

# POWER QUALITY METER

WITH MODBUS RTU (RS-485) PROTOCOL

## ND31LITE



## USER MANUAL





# 1. APPLICATION

The ND31LITE meter is a programmable digital instrument designed for the measurement of 1-phase 2-wire and 3-phase 3 and 4-wire power network parameters in balanced or unbalanced systems. The measured values are displayed on a 3,5" TFT full-color screen, resolution: 320 x 240 pixel. The meter enables control and optimization of the power electronic devices, systems and industrial installations.

The meter provides measurement of: RMS of voltage and current, active, reactive and apparent power, active, reactive and apparent energy, power factors, frequency, the harmonics of current and voltage /up to 63rd/, THD of voltage and current, averaged active and apparent power P Demand, S Demand, averaged current I Demand /15, 30 or 60 minutes/. Voltages and currents are multiplied by given voltage and current ratios of the measuring transformers. Power and energy indications take into account all programmed ratio values. The value of each measured value can be transmitted to the master system via the RS-485, relay outputs signal the overflow of the chosen value.

There is a galvanic separation between following units of the meter:

- supply
- voltage inputs,
- current inputs,
- RS485 interface

# 2. METER SET

Complete set of the meter includes:

- |                                   |       |
|-----------------------------------|-------|
| • ND31 meter                      | 1 pc  |
| • gasket                          | 1 pc  |
| • screw clamp to fix in the panel | 4 pcs |
| • plug with 16 screw terminals    | 1 pc  |
| • plug with 14 screw terminals    | 1 pc  |
| • quick start                     | 1 pc  |

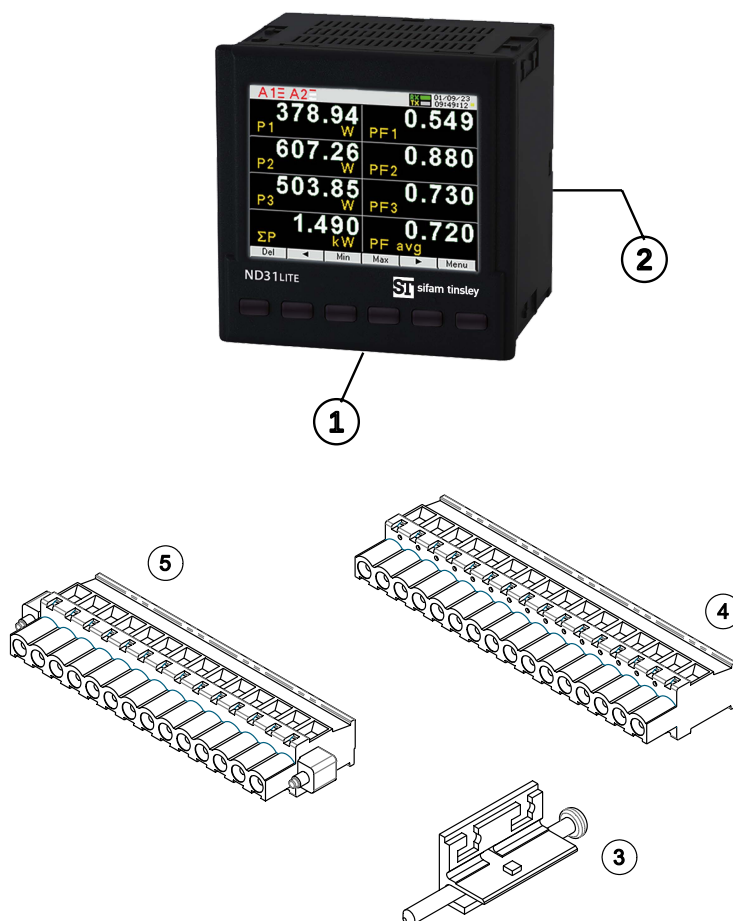


Fig. 1. Meter set

### 3. BASIC REQUIREMENTS, OPERATIONAL SAFETY

In terms of operational safety the controller meets the requirements of the EN 61010-1 (incl. changes) standard.

Remarks concerning safety:

- The meter should be installed and connected only by a qualified personnel.

All relevant safety measures should be observed during installation.

- Always check the connections before turning the meter on.
- Prior to taking the meter housing off, always turn the supply off and disconnect the measuring circuits.
- Removal of the meter housing during the warranty period voids the warranty.
- This meter conforms to all requirements of the electromagnetic compatibility in the industrial environment.
- A switch or a circuit-breaker should be installed in the building or facility. It should be located near the device, easily accessible by the operator, and suitably marked.
- The meter must not be mounted within 50.8 mm (2 inches) of any electrically live parts, including primary wires, primary terminals and primary pins. This requirement does not apply to insulated cables.
- The meter attached to the housing must not come into contact with the insulation of the interior of the panel.
- Mounting brackets must not be attached to any electrically live part.
- Do not install the meter in places where the gases emitted during arc discharge from the circuit breakers can be diverted to any measuring part of the installation.
- Protection of the supply voltage path:  
Protect the supply voltage with an approved (UL / IEC) fuse: ND31LITE at 85-253V AC or 90-300V DC, 1.0 A, type C;
- Protection of current measurement inputs:  
The meter allows current measurement via current transformers. The circuits should then not be protected by any fuse! Never open the secondary circuit of the current transformers under load. The terminals of the secondary circuit of the current transformers must be short-circuited before dismantling the device.
- Protection of voltage measurement inputs:  
In the case of direct connection and connection using transformers, the device must be protected by an approved (UL / IEC) 10 A emergency fuse or an approved (UL / IEC) 10 A miniature overcurrent circuit breaker. When using voltage transformers, their secondary terminals must never be shorted.

## 4. INSTALLATION

The meter is intended to be fixed to the panel with mounting brackets as presented on Fig. 1. The meter housing is made of a self-extinguishing plastics.

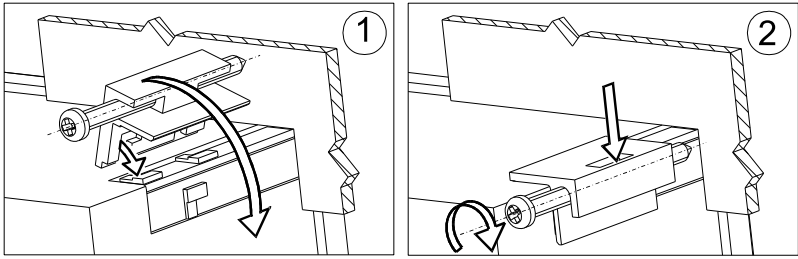


Fig. 2. Meter fitting

Housing overall dimensions 96 x 96 x 77 mm, dimensions of the assembly hole 92.5 x 92.5 mm. There are screw terminal strips on the outer side of the meter which enable the connection of external wires of diameter up to 2.5 mm<sup>2</sup>

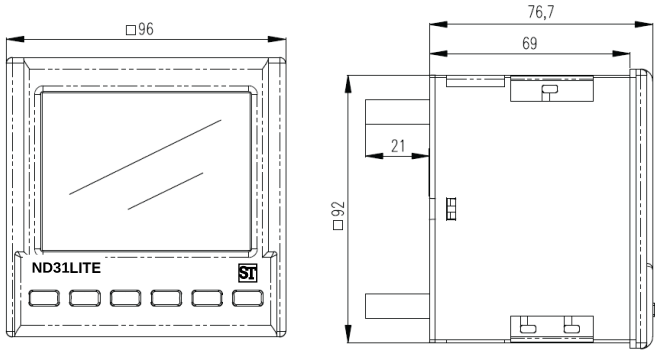


Fig. 3. Overall dimensions of the ND31LITE meter

## 5. METER DESCRIPTION

### 5.1. Current inputs

All current inputs are galvanically isolated (internal current transformers). The meter is adapted to work with external measuring current transformers / 1 A or 5 A /. Displayed current values and derivative values are automatically converted in relation to the introduced external current transformer ratio.

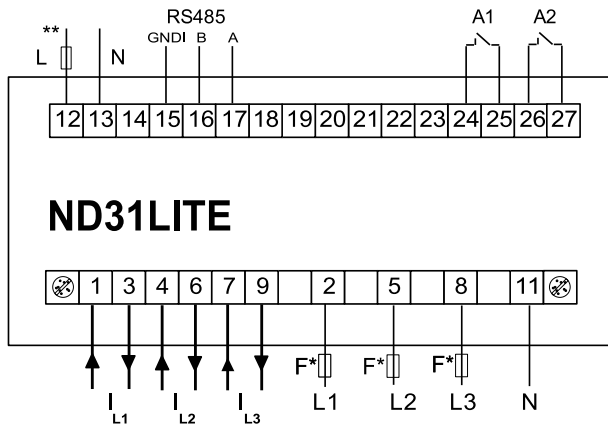
### 5.2. Voltage inputs

All voltage inputs are galvanically isolated (internal transformers). Values on voltage inputs are automatically converted according to the introduced ratio of the external voltage transformer. Voltage inputs are specified in the order as 3x57.7/100 V, 3x230/400 V.  
Available connection types:

- Three-phase four-wire systems with grounded/ungrounded neutral conductor with a system voltage of 3x57.7/100 V to 3x230/400V.
- Three-phase three-wire systems with grounded/ungrounded phase with a system voltage of 3x100 V to 3x400V,
- Single-phase two-wire systems 1x57.7V to 1x400V

### 5.3. External connection diagrams

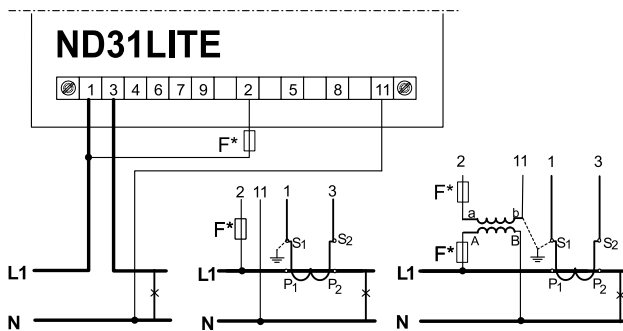
External connections are shown in Fig. 4-7.



\* Fuses must be provided by the customer

\*\* Connection of supply voltage

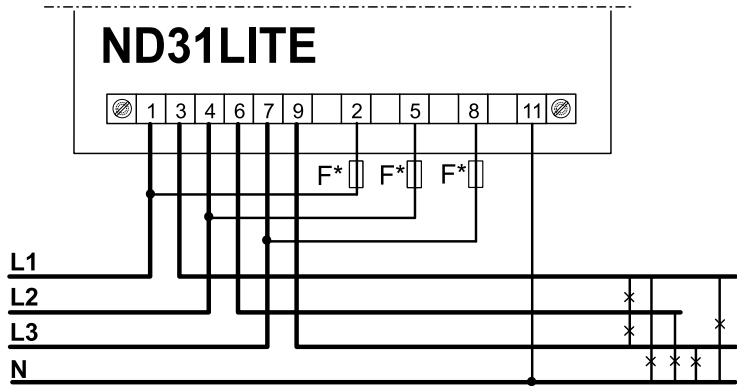
Fig. 4. Meter connections



\* Fuses must be provided by the customer

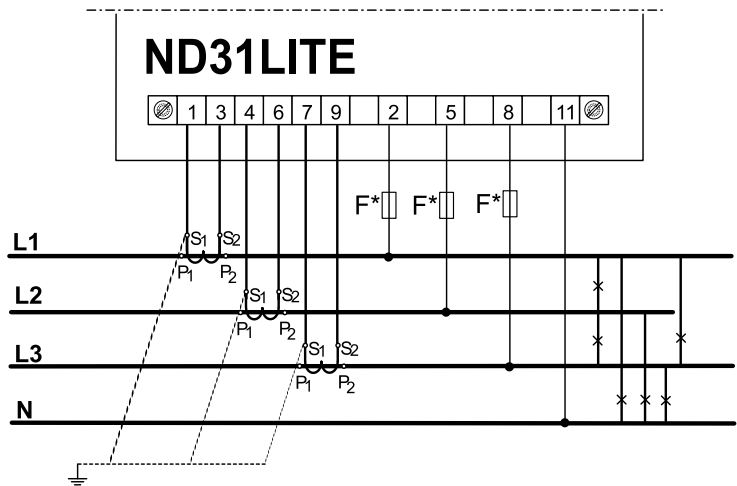
Fig. 5. Direct, semi-direct and indirect measurement in a 1-phase network

Direct measurement in a 4-wire network



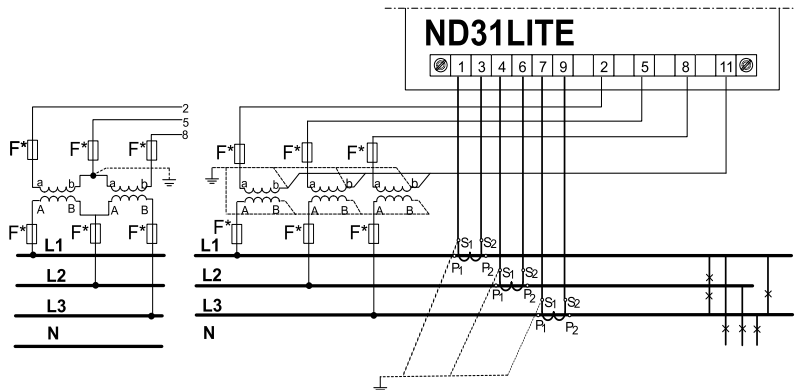
\* Fuses must be provided by the customer

Semi-direct measurement in a 4-wire network



\* Fuses must be provided by the customer

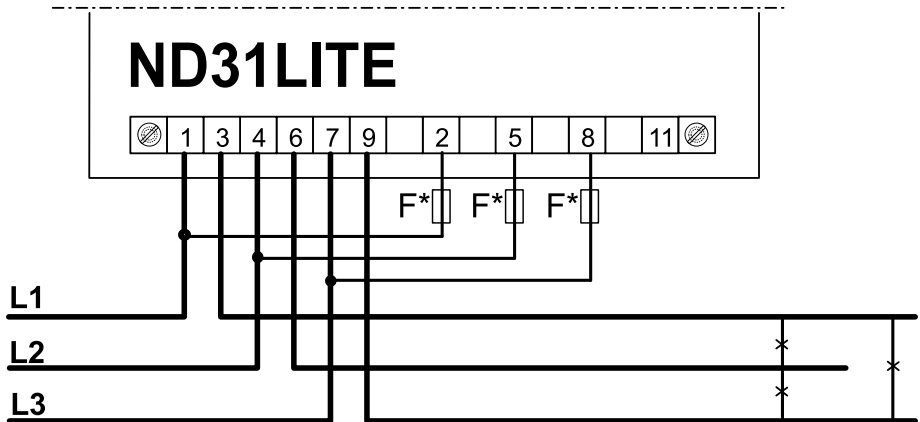
Indirect measurement in a 4-wire network



\* Fuses must be provided by the customer

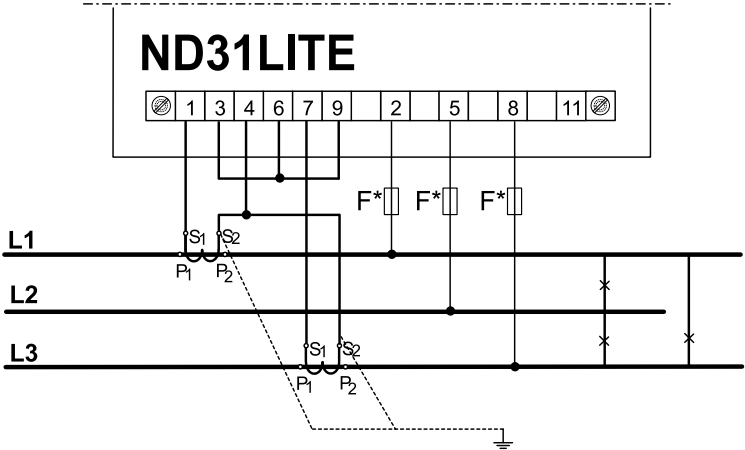
Fig.6.Connections of input signals in three-phase 4-wire network

Direct measurement in a 3-phase network



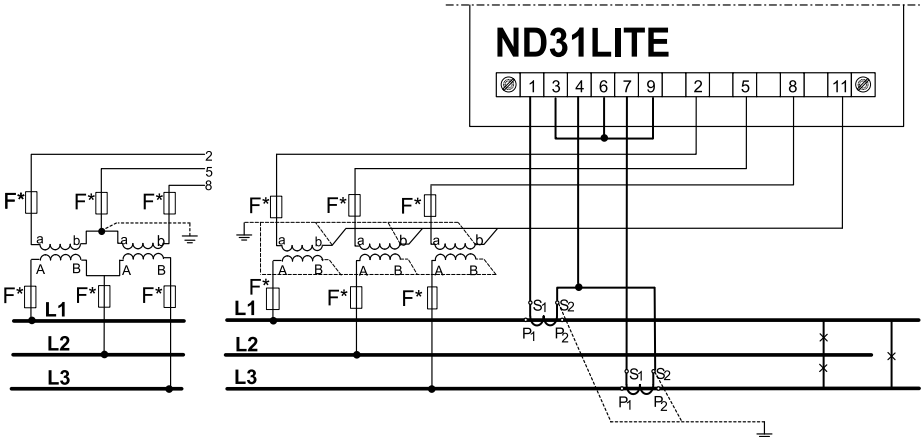
\* Fuses must be provided by the customer

Semi-direct measurement using 2 current transformers in a 3-wire network



\* Fuses must be provided by the customer

Indirect measurement using 2 current transformers and 2 or 3 voltage transformers in a 3-wire network



\* Fuses must be provided by the customer

Fig 7. Connections of input signals in 3-phase 3-wire network

# 6. ND31LITE PROGRAMMING

## 6.1. Front panel



Fig. 8. Front panel

The ND31 meter has 6 buttons and a full-color graphic screen.  
Front panel description:

|                                                                                                                                                                         |                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| f1, ... ,f8                                                                                                                                                             | 8 field displays - the digits for readout and settings,       |
| DMD                                                                                                                                                                     | Averaged value indicator (Demand)                             |
| V,A,W,var,<br>VA, Wh, varh,<br>Hz,                                                                                                                                      | units of the displayed values                                 |
| k, M                                                                                                                                                                    | kilo = 10 <sup>3</sup> , Mega = 10 <sup>6</sup>               |
| U1,I1, P1, ...<br>..EnQ                                                                                                                                                 | displayed parameters markings                                 |
|   | The markers indicating the inductive, capacity load character |

The values of the measured parameters are shown on the active pages selected by subsequent pressing the buttons  (next page) or  (previous page).

The page consists any 8 values selected from the Table 1 and displayed simultaneously on the display. The page definition is described in the Display mode. Depending on the location, meter buttons can perform different functions. Functions are described in the bar on the bottom of the screen. If the button lacks description, it is inactive at the moment.

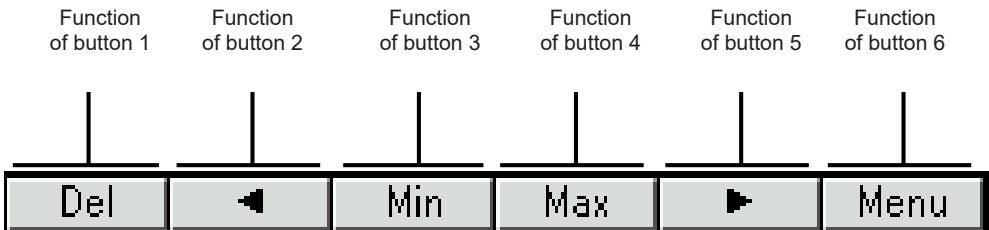


Fig. 9. Buttons marking – example

Information bar at the top of the screen displays the status of the alarm outputs, alarm conditions, the indicators of receiving and transmitting data on the RS485 link, date and real-time clock. A symbol „phase sequence error” will be blinking in case of a negative phase sequence.

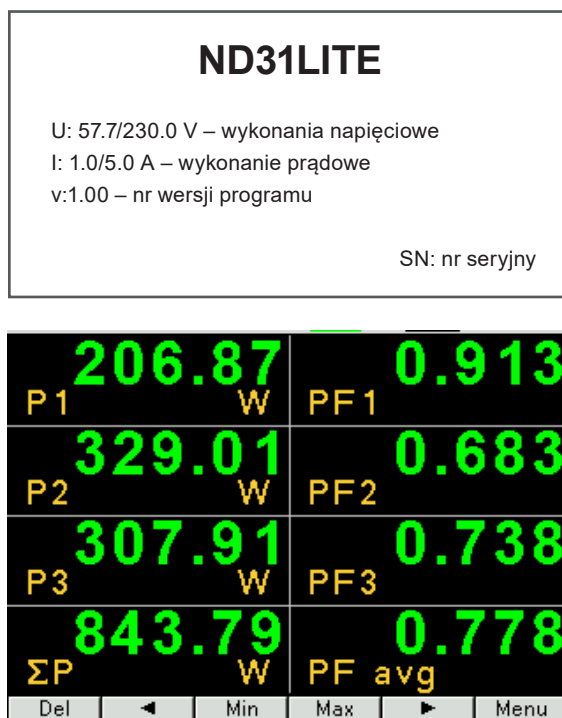


Fig. 10. Information bar

## 6.2. Starting work

After switching the supply on, the meter displays the ND31LITE meter name, version, current software version and then moves to the measurement mode and last saved page. If during the power-up the displayed screen shift to the right or left is observed, it is possible to correct this shift by setting the appropriate type of LCD display. To do this, go to the programming menu **Display** → **Settings** → **Display** type and select the correct type for which the image on the LCD screen is displayed correctly.

Displayed information:



Rys. 11. Ekran trybu pomiarowego miernika

## 6.3 Language selection

The preset language is English. To select a different language, press and hold the Menu button for about 10 seconds. The language selection menu will appear. The language selection is made with the ▲ or ▼ buttons and then confirmed again by pressing the OK button.

## 7. OPERATING MODES

The ND31LITE meter has 7 operating modes:

**Measure** – normal work mode. In the **Measure** mode the values are displayed according to the pages that are preset at the factory or configured by the user.

**Parameters** – meter parameters configuration,

**Alarms** – Alarm 1, Alarm 2 configuration,

**Display** – displayed pages configuration,

**Modbus** – RS485 interface parameters configuration,

**Settings** – settings: password, language, time, date,

**Information** – preview of a program version, serial number,

To move from the **Measure** mode to any other mode, press the button  for approx. 3 seconds.

Buttons   allow to select the appropriate mode, to accept press the button .

