EUROTEC
TECNOLOGIE IMPIANTISTICHE - AUTOMAZIONE - TELECONTROLLO

LUMEL

RAIL MOUNTED NETWORK METER TYPE N27P



USER'S MANUAL

CE

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1. APPLICATION

The N27P is a programmable digital device used to measure the parameters of single-phase electrical networks.

The meter measures and calculates the following values:

- phase voltage
- 10 minutes' mean voltage
- current
- active power
- reactive power
- apparent power
- active power factor
- ratio of reactive/active power
- mean active power
- phase shift
- input of active energy
- output of active energy
- input of reactive energy
- output of reactive energy
- apparent energy
- frequency
- 10 seconds' mean frequency
- time
- maximum and minimum values of:
  - phase-to-neutral voltage;
  - current;
  - active power;
  - reactive power;
  - apparent power;
  - active power factor;
  - tangent φ;
  - frequency;
  - average active power;

It is possible to enter transformer ratio of used external current or voltage transformers which will be accounted for in the measurement and calculation of all values. All values and configuration parameters are accessible through the RS485 and USB interfaces.The meter output signals are galvanically isolated from the input and power supply signals.



Figure 1. Meter for direct measurements (left)
Meter for indirect measurements (right)

2. METER SET

The meter set comprises:

- N27P meter ..... 1 pc
- User Manual ..... 1 pc
- Warranty Card ..... 1 pc
- CD ..... 1 pc

Accessories:

The following accessories can be ordered for the N27P meter:

- USB A/miniUSB cable – 1 m, black; order code: 1126-271-028

3. BASIC REQUIREMENTS, SAFETY OF USE

The symbols used in the manual have the following meaning:



Warning!

Potentially hazardous situations. Read before connecting the device! Failure to observe recommendations marked with this symbol can result in heavy personal injuries and device damage



Caution!

Generally useful notes. Read them to make the device use easier. Pay attention to these notes when the device is not working correctly.

Possible consequences if the information is disregarded!

In terms of safety of use the meter conforms to EN 61010-1.



Safety notes:

- Electrical connections should be made by a person with required licences to install electrical devices.
- Check the correctness of connections before turning the meter on.
- Removal of the meter cover during the warranty period makes the warranty null and void.

- The meter is intended for installation and use in industrial electromagnetic environments.
- The building electrical installation should have a switch or a circuit breaker located near the device, easily accessible and properly marked.

4. INSTALLATION

4.1. Mounting method

The N27P meter can be installed in modular distribution boards on the 35 mm rail bracket. The meter enclosure is made of plastic and its dimensions are 53 x 110 x 60.5 mm. On the outside of the meter there are screw terminal blocks to connect the measurement signals using the leads up to 5.3 mm^2 in cross section (1 A / 5 A), and up to 16 mm^2 (32 A / 63 A) and the remaining signals using the leads up to 2.5 mm^2. The meter dimensions are shown in Figure 2.

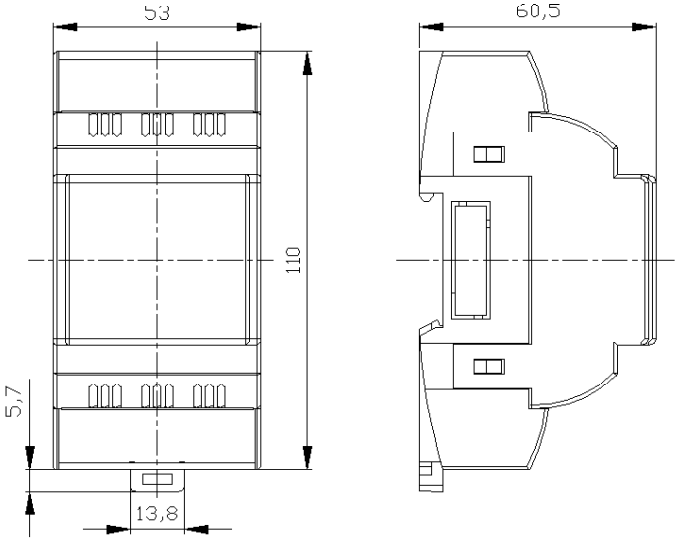


Figure 2. Meter dimensions

The meters shall not be installed on the rail in direct contact with other heat emitting devices (e.g. successive N27P meters). Leave the minimum 5-mm space between devices to enable radiation of heat from the enclosure to the ambient air. Otherwise, the temperature in direct vicinity of the meter may exceed the rated operating temperature.

4.2 Connections

The meter connections are shown in Figure 3.

