.1000 V) |
| - current inputs | 10 In |
| - operating position | any |
| - preheating time | 5 min. |

**Additional errors:**

in % of the basic error

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

**Standards fulfilled by the meter:**

***Electromagnetic compatibility:***

- noise immunity acc. to EN 61326-1 Class A:Industrial env.
- noise emissions acc. to EN 61000-6-4

***Safety requirements:***

according to EN 61010 -1 standard

- isolation between circuits: basic
- installation category: III
- pollution level: 2
- maximum phase-to-earth voltage:
  - for supply and measuring circuits 300 V
  - for remaining circuits 50 V
- altitude above sea level: < 2000 m.

# 11. ORDERING CODES

Table 12

| Code | Description |
|---|---|
| **ND20LITE22100M1*** | 3-phase power network meter ND20LITE<br>current input 1A/5A, X/1A, X/5A,<br>voltage input 3x57,7/100V, 3x69,3/120V, 3x230/400V<br>RS-485 interface,<br>supply 85-253Va.c. or 90-300V d.c.,<br>documentation and descriptions in Polish and English version, test certificate |

* Upon agreement, an option to order a calibration certificate for the product is available against payment. Then, in the execution code, in the place of the last character, enter the digit **2**, e.g. **ND20LITE22100M2**. The customer will then receive a standard test certificate and a calibration certificate (against payment).

**LUMEL S.A.**

ul. Słubicka 4, 65-127 Zielona Góra, Poland
tel.: +48 68 45 75 100
**www.lumel.com.pl**

**Technical Support & Export Department:**
tel.: +48 68 45 75 146, (WhatsApp) +48 536 550 007
+48 68 45 75 130, (WhatsApp) +48 733 393 603
e-mail: export@lumel.com.pl

**Calibration & Attestation:**
e-mail: laboratorium@lumel.com.pl

ND20LITE-09C_R1