To return to a measurement mode use the button .

| Parameters | Connection wire                                                                                                                                                                    | Current input range                                                          | Voltage input range                                                                                                                                                  | Voltage transformer primary                                                                 | Voltage transformer secondary                                                               | Current transformer primary                                                                                                                                                        | Current transformer secondary                                                                                                                                                      |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | <input checked="" type="radio"/> 3 phase-4 wire<br><input type="radio"/> 3 phase-3 wire<br><input type="radio"/> 1 phase-2 wire                                                    | <input type="radio"/> 1 A<br><input type="radio"/> 5 A                       | <input checked="" type="radio"/> 3x57.7/100 V<br><input type="radio"/> 3x230/400 V                                                                                   | 0000100                                                                                     | 00100.0                                                                                     | 00005                                                                                                                                                                              | 00005                                                                                                                                                                              |
|            | Demand integ. time                                                                                                                                                                 | AVG synchronization                                                          | Voltage connector                                                                                                                                                    | Voltage connector 5                                                                         | Voltage connector 8                                                                         | Current connector 1-3                                                                                                                                                              | Current connector 4-6                                                                                                                                                              |
|            | <input checked="" type="radio"/> 15 min<br><input type="radio"/> 30 min<br><input type="radio"/> 60 min                                                                            | <input checked="" type="radio"/> lack<br><input type="radio"/> with RTC      | <input checked="" type="radio"/> U1<br><input type="radio"/> U2<br><input type="radio"/> U3                                                                          | <input type="radio"/> U1<br><input checked="" type="radio"/> U2<br><input type="radio"/> U3 | <input type="radio"/> U1<br><input type="radio"/> U2<br><input checked="" type="radio"/> U3 | <input checked="" type="radio"/> I1<br><input type="radio"/> -I1<br><input type="radio"/> I2<br><input type="radio"/> -I2<br><input type="radio"/> I3<br><input type="radio"/> -I3 | <input type="radio"/> I1<br><input type="radio"/> -I1<br><input checked="" type="radio"/> I2<br><input type="radio"/> -I2<br><input type="radio"/> I3<br><input type="radio"/> -I3 |
|            | Current connector 7-9                                                                                                                                                              | EnP energy count mode                                                        | Delete energy counters                                                                                                                                               | Delete demand values                                                                        | Set parameters default                                                                      |                                                                                                                                                                                    |                                                                                                                                                                                    |
|            | <input type="radio"/> I1<br><input type="radio"/> -I1<br><input type="radio"/> I2<br><input type="radio"/> -I2<br><input checked="" type="radio"/> I3<br><input type="radio"/> -I3 | <input checked="" type="radio"/> Ferraris<br><input type="radio"/> Per phase | <input checked="" type="radio"/> No<br><input type="radio"/> active<br><input type="radio"/> reactive<br><input type="radio"/> apparent<br><input type="radio"/> all | <input checked="" type="radio"/> No<br><input type="radio"/> Yes                            | <input checked="" type="radio"/> No<br><input type="radio"/> Yes                            |                                                                                                                                                                                    |                                                                                                                                                                                    |

Fig. 12. Programming matrix (Parameters)

| Alarms Configuration | Protection Relay 1                                    | Protection Relay 2                                    |
|----------------------|-------------------------------------------------------|-------------------------------------------------------|
|                      | <input type="radio"/> Off<br><input type="radio"/> On | <input type="radio"/> Off<br><input type="radio"/> On |

Menu only visible when Supervisory Relay is off

| Alarm 1<br>Alarm 2 | Settings                                     | Logical conditions                                                                                                                                                                   | Relay state if alarm on                                                                                                                                                            | Holdback alarm off                                    | Display alarm event                                   | Default settings                                                 |
|--------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------|
|                    |                                              | <input type="radio"/> C1<br><input type="radio"/> C1 v C2 v C3<br><input type="radio"/> C1 ^ C2 ^ C3<br><input type="radio"/> (C1 ^ C2) v C3<br><input type="radio"/> (C1 v C2) ^ C3 | <input type="radio"/> Off<br><input type="radio"/> On                                                                                                                              | <input type="radio"/> Off<br><input type="radio"/> On | <input type="radio"/> Off<br><input type="radio"/> On | <input checked="" type="radio"/> No<br><input type="radio"/> Yes |
|                    | Condition C1<br>Condition C2<br>Condition C3 | Value                                                                                                                                                                                | Condition type                                                                                                                                                                     | Low limit condition [%]                               | High limit condition [%]                              | Delay to condition on [s]                                        |
|                    |                                              | <input type="radio"/> U1<br><input type="radio"/> I1<br><input type="radio"/> P1<br><input type="radio"/> Q1<br>:<br><input type="radio"/> hh:mm                                     | <input type="radio"/> n_on<br><input type="radio"/> noFF<br><input type="radio"/> on<br><input type="radio"/> oFF<br><input type="radio"/> H_on<br>:<br><input type="radio"/> 3_oF | +0099.0                                               | +101.0                                                | 0000                                                             |
|                    |                                              | Delay to condition off [s]                                                                                                                                                           | Holdback condition on [s]                                                                                                                                                          | Display condition event                               |                                                       |                                                                  |
|                    |                                              | 0000                                                                                                                                                                                 | 0000                                                                                                                                                                               | <input type="radio"/> Off<br><input type="radio"/> On |                                                       |                                                                  |

Menu only visible when Supervisory Relay is on

| Alarm 1<br>Alarm 2        | Relay State during Alarm                              | Active phases count                                                                                                                                                                                                                                              | Alarm Type                                                                                                                                                                                                                                                                                                                                                                                              | Latch                                                 | Low Threshold [%]                                     |
|---------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| (Supervisory Relay is on) | <input type="radio"/> Off<br><input type="radio"/> On | <input type="radio"/> 1-st Phase<br><input type="radio"/> 2-nd Phase<br><input type="radio"/> 3-rd Phase<br><input type="radio"/> 1-2 Phasey<br><input type="radio"/> 1-3 Phase<br><input type="radio"/> 2-3 Phase<br><input checked="" type="radio"/> All Phase | <input type="radio"/> Undervoltage<br><input type="radio"/> Undercurrent<br><input type="radio"/> Overvoltage<br><input type="radio"/> Overcurrent<br><input type="radio"/> Window (Volt.)<br><input type="radio"/> Window (Curr.)<br><input type="radio"/> Phase Failure<br><input type="radio"/> Assymetry (Volt.)<br><input type="radio"/> Assymetry (Curr.)<br><input type="radio"/> Phase Sequence | <input type="radio"/> Off<br><input type="radio"/> On | 095                                                   |
|                           | High Threshold [%]                                    | Assymetry Threshold [%]                                                                                                                                                                                                                                          | ON State Delay [s]                                                                                                                                                                                                                                                                                                                                                                                      | OFF State Delay [s]                                   | Alarm Hold ON Reset                                   |
|                           | 105                                                   | 03                                                                                                                                                                                                                                                               | 0000                                                                                                                                                                                                                                                                                                                                                                                                    | 0000                                                  | <input type="radio"/> No<br><input type="radio"/> Yes |

Fig. 13. Programming matrix (Alarms)

|            |                            |                                                                                                                                                                                       |                                                                                                                                                                                         |                                                                                                                                            |                                                                                                                              |                                                              |                                                       |
|------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------|
| Displaying | Settings                   | Backlight level                                                                                                                                                                       | Time to backlight level min [s]                                                                                                                                                         | Screens cfg                                                                                                                                | Screens color                                                                                                                | LCD Display type                                             | Set screens defaults                                  |
|            |                            | <input type="radio"/> Screensaver<br><input type="radio"/> Minimum<br><input type="radio"/> Medium<br><input type="radio"/> Maximum                                                   | 0180                                                                                                                                                                                    | <input type="radio"/> Screen 1<br><input type="radio"/> Screen 2<br><input type="radio"/> Screen 3<br>:<br><input type="radio"/> Screen 13 | <input type="radio"/> Green<br><input type="radio"/> Red<br><input type="radio"/> Yellow<br>:<br><input type="radio"/> Olive | <input type="radio"/> Type 1<br><input type="radio"/> Type 2 | <input type="radio"/> No<br><input type="radio"/> Yes |
|            | Screen 1<br>:<br>Screen 10 | Display field 1<br>Display field 2<br>:<br>:<br>Display field 8                                                                                                                       | Displayed value                                                                                                                                                                         |                                                                                                                                            |                                                                                                                              |                                                              |                                                       |
|            |                            |                                                                                                                                                                                       | <input type="radio"/> Off<br><input checked="" type="radio"/> U1<br><input type="radio"/> I1<br><input type="radio"/> P1<br><input type="radio"/> Q1<br>:<br><input type="radio"/> En S |                                                                                                                                            |                                                                                                                              |                                                              |                                                       |
|            | Screen 13                  | Displayed value                                                                                                                                                                       | Bottom scale [%]                                                                                                                                                                        | Upper scale [%]                                                                                                                            |                                                                                                                              |                                                              |                                                       |
|            |                            | <input type="radio"/> Off<br><input checked="" type="radio"/> U1<br><input type="radio"/> I1<br><input type="radio"/> P1<br><input type="radio"/> Q1<br>:<br><input type="radio"/> T2 | -0144.0                                                                                                                                                                                 | +0144.0                                                                                                                                    |                                                                                                                              |                                                              |                                                       |

Fig. 14. Programming matrix (Displaying)

|             |          |                                                                                                                                                                                                                          |                                                                                                                                  |                                                        |                                                       |                                                       |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| Modbus      | Address  | Baud rate                                                                                                                                                                                                                | Mode                                                                                                                             | Set Defaults 42xx registers                            |                                                       |                                                       |
|             | 001      | <input type="radio"/> 4800 b/s<br><input checked="" type="radio"/> 9600 b/s<br><input type="radio"/> 19,2 kb/s<br><input type="radio"/> 38,4 kb/s<br><input type="radio"/> 57,6 kb/s<br><input type="radio"/> 115,2 kb/s | <input type="radio"/> RTU 8N2<br><input type="radio"/> RTU 8N1<br><input type="radio"/> RTU 8O1<br><input type="radio"/> RTU 8N1 | <input type="radio"/> Nie<br><input type="radio"/> Tak |                                                       |                                                       |
| Settings    | Password | Language                                                                                                                                                                                                                 | Time                                                                                                                             | Date                                                   | Synchronize time now                                  | Set defaults                                          |
|             | ****     | <input checked="" type="radio"/> English<br><input type="radio"/> Polski<br><input type="radio"/> Deutsch                                                                                                                | 13.47                                                                                                                            | 09/05/2023                                             | <input type="radio"/> No<br><input type="radio"/> Yes | <input type="radio"/> No<br><input type="radio"/> Yes |
| Information | Type     | Order code                                                                                                                                                                                                               | Boot Version                                                                                                                     | Program Version                                        | Serial Number                                         | MAC Address                                           |
|             | ND31     | 121100                                                                                                                                                                                                                   | 2.00                                                                                                                             | 1.00                                                   | 23050009                                              | aa.bb.<br>cc.00.21.01                                 |

Fig. 15. Programming matrix (others)

## 7.1. Measurement mode

In the **Measure** mode the values are displayed according to the screens that are preset at the factory or configured by the user in the **Display** mode.

Changing the screen is done by pressing the buttons  or .

Preview of the maximum or minimum values respectively is done while the button  or  is pressed down. Reset of maximum or minimum values is done by pressing the button  while viewing their values, i.e. first the button  or  and then  must be pressed.

Simultaneously pressing the button  and  will copy internal memory to files archive.

When reactive power or reactive inductive or capacity energy is displayed, this indication is accompanied by a symbol of the load character:  $\xi$  for an inductive load or  $\oplus$  for a capacity load.

When displaying the active power, the sign „+“ is displayed for active energy import or „-“ for active energy export.

Exceeding of the upper or lower indication range is signaled on the display by  $\wedge\wedge\wedge\wedge$  or  $\vee\vee\vee\vee$ .

For measurement of the averaged values (P DMD, S DMD, I DMD) single measurements are carried out with 0.25 second quantum. Averaging time to choose from: 15, 30 or 60 minutes. Until all samples of the averaged values are acquired, the values are calculated from already measured samples.

Current value in the neutral wire IN is calculated from phase current vectors.

### 7.1.1. Measurement of voltage and current harmonics

The choice of harmonics is done by selecting the screens dedicated to display the values of voltage harmonics U1, U2, U3 and currents I1, I2, I3 simultaneously for 3-phase (screen 11). The number of a displayed harmonics can be changed in the range of 2..63 by the buttons  or .

screen 12 shows a bar chart of the harmonics for each phase: voltage at the top and currents at the bottom of the screen. screen 12 shows a bar chart of the harmonics. The choice of displayed harmonics is done by pressing a button . The button  is used to select the groups of harmonics: harm<sub>2</sub> - harm<sub>26</sub>, harm<sub>27</sub> - harm<sub>52</sub> or harm<sub>2</sub> - harm<sub>51</sub>.

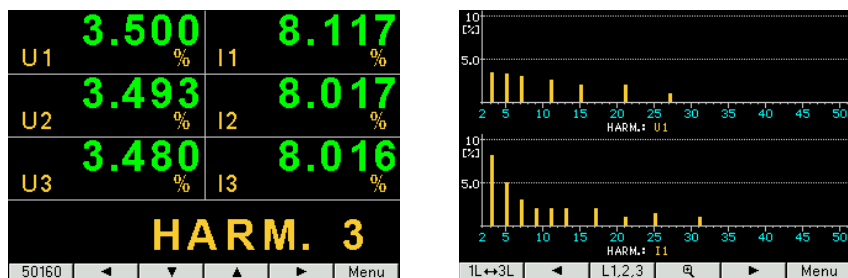


Fig. 16. Screens 11 and 12 - visualization of harmonics

## 7.1.2. Analog indicator

Screen 13 shows the mapping of the selected quantity on the analog indicator. The selection of displayed quantity is made in the Display mode as described in item 7.5, by selecting screen 13. Preview or hiding of the maximum or minimum values takes place after pressing the **Max** or **Min** button respectively. Deleting the maximum or minimum values is done by pressing the **Del** and then **Max** or **Min** button. If the lower or upper scale threshold is exceeded, the message BOTTOM SCALE or UPPER SCALE appears.

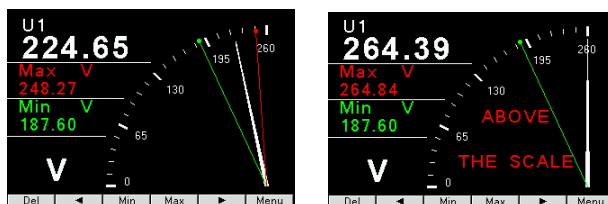


Fig. 17. Screen 13 - visualization of the analog indicator

## 7.2. Access password

### The principle of access password

Access to the meter configuration is protected by a password if it is entered and is different from zero. If the password is 0000, the password question is skipped. If the password is wrong, the message „Incorrect password. Read-only menu.“ Then it is possible to view the meter configuration, but changes are blocked.

**Note 1:** If the user has a valid password set, and it is a password other than „0000“, and the user unlocks the password, then when the power is turned off and on again, access to the configuration is again locked with the password. To erase the forgotten access password, contact the manufacturer's service

department.

**Note 2:** The valid range of values for the password is „0000 ... 9999”.

**Note 3:** The factory default password is „0000” and the password lock function is disabled.

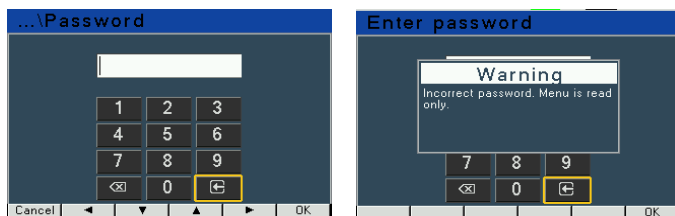


Fig. 18. Screens while entering a password

### 7.3. Parameters mode

This mode is used to determine the parameters of the meter. To enter Parameters mode press the button **Menu** for approx. 3 seconds and next using the button **▲** or **▼** select Parameters mode, to accept press the button **Select**. The parameters configuration mode is protected by a password, if it was entered and it is different from zero.

If the password is correct or it has not been entered, you can set the values according to Table 1. Buttons **▲** **▼** are used to choose the parameter, to accept press the button **Select**.

Then use the buttons **▲** **▼** to choose the features of a parameter or set the requested parameter values, i.e. you can choose the digit in the decimal position by the button **◀** or **▶** the digit value by the button **▲** or **▼**. The active position is signaled by the cursor. Set value or parameter can be accepted by the button **OK** or canceled by pressing **Cancel**. Exit from the Parameters procedure follows pressing simultaneously the button **Esc** or after waiting for approx. 120 seconds. Exit from the Selecting parameters menu follows pressing the button **Exit** or after waiting for approx. 120 seconds.

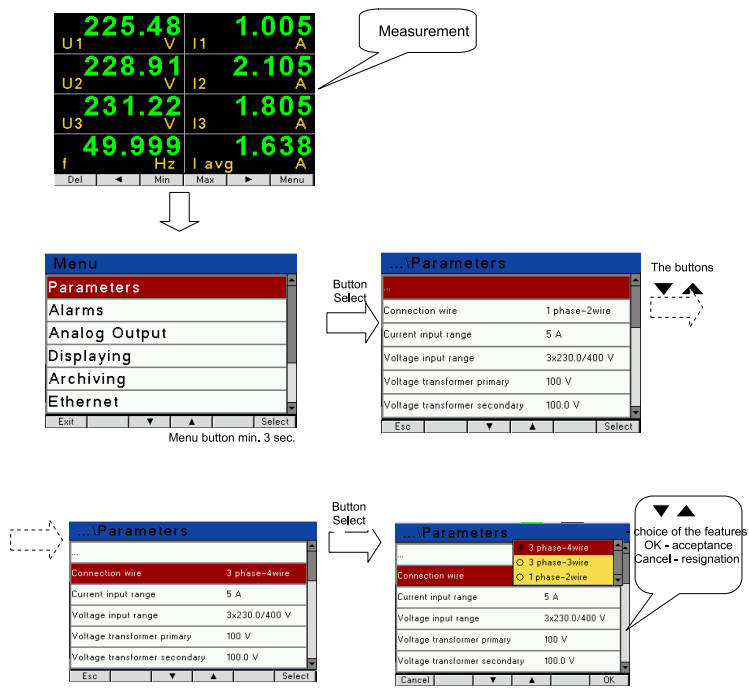


Fig. 19. Screens of Parameters mode

Table 1

| Item | Parameter name                | Feature / value                                                     | Description                                                                 | Default settings                 |
|------|-------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------|
| 1    | Connection wire               | 3 phase -4 wire<br>3 phase -3 wire<br>1 phase -2 wire               | Type of power network<br>3-phase 4-wire<br>3-phase 3-wire<br>1-phase 2-wire | 3 phase -4 wire                  |
| 2    | Current input range           | 1A, 5A                                                              | Input range: 1A or 5A                                                       | 5A                               |
| 3    | Voltage input range           | 3x57.7/100 V;<br>3x230/400 V;<br>or<br>3x110/190 V;<br>3x400/690 V; | Choice of the ranges depending on the ordering code                         | 3x230/400 V<br>or<br>3x400/690 V |
| 4    | Voltage transformer primary   | 1 .. 1245183 V                                                      |                                                                             | 100                              |
| 5    | Voltage transformer secondary | 0.1 .. 1000.0                                                       |                                                                             | 100.0                            |
| 6    | Current transformer primary   | 1...20000                                                           |                                                                             | 5                                |
| 7    | Current transformer secondary | 1...1000                                                            |                                                                             | 5                                |

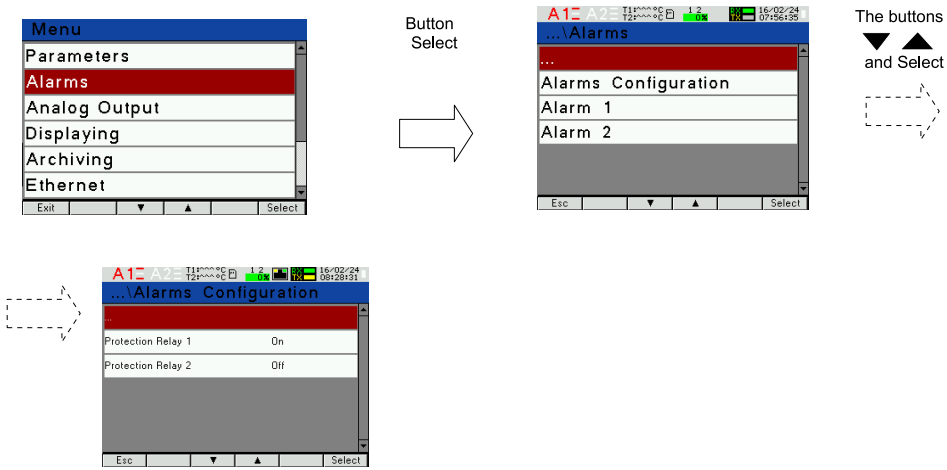
|    |                        |                                        |                                                                                                                                                                                                                                               |               |
|----|------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 8  | Damend integ. time     | 15 min, 30 min, 60 min                 | Averaging time<br>active power P DMD,<br>apparent power S DMD,<br>current I DMD                                                                                                                                                               | 15 min        |
| 9  | AVG synchronization    | none, with RTC                         | Averaging synchronized with the real-time clock                                                                                                                                                                                               | none          |
| 10 | PT100 resist on inp 1  | 0000.00                                | Resistance value in $\Omega$                                                                                                                                                                                                                  | 0.00 $\Omega$ |
| 11 | PT100 resist on inp 2  | 0000.00                                | Resistance value in $\Omega$                                                                                                                                                                                                                  | 0.00 $\Omega$ |
| 12 | Voltage connector 2    | U1, U2, U3                             |                                                                                                                                                                                                                                               | U1            |
| 13 | Voltage connector 5    | U1, U2, U3                             |                                                                                                                                                                                                                                               | U2            |
| 14 | Voltage connector 8    | U1, U2, U3                             |                                                                                                                                                                                                                                               | U3            |
| 15 | Current connector 1-3  | I1,-I1,I2,-I2,I3,-I3                   |                                                                                                                                                                                                                                               | I1            |
| 16 | Current connector 4-6  | I1,-I1,I2,-I2,I3,-I3                   |                                                                                                                                                                                                                                               | I2            |
| 17 | Current connector 7-9  | I1,-I1,I2,-I2,I3,-I3                   |                                                                                                                                                                                                                                               | I3            |
| 18 | EnP energy count mode  | Ferraris, Per phase                    | Ferraris:<br>EnP+ = L1 + L2 + L3<br>(if sum > 0)<br>EnP- = L1 + L2 + L3<br>(if sum < 0)<br><br>Per phase:<br>EnP+ consumption from individual phases<br>whose power P > 0<br><br>EnP- consumption from individual phases<br>whose power P < 0 | Ferraris      |
| 19 | Delete energy counters | No, Active, Reactive,<br>Apparent, All |                                                                                                                                                                                                                                               | No            |
| 20 | Delete demand values   | No, Yes                                |                                                                                                                                                                                                                                               | No            |
| 21 | Default parameters     | No, Yes                                |                                                                                                                                                                                                                                               | No            |

During changing the parameter, it is check if the value is in the range. If the set value falls outside the allowable range, the value is set to the maximum value (when entered value is too high) or minimum value (when it is too low).

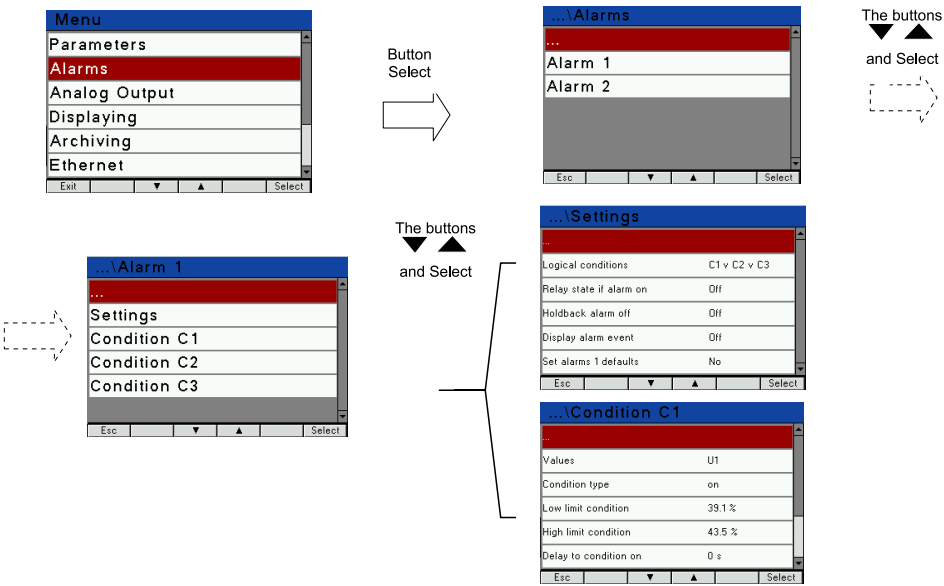
**Free eCon software can also be used for configuration of the ND31 meters, it is available on the website [www.lumel.com.pl](http://www.lumel.com.pl).**

7.4. Alarms mode

In the options, select the Alarms mode and confirm selection by pressing the button **Select**.