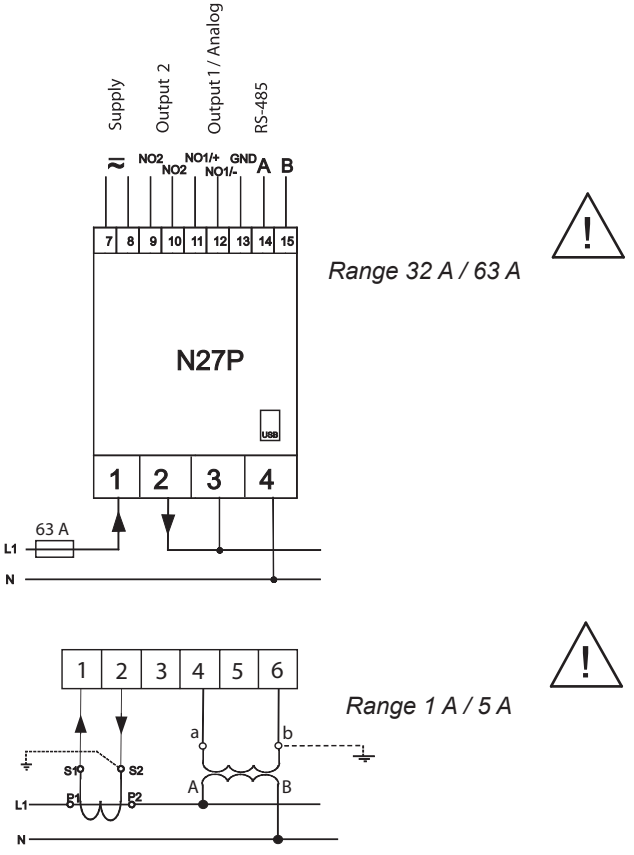


Figure 3. N27P wiring diagrams

5. OPERATION

5.1 Description of front panel

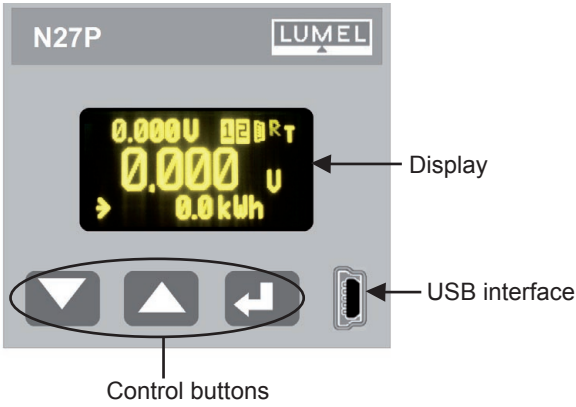


Figure 4. Front panel

5.2 Messages after switching the power supply on

After switching the power on, the meter shows information about manufacturer, software version and device serial number. Then the meter goes to display the measured values.

6. MENU

6.1 Display

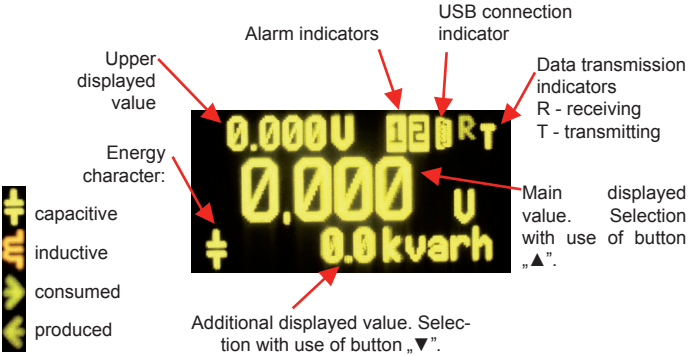


Figure 5. N27P meter display

The main displayed value is selected using the UP button ▲ in the following sequence:

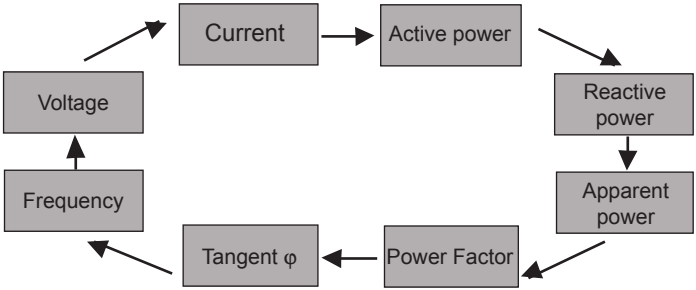


Figure 6. Selecting main displayed value

The additional displayed value is selected using the DOWN button ▲ in the following sequence:

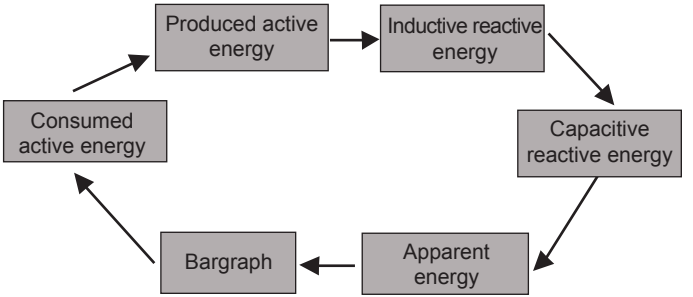


Figure 7. Selecting additional displayed value

The upper displayed value is selected from the meter menu (DISPLAY→UP DISPLAY).

6.2 Menu structure

The N27P parameters may be modified from the display menu level. and hold it for about 3 seconds. Use the UP and DOWN buttons ( ) and hold it for about 3 seconds. Use the UP and DOWN buttons (,), to navigate the menu. To accept choice press ENTER, to cancel or exit press the UP and DOWN buttons simultaneously or wait 15 seconds. Another way to go level up is to select the last position on every submenu (-----).
The menu structure is shown in table 1.

Note: You can protect the editing of parameters from the display menu with a password. In such case, it is possible only to view the meter settings and not to modify them. To set or change the password use the SERVICE→PASSWORD menu option. If you forgot the password carry out the following procedure to remove it:

1. Turn the meter power off
2. Press simultaneously and hold the UP and DOWN buttons (,),
3. Turn the meter power on
4. Wait for about 5 seconds and release the buttons

Table 1

INPUT Parameters of input	VOLTAGE RANGE Voltage range of votalge input	CURRENT RANGE Current range of current input	VOLTAGE RATIO Voltage transformer ratio	CURRENT RATIO Current transformer ratio	INPUT SYNCH Input synchronizing method
CLEAR Counters reseting	CLR EN COUNT Reseting energy counters	CLR AVG POWER Reseting average power counter	CLR 10 MIN V Reseting 10-minutes and maximal values counters	CRL MIN-MAX Reseting minimal and maximal values counters	CRL TIME CNT Reseting turning-on counter
DISPLAY Display settings	UPPER DISPLAY Selection of value displayed on upper line of display	BARGRAPH PAR. Selection of input parameter for bargraph	BARGRAPH SYM. Selection of bargraph style	BARGRAPH% Percent of input parameters as 100% of bargraph	
ALARM 1 Alarm 1 setting	INPUT VALUE Selection of input signal	OUTPUT TYPE Selection of output type	LOW LEVEL IN Low level of input signal	HIGH LEVEL IN High level of input signal	DELAY ON Delay for alarm 1 turning on
ALARM 2 Alarm 2 setting	INPUT VALUE Selection of input signal	OUTPUT TYPE Selection of output type	LOW LEVEL IN Low level of input signal	HIGH LEVEL IN High level of input signal	DELAY ON Delay for alarm 2 turning on
OUTPUT Output settings	INPUT VALUE Selection of input signal	OUTPUT TYPE Selection of output type	LOW LEVEL IN Low level of input signal	HIGH LEVEL IN High level of input signal	LOW LEV OUT Low level of output signal
SERVICE Service settings	DEFAULT PARAM Restore factory settings	PASSWORD Menu lock password	TIME Time settins	DATE Date settings	LANGUAGE Selection of menu language

REACT PW MODE	REACT EN MODE	PW AVG SYNCH	DEMAND POWER
Reactive power calculation method	Reactive energy calculation method	Avarage power synchronization method	Ordered power

DELAY OFF	LOCK TURN ON	SIGNAL MAINT
Delay for alarm 1 turning off	Restart interlock	Maintenance of alarm indication
DELAY OFF	LOCK TURN ON	SIGNAL MAINT
Delay for alarm 2 turning off	Restart interlock	Maintenance of alarm indication

HIGH LEV OUT	OUTPUT MODE	ERROR VALUE	ADDRESS	MODE	BAUDRATE
High level of output signal	Output mode	Output signal level on error	Device address	Transmission mode	Transmis-sion speed

6.3 Programming the inputs

The inputs can be programmed from the INPUTS menu according to table 2.