When the supervisory relay is off



When the supervisory relay is on::

| ...\Alarm 1              |              |
|--------------------------|--------------|
| Relay State during Alarm | Off          |
| Active phases count      | All Phases   |
| Alarm Type               | Undervoltage |
| Latch                    | Off          |
| Low Threshold            | 95 %         |
| Esc                      | Select       |

Fig. 20. Screens of Alarms mode

Table 2

| Item |                     | Parameter name      | Range                   | Notes / description                                                    | Default settings                                                                                                                                                                                                                                                                                                                                                    |
|------|---------------------|---------------------|-------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Protection Relay on | Alarm configuration | Protection Relay 1, 2   |                                                                        | Off                                                                                                                                                                                                                                                                                                                                                                 |
| 2    |                     | Settings            | Logical conditions      | C1<br>C1 ∨ C2 ∨ C3<br>C1 ∧ C2 ∧ C3<br>(C1 ∧ C2) ∨ C3<br>(C1 ∨ C2) ∧ C3 | C1<br><br>∨ – logic sum<br>∧ – logic product                                                                                                                                                                                                                                                                                                                        |
| 3    |                     |                     | Relay state if alarm on | Off/On                                                                 | State of the relay at the alarm switched on Off/On                                                                                                                                                                                                                                                                                                                  |
| 4    |                     |                     | Holdback alarm off      | Off/On                                                                 |                                                                                                                                                                                                                                                                                                                                                                     |
| 5    |                     |                     | Display alarm event     | Off/On                                                                 | When alarm indication function is enabled and the alarm state ends, alarm symbol is not turned off but begins to flash. Signalization symbol flashes until it is turned off by pressing the button  and  (> 1 sec.). This function refers only to the alarm signalization, so the relay contacts will operate without a latch according to the selected alarm type. |

|    |                                |                                           |                            |                                                                                                                                                                             |                                                                                                                                                                                                                                             |       |
|----|--------------------------------|-------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 6  | Przełącznik nadzorczy włączony | Condition 1<br>Condition 2<br>Condition 3 | Values                     | U1,I1,...,T2,hh:mm                                                                                                                                                          | Value on the alarm output parameters acc. to Table 8                                                                                                                                                                                        | U1    |
| 7  |                                |                                           | Condition 1                | n_on, noFF, on,oFF, H_on, HoFF, 3non, 3noF, 3_on, 3_oF                                                                                                                      | Acc. to Fig.17.                                                                                                                                                                                                                             | n-on  |
| 8  |                                |                                           | Low limit condition        | -144.0...144.0                                                                                                                                                              | in % of the rated input value                                                                                                                                                                                                               | 90.0  |
| 9  |                                |                                           | Condition 2                | -144.0...144.0                                                                                                                                                              | in % of the rated input value                                                                                                                                                                                                               | 110.0 |
| 10 |                                |                                           | Condition 3                | 0 ... 3600                                                                                                                                                                  | in seconds                                                                                                                                                                                                                                  | 0     |
| 11 |                                |                                           | Delay to condition off     | 0 ... 3600                                                                                                                                                                  | in seconds                                                                                                                                                                                                                                  | 0     |
| 12 |                                |                                           | Holdback condition off->on | 0 ... 3600                                                                                                                                                                  | in seconds                                                                                                                                                                                                                                  | 0     |
| 13 |                                |                                           | Display condition event    | Off/On                                                                                                                                                                      | When a latch function is enabled and the condition state ends, condition symbol is not turned off but begins to flash. Signalization symbol flashes until it is turned off by pressing the button <b>Kasuj</b> and <b>Alarm</b> (> 3 sec.). | Off   |
| 14 | Przełącznik nadzorczy włączony | Condition 1<br>Condition 2<br>Condition 3 | Relay State during Alarm   | Off/On                                                                                                                                                                      |                                                                                                                                                                                                                                             | U1    |
| 15 |                                |                                           | Liczba aktywnych faz       | 1-st Phase, 2-nd Phase, 3-rd Phase, 1-2 Phases, 2-3 Phases, All Phases                                                                                                      |                                                                                                                                                                                                                                             | n-on  |
| 16 |                                |                                           | Typ alarmu                 | Undervoltage<br>Undercurrent<br>Overvoltage<br>Overcurrent<br>Window (Volt.)<br>Window (Curr.)<br>Phase Failure<br>Assymetry (Volt.)<br>Assymetry (Curr.)<br>Phase Sequence |                                                                                                                                                                                                                                             | 90.0  |
| 17 |                                |                                           | Latch                      | off/on                                                                                                                                                                      |                                                                                                                                                                                                                                             | Wyl.  |
| 18 |                                |                                           | Low Threshold              | 5...140                                                                                                                                                                     |                                                                                                                                                                                                                                             | 95    |

|    |                                       |                     |          |  |     |
|----|---------------------------------------|---------------------|----------|--|-----|
| 19 | Condition 1<br>Warunek 2<br>Warunek 3 | High Threshold      | 5...140  |  | 105 |
| 20 |                                       | Assymetry Threshold | 1...30   |  | 3   |
| 21 |                                       | ON State Delay [s]  | 0...3600 |  | 0   |
| 22 |                                       | OFF State Delay [s] | 0...3600 |  | 0   |
| 23 |                                       | Alarm Hold ON Reset | Nie/Tak  |  | Nie |

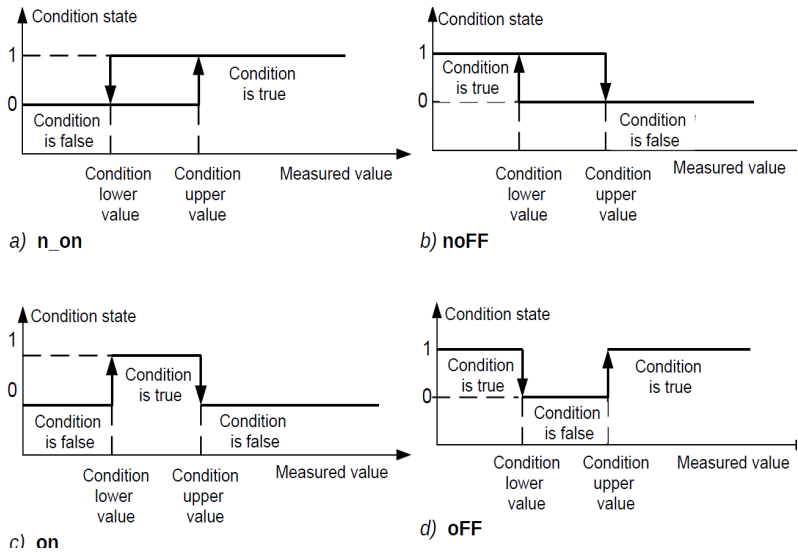


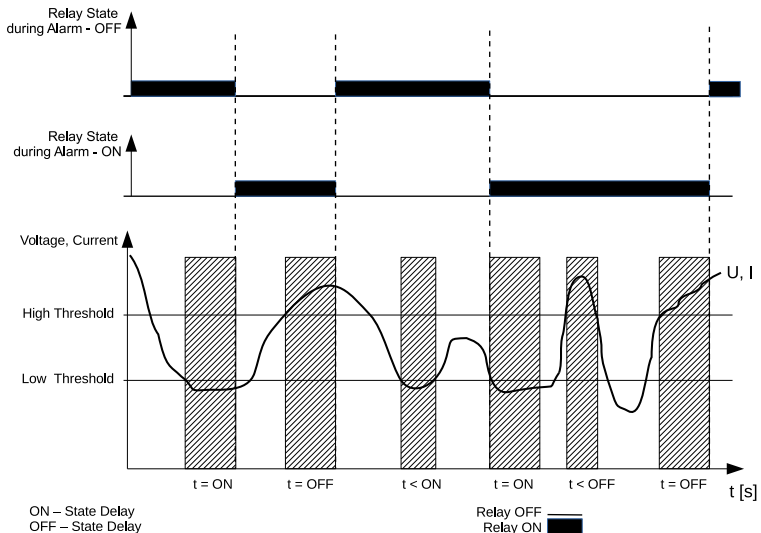
Fig. 21. Condition types: a) n\_on b) noFF c) on d) oFF

Remaining types of the condition:

- **H\_on** – always true;
- **HoFF** – always not true,
- **3non** – when the measuring value on any phase exceeds the „Condition upper value” - condition is true. The condition will be disabled if the measuring value on all phases will be lower than „Condition lower value”.
- **3noF** – when the measuring value on any phase will be lower than the „Condition lower value” - condition is true. The condition will be disabled if the measuring value on all phases will be higher than „Condition upper value”.
- **3\_on** – when the measuring value on any phase will be between the „Condition lower value” and „Condition upper value” - condition is true. The condition will be disabled if the measuring value on all phases will be below „Condition lower value” or above „Condition upper value”.
- **3\_oF** – when the measuring value on any phase will be below the „Condition lower value” or above „Condition upper value” - condition is true. The condition will be disabled if the measuring value on all phases will be between the „Condition lower value” and „Condition upper value”.
- The alarm value in the series 3 alarms must be in the range: 01-09, 10-18 and 19-27 (acc. to Table 8). They work with identical thresholds „Condition lower value” and „Condition upper value” for each phase. The blanking of the alarm signalization latch follows pressing the buttons **Del** | **Alarm** (> 3 sek).

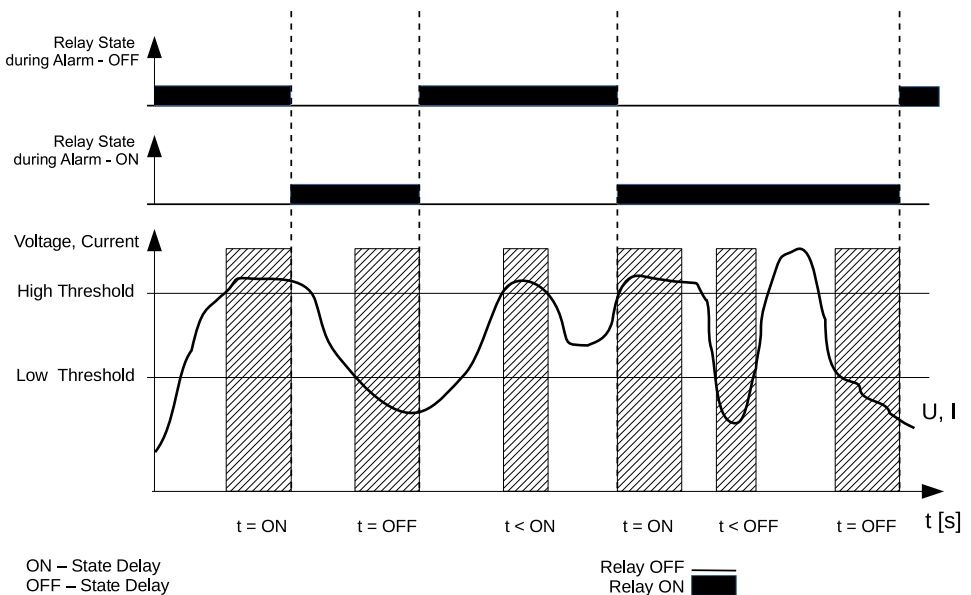
**Operation of alarms when the supervisory relay is on.**

**Alarms types: „Undervoltage”, „Undercurrent”**



The alarm is activated when the measured value (rms. value) of the voltage or current (depends on the „Alarm type” parameter) on one, one of two or one of three phases (depends on the „Active phases count” parameter) drops below the value specified by the „Low threshold” parameter. Once the threshold is exceeded, the alarm activation delay time („ON State Delay” parameter) starts to count down. After this time, the alarm is activated and the relay enters the state defined by the parameter „Relay State during Alarm”. The alarm is deactivated when the measured value (rms value) of the voltage or current on one, two or three phases (depends on the „Active phases count” parameter) rises above the value specified by the „High threshold” parameter. At that time, the alarm deactivation delay time (parameter „OFF State Delay”) begins to count down. After this time, the alarm is switched off. If the value of any of the parameters „ON State Delay”, „OFF State Delay” is equal to zero, the relay will be simultaneously activated/deactivated when the alarm is activated/deactivated.

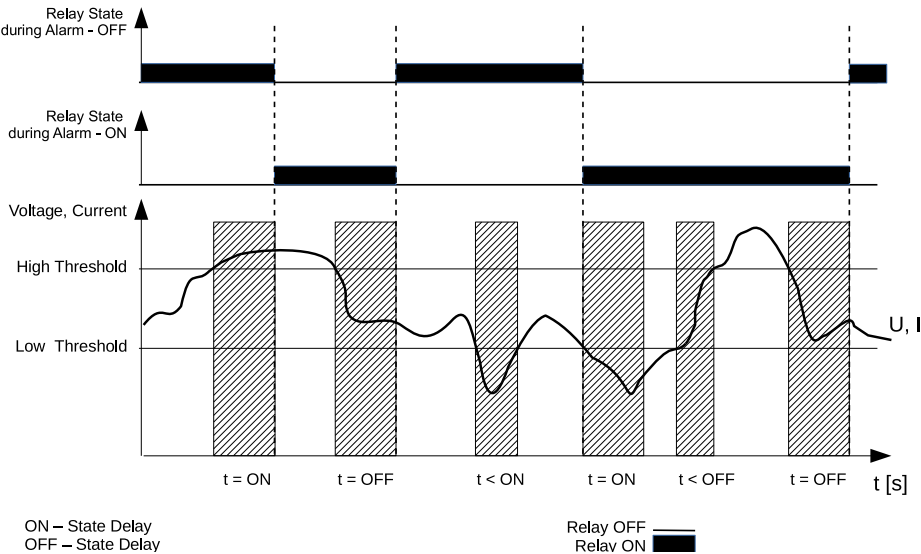
### Alarms types: „Overvoltage”, „Overcurrent”



The alarm is activated when the measured value (rms value) of the voltage or current (depends on the „Alarm type” parameter) on one, one of two or one of three phases (depends on the „Active phases count” parameter) rises above the value specified by the „High threshold” parameter. Once the threshold is exceeded, the alarm activation delay time („ON State Delay” parameter) starts counting down. After this time, the alarm is activated and the relay enters the state defined by the parameter „Relay State during Alarm”. The alarm is

deactivated when the measured value (rms value) of the voltage or current on one, two or three phases (depends on the „Active phases count” parameter) drops below the value specified by the „Low threshold” parameter. At that moment, the alarm deactivation delay time („OFF State Delay” parameter) starts to count down. After this time, the alarm is deactivated. If the value of any of the parameters „ON State Delay”, „OFF State Delay” is equal to zero, the transmitter will be switched on/off simultaneously when the alarm is switched on/off.

### Alarm types: „Window (Volt.)”, „Window (Curr.)”



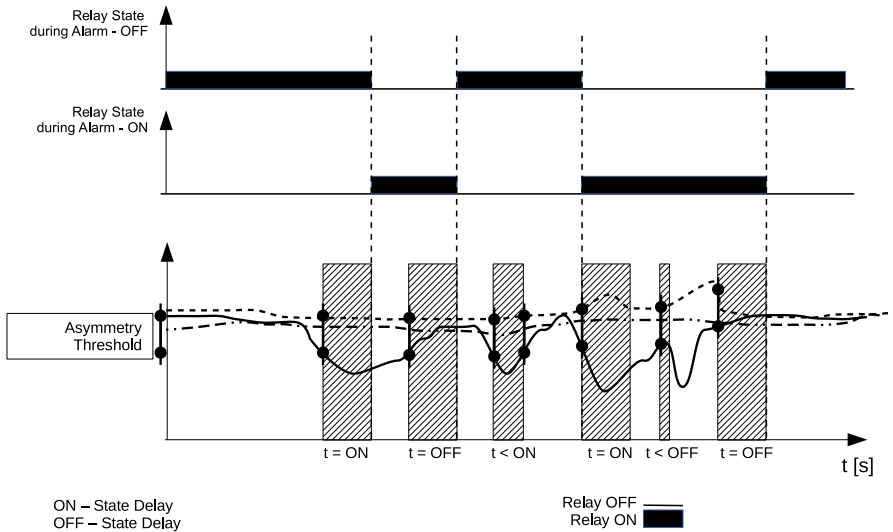
The alarm is activated when the measured value (rms value) of the voltage or current (depends on the „Alarm type” parameter) on one, one of two or one of three phases (depends on the „Active phases count” parameter) rises above the value specified by the „High threshold” parameter or falls below the value specified by the „Low threshold” parameter. When the threshold is exceeded, the alarm activation delay time („Alarm activation delay” parameter) begins to count down. After this time, the alarm is activated and the relay enters the state specified by the parameter „Relay State during Alarm”. The alarm is deactivated when the measured value (rms value) of the voltage or current on one, two or three phases (depends on the „Active phases count” parameter) falls between the values specified by the „Low threshold” and „High threshold” parameters. Then, the alarm deactivation delay time („OFF State Delay” parameter) starts counting down. After this time, the alarm is switched off. If the value of any of the parameters „ON State Delay”, „OFF State Delay” is equal

to zero, the transmitter will be switched on/off simultaneously when the alarm is switched on/off.

### Alarm type: „Phase Failure”

The principle of the alarm is analogous to that of the type alarm: „Undervoltage”, „Undercurrent”

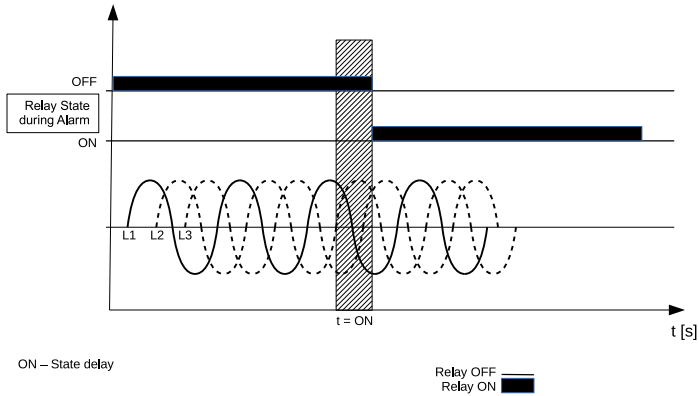
### Alarm types: „Asymmetry (Volt.)”, „Asymmetry (Curr.)”



When the asymmetry for the measured values (rms values) of voltages or currents (depends on the „Alarm Type” parameter) between two phases (depends on the „Active phases count” parameter) rises above the value specified by the „Asymmetry Threshold” parameter, the countdown of the alarm activation delay time („ON State Delay” parameter) begins. After this time, the alarm is activated and the transmitter goes into the state defined by the parameter „Relay State during Alarm”. The alarm is deactivated when the asymmetry for the measured values (rms values) of voltages or currents (depends on the „Alarm type” parameter) between phases (depends on the „Active phases count” parameter) drops below the value specified by the „Asymmetry Threshold” parameter. The alarm deactivation delay time („OFF State Delay” parameter) then starts to count down. After this time, the alarm is switched off. If the value of any of the parameters „ON State Delay”, „OFF State Delay” is equal to zero, the relay will be simultaneously activated/deactivated when the alarm is activated/deactivated.

For this type of alarm, the parameter „Active phases count” must be set to two or all phases.

### Alarm type: „Phase Sequence”



If a change in the phase sequence is detected, the alarm activation delay time („ON State Delay” parameter) begins to count down. After this time the alarm is activated and the transmitter enters the state defined by the parameter „Relay State during Alarm”. The alarm is deactivated when the phase sequence is correct. The alarm deactivation delay time starts then (parameter „OFF State Delay”). After this time, the alarm is switched off. If the value of any of the parameters „ON State Delay”, „OFF State Delay” is equal to zero, the transmitter will be simultaneously activated/deactivated when the alarm is activated/deactivated.

For this type of alarm, the parameter „Active phases count” must be set to two or all phases.

## 7.5 Display mode

In this mode, you can configure the screens displayed in a normal work mode of the meter Measurement

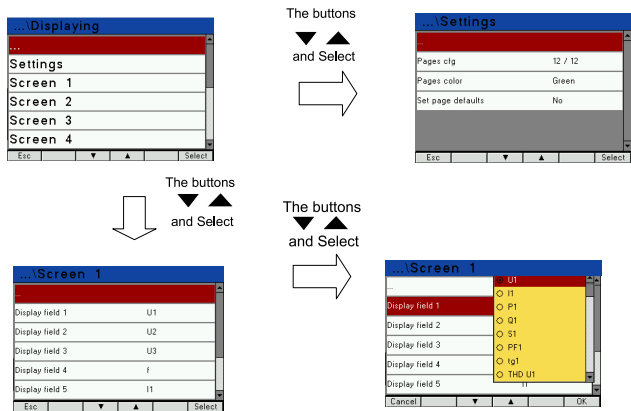


Fig. 22. Screens of Analog output mode

Table 3

| Item |                                 | Parameter name                               | Range                                               | Notes/description                                                                      | Default settings                                          |
|------|---------------------------------|----------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 1    | Settings                        | Back light level                             | Screensaver, Minimum, Medium, Maximum               |                                                                                        | Screensaver                                               |
|      |                                 | Time to Backlight level min                  | 0 .. 9999                                           | in seconds                                                                             | 180                                                       |
|      |                                 | screens cfg                                  | screen 1<br>screen 2<br>:<br>screen 11<br>screen 12 | Selection of screens visualized in Measurement mode                                    | screen 1<br>screen 2<br>:<br>screen 11<br>screen 12       |
|      |                                 | screens color                                | Green<br>Red<br>Yellow<br>:<br>Olive                | Color of displayed values in Measurement mode                                          | Green                                                     |
|      |                                 | Display type                                 | Type 1/ Type 2                                      | Type of display                                                                        | Type 1                                                    |
|      |                                 | Set screen defaults                          | No<br>Yes                                           |                                                                                        | No                                                        |
| 2    | Screen 1<br>:<br>:<br>Screen 10 | Display field 1<br>:<br>:<br>Display field 8 | Off<br>U1<br>:<br>I1<br>:<br>P1<br>:<br>En S        | Selection of displayed values on a selected screen and selected field acc. to Table 5. | Table 6a or 6b or 6c - depending on the connection system |

|   |           |                 |                            |                                                                                      |       |
|---|-----------|-----------------|----------------------------|--------------------------------------------------------------------------------------|-------|
| 3 | Screen 13 | Displayed value | Off<br>U1<br>I1<br>:<br>T2 | Selection of the visualized quantity on the analogue indicator according to table 5g | U1    |
|   |           | Bottom scale    | -0144.0                    | The lower value of the analog indicator scale                                        | 0.0   |
|   |           | Upper scale     | +0144.0                    | The upper value of the analog indicator scale                                        | 100.0 |

The **Backlight level** parameter is used to set the intensity of the LCD backlight. The set brightness level is constant as long as the **Time to Backlight level min** parameter has a value of 0. Setting the **Time to Backlight level min** parameter to a value different from zero, causes that after this time (when the buttons are not used) the LCD backlight is set to the minimum.

In order to protect the LCD screen, the meter is equipped with a screen saver function, which turns off the screen during operation and displays the date and time in random places. The screensaver is turned on by setting the **Backlight level** parameter to the **Screensaver** value and the time (when the buttons are not used) after which the screen is blanked is set by the **Time to Backlight level min** parameter.

Caution!

If during the power-up the displayed screen shift to the right or left is observed, it is possible to correct this shift by setting the appropriate type of LCD display – parameter **Display type**.

Selection of displayed values:

Table 4

| Item | value name                       | marking | unit   | Signaling | 3Ph | 3Ph | 1Ph |
|------|----------------------------------|---------|--------|-----------|-----|-----|-----|
| 00   | no value - blanked display field | Off     |        |           | √   | √   | √   |
| 01   | L1 phase voltage                 | U1      | (M,k)V |           | √   | x   | √   |
| 02   | L1 phase wire current            | I1      | (k)A   |           | √   | √   | √   |

|    |                                          |        |            |                                                                                   |   |   |   |
|----|------------------------------------------|--------|------------|-----------------------------------------------------------------------------------|---|---|---|
| 03 | L1 phase active power                    | P1     | (G,M,k)W   |                                                                                   | √ | x | √ |
| 04 | L1 phase reactive power                  | Q1     | (G,M,k)var |  | √ | x | √ |
| 05 | L1 phase apparent power                  | S1     | (G,M,k)VA  |                                                                                   | √ | x | √ |
| 06 | L1 phase active power factor (PF1=P1/S1) | PF1    |            |                                                                                   | √ | x | √ |
| 07 | tgφ factor of L1 phase (tg1=Q1/P1)       | tg1    |            |                                                                                   | √ | x | √ |
| 08 | L1 phase voltage THD*                    | THD U1 | %          |                                                                                   | √ | √ | √ |
| 09 | L1 phase current THD                     | THD I1 | %          |                                                                                   | √ | √ | √ |
| 10 | L2 phase voltage                         | U2     | (M,k)V     |                                                                                   | √ | x | x |
| 11 | L2 phase wire current                    | I2     | (k)A       |                                                                                   | √ | √ | x |
| 12 | L2 phase active power                    | P2     | (G,M,k)W   |                                                                                   | √ | x | x |
| 13 | L2 phase reactive power                  | Q2     | (G,M,k)var |  | √ | x | x |
| 14 | L2 phase apparent power                  | S2     | (G,M,k)VA  |                                                                                   | √ | x | x |
| 15 | L2 phase active power factor (PF2=P2/S2) | PF2    | PF         |                                                                                   | √ | x | x |
| 16 | tgφ factor of L2 phase (tg2=Q2/P2)       | tg2    |            |                                                                                   | √ | x | x |
| 17 | L2 phase voltage THD*                    | THD U2 | %          |                                                                                   | √ | √ | x |
| 18 | L2 phase current THD                     | THD I2 | %          |                                                                                   | √ | √ | x |

|    |                                             |        |            |                                                                                                                                                                       |   |   |   |
|----|---------------------------------------------|--------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|
| 19 | L3 phase voltage                            | U3     | (M,k)V     |                                                                                                                                                                       | √ | x | x |
| 20 | L3 phase wire current                       | I3     | (k)A       |                                                                                                                                                                       | √ | √ | x |
| 21 | L3 phase active power                       | P3     | (G,M,k)W   |                                                                                                                                                                       | √ | x | x |
| 22 | L3 phase reactive power                     | Q3     | (G,M,k)var |  /  | √ | x | x |
| 23 | L3 phase apparent power                     | S3     | (G,M,k)VA  |                                                                                                                                                                       | √ | x | x |
| 24 | L3 phase active power factor<br>(PF3=P3/S3) | PF3    |            |                                                                                                                                                                       | √ | x | x |
| 25 | tgφ factor of L3 phase<br>(tg3=Q3/P3)       | tg3    |            |                                                                                                                                                                       | √ | x | x |
| 26 | L3 phase voltage THD*                       | THD U3 | V%         |                                                                                                                                                                       | √ | √ | x |
| 27 | L3 phase current THD                        | THD I3 | A%         |                                                                                                                                                                       | √ | √ | x |
| 28 | mean phase voltage                          | U avg  | (M,k)V     |                                                                                                                                                                       | √ | x | x |
| 29 | mean 3-phase current                        | I avg  | (k)A       |                                                                                                                                                                       | √ | √ | x |
| 30 | 3-phase active power                        | ΣP     | (G,M,k)W   | +/-                                                                                                                                                                   | √ | √ | √ |
| 31 | 3-phase reactive power                      | ΣQ     | (G,M,k)var |  /  | √ | √ | √ |
| 32 | 3-phase apparent power                      | ΣS     | (G,M,k)VA  |                                                                                                                                                                       | √ | √ | √ |
| 33 | active power factor<br>3-phase (PF=P/S)     | PF avg |            |                                                                                                                                                                       | √ | √ | x |
| 34 | tgφ factor average for 3<br>phases (tg=Q/P) | tg avg |            |                                                                                                                                                                       | √ | √ | x |
| 35 | THD U mean 3-phase*                         | THD U  | %          |                                                                                                                                                                       | √ | √ | x |
| 36 | THD I mean 3-phase                          | THD I  | %          |                                                                                                                                                                       | √ | √ | x |
| 37 | frequency                                   | f      | Hz         |                                                                                                                                                                       | √ | √ | √ |

|    |                                            |                                                                                                 |           |  |   |   |   |
|----|--------------------------------------------|-------------------------------------------------------------------------------------------------|-----------|--|---|---|---|
| 38 | phase-to-phase voltage<br>L1-L2            | U12                                                                                             | (M,k)V    |  | √ | √ | x |
| 39 | phase-to-phase voltage<br>L2-L3            | U23                                                                                             | (M,k)V    |  | √ | √ | x |
| 40 | phase-to-phase voltage<br>L3-L1            | U31                                                                                             | (M,k)V    |  | √ | √ | x |
| 41 | mean phase-to-phase<br>voltage             | U123                                                                                            | (M,k)V    |  | √ | √ | x |
| 42 | active power averaged<br>(P Demand)        | P DMD                                                                                           | (G,M,k)W  |  | √ | √ | √ |
| 43 | apparent power avera-<br>ged (S Demand)    | S DMD                                                                                           | (G,M,k)VA |  | √ | √ | √ |
| 44 | current averaged (I<br>Demand)             | I DMD                                                                                           | (k)A      |  | √ | √ | √ |
| 45 | neutral wire current                       | I(N)                                                                                            | (k)A      |  | √ | x | x |
| 46 | Temperature T1 of<br>input 1               | T1                                                                                              | °C        |  | √ | √ | √ |
| 47 | Temperature T2 of<br>input 2               | T2                                                                                              | °C        |  | √ | √ | √ |
| 48 | 3-phase imported active<br>energy **       | En P+                                                                                           | kWh       |  | √ | √ | √ |
| 49 | 3-phase exported active<br>energy **       | En P-                                                                                           | kWh       |  | √ | √ | √ |
| 50 | 3-phase reactive<br>inductive energy **    | Ev $\Theta$  | kvarh     |  | √ | √ | √ |
| 51 | 3-phase reactive capaci-<br>tive energy ** | Ev $\Theta$  | kvarh     |  | √ | √ | √ |
| 52 | 3-phase apparent<br>energy **              | Ev $\Sigma$                                                                                     | kVAh      |  | √ | √ | √ |

\* In the 3-phase 3-wire system (3Ph / 3W) respectively THD U12, THD U23, THD U31, THD U123

\*\* The quantities can not be visualized on the analogue indicator

Default settings of the displayed screens in 3-phase 4-wire system

Table 5

| P1         |         | P2                        |        | P3     |        | P4      |         | P5        |            |
|------------|---------|---------------------------|--------|--------|--------|---------|---------|-----------|------------|
| U1 V       | I1 A    | U12 V                     | ΣP W   | P1 W   | PF1    | P1 W    | Q1 var  | THD U1 %  | THD I1 %   |
| U2 V       | I2 A    | U23 V                     | ΣQ var | P2 W   | PF2    | P2 W    | Q2 var  | THD U2 %  | THD I2 %   |
| U3 V       | I3 A    | U31 V                     | ΣS VA  | P3 W   | PF3    | P3 W    | Q3 var  | THD U3 %  | THD I3 %   |
| f Hz       | I avg A | U123 V                    | PF avg | ΣP W   | PF avg | ΣP W    | ΣQ var  | THD U %   | THD I %    |
| P6         |         | P7                        |        | P8     |        | P9      |         | P10       |            |
| U1 V       | S1 VA   | U2 V                      | S2 VA  | U3 V   | S3 VA  | ΣP W    | P DMD W | ΣP W      | +En P kWh  |
| I1 A       | PF1     | I2 A                      | PF2    | I3 A   | PF3    | ΣQ var  | S DMD W | ΣQ var    | -En P kWh  |
| P1 W       | tg1     | P2 W                      | tg2    | P3 W   | tg3    | I avg A | I DMD A | ΣS VA     | En Q kvarh |
| Q1 var     | f Hz    | Q2 var                    | f Hz   | Q3 var | f Hz   | I(N) A  | f Hz    | En S kVAh | En Q kvarh |
| P11        |         | P12                       |        |        |        |         |         |           |            |
| U1 %       | I1 %    | HARM.:U1U2U3 %<br>bargraf |        |        |        |         |         |           |            |
| U2 %       | I2 %    |                           |        |        |        |         |         |           |            |
| U3 %       | I3 %    | HARM.:I1I2I3 %<br>bargraf |        |        |        |         |         |           |            |
| HARM.2..63 |         |                           |        |        |        |         |         |           |            |

screens 11 and 12 cannot be configured.

Default settings of the displayed screens in 3-phase 3-wire system

Table 6

| P1    |         | P2     |        | P3      |         | P4         |          | P5        |            |
|-------|---------|--------|--------|---------|---------|------------|----------|-----------|------------|
| U12 V | I1 A    | U12 V  | ΣP W   | ΣP W    | P DMD W | THD U12 %  | THD I1 % | ΣP W      | En P+ kWh  |
| U23 V | I2 A    | U23 V  | ΣQ var | ΣQ var  | S DMD W | THD U23 %  | THD I2 % | ΣQ var    | En P- kWh  |
| U31 V | I3 A    | U31 V  | ΣS VA  | I avg A | I DMD A | THD U31 %  | THD I3 % | ΣS VA     | En Q kvarh |
| f Hz  | I avg A | U123 V | PF avg | tg avg  | PF avg  | THD U123 % | THD I %  | En S kVAh | En Q kvarh |

Default settings of the displayed screens in 1-phase system

Table 7

| P1     |       | P2    |         | P3        |            |
|--------|-------|-------|---------|-----------|------------|
| U1 V   | S1 VA | P1 W  | P DMD W | P1 W      | En P+ kWh  |
| I1 A   | PF1   | S1 VA | S DMD W | Q1 var    | En P- kWh  |
| P1 W   | tg1   | I1 A  | I DMD A | S1 VA     | En Q kvarh |
| Q1 var | f Hz  | PF1   | f Hz    | En S kVAh | En Q kvarh |

Tablica 8

| Value in registers | Displayed element | Value type                      | Value of the needed for calculations of percentage corresponding to 100% of the rated range.. |
|--------------------|-------------------|---------------------------------|-----------------------------------------------------------------------------------------------|
| 01                 | U1                | L1 phase voltage                | Un [V] *                                                                                      |
| 02                 | I1                | L1 phase wire current           | In [A] *                                                                                      |
| 03                 | P1                | L1 phase active power           | Un x In x cos(0°) [W] *                                                                       |
| 04                 | Q1                | L1 phase reactive power         | Un x In x sin(90°) [Var] *                                                                    |
| 05                 | S1                | L1 phase apparent power         | Un x In [VA] *                                                                                |
| 06                 | PF1               | L1 phase power factor (PF)      | 1                                                                                             |
| 07                 | tg1               | tg factor of L1 phase           | 1                                                                                             |
| 08                 | THD U1            | L1 phase voltage THD**          | 100,00 [%]                                                                                    |
| 09                 | THD I1            | L1 phase current THD            | 100,00 [%]                                                                                    |
| 10                 | U2                | L2 phase voltage                | Un [V] *                                                                                      |
| 11                 | I2                | L2 phase wire current           | In [A] *                                                                                      |
| 12                 | P2                | L2 phase active power           | Un x In x cos(0°) [W] *                                                                       |
| 13                 | Q2                | L2 phase reactive power         | Un x In x sin(90°) [Var] *                                                                    |
| 14                 | S2                | L2 phase apparent power         | Un x In [VA] *                                                                                |
| 15                 | PF2               | L2 phase active power factor PF | 1                                                                                             |
| 16                 | tg2               | tg factor of L2 phase           | 1                                                                                             |
| 17                 | THD U2            | L2 phase voltage THD**          | 100,00 [%]                                                                                    |
| 18                 | THD I2            | L2 phase current THD            | 100,00 [%]                                                                                    |
| 19                 | U3                | L3 phase voltage                | Un [V] *                                                                                      |
| 20                 | I3                | L3 phase wire current           | In [A] *                                                                                      |
| 21                 | P3                | L3 phase active power           | Un x In x cos(0°) [W] *                                                                       |
| 22                 | Q3                | L3 phase reactive power         | Un x In x sin(90°) [Var] *                                                                    |
| 23                 | S3                | L3 phase apparent power         | Un x In [VA] *                                                                                |
| 24                 | PF3               | L3 phase active power factor PF | 1                                                                                             |
| 25                 | tg3               | tg factor of L3 phase           | 1                                                                                             |
| 26                 | THD U3            | L3 phase voltage THD**          | 100,00 [%]                                                                                    |
| 27                 | THD I3            | L3 phase current THD            | 100,00 [%]                                                                                    |
| 28                 | U avg             | mean phase voltage              | 0,00 [%]                                                                                      |
| 29                 | I avg             | mean 3-phase current            | In [A] *                                                                                      |

|    |               |                                      |                                                         |
|----|---------------|--------------------------------------|---------------------------------------------------------|
| 30 | $\Sigma P$    | 3-phase active power<br>(P1+P2+P3)   | $3 \times U_n \times I_n \times \cos(0^\circ)$ [W] *    |
| 31 | $\Sigma Q$    | 3-phase reactive power<br>(Q1+Q2+Q3) | $3 \times U_n \times I_n \times \sin(90^\circ)$ [Var] * |
| 32 | $\Sigma S$    | 3-phase apparent power<br>(S1+S2+S3) | $3 \times U_n \times I_n$ [VA] *                        |
| 33 | PF avg        | 3-phase power factor (PF)            | 1                                                       |
| 34 | tg avg        | tg factor $\phi$ for 3 phases        | 1                                                       |
| 35 | THD U         | 3-phase voltage THD**                | 100,00 [%]                                              |
| 36 | THD I         | 3-phase current THD                  | 100,00 [%]                                              |
| 37 | f             | frequency                            | 100 [Hz]                                                |
| 38 | U12           | phase-to-phase voltage L1-L2         | $U_n$ [V] *                                             |
| 39 | U23           | phase-to-phase voltage L2-L3         | $U_n$ [V] *                                             |
| 40 | U31           | phase-to-phase voltage L3-L1         | $U_n$ [V] *                                             |
| 41 | U123          | mean phase-to-phase voltage          | $U_n$ [V] *                                             |
| 42 | P DMD         | active power averaged (P Demand)*    | $3 \times U_n \times I_n \times \cos(0^\circ)$ [W] *    |
| 43 | S DMD         | apparent power averaged (S Demand)*  | $3 \times U_n \times I_n$ [VA] *                        |
| 44 | I DMD         | current averaged (I Demand) *        | $I_n$ [A] *                                             |
| 45 | I(N)          | neutral wire current                 | $I_n$ [A] *                                             |
| 46 | T1            | Temperature T1 of input 1            | 400 [°C]                                                |
| 47 | T2            | Temperature T2 of input 2            | 400 [°C]                                                |
| 48 | En P+         | Active 3-phase import energy         | 100000 [kWh]                                            |
| 49 | En P-         | Active 3-phase export energy         | 100000 [kWh]                                            |
| 50 | En Q          | Reactive 3-phase inductive energy    | 100000 [kvarh]                                          |
| 51 | En Q          | Reactive 3-phase capacity energy     | 100000 [kvarh]                                          |
| 52 | En S          | 3-phase apparent energy              | 100000 [kVAh]                                           |
| 53 | Kolejność faz | Phase sequence                       | L1,L2,L3 - 0,00 [%]                                     |
| 54 | gg:mm         | time, hhx100+mm                      | L1,L3,L2 - 100,00 [%]                                   |

\* $U_n$ ,  $I_n$  - rated values of rated voltages and currents

\*\* In the 3-phase 3-wire (3Ph / 3W) respectively THD U12, THD U23, THD U31 THD U123

To register in each group, you can select 16 of 53 parameters (bits 1 to 53 of the registers 4106...4109 and 4115...4118). Bit set to „1” adds a parameter to a registration, set to „0” deletes. It is possible to set all 53 bits but only the first 16 bits set to „1” will be taken for a registration.

## 7.6. Modbus mode

In the options, select the Modbus mode and confirm your choice by pressing the button  .

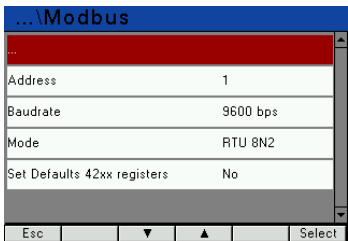


Fig.23. Screens of Modbus mode

Table 9

| Item | Parameter name              | Feature / value                                                 | Description                                 | Manufacturer's value |
|------|-----------------------------|-----------------------------------------------------------------|---------------------------------------------|----------------------|
| 1    | Address                     | 1...247                                                         | Modbus Network Address                      | 1                    |
| 2    | Baud rate                   | 4800 b/s, 9600 b/s, 19,2 kb/s, 38,4 kb/s, 57,7 kb/s, 115,2 kb/s | Baud rate                                   | 9600 b/s             |
| 3    | Mode                        | RTU 8N2, RTU 8N1, RTU 8O1, RTU 8N1                              | Transmission mode                           | RTU 8N2              |
| 4    | Set Defaults 42xx registers | No, Yes                                                         | Programmable group of registers for readout | No                   |

## 7.7. Settings mode

In the options, select the Settings mode and confirm your choice by pressing the button  .

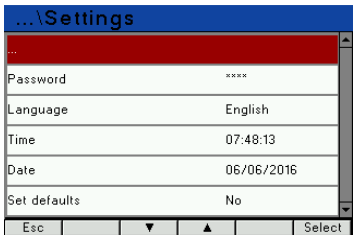


Fig.24. Screens of Settings mode

Table 10

| Item. | Parameter name | Feature / value          | Description    | Manufacturer's value |
|-------|----------------|--------------------------|----------------|----------------------|
| 1     | Password       | 0 .. 9999                | 0 - disabled   | 0                    |
| 2     | Language       | English, Polski, Deutsch |                | English              |
| 3     | Time           | hh:mm                    | hour:minute    | 00:00:00             |
| 4     | Date           | dd/mm/yyyy               | Day/month/year | 1.01.2015            |
| 5     | Set defaults   | No, Yes                  |                | No                   |

7.11. Information mode

In the options, select the Information mode and confirm your choice by pressing the button **Select** .

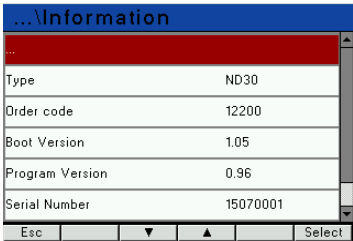


Fig.25. Screens of Information mode

Tablica 11

| Item | Parameter name  | Feature / value | Description                                                    | Manufacturer's value |
|------|-----------------|-----------------|----------------------------------------------------------------|----------------------|
| 1    | Type            |                 | Meter type                                                     | ND31                 |
| 2    | Order code      |                 | First 5 digits of the ordering code                            | e.g. 12200           |
| 3    | Boot version    |                 | Bootloader version                                             | e.g. 1.04            |
| 4    | Program version |                 | Main program version of the meter                              | e.g. 0.60            |
| 5    | Serial number   | ddmmxxxx        | Current serial number of the meter<br>day month current number | e.g. 15070006        |

# 8. SERIAL INTERFACES

## 8.1. RS485 INTERFACE – list of parameters

The implemented protocol is compliant with the PI-MBUS-300 Rev G specification of Modicon. List of ND31 meter serial interface parameters:

- identifier 0xF0
- meter address 1..247,
- baud rate 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbit/s,
- operating mode Modbus RTU,
- transmission mode 8N2, 8E1, 8O1, 8N1,
- max. response time 600 ms,
- max. no. of registers read in a single query
  - 61 – for 4-byte registers
  - 122 – for 2-byte registers
- implemented functions
  - 03, 04, 06, 16, 17,
  - 03, 04 register readout
  - 06 single register writing
  - 16 writing of n-registers,
  - 17 device identification

Default settings: address 1, baud rate 9.6 kbit/s, mode RTU 8N2

## 8.2. Examples of registers' readout and write

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

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

Request

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

Response:

| Device address | Function | Number of bytes | Value from the register 0FA0 (4000) |    | Value from the register 0FA1 (4001) |    | CRC checksum |
|----------------|----------|-----------------|-------------------------------------|----|-------------------------------------|----|--------------|
|                |          |                 | B1                                  | B0 | B1                                  | B0 |              |
| 01             | 03       | 04              | 00                                  | 0A | 00                                  | 64 | E4 6F        |

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

Request:

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

Response:

| Device address | Function | Number of bytes | Value from the register 1B58 (7000) |    | Value from the register 1B59 (7001) |    | Value from the register 1B5A (7002) |    | Value from the register 1B5B (7003) |    | CRC checksum |
|----------------|----------|-----------------|-------------------------------------|----|-------------------------------------|----|-------------------------------------|----|-------------------------------------|----|--------------|
|                |          |                 | 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 two 32-bit float registers as a combination of two 16-bit registers, starting with the register address 1770h (6000) - register values 10, 100.

Request:

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

Response:

| Device address | Function | Number of bytes | Value from the register 1770h (6000) |    | Value from the register 1770h (6000) |    | Value from the register 1772h (6002) |    | Value from the register 1772h (6002) |    | CRC checksum |
|----------------|----------|-----------------|--------------------------------------|----|--------------------------------------|----|--------------------------------------|----|--------------------------------------|----|--------------|
|                |          |                 | 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 two 32-bit float registers, starting with the register address 1D4Ch (7500) - register values 10, 100.

Request

| Adres urządzenia | Funkcja | Adres rejestru |    | Liczba rejestrów |    | Suma kontrolna CRC |
|------------------|---------|----------------|----|------------------|----|--------------------|
|                  |         | B1             | B0 | B1               | B0 |                    |
| 01               | 03      | 1D             | 4C | 00               | 02 | 03 B0              |

Response:

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

Single register writing (code 06h)

**Example 5.** Writing the value 543 (0x021F) to the register 4000 (0x0FA0)

Request:

| Device address | Function | Register address |    | Register value |    | CRC checksum |
|----------------|----------|------------------|----|----------------|----|--------------|
|                |          | B1               | B0 | B1             | B0 |              |
| 01             | 06       | 0F               | A0 | 02             | 1F | CA 54        |

Response:

| Device address | Function | Register address |    | Register value |    | CRC checksum |
|----------------|----------|------------------|----|----------------|----|--------------|
|                |          | B1               | B0 | B1             | B0 |              |
| 01             | 06       | 0F               | A0 | 02             | 1F | CA 54        |

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

**Example 6.** Writing two registers starting with the register address 0FA3h (4003)

Writing the values 20, 2000.

Request:

| Device address | Function | Address reg.Hi | Address reg.Lo | No. of registers Hi | No. of registers Lo | Number of bytes | Value for the register 0FA3 (4003) |    | Value for the register 0FA4 (4004) |    | CRC checksum |
|----------------|----------|----------------|----------------|---------------------|---------------------|-----------------|------------------------------------|----|------------------------------------|----|--------------|
|                |          |                |                |                     |                     |                 | 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 checksum |
|----------------|----------|------------------|----|---------------------|----|--------------|
|                |          | B1               | B0 | B1                  | B0 |              |
| 01             | 10       | 0F               | A3 | 00                  | 02 | B2 FE        |

1. *Journal of Management Studies*, 1997, 34, 1, 1-14.

|              |         |                |
|--------------|---------|----------------|
| Adres urzędu | Funkcja | Suma kontrolna |
| 01           | 11      | C0 2C          |

| Address | Function | Number of bytes | Identifier | Device status | Information field of the device software version (e.g. „ND31-0.81“ - ND31 device with software version 0.81) | Checksum (CRC) |
|---------|----------|-----------------|------------|---------------|--------------------------------------------------------------------------------------------------------------|----------------|
| 01      | 11       | 19              | F0         | FF            | 4E 44 33 31 2D 30 2E 38 31 20 20 20 20 20 20 20 20 20 20 20<br>20 20 20                                      | 92 F3          |

In the ND31LITE 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 register are numbered from the youngest to the oldest (b0-b15). The 32-m bit registers contain numbers of float type in IEEE-754 standard. 3210 byte sequence - the oldest is sent first.

| Adress range | Value type           | Description                                                                                                                                                                                     |
|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4000 – 4159  | Integer<br>(16 bits) | Value set in the 16-bit register. Registers for meter configuration. Description of registers is shown in Table 16. Registers for writing and readout.                                          |
| 4200 – 4260  | Integer<br>(16 bits) | Value set in the 16-bit register. Registers for configuration of programmable group of registers for readout. Description of registers is shown in Table 36. Registers for writing and readout. |
| 4300 – 4388  | Integer<br>(16 bits) | Value set in the 16-bit register. Registers for displayed screens configuration. Description of registers is shown in Table 37. Registers for writing and readout.                              |
| 4400 – 4485  | Integer<br>(16 bits) | Value set in the 16-bit register. Status registers, energy value, MAC address of the meter, configuration data. Description of registers is shown in Table 38. Readout registers.               |
| 4500 – 4529  | Integer<br>(16 bits) | Value placed in one 16-bit register. Configuration registers of the MQTT protocol.                                                                                                              |
| 4600 – 4610  | Integer<br>(16 bits) | Value placed in one 16-bit register. Configuration registers of the supervisory relay.                                                                                                          |

|             |                      |                                                                                                                                                                                    |
|-------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6000 – 6970 | Float<br>(2x16 bits) | Value is set in the two following 16-bit registers. Registers contain exactly the same data, as 32-bit registers of 7500 – 7953 range. Readout registers. Bytes sequence (1-0-3-2) |
| 7000 - 7118 | Float<br>(2x16 bits) | Content of the registers set in the registers 4200 – 4359. Bytes sequence (3-2-1-0)                                                                                                |
| 7200 – 7318 | Float<br>(2x16 bits) | Content of the registers set in the registers 4200 – 4359. Bytes sequence (1-0-3-2)                                                                                                |
| 7400 – 7459 | Float<br>(32 bits)   | Content of the registers set in the registers 4200 – 4359. Values set in one 32-bit register.                                                                                      |
| 7500 – 7985 | Float<br>(32 bits)   | Values set in one 32-bit register. Description of registers is shown in Table 41. Readout registers.                                                                               |
| 8000 – 8970 | Float<br>(2x16 bits) | Value is set in the two following 16-bit registers. Registers contain exactly the same data, as 32-bit registers of 7500 – 7953 range. Readout registers. Bytes sequence (3-2-1-0) |
| 9000 – 9144 | Float<br>(2x16 bits) | Value is set in the two following 16-bit registers Description of registers is shown in Table 42. Readout registers. Bytes sequence (1-0-3-2)                                      |
| 9200 – 9344 | Float<br>(2x16 bits) | Value is set in the two following 16-bit registers. Description of registers is shown in Table 42. Readout registers. Bytes sequence (3-2-1-0)                                     |

Table 13

| Register address | Operations | Range    | Description                                                                                                                                                                                                                                                                                               | Default |
|------------------|------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 4000             | RW         | 0...9999 | Protection - password                                                                                                                                                                                                                                                                                     | 0       |
| 4001             | RW         | 0 .. 1   | Type of connection<br>0 - 3Ph/4W<br>1 - 3Ph/3W<br>2 - 1Ph/2W                                                                                                                                                                                                                                              | 0       |
| 4002             | RW         | 0 .. 2   | Voltage on terminal 2<br>0 - first L1 phase voltage<br>1 - second L2 phase voltage<br>2 - third L3 phase voltage                                                                                                                                                                                          | 0       |
| 4003             | RW         | 0 .. 2   | Voltage on terminal 5<br>0 - first L1 phase voltage<br>1 - second L2 phase voltage<br>2 - third L3 phase voltage                                                                                                                                                                                          | 1       |
| 4004             | RW         | 0 .. 2   | Voltage on terminal 8<br>0 - first L1 phase voltage<br>1 - second L2 phase voltage<br>2 - third L3 phase voltage                                                                                                                                                                                          | 2       |
| 4005             | RW         | 0..5     | Current on terminals 1, 3:<br>0 - first phase IL1 current<br>1 - reversed direction of the current of phase L1: -IL1<br>2 - second phase IL2 current<br>3 - reversed direction of the current of phase L2: -IL2<br>4 - third phase IL3 current<br>5 - reversed direction of the current of phase L3: -IL3 | 0       |

|      |    |            |                                                                                                                                                                                                                                                                                                                          |      |
|------|----|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 4006 | RW | 0..5       | Current on terminals 4, 6:<br>0 - first phase IL1 current<br>1 - reversed direction of the current of phase L1: $-I_{L1}$<br>2 - second phase IL2 current<br>3 - reversed direction of the current of phase L2: $-I_{L2}$<br>4 - third phase IL3 current<br>5 - reversed direction of the current of phase L3: $-I_{L3}$ | 2    |
| 4007 | RW | 0..5       | Current on terminals 7, 9:<br>0 - first phase IL1 current<br>1 - reversed direction of the current of phase L1: $-I_{L1}$<br>2 - second phase IL2 current<br>3 - reversed direction of the current of phase L2: $-I_{L2}$<br>4 - third phase IL3 current<br>5 - reversed direction of the current of phase L3: $-I_{L3}$ | 4    |
| 4008 | RW | 0,1        | Input current range: 1 A or 5 A: 0 - 1 A, 1 - 5 A                                                                                                                                                                                                                                                                        | 1    |
| 4009 | RW | 0,1        | Input voltage range:<br>0 – 3 x 57.7/100 V; 1 – 3 x 230/400 V (version 1)<br>0 – 3 x 110/190 V; 1 – 3 x 400/690 V (version 2)                                                                                                                                                                                            | 1    |
| 4010 | RW | 0..18      | Transformer primary voltage, two older bytes                                                                                                                                                                                                                                                                             | 0    |
| 4011 | RW | 0..65535   | Transformer primary voltage, two younger bytes                                                                                                                                                                                                                                                                           | 100  |
| 4012 | RW | 1 .. 10000 | Transformer secondary voltage x 10                                                                                                                                                                                                                                                                                       | 1000 |
| 4013 | RW | 1 .. 20000 | Transformer primary current                                                                                                                                                                                                                                                                                              | 5    |
| 4014 | RW | 1 .. 1000  | Transformer secondary current                                                                                                                                                                                                                                                                                            | 5    |
| 4015 | RW | 0...2      | Averaging time of the active power P Demand<br>apparent power S Demand<br>current I Demand<br>0 – 15, 1- 30, 2- 60 minutes                                                                                                                                                                                               | 0    |
| 4016 | RW | 0,1        | Synchronization with real-time clock<br>0 - no synchronization<br>1 - synchronization with a clock                                                                                                                                                                                                                       | 1    |
| 4017 | RW |            | reserved                                                                                                                                                                                                                                                                                                                 |      |
| 4018 | RW |            | reserved                                                                                                                                                                                                                                                                                                                 |      |
| 4019 | RW |            | reserved                                                                                                                                                                                                                                                                                                                 |      |
| 4020 | RW |            | reserved                                                                                                                                                                                                                                                                                                                 | 0    |
| 4021 | RW |            | reserved                                                                                                                                                                                                                                                                                                                 | 0    |
| 4022 | RW |            | reserved                                                                                                                                                                                                                                                                                                                 |      |

|      |    |                         |                                                                                                                                                                                              |      |
|------|----|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 4023 | RW | 0..1                    | EnP active energy counting method<br>0 – Ferraris<br>1 – Per phase                                                                                                                           | 0    |
| 4024 | RW | 0...4                   | Energy counters erasing<br>0 – no changes, 1 – erase active energies<br>2 – erase reactive energies, 3 – erase apparent energies, 4 – erase all energies                                     | 0    |
| 4025 | RW | 0,1                     | Erasing averaged parameters<br>P Demand, S Demand, I Demand                                                                                                                                  | 0    |
| 4026 | RW | 0,1                     | Min, max erasing                                                                                                                                                                             | 0    |
| 4027 | RW | 0,1                     | Erasing alarm signalization latch                                                                                                                                                            | 0    |
| 4028 | RW |                         | reserved                                                                                                                                                                                     |      |
| 4029 | RW |                         | reserved                                                                                                                                                                                     |      |
| 4030 | RW | 0...4                   | Alarm output 1 - Logic tasks of the conditions 1, 2, 3<br>0 – C1<br>1 – $C1 \vee C2 \vee C3$<br>2 – $C1 \wedge C2 \wedge C3$<br>3 – $(C1 \wedge C2) \vee C3$<br>4 – $(C1 \vee C2) \wedge C3$ | 0    |
| 4031 | RW | 0,1                     | Alarm output 1 - State of the relay at the alarm switched on:<br>0 - relay disabled<br>1 - relay enabled                                                                                     | 1    |
| 4032 | RW | 0,1                     | Alarm output 1 - alarm deactivation lock                                                                                                                                                     | 0    |
| 4033 | RW | 0,1                     | Alarm output 1 - alarm signalization                                                                                                                                                         | 0    |
| 4034 | RW | 0,1..54                 | Alarm output 1 - value for the condition 1 (c1)<br>(code as in Table 8)                                                                                                                      | 38   |
| 4035 | RW | 0..9                    | Alarm output 1 - type for the condition 1: 0 – n_on,<br>1 – noFF, 2 – on, 3 – oFF, 4 – H_on, 5 – HoFF,<br>6 – 3non, 7 – 3noF, 8 – 3_on, 9 – 3_oF                                             | 0    |
| 4036 | RW | -1440..0..1440<br>[°/∞] | Alarm output 1 - lower value of the condition 1 switch of the rated input range                                                                                                              | 900  |
| 4037 | RW | -1440..0..1440<br>[°/∞] | Alarm output 1 - upper value of the condition 1 switch of the rated input range                                                                                                              | 1100 |
| 4038 | RW | 0..3600 s               | Alarm output 1 - condition 1 activation delay                                                                                                                                                | 0    |
| 4039 | RW | 0..3600 s               | Alarm output 1 - condition 1 deactivation delay                                                                                                                                              | 0    |
| 4040 | RW | 0..3600 s               | Alarm output 1 - condition 1 re-activation lock                                                                                                                                              | 0    |

|      |    |                          |                                                                                                                                                  |      |
|------|----|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 4041 | RW | 0,1                      | Alarm output 1 - condition 1 signalization                                                                                                       | 0    |
| 4042 | RW |                          | reserved                                                                                                                                         |      |
| 4043 | RW | 0,1..54                  | Alarm output 1 - value for the condition 2 (c2)<br>(code as in Table 8)                                                                          | 38   |
| 4044 | RW | 0..9                     | Alarm output 1 - type for the condition 2: 0 – n_on,<br>1 – noFF, 2 – on, 3 – oFF, 4 – H_on, 5 – HoFF,<br>6 – 3non, 7 – 3noF, 8 – 3_on, 9 – 3_oF | 0    |
| 4045 | RW | -1440..0..1440<br>[°_oo] | Alarm output 1 - lower value of the condition 2 switch of the rated input<br>range                                                               | 900  |
| 4046 | RW | -1440..0..1440<br>[°_oo] | Alarm output 1 - upper value of the condition 2 switch of the rated input<br>range                                                               | 1100 |
| 4047 | RW | 0..3600 s                | Alarm output 1 - condition 2 activation delay                                                                                                    | 0    |
| 4048 | RW | 0..3600 s                | Alarm output 1 - condition 2 deactivation delay                                                                                                  | 0    |
| 4049 | RW | 0..3600 s                | Alarm output 1 - condition 2 re-activation lock                                                                                                  | 0    |
| 4050 | RW | 0,1                      | Alarm output 1 – condition 2 signalization                                                                                                       | 0    |
| 4051 | RW |                          | reserved                                                                                                                                         |      |
| 4052 | RW | 0,1..54                  | Alarm output 1 - value for the condition 3 (c3)<br>(code as in Table 8)                                                                          | 38   |
| 4053 | RW | 0..9                     | Alarm output 1 - type for the condition 3: 0 – n_on, 1 – noFF, 2 – on, 3 –<br>oFF, 4 – H_on, 5 – HoFF, 6 – 3non, 7 – 3noF, 8 – 3_on, 9 – 3_oF    | 0    |
| 4054 | RW | -1440..0..1440<br>[°_oo] | Alarm output 1 - lower value of the condition 3 switch of the rated input<br>range                                                               | 900  |
| 4055 | RW | -1440..0..1440<br>[°_oo] | Alarm output 1 - upper value of the condition 3 switch of the rated input<br>range                                                               | 1100 |
| 4056 | RW | 0..3600 s                | Alarm output 1 - condition 3 activation delay                                                                                                    | 0    |
| 4057 | RW | 0..3600 s                | Alarm output 1 - condition 3 deactivation delay                                                                                                  | 0    |
| 4058 | RW | 0..3600 s                | Alarm output 1 - condition 2 re-activation lock                                                                                                  | 0    |
| 4059 | RW | 0,1                      | Alarm output 1 – condition 2 signalization                                                                                                       | 0    |
| 4060 | RW |                          | reserved                                                                                                                                         |      |

|      |    |                          |                                                                                                                                                                                              |      |
|------|----|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 4061 | RW | 0..4                     | Alarm output 2 - Logic tasks of the conditions 1, 2, 3<br>0 – C1<br>1 – $C1 \vee C2 \vee C3$<br>2 – $C1 \wedge C2 \wedge C3$<br>3 – $(C1 \wedge C2) \vee C3$<br>4 – $(C1 \vee C2) \wedge C3$ | 0    |
| 4062 | RW | 0,1                      | Alarm output 2 - State of the relay at the alarm switched on:<br>0 - relay disabled<br>1 - relay enabled                                                                                     | 1    |
| 4063 | RW | 0,1                      | Alarm output 2 - alarm deactivation lock                                                                                                                                                     | 0    |
| 4064 | RW | 0,1                      | Alarm output 2 - alarm signalization                                                                                                                                                         | 0    |
| 4065 | RW | 0,1..54                  | Alarm output 2 - value for the condition 1 (c1)<br>(code as in Table 8)                                                                                                                      | 38   |
| 4066 | RW | 0..9                     | Alarm output 2 - type for the condition 1: 0 – n_on,<br>1 – noFF, 2 – on, 3 – oFF, 4 – H_on, 5 – HoFF, 6 – 3non, 7 – 3noF,<br>8 – 3_on, 9 – 3_oF                                             | 0    |
| 4067 | RW | -1440..0..1440<br>[°/oo] | Alarm output 2 - lower value of the condition 1 switch of the rated input range                                                                                                              | 900  |
| 4068 | RW | -1440..0..1440<br>[°/oo] | Alarm output 2 - upper value of the condition 1 switch of the rated input range                                                                                                              | 1100 |
| 4069 | RW | 0..3600 s                | Alarm output 2 - condition 1 activation delay                                                                                                                                                | 0    |
| 4070 | RW | 0..3600 s                | Alarm output 2 - condition 1 deactivation delay                                                                                                                                              | 0    |
| 4071 | RW | 0..3600 s                | Alarm output 2 - condition 1 re-activation lock                                                                                                                                              | 0    |
| 4072 | RW | 0,1                      | Alarm output 2 – condition 1 signalization                                                                                                                                                   | 0    |
| 4073 | RW |                          | reserved                                                                                                                                                                                     |      |
| 4074 | RW | 0,1..54                  | Alarm output 2 - value for the condition 2 (c2)<br>(code as in Table 8)                                                                                                                      | 38   |
| 4075 | RW | 0..9                     | Alarm output 2 - type for the condition 2: 0 – n_on,<br>1 – noFF, 2 – on, 3 – oFF, 4 – H_on, 5 – HoFF,<br>6 – 3non, 7 – 3noF, 8 – 3_on, 9 – 3_oF                                             | 0    |
| 4076 | RW | -1440..0..1440<br>[°/oo] | Alarm output 2 - lower value of the condition 2 switch of the rated input range                                                                                                              | 900  |
| 4077 | RW | -1440..0..1440<br>[°/oo] | Alarm output 2 - upper value of the condition 2 switch of the rated input range                                                                                                              | 1100 |
| 4078 | RW | 0..3600 s                | Alarm output 2 - condition 2 activation delay                                                                                                                                                | 0    |
| 4079 | RW | 0..3600 s                | Alarm output 2 - condition 2 deactivation delay                                                                                                                                              | 0    |

|      |    |                         |                                                                                                                                                  |      |
|------|----|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 4080 | RW | 0..3600 s               | Alarm output 2 - condition 2 re-activation lock                                                                                                  | 0    |
| 4081 | RW | 0,1                     | Alarm output 2 – condition 2 signalization                                                                                                       | 0    |
| 4082 | RW |                         | reserved                                                                                                                                         |      |
| 4083 | RW | 0,1..54                 | Alarm output 2 - value for the condition 3 (c3)<br>(code as in Table 8)                                                                          | 38   |
| 4084 | RW | 0..9                    | Alarm output 2 - type for the condition 3: 0 – n_on,<br>1 – noFF, 2 – on, 3 – oFF, 4 – H_on, 5 – HoFF,<br>6 – 3non, 7 – 3noF, 8 – 3_on, 9 – 3_oF | 0    |
| 4085 | RW | -1440..0..1440<br>[°/∞] | Alarm output 2 - lower value of the condition 3 switch of the rated input<br>range                                                               | 900  |
| 4086 | RW | -1440..0..1440<br>[°/∞] | Alarm output 2 - upper value of the condition 3 switch of the rated input<br>range                                                               | 1100 |
| 4087 | RW | 0..3600 s               | Alarm output 2 - condition 3 activation delay                                                                                                    | 0    |
| 4088 | RW | 0..3600 s               | Alarm output 2 - condition 3 deactivation delay                                                                                                  | 0    |
| 4089 | RW | 0..3600 s               | Alarm output 2 - condition 2 re-activation lock                                                                                                  | 0    |
| 4090 | RW | 0,1                     | Alarm output 2 - condition 2 signalization                                                                                                       | 0    |
| 4091 | RW |                         | reserved                                                                                                                                         |      |
| 4092 | RW |                         | reserved                                                                                                                                         |      |
| 4093 | RW |                         | reserved                                                                                                                                         |      |
| 4094 | RW |                         | reserved                                                                                                                                         |      |
| 4095 | RW |                         | reserved                                                                                                                                         |      |
| 4096 | RW |                         | reserved                                                                                                                                         |      |
| 4097 | RW |                         | reserved                                                                                                                                         |      |
| 4098 | RW |                         | reserved                                                                                                                                         |      |
| 4099 | RW |                         | reserved                                                                                                                                         |      |

|      |    |        |                                                                        |   |
|------|----|--------|------------------------------------------------------------------------|---|
| 4100 | RW | 1..247 | Modbus Network Address                                                 | 1 |
| 4101 | RW | 0..3   | Transmission mode: 0->8n2, 1->8e1, 2->8o1, 3->8n1                      | 0 |
| 4102 | RW | 0..5   | Baud rate: 0->4800, 1->9600<br>2->19200, 3->38400, 4->57600, 5->115200 | 1 |
| 4103 | RW |        | reserved                                                               |   |
| 4104 | RW | 0,1    | Upgrade change of transmission parameters                              | 0 |
| 4105 | RW |        | reserved                                                               |   |
| 4106 | RW |        | reserved                                                               |   |
| 4107 | RW |        | reserved                                                               |   |
| 4108 | RW |        | reserved                                                               |   |
| 4109 | RW |        | reserved                                                               |   |
| 4110 | RW |        | reserved                                                               |   |
| 4111 | RW |        | reserved                                                               |   |
| 4112 | RW |        | reserved                                                               |   |
| 4113 | RW |        | reserved                                                               |   |
| 4114 | RW |        | reserved                                                               |   |
| 4115 | RW |        | reserved                                                               |   |
| 4116 | RW |        | reserved                                                               |   |
| 4117 | RW |        | reserved                                                               |   |
| 4118 | RW |        | reserved                                                               |   |
| 4119 | RW |        | reserved                                                               |   |
| 4120 | RW |        | reserved                                                               |   |

|      |    |  |          |  |
|------|----|--|----------|--|
| 4121 | RW |  | reserved |  |
| 4122 | RW |  | reserved |  |
| 4123 | RW |  | reserved |  |
| 4124 | RW |  | reserved |  |
| 4125 | RW |  | reserved |  |
| 4126 | RW |  | reserved |  |
| 4127 | RW |  | reserved |  |
| 4128 | RW |  | reserved |  |
| 4129 | RW |  | reserved |  |
| 4130 | RW |  | reserved |  |
| 4131 | RW |  | reserved |  |
| 4132 | RW |  | reserved |  |
| 4133 | RW |  | reserved |  |
| 4134 | RW |  | reserved |  |
| 4135 | RW |  | reserved |  |
| 4136 | RW |  | reserved |  |
| 4137 | RW |  | reserved |  |
| 4138 | RW |  | reserved |  |
| 4139 | RW |  | reserved |  |
| 4140 | RW |  | reserved |  |

|      |    |             |                                                                                                                  |      |
|------|----|-------------|------------------------------------------------------------------------------------------------------------------|------|
| 4141 | RW |             | reserved                                                                                                         |      |
| 4142 | RW |             | reserved                                                                                                         |      |
| 4143 | RW |             | reserved                                                                                                         |      |
| 4144 | RW |             | reserved                                                                                                         |      |
| 4145 | RW |             | reserved                                                                                                         |      |
| 4146 | RW |             | reserved                                                                                                         |      |
| 4147 | RW |             | reserved                                                                                                         |      |
| 4148 | RW |             | reserved                                                                                                         |      |
| 4149 | RW |             | reserved                                                                                                         |      |
| 4150 | RW | 0..2        | Menu language: 0-ENG, 1-PL, 2-DE                                                                                 | 0    |
| 4151 | RW | 0,1         | reserved                                                                                                         |      |
| 4152 | RW | 0,1         | Saving default parameters (complete with resetting energy as well as min, max and mean power to 0) and Ethernet, | 0    |
| 4153 | RW | 0..59       | Seconds                                                                                                          | 0    |
| 4154 | RW | 0...2359    | Hour *100 + minutes                                                                                              | 0    |
| 4155 | RW | 101...1231  | Month * 100 + day                                                                                                | 101  |
| 4156 | RW | 2015...2077 | Year                                                                                                             | 2015 |
| 4157 | RW |             | reserved                                                                                                         |      |
| 4158 | RW |             | reserved                                                                                                         |      |
| 4159 | RW |             | reserved                                                                                                         |      |

The alarm switching values stored in the registers 4036, 4037, 4054, 4055, 4067, 4068, 4076, 4077, 4085, 4086 are multiplied by 10, e.g. the value of 100% should be entered as „1000”.

Table 14

| Register address | Operations | Range        | Description                                                | Default |
|------------------|------------|--------------|------------------------------------------------------------|---------|
| 4200             | RW         | 7500 .. 7957 | Register 1 of programmable group of registers for readout  | 7500    |
| 4201             | RW         | 7500 .. 7957 | Register 2 of programmable group of registers for readout  | 7501    |
| 4202             | RW         | 7500 .. 7957 | Register 3 of programmable group of registers for readout  | 7502    |
| 4203             | RW         | 7500 .. 7957 | Register 4 of programmable group of registers for readout  | 7503    |
| 4204             | RW         | 7500 .. 7957 | Register 5 of programmable group of registers for readout  | 7504    |
| 4205             | RW         | 7500 .. 7957 | Register 6 of programmable group of registers for readout  | 7505    |
| 4206             | RW         | 7500 .. 7957 | Register 7 of programmable group of registers for readout  | 7506    |
| 4207             | RW         | 7500 .. 7957 | Register 8 of programmable group of registers for readout  | 7507    |
| 4208             | RW         | 7500 .. 7957 | Register 9 of programmable group of registers for readout  | 7508    |
| 4209             | RW         | 7500 .. 7957 | Register 10 of programmable group of registers for readout | 7509    |
| 4210             | RW         | 7500 .. 7957 | Register 11 of programmable group of registers for readout | 7510    |
| 4211             | RW         | 7500 .. 7957 | Register 12 of programmable group of registers for readout | 7511    |
| 4212             | RW         | 7500 .. 7957 | Register 13 of programmable group of registers for readout | 7512    |
| 4213             | RW         | 7500 .. 7957 | Register 14 of programmable group of registers for readout | 7513    |
| 4214             | RW         | 7500 .. 7957 | Register 15 of programmable group of registers for readout | 7514    |
| 4215             | RW         | 7500 .. 7957 | Register 16 of programmable group of registers for readout | 7515    |
| 4216             | RW         | 7500 .. 7957 | Register 17 of programmable group of registers for readout | 7516    |
| 4217             | RW         | 7500 .. 7957 | Register 18 of programmable group of registers for readout | 7517    |
| 4218             | RW         | 7500 .. 7957 | Register 19 of programmable group of registers for readout | 7518    |
| 4219             | RW         | 7500 .. 7957 | Register 20 of programmable group of registers for readout | 7519    |
| 4220             | RW         | 7500 .. 7957 | Register 21 of programmable group of registers for readout | 7520    |

|      |    |              |                                                            |      |
|------|----|--------------|------------------------------------------------------------|------|
| 4221 | RW | 7500 .. 7957 | Register 22 of programmable group of registers for readout | 7521 |
| 4222 | RW | 7500 .. 7957 | Register 23 of programmable group of registers for readout | 7522 |
| 4223 | RW | 7500 .. 7957 | Register 24 of programmable group of registers for readout | 7523 |
| 4224 | RW | 7500 .. 7957 | Register 25 of programmable group of registers for readout | 7524 |
| 4225 | RW | 7500 .. 7957 | Register 26 of programmable group of registers for readout | 7525 |
| 4226 | RW | 7500 .. 7957 | Register 27 of programmable group of registers for readout | 7526 |
| 4227 | RW | 7500 .. 7957 | Register 28 of programmable group of registers for readout | 7527 |
| 4228 | RW | 7500 .. 7957 | Register 29 of programmable group of registers for readout | 7528 |
| 4229 | RW | 7500 .. 7957 | Register 30 of programmable group of registers for readout | 7529 |
| 4230 | RW | 7500 .. 7957 | Register 31 of programmable group of registers for readout | 7530 |
| 4231 | RW | 7500 .. 7957 | Register 32 of programmable group of registers for readout | 7531 |
| 4232 | RW | 7500 .. 7957 | Register 33 of programmable group of registers for readout | 7532 |
| 4233 | RW | 7500 .. 7957 | Register 34 of programmable group of registers for readout | 7533 |
| 4234 | RW | 7500 .. 7957 | Register 35 of programmable group of registers for readout | 7534 |
| 4235 | RW | 7500 .. 7957 | Register 36 of programmable group of registers for readout | 7535 |
| 4236 | RW | 7500 .. 7957 | Register 37 of programmable group of registers for readout | 7536 |
| 4237 | RW | 7500 .. 7957 | Register 38 of programmable group of registers for readout | 7537 |
| 4238 | RW | 7500 .. 7957 | Register 39 of programmable group of registers for readout | 7538 |
| 4239 | RW | 7500 .. 7957 | Register 40 of programmable group of registers for readout | 7539 |
| 4240 | RW | 7500 .. 7957 | Register 41 of programmable group of registers for readout | 7540 |
| 4241 | RW | 7500 .. 7957 | Register 42 of programmable group of registers for readout | 7541 |
| 4242 | RW | 7500 .. 7957 | Register 43 of programmable group of registers for readout | 7542 |
| 4243 | RW | 7500 .. 7957 | Register 44 of programmable group of registers for readout | 7543 |

|      |    |              |                                                                 |      |
|------|----|--------------|-----------------------------------------------------------------|------|
| 4244 | RW | 7500 .. 7957 | Register 45 of programmable group of registers for readout      | 7544 |
| 4245 | RW | 7500 .. 7957 | Register 46 of programmable group of registers for readout      | 7545 |
| 4246 | RW | 7500 .. 7957 | Register 47 of programmable group of registers for readout      | 7546 |
| 4247 | RW | 7500 .. 7957 | Register 48 of programmable group of registers for readout      | 7547 |
| 4248 | RW | 7500 .. 7957 | Register 49 of programmable group of registers for readout      | 7548 |
| 4249 | RW | 7500 .. 7957 | Register 50 of programmable group of registers for readout      | 7549 |
| 4250 | RW | 7500 .. 7957 | Register 51 of programmable group of registers for readout      | 7550 |
| 4251 | RW | 7500 .. 7957 | Register 52 of programmable group of registers for readout      | 7551 |
| 4252 | RW | 7500 .. 7957 | Register 53 of programmable group of registers for readout      | 7552 |
| 4253 | RW | 7500 .. 7957 | Register 54 of programmable group of registers for readout      | 7553 |
| 4254 | RW | 7500 .. 7957 | Register 55 of programmable group of registers for readout      | 7554 |
| 4255 | RW | 7500 .. 7957 | Register 56 of programmable group of registers for readout      | 7559 |
| 4256 | RW | 7500 .. 7957 | Register 57 of programmable group of registers for readout      | 7560 |
| 4257 | RW | 7500 .. 7957 | Register 58 of programmable group of registers for readout      | 7561 |
| 4258 | RW | 7500 .. 7957 | Register 59 of programmable group of registers for readout      | 7566 |
| 4259 | RW | 7500 .. 7957 | Register 60 of programmable group of registers for readout      | 7567 |
| 4260 | RW | 0,1          | Restore default group 0 – no changes, 1 – restore default group | 0    |

Table 15

| Register address | Operations | Range     | Description                                                             | Default |
|------------------|------------|-----------|-------------------------------------------------------------------------|---------|
| 4300             | RW         | 0...3     | Luminosity level: 0 – Screensaver, 1 – Minimum, 2 – Medium, 3 - Maximum | 0       |
| 4301             | RW         | 0 .. 3600 | Time to min. luminosity                                                 | 180     |
| 4302             | RW         | 0..7      | Screen colour                                                           | 0       |

|      |    |                 |                                                                                   |        |
|------|----|-----------------|-----------------------------------------------------------------------------------|--------|
| 4303 | RW | 0x0001...0x1FFF | Enabling screen display Bit0 – screen 1,<br>Bit1 – screen 2, ...Bit12 – screen 13 | 0x1FFF |
| 4304 | RW |                 | reserved                                                                          |        |
| 4305 | RW | 00..52          | Screen 1 display 1, U1                                                            | 1      |
| 4306 | RW | 00..52          | Screen 1 display 2, U2                                                            | 10     |
| 4307 | RW | 00..52          | Screen 1 display 3, U3                                                            | 19     |
| 4308 | RW | 00..52          | Screen 1 display 4, f                                                             | 37     |
| 4309 | RW | 00..52          | Screen 1 display 5, I1                                                            | 2      |
| 4310 | RW | 00..52          | Screen 1 display 6, I2                                                            | 11     |
| 4311 | RW | 00..52          | Screen 1 display 7, I3                                                            | 20     |
| 4312 | RW | 00..52          | Screen 1 display 8, I avg                                                         | 28     |
| 4313 | RW | 00..52          | Screen 2 display 1, U12                                                           | 38     |
| 4314 | RW | 00..52          | Screen 2 display 2, U23                                                           | 39     |
| 4315 | RW | 00..52          | Screen 2 display 3, U31                                                           | 40     |
| 4316 | RW | 00..52          | Screen 2 display 4, U123                                                          | 41     |
| 4317 | RW | 00..52          | Screen 2 display 5, ΣP                                                            | 30     |
| 4318 | RW | 00..52          | Screen 2 display 6, ΣQ                                                            | 31     |
| 4319 | RW | 00..52          | Screen 2 display 7, ΣS                                                            | 32     |
| 4320 | RW | 00..52          | Screen 2 display 8, PF avg                                                        | 33     |
| 4321 | RW | 00..52          | Screen 3 display 1, P1                                                            | 3      |
| 4322 | RW | 00..52          | Screen 3 display 2, P2                                                            | 12     |
| 4323 | RW | 00..52          | Screen 3 display 3, P3                                                            | 21     |
| 4324 | RW | 00..52          | Screen 3 display 4, ΣP                                                            | 30     |
| 4325 | RW | 00..52          | Screen 3 display 5, PF1                                                           | 6      |

|      |    |        |                            |    |
|------|----|--------|----------------------------|----|
| 4326 | RW | 00..52 | Screen 3 display 6, PF2    | 15 |
| 4327 | RW | 00..52 | Screen 3 display 7, PF3    | 24 |
| 4328 | RW | 00..52 | Screen 3 display 8, PF avg | 33 |
| 4329 | RW | 00..52 | Screen 4 display 1, P1     | 3  |
| 4330 | RW | 00..52 | Screen 4 display 2, P2     | 12 |
| 4331 | RW | 00..52 | Screen 4 display 3, P3     | 21 |
| 4332 | RW | 00..52 | Screen 4 display 4, ΣP     | 30 |
| 4333 | RW | 00..52 | Screen 4 display 5, Q1     | 4  |
| 4334 | RW | 00..52 | Screen 4 display 6, Q2     | 13 |
| 4335 | RW | 00..52 | Screen 4 display 7, Q3     | 22 |
| 4336 | RW | 00..52 | Screen 4 display 8, ΣQ     | 31 |
| 4337 | RW | 00..52 | Screen 5 display 1, THD U1 | 8  |
| 4338 | RW | 00..52 | Screen 5 display 2, THD U2 | 17 |
| 4339 | RW | 00..52 | Screen 5 display 3, THD U3 | 26 |
| 4340 | RW | 00..52 | Screen 5 display 4, THD U  | 35 |
| 4341 | RW | 00..52 | Screen 5 display 5, THD I1 | 9  |
| 4342 | RW | 00..52 | Screen 5 display 6, THD I2 | 18 |
| 4343 | RW | 00..52 | Screen 5 display 7, THD I3 | 27 |
| 4344 | RW | 00..52 | Screen 5 display 8, THD I  | 36 |
| 4345 | RW | 00..52 | Screen 6 display 1, U1     | 1  |
| 4346 | RW | 00..52 | Screen 6 display 2, I1     | 2  |
| 4347 | RW | 00..52 | Screen 6 display 3, P1     | 3  |
| 4348 | RW | 00..52 | Screen 6 display 4, Q1     | 4  |

|      |    |        |                           |    |
|------|----|--------|---------------------------|----|
| 4349 | RW | 00..52 | Screen 6 display 5, S1    | 5  |
| 4350 | RW | 00..52 | Screen 6 display 6, PF1   | 6  |
| 4351 | RW | 00..52 | Screen 6 display 7, tg1   | 7  |
| 4352 | RW | 00..52 | Screen 6 display 8, f     | 37 |
| 4353 | RW | 00..52 | Screen 7 display 1, U2    | 10 |
| 4354 | RW | 00..52 | Screen 7 display 2, I2    | 11 |
| 4355 | RW | 00..52 | Screen 7 display 3, P2    | 12 |
| 4356 | RW | 00..52 | Screen 7 display 4, Q2    | 13 |
| 4357 | RW | 00..52 | Screen 7 display 5, S2    | 14 |
| 4358 | RW | 00..52 | Screen 7 display 6, PF2   | 15 |
| 4359 | RW | 00..52 | Screen 7 display 7, tg2   | 16 |
| 4360 | RW | 00..52 | Screen 7 display 8, f     | 37 |
| 4361 | RW | 00..52 | Screen 8 display 1, U3    | 19 |
| 4362 | RW | 00..52 | Screen 8 display 2, I3    | 20 |
| 4363 | RW | 00..52 | Screen 8 display 3, P3    | 21 |
| 4364 | RW | 00..52 | Screen 8 display 4, Q3    | 22 |
| 4365 | RW | 00..52 | Screen 8 display 5, S3    | 23 |
| 4366 | RW | 00..52 | Screen 8 display 6, PF3   | 24 |
| 4367 | RW | 00..52 | Screen 8 display 7, tg3   | 25 |
| 4368 | RW | 00..52 | Screen 8 display 8, f     | 37 |
| 4369 | RW | 00..52 | Screen 9 display 1, IP    | 30 |
| 4370 | RW | 00..52 | Screen 9 display 2, IQ    | 31 |
| 4371 | RW | 00..52 | Screen 9 display 3, I avg | 29 |

|      |    |               |                                                                                                             |      |
|------|----|---------------|-------------------------------------------------------------------------------------------------------------|------|
| 4372 | RW | 00..52        | Screen 9 display 4, I(N)                                                                                    | 45   |
| 4373 | RW | 00..52        | Screen 9 display 5, P DMD                                                                                   | 42   |
| 4374 | RW | 00..52        | Screen 9 display 6, S DMD                                                                                   | 43   |
| 4375 | RW | 00..52        | Screen 9 display 7, I DMD                                                                                   | 44   |
| 4376 | RW | 00..52        | Screen 9 display 8, f                                                                                       | 37   |
| 4377 | RW | 00..52        | Screen 10 display 1, $\Sigma P$                                                                             | 30   |
| 4378 | RW | 00..52        | Screen 10 display 2, $\Sigma Q$                                                                             | 31   |
| 4379 | RW | 00..52        | Screen 10 display 3, $\Sigma S$                                                                             | 32   |
| 4380 | RW | 00..52        | Screen 10 display 4, En S                                                                                   | 52   |
| 4381 | RW | 00..52        | Screen 10 display 5, +En P                                                                                  | 48   |
| 4382 | RW | 00..52        | Screen 10 display 6, -En P                                                                                  | 49   |
| 4383 | RW | 00..52        | Screen 10 display 7,  En Q | 50   |
| 4384 | RW | 00..52        | Screen 10 display 8,  En Q | 51   |
| 4385 | RW | 0..3          | Restore manufacturer's Screens<br>0 - no ,<br>1 - 3Ph/4W ,<br>2 - 3Ph/3W<br>3 - 1PH/2W                      | 0    |
| 4386 | RW | 00..47        | Quantity displayed on the analog indicator:<br>0-Off, 1-U1, 2-I1, ...47-T2                                  | 1    |
| 4387 | RW | -1440 .. 1440 | Bottom scale                                                                                                | 0    |
| 4388 | RW | -1440 .. 1440 | Upper scale                                                                                                 | 1000 |

Table 16

| Register address | Operations | Range    | Description              | Default |
|------------------|------------|----------|--------------------------|---------|
| 4400             | R          |          | reserved                 |         |
| 4401             | R          | 0..65535 | Identifier               | D9      |
| 4402             | R          | 0..65535 | Bootloader version x 100 | -       |

|      |   |          |                                                                                               |           |
|------|---|----------|-----------------------------------------------------------------------------------------------|-----------|
| 4403 | R | 0..65535 | Program version x100                                                                          | -         |
| 4404 | R |          | reserved                                                                                      |           |
| 4405 | R | 0..65535 | Ordering codes                                                                                | -         |
| 4406 | R | 0..65535 | Nominal voltage x10                                                                           | 577/2300  |
| 4407 | R | 0..65535 | Nominal voltage x10                                                                           | 1100/4000 |
| 4408 | R | 0..65535 | Nominal current (1 A)<br>x 100                                                                | 100       |
| 4409 | R | 0..65535 | Nominal current (5 A)<br>x 100                                                                | 500       |
| 4410 | R |          | reserved                                                                                      |           |
| 4411 | R | 0..65535 | Seventh and sixth<br>byte (B7.B6) of a<br>serial number, format<br>B7:B6:B5:B4:B3:B2:B1:B0    | -         |
| 4412 | R | 0..65535 | Fifth and fourth byte<br>(B5.B4) of a serial<br>number, format<br>B7:B6:B5:B4:B3:B2:B1:B0     | -         |
| 4413 | R | 0..65535 | Third and second<br>byte (B3.B2) of a<br>serial number, format<br>B7:B6:B5:B4:B3:B2:B1:B0     | -         |
| 4414 | R | 0..65535 | First and zero byte<br>(B1.B0) of a serial<br>number, format<br>B7:B6:B5:B4:B3:B2:B1:B0       | -         |
| 4415 | R | 0..65535 | Status 1 Register – see<br>description below                                                  | 0         |
| 4416 | R | 0..65535 | Status 2 Register – see<br>description below                                                  | 0         |
| 4417 | R | 0..65535 | Status 3 Register – see<br>description below                                                  | 0         |
| 4418 | R | 0..65535 | Status 4 Register – see<br>description below                                                  | 0         |
| 4419 | R | 0..65535 | Status 5 Register – see<br>description below                                                  | 0         |
| 4420 | R | 0..65535 | Status 6 Register – see<br>description below                                                  | 0         |
| 4421 | R | 0..65535 | Fifth and fourth byte (B5.<br>B4) of MAC address<br>of the meter, format<br>B5:B4:B3:B2:B1:B0 | -         |

|      |   |              |                                                                                         |   |
|------|---|--------------|-----------------------------------------------------------------------------------------|---|
| 4422 | R | 0...65535    | Third and second byte (B3.B2) of MAC address of the meter, format B5:B4:B3:B2:B1:B0     | - |
| 4423 | R | 0...65535    | The fifth and fourth byte (B1.B0) of MAC address of the meter, format B5:B4:B3:B2:B1:B0 | - |
| 4424 | R |              | reserved                                                                                | 0 |
| 4425 | R |              | reserved                                                                                | 0 |
| 4426 | R | 0..152       | Active import energy, two older bytes                                                   | 0 |
| 4427 | R | 0..65535     | Active import energy, two younger bytes                                                 | 0 |
| 4428 | R | 0..152       | Active export energy, two older bytes                                                   | 0 |
| 4429 | R | 0..65535     | Active export energy, two younger bytes                                                 | 0 |
| 4430 | R | 0..152       | Reactive inductive energy, two older bytes                                              | 0 |
| 4431 | R | 0..65535     | Reactive capacity energy, two older bytes                                               | 0 |
| 4432 | R | 0..152       | Reactive capacity energy, two younger bytes                                             | 0 |
| 4433 | R | 0..65535     | Apparent energy, two older bytes                                                        | 0 |
| 4434 | R | 0..152       | Apparent energy , two younger bytes                                                     | 0 |
| 4435 | R | 0..65535     | reserved                                                                                | 0 |
| 4436 | R |              | reserved                                                                                |   |
| 4437 | R |              | Resistance Pt100 x100 (T1)                                                              |   |
| 4438 | R | 0..2000/0..1 | Resistance Pt100 x100 (T2)                                                              | 0 |
| 4439 | R | 0..2000/0..1 | Filling the file archive in o/oo                                                        | 0 |
| 4440 | R | 0..1000      | Filling of internal memory of group 1 archive in %/∞                                    | 0 |
| 4441 | R | 0..1000      | Zapelnienie pamięci wewnętrznej archiwum grupy 1 w %/∞                                  | 0 |
| 4442 | R | 0..1000      | Filling of internal memory of group 2 archive in %/∞                                    | 0 |

|      |   |          |                                                                                                                  |   |
|------|---|----------|------------------------------------------------------------------------------------------------------------------|---|
| 4443 | R | 0..1000  | Total filling of the archive's internal memory for groups 1 and 2 in $\frac{\%}{\infty}$                         | 0 |
| 4444 | R | 0..1000  | Percentage progress when copying internal archive to file archive for group 1 in $\frac{\%}{\infty}$             | 0 |
| 4445 | R | 0..1000  | Percentage progress when copying internal archive to file archive for group 2 in $\frac{\%}{\infty}$             | 0 |
| 4446 | R | 0..1000  | Total percentage progress when copying internal archive to file archive for group 1 and 2 in $\frac{\%}{\infty}$ | 0 |
| 4447 | R |          | Reserved                                                                                                         | 0 |
| ...  |   |          |                                                                                                                  |   |
| 4461 | R |          | Reserved                                                                                                         | 0 |
| 4462 | R | 0..152   | Active imported 3-phase energy for the previous year, two older bytes                                            | 0 |
| 4463 | R | 0..65535 | Active imported 3-phase energy for the previous year, two younger bytes                                          | 0 |
| 4464 | R | 0..152   | Active exported 3-phase energy for the previous year, two older bytes                                            | 0 |
| 4465 | R | 0..65535 | Active exported 3-phase energy for the previous year, two younger bytes                                          | 0 |
| 4466 | R | 0..152   | Active imported 3-phase energy for the current year, two older bytes                                             | 0 |
| 4467 | R | 0..65535 | Active imported 3-phase energy for the current year, two younger bytes                                           | 0 |
| 4468 | R | 0..152   | Active exported 3-phase energy for the current year, two older bytes                                             | 0 |
| 4469 | R | 0..65535 | Active exported 3-phase energy for the current year, two younger bytes                                           | 0 |
| 4470 | R | 0..152   | Active imported 3-phase energy for the current month, two older bytes                                            | 0 |
| 4471 | R | 0..65535 | Active imported 3-phase energy for the current month, two younger bytes                                          | 0 |

|      |   |          |                                                                            |   |
|------|---|----------|----------------------------------------------------------------------------|---|
| 4472 | R | 0..152   | Active exported 3-phase energy for the current month, two older bytes      | 0 |
| 4473 | R | 0..65535 | Active exported 3-phase energy for the current month, two younger bytes    | 0 |
| 4474 | R | 0..152   | Active imported 3-phase energy for the current week, two older bytes       | 0 |
| 4475 | R | 0..65535 | Active imported 3-phase energy for the current week, two younger bytes     | 0 |
| 4476 | R | 0..152   | Active exported 3-phase energy for the current week, two older bytes       | 0 |
| 4477 | R | 0..65535 | Active exported 3-phase energy for the current week, two younger bytes     | 0 |
| 4478 | R | 0..152   | Active imported 3-phase energy for the current 48 hours, two older bytes   | 0 |
| 4479 | R | 0..65535 | Active imported 3-phase energy for the current 48 hours, two younger bytes | 0 |
| 4480 | R | 0..152   | Active exported 3-phase energy for the current 48 hours, two older bytes   | 0 |
| 4481 | R | 0..65535 | Active exported 3-phase energy for the current 48 hours, two younger bytes | 0 |
| 4482 | R | 0..152   | Active imported 3-phase energy for the current 24 hours, two older bytes   | 0 |
| 4483 | R | 0..65535 | Active imported 3-phase energy for the current 24 hours, two younger bytes | 0 |
| 4484 | R | 0..152   | Active exported 3-phase energy for the current 24 hours, two older bytes   | 0 |
| 4485 | R | 0..65535 | Active exported 3-phase energy for the current 24 hours, two younger bytes | 0 |

Energy is made available in hundreds of watt-hours (Var-hours) in double 16-bit registers, so when converting the values of individual energies from the registers, it is necessary to divide them by 100 i.e:

Active energy consumed = (reg. value 4426 x 65536 + reg. value 4427) / 100 [kWh]

Active energy given up = (value of rej.4428 x 65536 + value of rej. 4429) / 100 [kWh].

Inductive reactive energy = (rej.4430 value x 65536 + rej.4431 value) / 100 [kVarh].

Capacitive reactive energy = (rej.4432 value x 65536 + rej.4433 value) / 100 [kVarh]

Apparent energy = (rej.4434 value x 65536 + rej.4435 value) / 100 [kVAh],

Similarly, recalculate the energies from registers 4462 to 4485

### Status 1 Register of a device (address 4415, R):

Bit 15 – "1" – FRAM memory damage

Bit 14 – "1" – no calibration of the input

Bit 13 – "1" – no calibration of the output

Bit 12 – "1" – PT100 calibration error

Bit 11 – "1" – error in configuration registers

Bit 10 – "1" – error in displayed screens registers

Bit 9 – "1" – error in registers for configuration of programmable group of registers for readout

Bit 8 – "1" – energy value error

Bit 7 – "1" – phase sequence error

Bit 6 – "1" – error in MQTT protocol registers

Bit 5 – "1" – error in the supervisory relay registers

Bit 4 – "1" – present analog output

Bit 3 – "1" – present PT100

Bit 2 – "1" – present Ethernet and internal memory

Bit 1 – "1" – used battery of RTC

Bit 0 – reserved

### Status 2 Register – (address 4416, R):

Bit 15 – "1" – condition 3 for alarm 2 signalization

Bit 14 – "1" – condition 2 for alarm 2 signalization

Bit 13 – "1" – condition 1 for alarm 2 signalization

Bit 12 – "1" – alarm 2 signalization

Bit 11 – "1" – alarm 2 condition 3 activated

Bit 10 – "1" – alarm 2 condition 2 activated

Bit 9 – "1" – alarm 2 condition 1 activated

Bit 8 – "1" – alarm 2 activated

Bit 7 – "1" – condition 3 for alarm 1 signalization

Bit 6 – "1" – condition 2 for alarm 1 signalization

Bit 5 – "1" – condition 1 for alarm 1 signalization

Bit 4 – "1" – alarm 1 signalization

Bit 3 – "1" – alarm 1 condition 3 activated

Bit 2 – "1" – alarm 1 condition 2 activated

Bit 1 – "1" – alarm 1 condition 1 activated

Bit 0 – "1" – alarm 1 activated

### Status 3 Register – (address 4417, R): Files archive status

|                                                                                                        |                                                                                                                         |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Bit 15 – Ethernet connected                                                                            | Bit 7 – Archiving group 1 enabled                                                                                       |
| Bit 14 – reserved                                                                                      | Bit 6 – reserved                                                                                                        |
| Bit 13 – reserved                                                                                      | Bit 5 – copying of internal memory to files archive from archiving group 2                                              |
| Bit 12 – reserved                                                                                      | Bit 4 – copying of internal memory to files archive from archiving group 1                                              |
| Bit 11 – „0” - waiting for the archiving conditions to be met „1” - archiving in the archiving group 2 | Bit 3 – Files archive space is full, (less then 14 days at 1 sec. interval to completely use a the files archive space) |
| Bit 10 – „0” - waiting for the archiving conditions to be met „1” - archiving in the archiving group 1 | Bit 2 – 70% of files archive space is full                                                                              |
| Bit 9 – reserved                                                                                       | Bit 1 – Files archive initialized correctly                                                                             |
| Bit 8 – Archiving group 2 enabled                                                                      | Bit 0 – Files archive file system error                                                                                 |

### Status 4 Register – (address 4418, R) reactive power characteristics:

|                                         |                                |
|-----------------------------------------|--------------------------------|
| Bit 15 – reserved                       | Bit 7 – "1" – capacity L3 min. |
| Bit 14 – "1" - Demand- capacity 3L max. | Bit 6 – "1" – capacity L3      |
| Bit 13 – "1" - Demand- capacity 3L min. | Bit 5 – "1" – capacity L2 max. |
| Bit 12 – "1" - Demand- capacity 3L      | Bit 4 – "1" – capacity L2 min. |
| Bit 11 – "1" – capacity 3L max.         | Bit 3 – "1" – capacity L2      |
| Bit 10 – "1" – capacity 3L min.         | Bit 2 – "1" – capacity L1 max. |
| Bit 9 – "1" – capacity 3L               | Bit 1 – "1" – capacity L1 min. |
| Bit 8 – "1" – leading L3 max.           | Bit 0 – "1" – capacity L1      |

### Status 5 Register – (address 4419, R)

|                                                       |
|-------------------------------------------------------|
| Bit 8 – "1" – alarm 1 condition 3 for phase L3 active |
| Bit 7 – "1" – alarm 1 condition 3 for phase L2 active |
| Bit 6 – "1" – alarm 1 condition 3 for phase L1 active |
| Bit 5 – "1" – alarm 1 condition 2 for phase L3 active |
| Bit 4 – "1" – alarm 1 condition 2 for phase L2 active |
| Bit 3 – "1" – alarm 1 condition 2 for phase L1 active |
| Bit 2 – "1" – alarm 1 condition 1 for phase L3 active |
| Bit 1 – "1" – alarm 1 condition 1 for phase L2 active |
| Bit 0 – "1" – alarm 1 condition 1 for phase L1 active |

## Status 6 Register – (address 4420, R)

Bit 8 – "1" – alarm 2 condition 3 for phase L3 active

Bit 7 – "1" – alarm 2 condition 3 for phase L2 active

Bit 6 – "1" – alarm 2 condition 3 for phase L1 active

Bit 5 – "1" – alarm 2 condition 2 for phase L3 active

Bit 4 – "1" – alarm 2 condition 2 for phase L2 active

Bit 3 – "1" – alarm 2 condition 2 for phase L1 active

Bit 2 – "1" – alarm 2 condition 1 for phase L3 active

Bit 1 – "1" – alarm 2 condition 1 for phase L2 active

Bit 0 – "1" – alarm 2 condition 1 for phase L1 active

Table 17

| Register address | Operations | Range  | Description                                                                                                                                                                                                                                                                                                                                                                                                    | Default |
|------------------|------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 4600             | RW         | 0 .. 1 | The number of the relay for configuration.<br>0 – relay number one,<br>1 – relay number two,                                                                                                                                                                                                                                                                                                                   | 0       |
| 4601             | RW         | 0 .. 1 | Relay function:<br>0 – standard relay supported by the ND31LITE alarm functions,<br>1 – function of the Protection relay,                                                                                                                                                                                                                                                                                      | 0       |
| 4603             | RW         | 0 .. 6 | The quantities to which the alarm is to operate:<br>0 - first phase,<br>1 - second phase,<br>2 - third phase,<br>3 - first and second phase,<br>4 - first and third phase,<br>5 - second and third phase,<br>6 - all phases,                                                                                                                                                                                   | 6       |
| 4604             | RW         | 0 .. 9 | Alarm type<br>0 - Minimum voltage,<br>1 - Minimum current,<br>2 - Maximum voltage,<br>3 - Maximum current,<br>4 - Window (voltage),<br>5 - Window (current),<br>6 - Phase loss,<br>7 - Asymmetry (voltage) - available at supervision of at least 2 phases,<br>8 - Asymmetry (current) - available at supervision of at least 2 phases,<br>9 - Phase sequence - available with supervision of 3 voltage phases | 0       |

|      |    |               |                                                                                                                                                                                                                                                                                         |     |
|------|----|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 4605 | RW | 0 .. 2        | Latch:<br>0 - when an alarm occurs, it will not latch,<br>1 - when an alarm occurs, it will latch, that is, after the alarm condition disappears, it is still active,<br>2 - resetting the alarm occurrence and returning the relay to the position that occurs when there is no alarm, | 0   |
| 4606 | RW | 5 .. 140 [%]  | Lower threshold of quantity in percentage (relative to nominal current or voltage)                                                                                                                                                                                                      | 95  |
| 4607 | RW | 5 .. 140 [%]  | Upper threshold in percentage (relative to nominal current or voltage) - upper threshold value cannot be lower than the lower threshold                                                                                                                                                 | 105 |
| 4608 | RW | 1 .. 30 [%]   | Upper threshold in percentage (relative to nominal current or voltage) - upper threshold value cannot be lower than the lower threshold                                                                                                                                                 | 3   |
| 4609 | RW | 0 .. 3600 [s] | Czas opóźnienia (w jednostkach 1s) załączenia alarmu w sekundach – czas 0 oznacza najkrótszy możliwy czas załączenia wynikający z ograniczeń sprzętowych                                                                                                                                | 0   |
| 4610 | RW | 0 .. 3600 [s] | Czas opóźnienia (w jednostkach 1s) wyłączenia alarmu w sekundach - czas 0 oznacza najkrótszy możliwy czas wyłączenia wynikający z ograniczeń sprzętowych                                                                                                                                | 0   |

Table 18

| 16-bit register address<br>2x16 1032/<br>2x16 3210 | Register address<br>32-bit | Operations | Description                                       |
|----------------------------------------------------|----------------------------|------------|---------------------------------------------------|
| 7200/7000                                          | 7400                       | R          | Content of the register set in the registers 4200 |
| 7202/7002                                          | 7401                       | R          | Content of the register set in the registers 4201 |
| 7204/7004                                          | 7402                       | R          | Content of the register set in the registers 4202 |
| 7206/7006                                          | 7403                       | R          | Content of the register set in the registers 4203 |
| 7208/7008                                          | 7404                       | R          | Content of the register set in the registers 4204 |
| 7210/7010                                          | 7405                       | R          | Content of the register set in the registers 4205 |
| 7212/7012                                          | 7406                       | R          | Content of the register set in the registers 4206 |
| 7214/7014                                          | 7407                       | R          | Content of the register set in the registers 4207 |
| 7216/7016                                          | 7408                       | R          | Content of the register set in the registers 4208 |
| 7218/7018                                          | 7409                       | R          | Content of the register set in the registers 4209 |
| 7220/7020                                          | 7410                       | R          | Content of the register set in the registers 4210 |
| 7222/7022                                          | 7411                       | R          | Content of the register set in the registers 4211 |
| 7224/7024                                          | 7412                       | R          | Content of the register set in the registers 4212 |

|           |      |   |                                                   |
|-----------|------|---|---------------------------------------------------|
| 7226/7026 | 7413 | R | Content of the register set in the registers 4213 |
| 7228/7028 | 7414 | R | Content of the register set in the registers 4214 |
| 7230/7030 | 7415 | R | Content of the register set in the registers 4215 |
| 7232/7032 | 7416 | R | Content of the register set in the registers 4216 |
| 7234/7034 | 7417 | R | Content of the register set in the registers 4217 |
| 7236/7036 | 7418 | R | Content of the register set in the registers 4218 |
| 7238/7038 | 7419 | R | Content of the register set in the registers 4219 |
| 7240/7040 | 7420 | R | Content of the register set in the registers 4220 |
| 7242/7042 | 7421 | R | Content of the register set in the registers 4221 |
| 7244/7044 | 7422 | R | Content of the register set in the registers 4222 |
| 7246/7046 | 7423 | R | Content of the register set in the registers 4223 |
| 7248/7048 | 7424 | R | Content of the register set in the registers 4224 |
| 7250/7050 | 7425 | R | Content of the register set in the registers 4225 |
| 7252/7052 | 7426 | R | Content of the register set in the registers 4226 |
| 7254/7054 | 7427 | R | Content of the register set in the registers 4227 |
| 7256/7056 | 7428 | R | Content of the register set in the registers 4228 |
| 7258/7058 | 7429 | R | Content of the register set in the registers 4229 |
| 7260/7060 | 7430 | R | Content of the register set in the registers 4230 |
| 7262/7062 | 7431 | R | Content of the register set in the registers 4231 |
| 7264/7064 | 7432 | R | Content of the register set in the registers 4232 |
| 7266/7066 | 7433 | R | Content of the register set in the registers 4233 |
| 7268/7068 | 7434 | R | Content of the register set in the registers 4234 |
| 7270/7070 | 7435 | R | Content of the register set in the registers 4235 |

|           |      |   |                                                   |
|-----------|------|---|---------------------------------------------------|
| 7272/7072 | 7436 | R | Content of the register set in the registers 4236 |
| 7274/7074 | 7437 | R | Content of the register set in the registers 4237 |
| 7276/7076 | 7438 | R | Content of the register set in the registers 4238 |
| 7278/7078 | 7439 | R | Content of the register set in the registers 4239 |
| 7280/7080 | 7440 | R | Content of the register set in the registers 4240 |
| 7282/7082 | 7441 | R | Content of the register set in the registers 4241 |
| 7284/7084 | 7442 | R | Content of the register set in the registers 4242 |
| 7286/7086 | 7443 | R | Content of the register set in the registers 4243 |
| 7288/7088 | 7444 | R | Content of the register set in the registers 4244 |
| 7290/7090 | 7445 | R | Content of the register set in the registers 4245 |
| 7292/7092 | 7446 | R | Content of the register set in the registers 4246 |
| 7294/7094 | 7447 | R | Content of the register set in the registers 4247 |
| 7296/7096 | 7448 | R | Content of the register set in the registers 4248 |
| 7298/7098 | 7449 | R | Content of the register set in the registers 4249 |
| 7300/7100 | 7450 | R | Content of the register set in the registers 4250 |
| 7302/7102 | 7451 | R | Content of the register set in the registers 4251 |
| 7304/7104 | 7452 | R | Content of the register set in the registers 4252 |
| 7306/7106 | 7453 | R | Content of the register set in the registers 4253 |
| 7308/7108 | 7454 | R | Content of the register set in the registers 4254 |
| 7310/7110 | 7455 | R | Content of the register set in the registers 4255 |
| 7312/7112 | 7456 | R | Content of the register set in the registers 4256 |
| 7314/7114 | 7457 | R | Content of the register set in the registers 4257 |
| 7316/7116 | 7458 | R | Content of the register set in the registers 4258 |
| 7318/7118 | 7459 | R | Content of the register set in the registers 4259 |

Tablica 19

| 16-bit register address<br>2x16 1032/<br>2x16 3210 | Register address<br>32-bit | Operations | Description                               | Unit            | 3Ph<br>/<br>4W | 3Ph<br>/<br>3W | 1Ph<br>/<br>2W |
|----------------------------------------------------|----------------------------|------------|-------------------------------------------|-----------------|----------------|----------------|----------------|
| 6000/8000                                          | 7500                       | R          | L1 phase voltage                          | V               | √              | x              | √              |
| 6002/8002                                          | 7501                       | R          | L1 phase current                          | A               | √              | √              | √              |
| 6004/8004                                          | 7502                       | R          | L1 phase active power                     | W               | √              | x              | √              |
| 6006/8006                                          | 7503                       | R          | L1 phase reactive power                   | VA <sub>r</sub> | √              | x              | √              |
| 6008/8008                                          | 7504                       | R          | L1 phase apparent power                   | VA              | √              | x              | √              |
| 6010/8010                                          | 7505                       | R          | L1 phase active power factor (PF1=P1/S1)) | -               | √              | x              | √              |
| 6012/8012                                          | 7506                       | R          | tgφ factor of L1 phase (tg1=Q1/P1)        | -               | √              | x              | √              |
| 6014/8014                                          | 7507                       | R          | THD U1*                                   | %               | √              | √              | √              |
| 6016/8016                                          | 7508                       | R          | THD I1                                    | %               | √              | √              | √              |
| 6018/8018                                          | 7509                       | R          | L2 phase voltage                          | V               | √              | x              | x              |
| 6020/8020                                          | 7510                       | R          | L2 phase current                          | A               | √              | √              | x              |
| 6022/8022                                          | 7511                       | R          | L2 phase active power                     | W               | √              | x              | x              |
| 6024/8024                                          | 7512                       | R          | L2 phase reactive power                   | VA <sub>r</sub> | √              | x              | x              |
| 6026/8026                                          | 7513                       | R          | L2 phase apparent power                   | VA              | √              | x              | x              |
| 6028/8028                                          | 7514                       | R          | L2 phase active power factor (PF2=P2/S2)) | -               | √              | x              | x              |
| 6030/8030                                          | 7515                       | R          | tgφ factor of L2 phase (tg2=Q2/P2)        | -               | √              | x              | x              |
| 6032/8032                                          | 7516                       | R          | THD U2*                                   | %               | √              | √              | x              |
| 6034/8034                                          | 7517                       | R          | THD I2                                    | %               | √              | √              | x              |
| 6036/8036                                          | 7518                       | R          | L3 phase voltage                          | V               | √              | x              | x              |
| 6038/8038                                          | 7519                       | R          | L3 phase current                          | A               | √              | √              | x              |
| 6040/8040                                          | 7520                       | R          | L3 phase active power                     | W               | √              | x              | x              |
| 6042/8042                                          | 7521                       | R          | L3 phase reactive power                   | VA <sub>r</sub> | √              | x              | x              |
| 6044/8044                                          | 7522                       | R          | L3 phase apparent power                   | VA              | √              | x              | x              |
| 6046/8046                                          | 7523                       | R          | L3 phase active power factor (PF3=P3/S3)  | -               | √              | x              | x              |
| 6048/8048                                          | 7524                       | R          | tgφ factor of L3 phase (tg3=Q3/P3)        | -               | √              | x              | x              |
| 6050/8050                                          | 7525                       | R          | THD U3*                                   | %               | √              | √              | x              |
| 6052/8052                                          | 7526                       | R          | THD I3                                    | %               | √              | √              | x              |
| 6054/8054                                          | 7527                       | R          | Mean 3-phase voltage                      | V               | √              | x              | x              |
| 6056/8056                                          | 7528                       | R          | Mean 3-phase current                      | A               | √              | √              | x              |
| 6058/8058                                          | 7529                       | R          | 3-phase active power (P1+P2+P3)           | W               | √              | √              | x              |
| 6060/8060                                          | 7530                       | R          | 3-phase reactive power (Q1+Q2+Q3)         | VA <sub>r</sub> | √              | √              | x              |
| 6062/8062                                          | 7531                       | R          | 3-phase apparent power (S1+S2+S3)         | VA              | √              | √              | x              |
| 6064/8064                                          | 7532                       | R          | 3-phase active power factor (PF=P/S)      | -               | √              | √              | x              |
| 6066/8066                                          | 7533                       | R          | Mean tg factor φ for 3 phases (tg=Q/P)    | -               | √              | √              | x              |
| 6068/8068                                          | 7534                       | R          | THD U* mean 3-phase                       | %               | √              | √              | x              |

|           |      |   |                                                                                                             |          |   |   |   |
|-----------|------|---|-------------------------------------------------------------------------------------------------------------|----------|---|---|---|
| 6070/8070 | 7535 | R | THD I mean 3-phase                                                                                          | %        | √ | √ | x |
| 6072/8072 | 7536 | R | Frequency                                                                                                   | f        | √ | √ | √ |
| 6074/8074 | 7537 | R | Phase-to-phase voltage L1-2                                                                                 | V        | √ | √ | x |
| 6076/8076 | 7538 | R | Phase-to-phase voltage L2-3                                                                                 | V        | √ | √ | x |
| 6078/8078 | 7539 | R | Phase-to-phase voltage L3-1                                                                                 | V        | √ | √ | x |
| 6080/8080 | 7540 | R | Mean phase-to-phase voltage                                                                                 | V        | √ | √ | x |
| 6082/8082 | 7541 | R | Active power averaged (P Demand)                                                                            | W        | √ | √ | x |
| 6084/8084 | 7542 | R | Reactive power averaged (S Demand )                                                                         | VA       | √ | √ | x |
| 6086/8086 | 7543 | R | Current averaged (I Demand)                                                                                 | A        | √ | √ | x |
| 6088/8088 | 7544 | R | Neutral wire current (calculated from vectors)                                                              | A        | √ | x | x |
| 6090/8090 | 7545 | R | Active 3-phase import energy (no. of register 7546 overflows, resets to 0 after reaching 9999.9 MWh)        | 100 MWh  | √ | √ | √ |
| 6092/8092 | 7546 | R | Active 3-phase import energy (counter counting up to 99999.99 kWh)                                          | kWh      | √ | √ | √ |
| 6094/8094 | 7547 | R | Active 3-phase export energy (no. of register 7548 overflows, resets to 0 after reaching 9999.9 MWh)        | 100 MWh  | √ | √ | √ |
| 6096/8096 | 7548 | R | Active 3-phase export energy (counter counting up to 99999.99 kWh)                                          | kWh      | √ | √ | √ |
| 6098/8098 | 7549 | R | Reactive 3-phase inductive energy (no. of register 7550 overflows, resets to 0 after reaching 9999.9 MVAh). | 100 MVAh | √ | √ | √ |
| 6100/8100 | 7550 | R | Reactive 3-phase inductive energy (counter counting up to 99999.99 kVAh)                                    | kVAh     | √ | √ | √ |
| 6102/8102 | 7551 | R | Reactive 3-phase capacity energy (no. of register 7552 overflows, resets to 0 after reaching 9999.9 MVAh)   | 100 MVAh | √ | √ | √ |
| 6104/8104 | 7552 | R | Reactive 3-phase capacity energy (counter counting up to 99999.99 kVAh)                                     | kVAh     | √ | √ | √ |
| 6106/8106 | 7553 | R | Apparent energy (no. of register 7554 overflows, resets to 0 after reaching 9999.9 MVAh)                    | 100 MVAh | √ | √ | √ |
| 6108/8108 | 7554 | R | Apparent energy (counter counting up to 99999.99 kVAh)                                                      | kVAh     | √ | √ | √ |
| 6110/8110 | 7555 | R | Time – seconds                                                                                              | sek      | √ | √ | √ |
| 6112/8112 | 7556 | R | Time – hours, minutes                                                                                       |          | √ | √ | √ |
| 6114/8114 | 7557 | R | Date – month, day                                                                                           |          | √ | √ | √ |
| 6116/8116 | 7558 | R | Year – 2014 - 2100                                                                                          |          | √ | √ | √ |
| 6118/8118 | 7559 | R | Status 1 register                                                                                           | -        | √ | √ | √ |
| 6120/8120 | 7560 | R | Status 2 register                                                                                           | -        | √ | √ | √ |
| 6122/8122 | 7561 | R | Status 3 register                                                                                           | -        | √ | √ | √ |
| 6124/8124 | 7562 | R | Status 4 register                                                                                           | -        | √ | √ | √ |
| 6126/8126 | 7563 | R | Status 5 register                                                                                           | -        | √ | √ | √ |
| 6128/8128 | 7564 | R | Status 6 register                                                                                           | -        | √ | √ | √ |
| 6130/8130 | 7565 | R | Current value of the analog output 1                                                                        | mA       | √ | √ | √ |
| 6132/8132 | 7566 | R | Temperature Pt100 1                                                                                         | °C       | √ | √ | √ |

|           |      |   |                                       |     |   |   |   |
|-----------|------|---|---------------------------------------|-----|---|---|---|
| 6134/8134 | 7567 | R | Temperature Pt100 2                   | °C  | √ | √ | √ |
| 6136/8136 | 7568 | R | Voltage L1 min                        | V   | √ | x | √ |
| 6138/8138 | 7569 | R | Voltage L1 max                        | V   | √ | x | √ |
| 6140/8140 | 7570 | R | Voltage L2 min                        | V   | √ | x | x |
| 6142/8142 | 7571 | R | Voltage L2 max                        | V   | √ | x | x |
| 6144/8144 | 7572 | R | Voltage L3 min                        | V   | √ | x | x |
| 6146/8146 | 7573 | R | Voltage L3 max                        | V   | √ | x | x |
| 6148/8148 | 7574 | R | Current L1 min                        | A   | √ | √ | x |
| 6150/8150 | 7575 | R | Current L1 max                        | A   | √ | √ | x |
| 6152/8152 | 7576 | R | Current L2 min                        | A   | √ | √ | x |
| 6154/8154 | 7577 | R | Current L2 max                        | A   | √ | √ | x |
| 6156/8156 | 7578 | R | Current L3 min                        | A   | √ | √ | x |
| 6158/8158 | 7579 | R | Current L3 max                        | A   | √ | √ | x |
| 6160/8160 | 7580 | R | Active power L1 min                   | W   | √ | x | √ |
| 6162/8162 | 7581 | R | Active power L1 max                   | W   | √ | x | √ |
| 6164/8164 | 7582 | R | Active power L2 min                   | W   | √ | x | x |
| 6166/8166 | 7583 | R | Active power L2 max                   | W   | √ | x | x |
| 6168/8168 | 7584 | R | Active power L3 min                   | W   | √ | x | x |
| 6170/8170 | 7585 | R | Active power L3 max                   | W   | √ | x | x |
| 6172/8172 | 7586 | R | Reactive power L1 min                 | Var | √ | x | √ |
| 6174/8174 | 7587 | R | Reactive power L1 max                 | Var | √ | x | √ |
| 6176/8176 | 7588 | R | Reactive power L2 min                 | Var | √ | x | x |
| 6178/8178 | 7589 | R | Reactive power L2 max                 | Var | √ | x | x |
| 6180/8180 | 7590 | R | Reactive power L3 min                 | Var | √ | x | x |
| 6182/8182 | 7591 | R | Reactive power L3 max                 | Var | √ | x | x |
| 6184/8184 | 7592 | R | Apparent power L1 min                 | VA  | √ | x | √ |
| 6186/8186 | 7593 | R | Apparent power L1 max                 | VA  | √ | x | √ |
| 6188/8188 | 7594 | R | Apparent power L2 min                 | VA  | √ | x | x |
| 6190/8190 | 7595 | R | Apparent power L2 max                 | VA  | √ | x | x |
| 6192/8192 | 7596 | R | Apparent power L3 min                 | VA  | √ | x | x |
| 6194/8194 | 7597 | R | Apparent power L3 max                 | VA  | √ | x | x |
| 6196/8196 | 7598 | R | Power factor (PF) L1 min              | -   | √ | x | √ |
| 6198/8198 | 7599 | R | Power factor (PF) L1 max              | -   | √ | x | √ |
| 6200/8200 | 7600 | R | Power factor (PF) L2 min              | -   | √ | x | x |
| 6202/8202 | 7601 | R | Power factor (PF) L2 max              | -   | √ | x | x |
| 6204/8204 | 7602 | R | Power factor (PF) L3 min              | -   | √ | x | x |
| 6206/8206 | 7603 | R | Power factor (PF) L3 max              | -   | √ | x | x |
| 6208/8208 | 7604 | R | Reactive to active power ratio L1 min | -   | √ | x | √ |
| 6210/8210 | 7605 | R | Reactive to active power ratio L1 max | -   | √ | x | √ |

|           |      |   |                                                    |     |   |   |   |
|-----------|------|---|----------------------------------------------------|-----|---|---|---|
| 6212/8212 | 7606 | R | Reactive to active power ratio L1 min              | -   | √ | x | x |
| 6214/8214 | 7607 | R | Reactive to active power ratio L2 max              | -   | √ | x | x |
| 6216/8216 | 7608 | R | Reactive to active power ratio L3 min              | -   | √ | x | x |
| 6218/8218 | 7609 | R | Reactive to active power ratio L3 max              | -   | √ | x | x |
| 6220/8220 | 7610 | R | Phase-to-phase voltage L1-2 min                    | V   | √ | √ | x |
| 6222/8222 | 7611 | R | Phase-to-phase voltage L1-2 max                    | V   | √ | √ | x |
| 6224/8224 | 7612 | R | Phase-to-phase voltage L2-3 min                    | V   | √ | √ | x |
| 6226/8226 | 7613 | R | Phase-to-phase voltage L2-3 max                    | V   | √ | √ | x |
| 6228/8228 | 7614 | R | Phase-to-phase voltage L3-1 min                    | V   | √ | √ | x |
| 6230/8230 | 7615 | R | Phase-to-phase voltage L3-1 max                    | V   | √ | √ | x |
| 6232/8232 | 7616 | R | Mean 3-phase voltage (min)                         | V   | √ | x | x |
| 6234/8234 | 7617 | R | Mean 3-phase voltage (max)                         | V   | √ | x | x |
| 6236/8236 | 7618 | R | Mean 3-phase current (min)                         | A   | √ | √ | x |
| 6238/8238 | 7619 | R | Mean 3-phase current (max)                         | A   | √ | √ | x |
| 6240/8240 | 7620 | R | 3-phase active power (min)                         | W   | √ | √ | x |
| 6242/8242 | 7621 | R | 3-phase active power (max)                         | W   | √ | √ | x |
| 6244/8244 | 7622 | R | 3-phase reactive power (min)                       | var | √ | √ | x |
| 6246/8246 | 7623 | R | 3-phase reactive power (max)                       | var | √ | √ | x |
| 6248/8248 | 7624 | R | 3-phase apparent power (min)                       | VA  | √ | √ | x |
| 6250/8250 | 7625 | R | 3-phase apparent power (max)                       | VA  | √ | √ | x |
| 6252/8252 | 7626 | R | Power factor (PF) min                              | -   | √ | √ | x |
| 6254/8254 | 7627 | R | Power factor (PF) max                              | -   | √ | √ | x |
| 6256/8256 | 7628 | R | Reactive to active power ratio (3-phase mean min.) | -   | √ | √ | x |
| 6258/8258 | 7629 | R | Reactive to active power ratio (3-phase mean max.) | -   | √ | √ | x |
| 6260/8260 | 7630 | R | Min. frequency                                     | Hz  | √ | √ | √ |
| 6262/8262 | 7631 | R | Frequency max                                      | Hz  | √ | √ | √ |
| 6264/8264 | 7632 | R | Mean phase-to-phase voltage (min.)                 | V   | √ | √ | x |
| 6266/8266 | 7633 | R | Mean phase-to-phase voltage (max.)                 | V   | √ | √ | x |
| 6268/8268 | 7634 | R | Active power averaged (P Demand) min               | W   | √ | √ | √ |
| 6270/8270 | 7635 | R | Active power averaged (P Demand) max               | W   | √ | √ | √ |
| 6272/8272 | 7636 | R | Apparent power averaged (S Demand) min             | VA  | √ | √ | √ |
| 6274/8274 | 7637 | R | Apparent power averaged (S Demand) max             | VA  | √ | √ | √ |
| 6276/8276 | 7638 | R | Current averaged (I Demand) min                    | A   | √ | √ | √ |
| 6278/8278 | 7639 | R | Current averaged (I Demand) max                    | A   | √ | √ | √ |
| 6280/8280 | 7640 | R | Neutral wire current (min.)                        | A   | √ | x | x |
| 6282/8282 | 7641 | R | Neutral wire current (max.)                        | A   | √ | x | x |
| 6284/8284 | 7642 | R | Temperature T1 min                                 | °C  | √ | √ | √ |
| 6286/8286 | 7643 | R | Temperature T1 max                                 | °C  | √ | √ | √ |

|           |      |   |                                             |    |   |   |   |
|-----------|------|---|---------------------------------------------|----|---|---|---|
| 6288/8288 | 7644 | R | Temperature T2 min                          | °C | √ | √ | √ |
| 6290/8290 | 7645 | R | Temperature T2 max                          | °C | √ | √ | √ |
| 6292/8292 | 7646 | R | THD U1 min                                  | %  | √ | x | √ |
| 6294/8294 | 7647 | R | THD U1 max                                  | %  | √ | x | √ |
| 6296/8296 | 7648 | R | THD U2 min                                  | %  | √ | x | x |
| 6298/8298 | 7649 | R | THD U2 max                                  | %  | √ | x | x |
| 6300/8300 | 7650 | R | THD U3 min                                  | %  | √ | x | x |
| 6302/8302 | 7651 | R | THD U3 max                                  | %  | √ | x | x |
| 6304/8304 | 7652 | R | THD U min                                   | %  | √ | x | x |
| 6306/8306 | 7653 | R | THD U max                                   | %  | √ | x | x |
| 6308/8308 | 7654 | R | THD I1 min                                  | %  | √ | x | √ |
| 6310/8310 | 7655 | R | THD I1 max                                  | %  | √ | x | √ |
| 6312/8312 | 7656 | R | THD I2 min                                  | %  | √ | x | x |
| 6314/8314 | 7657 | R | THD I2 max                                  | %  | √ | x | x |
| 6316/8316 | 7758 | R | THD I3 min                                  | %  | √ | x | x |
| 6318/8318 | 7759 | R | THD I3 max                                  | %  | √ | x | x |
| 6320/8320 | 7660 | R | THD I min                                   | %  | √ | x | x |
| 6322/8322 | 7661 | R | THD I max                                   | %  | √ | x | x |
| 6324/8324 | 7662 | R | HarU1[2] 2nd harmonic of L1 phase voltage   | %  | √ | x | √ |
| 6326/8326 | 7663 | R | HarU1[3] 3rd harmonic of L1 phase voltage   | %  | √ | x | √ |
| :         | :    | R | :                                           |    |   |   |   |
| :         | :    | R | :                                           |    |   |   |   |
| 6420/8420 | 7710 | R | HarU1[50] 50th harmonic of L1 phase voltage | %  | √ | x | √ |
| 6422/8422 | 7711 | R | HarU1[51] 51st harmonic of L1 phase voltage | %  | √ | x | √ |
| 6424/8424 | 7712 | R | HarU2[2] 2nd harmonic of L2 phase voltage   | %  | √ | x | x |
| 6426/8426 | 7713 | R | HarU2[3] 3rd harmonic of L2 phase voltage   | %  | √ | x | x |
| :         | :    | R | :                                           |    |   |   |   |
| :         | :    | R | :                                           |    |   |   |   |
| 6520/8520 | 7760 | R | HarU2[50] 50th harmonic of L2 phase voltage | %  | √ | x | x |
| 6522/8522 | 7761 | R | HarU2[51] 51st harmonic of L2 phase voltage | %  | √ | x | x |
| 6524/8524 | 7762 | R | HarU3[2] 2nd harmonic of L3 phase voltage   | %  | √ | x | x |
| 6526/8526 | 7763 | R | HarU3[3] 3rd harmonic of L3 phase voltage   | %  | √ | x | x |
| :         | :    | R | :                                           |    |   |   |   |
| :         | :    | R | :                                           |    |   |   |   |
| 6620/8620 | 7810 | R | HarU3[50] 50th harmonic of L3 phase voltage | %  | √ | x | x |
| 6622/8622 | 7811 | R | HarU3[51] 51st harmonic of L3 phase voltage | %  | √ | x | x |
| 6624/8624 | 7812 | R | HarI1U1[2] 2nd harmonic of L1 phase current | %  | √ | x | √ |
| 6626/8626 | 7813 | R | HarI1U1[3] 3rd harmonic of L1 phase current | %  | √ | x | √ |
| :         | :    | R | :                                           |    |   |   |   |

|           |      |   |                                                                                                                             |         |   |   |   |
|-----------|------|---|-----------------------------------------------------------------------------------------------------------------------------|---------|---|---|---|
| :         | :    | R | :                                                                                                                           |         |   |   |   |
| 6720/8720 | 7860 | R | Har1U1[50] 50th harmonic of L1 phase current                                                                                | %       | √ | x | √ |
| 6722/8722 | 7861 | R | Har1[51] 51st harmonic of L1 phase current                                                                                  | %       | √ | x | √ |
| 6724/8724 | 7862 | R | Har2[2] 2nd harmonic of L2 phase current                                                                                    | %       | √ | x | x |
| 6726/8726 | 7863 | R | Har2[3] 3rd harmonic of L2 phase current                                                                                    | %       | √ | x | x |
| :         | :    | R | :                                                                                                                           |         |   |   |   |
| :         | :    | R | :                                                                                                                           |         |   |   |   |
| 6820/8820 | 7910 | R | Har2[50] 50th harmonic of L2 phase current                                                                                  | %       | √ | x | x |
| 6822/8822 | 7911 | R | Har2[51] 51st harmonic of L2 phase current                                                                                  | %       | √ | x | x |
| 6824/8824 | 7912 | R | Har3[2] 2nd harmonic of L3 phase current                                                                                    | %       | √ | x | x |
| 6826/8826 | 7913 | R | Har3[3] 3rd harmonic of L3 phase current                                                                                    | %       | √ | x | x |
| :         | :    | R | :                                                                                                                           |         |   |   |   |
| :         | :    | R | :                                                                                                                           |         |   |   |   |
| 6920/8920 | 7960 | R | Har3[50] 50th harmonic of L3 phase current                                                                                  | %       | √ | x | x |
| 6922/8922 | 7961 | R | Har3[51] 51st harmonic of L3 phase current                                                                                  | %       | √ | x | x |
| 6924/8924 | 7962 | R | Mean reactive power                                                                                                         | var     | √ | √ | √ |
| 6926/8926 | 7963 | R | Mean reactive power min                                                                                                     | var     | √ | √ | √ |
| 6928/8928 | 7964 | R | Mean reactive power max                                                                                                     | var     | √ | √ | √ |
| 6930/8930 | 7965 | R | Mean active power factor (PF1+PF2+PF3)/3                                                                                    | -       | √ | x | √ |
| 6932/8932 | 7966 | R | Mean active power factor min                                                                                                | -       | √ | x | √ |
| 6934/8934 | 7967 | R | Mean active power factor max                                                                                                | -       | √ | x | √ |
| 6936/8936 | 7968 | R | Active imported 3-phase energy for the previous year (overflows number of register 7563, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |
| 6938/8938 | 7969 | R | Active imported 3-phase energy for the previous year (counter up to 9999.99 kWh)                                            | kWh     | √ | √ | √ |
| 6940/8940 | 7970 | R | Active exported 3-phase energy for the previous year (overflows number of register 7565, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |
| 6942/8942 | 7971 | R | Active exported 3-phase energy for the previous year (counter up to 9999.99 kWh)                                            | kWh     | √ | √ | √ |
| 6944/8944 | 7972 | R | Active imported 3-phase energy for the current year (overflows number of register 7567, reset after 9999.9 MWh is reached)  | 100 MWh | √ | √ | √ |
| 6946/8946 | 7973 | R | Active imported 3-phase energy for the current year (counter up to 9999.99 kWh)                                             | kWh     | √ | √ | √ |
| 6948/8948 | 7974 | R | Active exported 3-phase energy for the current year (overflows number of register 7569, reset after 9999.9 MWh is reached)  | 100 MWh | √ | √ | √ |
| 6950/8950 | 7975 | R | Active exported 3-phase energy for the current year (counter up to 9999.99 kWh)                                             | kWh     | √ | √ | √ |
| 6952/8952 | 7976 | R | Active imported 3-phase energy for the current month (overflows number of register 7571, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |

|           |      |   |                                                                                                                                |         |   |   |   |
|-----------|------|---|--------------------------------------------------------------------------------------------------------------------------------|---------|---|---|---|
| 6954/8954 | 7977 | R | Active imported 3-phase energy for the current month (counter up to 9999.99 kWh)                                               | kWh     | √ | √ | √ |
| 6956/8956 | 7978 | R | Active exported 3-phase energy for the current month (overflows number of register 7573, reset after 9999.9 MWh is reached)    | 100 MWh | √ | √ | √ |
| 6958/8958 | 7979 | R | Active exported 3-phase energy for the current month (counter up to 9999.99 kWh)                                               | kWh     | √ | √ | √ |
| 6960/8960 | 7980 | R | Active imported 3-phase energy for the current week (overflows number of register 7575, reset after 9999.9 MWh is reached)     | 100 MWh | √ | √ | √ |
| 6962/8962 | 7981 | R | Active imported 3-phase energy for the current week (counter up to 9999.99 kWh)                                                | kWh     | √ | √ | √ |
| 6964/8964 | 7982 | R | Active exported 3-phase energy for the current week (overflows number of register 7577, reset after 9999.9 MWh is reached)     | 100 MWh | √ | √ | √ |
| 6966/8966 | 7983 | R | Active exported 3-phase energy for the current week (counter up to 9999.99 kWh)                                                | kWh     | √ | √ | √ |
| 6968/8968 | 7984 | R | Active imported 3-phase energy for the current 48 hours (overflows number of register 7579, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |
| 6970/8970 | 7985 | R | Active imported 3-phase energy for the current 48 hours (counter up to 9999.99 kWh)                                            | kWh     | √ | √ | √ |
| 6972/8974 | 7986 | R | Active exported 3-phase energy for the current 48 hours (overflows number of register 7581, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |
| 6974/8974 | 7987 | R | Active exported 3-phase energy for the current 48 hours (counter up to 9999.99 kWh)                                            | kWh     | √ | √ | √ |
| 6976/8976 | 7988 | R | Active imported 3-phase energy for the current 24 hours (overflows number of register 7583, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |
| 6978/8978 | 7989 | R | Active imported 3-phase energy for the current 24 hours (counter up to 9999.99 kWh)                                            | kWh     | √ | √ | √ |
| 6980/8980 | 7990 | R | Active exported 3-phase energy for the current 24 hours (overflows number of register 7585, reset after 9999.9 MWh is reached) | 100 MWh | √ | √ | √ |
| 6982/8982 | 7991 | R | Active exported 3-phase energy for the current 24 hours (counter up to 9999.99 kWh)                                            | kWh     | √ | √ | √ |

\* In three-phase 3-wire (3Ph/3W) system, THD U12, THD U23, THD U31, respectively, THD U123

| Register address<br>16 bit<br>2x16 1032/<br>2x16 3210 | Options | Description                                 | Unit | 3Ph<br>/<br>4W | 3Ph<br>/<br>3W | 1Ph<br>/<br>2W |
|-------------------------------------------------------|---------|---------------------------------------------|------|----------------|----------------|----------------|
| 9000/9200                                             | R       | HarU1[52] 52nd harmonic of L1 phase voltage | %    | √              | x              | √              |
| 9002/9202                                             | R       | HarU1[53] 53rd harmonic of L1 phase voltage | %    | √              | x              | √              |
| :                                                     | R       | :                                           |      |                |                |                |

|           |   |                                                |   |   |   |   |
|-----------|---|------------------------------------------------|---|---|---|---|
| :         | R | :                                              |   |   |   |   |
| 9020/9220 | R | HarU1[62] 62nd harmonic of L1 phase voltage    | % | √ | x | √ |
| 9022/9222 | R | HarU1[63] 63rd harmonic of L1 phase voltage    | % | √ | x | √ |
| 9024/9224 | R | HarU2[52] 52nd harmonica of L2 phase voltage   | % | √ | x | x |
| 9026/9226 | R | HarU2[53] 53rd harmonic of L2 phase voltage    | % | √ | x | x |
| :         | R | :                                              |   |   |   |   |
| :         | R | :                                              |   |   |   |   |
| 9044/9244 | R | HarU2[62] 62nd harmonic of L2 phase voltage    | % | √ | x | x |
| 9046/9246 | R | HarU2[63] 63rd harmonic of L2 phase voltage    | % | √ | x | x |
| 9048/9248 | R | HarU3[52] 52nd harmonic of L3 phase voltage    | % | √ | x | x |
| 9050/9250 | R | HarU3[53] 53rd harmonic of L3 phase voltage    | % | √ | x | x |
| :         | R | :                                              |   |   |   |   |
| :         | R | :                                              |   |   |   |   |
| 9068/9268 | R | HarU3[62] 62nd harmonic of L3 phase voltage    | % | √ | x | x |
| 9070/9270 | R | HarU3[63] 63rd harmonic of L3 phase voltage    | % | √ | x | x |
| 9072/9272 | R | HarI1[52] 52nd harmonic of L1 current voltage  | % | √ | x | √ |
| 9074/9274 | R | HarI1[53] 53rd harmonic of L1 current voltage  | % | √ | x | √ |
| :         | R | :                                              |   |   |   |   |
| :         | R | :                                              |   |   |   |   |
| 9092/9292 | R | HarI1[62] 62nd harmonic of L1 current voltage  | % | √ | x | √ |
| 9094/9294 | R | HarI1[63] 63rd harmonic of L1 current voltage  | % | √ | x | √ |
| 9096/9296 | R | HarI2[52] 52nd harmonica of L2 current voltage | % | √ | x | x |
| 9098/9298 | R | HarI2[53] 53rd harmonic of L2 current voltage  | % | √ | x | x |
| :         | R | :                                              |   |   |   |   |
| :         | R | :                                              |   |   |   |   |
| 9116/9316 | R | HarI2[62] 62nd harmonic of L2 current voltage  | % | √ | x | x |
| 9118/9318 | R | HarI2[63] 63rd harmonic of L2 current voltage  | % | √ | x | x |
| 9120/9320 | R | HarI3[52] 52nd harmonica of L3 current voltage | % | √ | x | x |
| 9122/9322 | R | HarI3[53] 53rd harmonic of L3 current voltage  | % | √ | x | x |
| :         | R | :                                              |   |   |   |   |
| :         | R | :                                              |   |   |   |   |
| 9140/9340 | R | HarI3[62] 62nd harmonic of L3 current voltage  | % | √ | x | x |
| 9142/9342 | R | HarI3[63] 63rd harmonic of L3 current voltage  | % | √ | x | x |

## 10. SOFTWARE UPGRADE

### 10.1. Firmware update

A feature implemented in the ND31LITE meters enables to upgrade firmware using a PC with eCon software installed. Free eCon software and the update files are available at [www.lumel.com.pl](http://www.lumel.com.pl). Upgrade of meter software (firmware) can be done via RS-485 interface. Go to LUMEL UPDATER tab to upgrade.

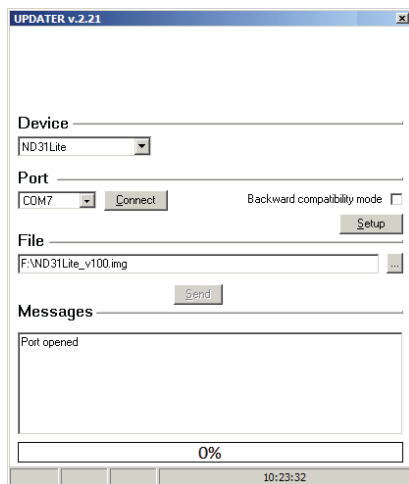
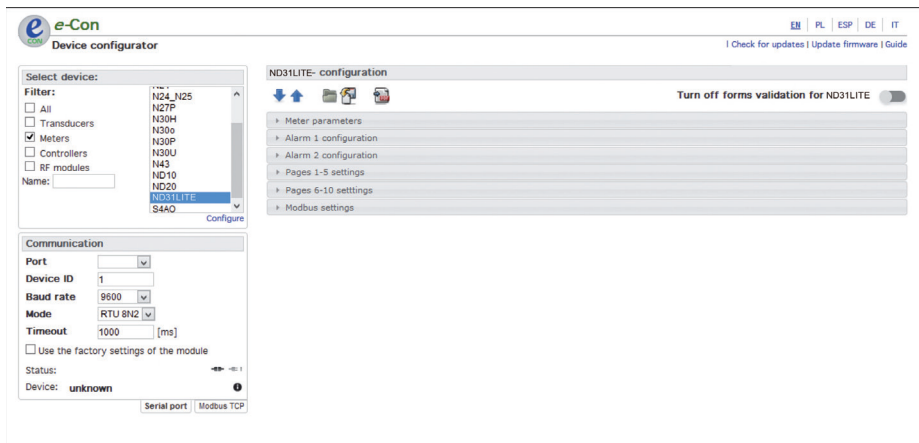


Fig. 26. Program window view: a) eCon, b) software upgrade

Note: Software update automatically resets meter settings to default settings, so it is recommended to save meter settings using eCon software before upgrading.

After launching eCon software, set in the settings required serial port, baud rate, mode and address of the meter. Next, select the ND31LITE meter and click Config. Click the down arrow icon to read all of the settings then the disk icon to save the settings to a file (required to restore the settings later). After selecting the option Update firmware (in the upper right corner of the screen) the window Lumel Updater (LU) will be opened – Fig. 26b.

There are two ways to enter upgrade mode in the meter:

1. remotely via LU (based on the settings in eCon - address, mode, baud rate, COM port)
2. by switching on the meter with the key held down (if the bootloader mode is entered with the key, the communication parameters are: baud rate 9600, RTU8N2, address 1).

Select the meter update file by pressing the „...” button. Click Connect. (NOTE!: for the 2nd update method, the meter must be switched on at this time). The Messages information window displays information concerning upgrade process. If the port is opened correctly, a Port opened message appears.

The display will show the bootloader version, while the LU program displays the message Device found and the name and version of the connected device. Press the Send button. When upgrade is successfully completed, the meter begins normal work while the information window displays Done message and upgrade elapsed time.

After the LU window is closed, go to parameter group Service parameters, select the option Set default settings of a meter and press a button Restore. Then press the folder icon to open a previously saved settings file and press the up arrow icon to save the settings in the meter. Current software version can be checked by reading the welcome message when switching the meter on.

Note: Turning meter supply off during upgrade process may result in permanent damage!

## 11 ERROR CODES

During the meter operation the error messages may be displayed. Following list shows reasons of errors.

Error:

- **MEMORY FR, - CAL INP, - CAL AN, - CAL Pt, - SD CARD** – displayed when the memory of the meter is corrupted. The meter must be sent to the manufacturer.
- **PAR.CFG** – displayed when the operating parameters of the meter are incorrect. The factory settings must be restored (from the menu „Settings

-> Set all defaults” or via RS485).

- **PAR.SCREEN** – displayed when the parameters related to the configuration of displayed parameters in the meter are incorrect. The factory settings should be restored (from the menu „ Displaying -> Settings -> Set screen defaults „or via RS485).
- **PAR.READ** – displayed when the parameters related to registers from the modbus 42xx group of addresses are incorrect. The factory settings must be restored (from the menu „ Modbus -> Set defaults 42xx” or via RS485).
- **ENERGY** – displayed when an error occurs in the value in one of the energy counters of the meter. The factory settings must be restored (from the menu „ Parameters -> Del energy counters” or via RS485).

– ^^^^ – upper overrun. Measuring value is out of the measuring range.

– vvvv – lower overrun. Measuring value is out of the measuring range.

## 12. TECHNICAL DATA

### Measuring ranges and permissible basic errors

Table 21

| Measuring value                                      | Measuring range                                                                                                                                                        | L1 | L2 | L3 | Σ | Class             |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|---|-------------------|
| Current I: 1/5 A    1 A~<br>5 A~                     | 0,002 .. 0,100 .. 1,200 A<br>0,010 .. 0,500 .. 6,000 A<br>...100,00 kA (tr <sub>I</sub> ≠1)                                                                            | •  | •  | •  |   | 0.2 (EN 61557-12) |
| Voltage U L-N: 57,7 V~<br>110 V~<br>230 V~<br>400 V~ | 5,700 .. 11,500 .. 70,000 V<br>11,000 .. 22,000 .. 132,000 V<br>23,000 .. 46,000 .. 276,000 V<br>40,000 .. 80,000 .. 480,000 V<br>...1920,0 kV (tr <sub>U</sub> ≠1)    | •  | •  | •  |   | 0.2 (EN 61557-12) |
| Voltage U L-L: 100 V~<br>190 V~<br>400 V~<br>690 V~  | 10,000 .. 20,000 .. 120,000 V<br>19,000 .. 38,000 .. 228,000 V<br>40,000 .. 80,000 .. 480,000 V<br>69,000 .. 138,000 .. 830,000 V<br>...1999,0 kV (tr <sub>U</sub> ≠1) | •  | •  | •  |   | 0.5 (EN 61557-12) |
| Voltage U L-L: 100 V~<br>190 V~<br>400 V~<br>690 V~  | 10.000 .. 20.000 .. 120.00 V<br>19.000 .. 38.000 .. 228.00 V<br>40.000 .. 80.00 .. 480.00 V<br>69.000 .. 138.00 .. 830.00 V<br>...1999.0 kV (tr <sub>U</sub> ≠1)       | •  | •  | •  |   | 0.5 (EN 61557-12) |
| Active power P                                       | -19999 MW .. 0,000 W ..<br>..19999 MW (tr <sub>U</sub> ≠1, tr <sub>I</sub> ≠1)                                                                                         | •  | •  | •  | • | 0.5 (EN 61557-12) |
| Reactive power Q                                     | -19999 MVar .. 0,000 Var ..<br>..19999 MVar (tr <sub>U</sub> ≠1, tr <sub>I</sub> ≠1)                                                                                   | •  | •  | •  | • | 2 (EN 61557-12)   |

|                                                                                                    |                                                       |   |   |   |   |                    |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------|---|---|---|---|--------------------|
| Apparent power S                                                                                   | 0,000 .. 1999,9 VA ..<br>..19999 MVA (tr_U≠1, tr_I≠1) | • | • | • | • | 0.5 (EN 61557-12)  |
| Active energy EnP<br>/ import or export /                                                          | 0,000 .. 99 999 999, 999 kWh                          |   |   |   | • | 0.2S (EN 62053-22) |
| Reactive energy EnQ<br>/ capacity or inductive /                                                   | 0,000 .. 99 999 999, 999 kVarh                        |   |   |   | • | 2 (EN 61557-12)    |
| Apparent energy EnS                                                                                | 0,000 .. 99 999 999, 999 kVAh                         |   |   |   | • | 0.5 (EN 61557-12)  |
| Active power factor PF                                                                             | -1,00 .. 0 .. 1,00                                    | • | • | • | • | 1 (EN 61557-12)    |
| Factor tg                                                                                          | -999,99 .. -1,20 .. 0 .. 1,20 .. 999,99               | • | • | • | • | 1                  |
| Frequency f                                                                                        | 45,000 .. 65,000 .. 100Hz                             |   |   |   | • | 0.1 (EN 61557-12)  |
| Harmonic distortion factor of<br>voltage THDU, current THDI                                        | 0,0 .. 100,0 %                                        | • | • | • | • | 5 (EN 61557-12)    |
| Harmonic amplitudes of<br>voltage Uh2 ...Uh <sub>63</sub> ,<br>of current Ih2 ... Ih <sub>63</sub> | 0,0 .. 100,0 %                                        | • | • | • |   | II (IEC61000-4-7)  |

tr\_I - Current transformer ratio = Transformer primary current / Current transformer secondary current  
tr\_U - Voltage transformer ratio = Transformer primary voltage / Voltage transformer secondary voltage

**Power consumption:**

- in supply circuit  $\leq 6 \text{ VA}$
- in voltage circuit  $\leq 0,5 \text{ VA}$
- in current circuit  $\leq 0,1 \text{ VA}$

**Readout field**

3.5" TFT full-color screen, resolution: 320 x 240 pixel

**Relay outputs (A1, A2)**

2 programmable relays, volt-free NO contacts, load capacity (resistive) 0.5 A/250 V AC or 5 A/30 V DC  
Switching number: mechanical min.  $5 \cdot 10^6$   
electric min.  $1 \cdot 10^5$

**Analog output (0 .. 20 mA)**

1 output: 0... 20 mA (4...20mA) programmable.  
Load resistance  $\leq 400 \Omega$ . Voltage 10 V. Basic error 0.2%.

**Inputs (T1, T2)**

2 x Pt100, 2-wire, -50 ...+400 °C, basic error 0.5 %

**Serial interface RS-485**

Modbus RTU 8N2, 8E1, 8O1, 8N1. Address 1..247,  
Baud rate 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbit/s  
Maximum response time: 600 ms

**Ethernet interface**

10/100 Base-T, RJ45 socket, web server, FTP Server  
Modbus TCP/IP server, DHCP client, SNMP, MQTT,  
BACnet

**Sampling**

A/D Converter 16-bit  
sampling rate 6.4 kHz at 50 Hz  
7.68 kHz at 60 Hz  
Simultaneous sampling of all loops, 128 samples per cycle

**Harmonics**

Harmonic (n) 1..63  
Harmonic distortion factor referred to the voltage THD,  
current THD (n=2..63) 0.0 ..100.0%  
FFT analysis (Fast Fourier Transform)

**Real Time Clock**

$\pm 20$  ppm, real time clock battery CR2032

**Registration**

Archiving period (registration interval) 1..3600 sec.  
Registration activation modes: n\_on, noFF, on,oFF,  
H\_on, HoFF, 3non, 3noF, 3\_on, 3\_oF,  
Registration time: depends on the configuration e.g.  
approx. 220 days for interval 1 sec.  
Files archive memory 8 GB

**Terminals**

Cross section 0.05 .. 2.5 mm<sup>2</sup>  
Clamping screws M3  
Tightening torque 0.5 Nm

**Protection grade ensured by the housing**

|                     |       |
|---------------------|-------|
| from the front      | IP 65 |
| from terminals 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..50..400 Hz), 90..300 V d.c.<br>or 20..40 V a.c. (40..50..400) Hz or 20..60 V d.c. |      |
| - input signal:           | 0 .. 0.1..1.2In; 0.1..0.2..1.2Un for current, voltage, PFI, tgi                                       |      |
| - frequency               | 45 ..50 .. 60 .. 100 Hz; sinusoidal (THD ≤ 8%)                                                        |      |
| - power factory           | -1...0...1                                                                                            |      |
| - ambient temperature     | -10..23..+55 oC, class K55 acc. to EN61557-12                                                         |      |
| - storage temperature     | -20..+70 °C                                                                                           |      |
| - humidity                | 0 .. 40 ..60 ..95% (no condensation)                                                                  |      |
| - max. peak factor:       |                                                                                                       |      |
| current                   | 2                                                                                                     |      |
| voltage                   | 2                                                                                                     |      |
| - external magnetic field | ≤ 40...400 A/m d.c.<br>≤ 3 A/m a.c. 50/60 Hz                                                          |      |
| - short-term overload     |                                                                                                       |      |
| voltage inputs            | 5 sec.                                                                                                | 2 Un |
| current inputs            | 1 sec.                                                                                                | 50 A |
| - working position        | any                                                                                                   |      |
| - warm-up time            | 15 min.                                                                                               |      |

**Real time clock battery:** CR2032

**Additional errors:**

|                                      |               |
|--------------------------------------|---------------|
| in % of the base error               |               |
| - --from ambient temperature changes | < 50% / 10 °C |
| - --for THD > 8%                     | < 50%         |

**Standards fulfilled by the meter:****Electromagnetic compatibility:**

- noise immunity in industrial environments acc. to EN 61000-6-2, EN IEC 61326-1
  - radio-frequency common mode:
- level 2: 0.15... 1 MHz

- level 3: 1 MHz...80 MHz
- noise emission acc. to EN 61000-6-4, EN IEC 61326-1

## Safety requirements:

according to EN 61010-1 (with changes) standard

- isolation between circuits: basic
- OVC surge category III for voltages with respect to ground up to 300V  
(for input voltages 3 x 57.7/100 V, 3 x 230/400 V) o
- OVC II overvoltage category for voltages with respect to ground up to 600V  
(for input voltages 3 x 110/190 V, 3 x 400/690 V) i
- pollution grade 2,
- maximum phase-to-earth operating voltage:
  - for supply circuits and relay outputs: 300 V
  - for measurement input: 500 V
  - for circuits RS-485, Ethernet, analog outputs: 50 V
- altitude a.s.l. < 2000 m,

## 14. ORDERING CODE

ND31LITE network parameters meter ordering code.

| ND31LITE                                       | X | X | X | X | X | X | XXXX |
|------------------------------------------------|---|---|---|---|---|---|------|
| <b>Input voltage (phase/phase-to-phase)Un:</b> |   |   |   |   |   |   |      |
| 3 x 57.7/100 V, 3 x 230/400 V                  | 1 |   |   |   |   |   |      |
| <b>Additional outputs/inputs:</b>              |   |   |   |   |   |   |      |
| 2x relay                                       |   | 1 |   |   |   |   |      |
| <b>Interfaces:</b>                             |   |   |   |   |   |   |      |
| RS485                                          |   |   | 1 |   |   |   |      |
| <b>Supply voltage:</b>                         |   |   |   |   |   |   |      |
| 85..253 V a.c., 90..300 V d.c.                 |   |   |   | 1 |   |   |      |
| <b>Language:</b>                               |   |   |   |   |   |   |      |
| polish/english                                 |   |   |   |   | M |   |      |
| other*                                         |   |   |   |   | X |   |      |
| <b>Acceptance tests:</b>                       |   |   |   |   |   |   |      |
| without additional quality requirements        |   |   |   |   |   | 0 |      |
| with an extra quality inspection certificate   |   |   |   |   |   | 1 |      |
| with an extra calibration certificate          |   |   |   |   |   | 2 |      |
| acc.to customer's request*                     |   |   |   |   |   | X |      |
| <b>Version:</b>                                |   |   |   |   |   |   |      |
| standard                                       |   |   |   |   |   |   |      |
| custom-made*                                   |   |   |   |   |   |   | XXXX |

\* only by agreement with the manufacture

ORDER EXAMPLE, code **ND31LITE 1111M0** means:

**ND31LITE** - ND31LITE meter,

**1** - input voltage 3 x 57.7/100 V, 3 x 230/400 V,

**1** - 2 x relay,

**1** – RS485,

**1** - supply voltage 85..253 V a.c., 90..300 V d.c.

**M** - Polish-English language version,

**0** - no additional requirements,

- standard version.



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