Table 2

INPUTS					
Lp.	Parameter	Parameter symbol	Range	Remarks/Description	Factory value
1	Voltage range	VOLTAGE RANGE	100 V, 400 V	Selection of input voltage range	400 V
2	Current range	CURRENT RANGE	1 A, 5 A (32 A, 63 A)*	Selection of input current range	5 A (63 A)*
3	Voltage transformer ratio	VOLTAGE RATIO	0,1...4 000,0		1,0
4	Current transformer ratio	CURRENT RATIO	1...10 000		1
5	Input synchronization	INPUT SYNCH	WITH VOLTAGE WITH CURRENT	WITH VOLTAGE (all parametrs are measured) WITH CURRENT (current and frequency only)	WITH VOLTAGE
6	Reactive power calculation method	REACT PW MODE	TRIANGLE SINUS-HARMON.	TRIANGLE $Q=\sqrt{S^2-P^2}$ SINUS-HARMON. $Q=\sum_{i=1}^{k} U_i \cdot I_i \cdot \sin(\sphericalangle U_i, I_i)$ k – HARMONIC NUMBER (21 FOR 50 Hz, 18 FOR 60 Hz)	TRIANGLE
7	Reactive energy calculation method	REACT EN MODE	CAPAC-INDUC POSIT-NEGATIVE	CAPAC-IINDUC – capacitiv or inductive energy POSIT-NEGATIVE – positive or negative energy	CAPAC-IINDUC

8	Synchro-nization of average active power	PW AVG SYNCH	MOVING WINDOW CLK 15 MIN CLK 30 MIN CLK 60 MIN	Average active power synchronization: MOVING WINDOW – 15-minutes moving window CLK 15 MIN – measuring synchronized with clock every 15-minutes CLK 30 MIN - measuring synchronized with clock every 30-minutes CLK 60 MIN - measuring synchronized with clock every 60-minutes,	MOVING WINDOW
9	Demand power	DEMAND POWER	-144.0 %...144.0 [%]	Demand power to predi-ct power consumption in percent of nominal value	100,0 [%]

*) - meter for direct measurements

6.4 Reseting counters

Reseting counters can be done from the CLEAR menu according to table 3.

Table 3

CLEAR					
Lp.	**Parameter**	**Parameter symbol**	**Range**	**Remarks/Description**	**Factory value**
1	Reseting energy counters	CLR EN COUNT	NO ACTIVE REACTIVE APPARENT ALL	Reseting active energy, reactive energy, apparent energy counters, or all of them.	NO
2	Reseting average power counters	CLR 10 MIN V	NO YES		NO
3	Reseting 10-minutes average voltage counter	CLR MIN MAX	NO YES		NO
4	Reseting minimal and maximal value counters	KASUJ MIN-MAX	NO YES		NO
5	Reseting powering on counter	CLR TIME CNT	NO YES		NO

6.5 Display settings

Additional display settings are available on DISPLAY position of menu, according to table 4.

Table 4

DISPLAY					
Lp.	Parameter	Parameter symbol	Range	Remarks/Description	Factory value
1	Upper display value	UPPER DISPLAY	VOLTAGE CURRENT ACTIVE POWER POWER FACTOR TANGENT FREQUENCY CURRENT /3	Selection of parameter to display on upper line of display, see Figure 5.	FREQUENCY
2	Input signal for bargraph	BAR-GRAPH PAR.	table 6	(see table 6)	VOLTAGE
3	Bargraph style	BAR-GRAPH SYM.	NO YES	Selection of bargraph style. NO – displaying values changing in range from 0 to 120% of input signal YES – displaying values changing in range from -120% to +120% of input signal. If measured value is equal or greater than 120 % of nominal value then bargraph will display with pulsing value 120 %.	NO

4	Bargraph range	BAR-GRAPH %	0...120 [%]	Settings a percentage value of input parameter as a nominal value of bargraph. For example, after selecting BARGRAPH PAR. as VOLTAGE and setting BARGRAPH % to 50.0 % at nominal voltage range as 400 V, you will get the 100 % bargraph reading at measured voltage equal 200 V.	100 [%]

6.6 Programming the alarms

The alarms can be programmed from the ALARM 1/ALARM 2 menus according to table 5.

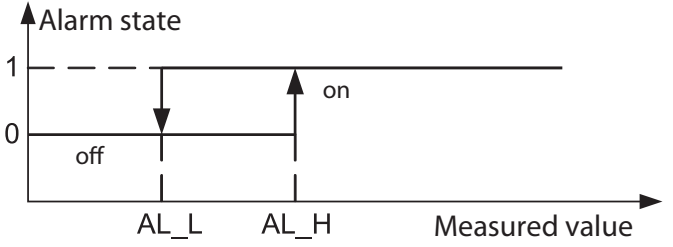
Table 5

ALARM 1 / ALARM 2					
Lp.	Parameter	Parameter symbol	Range	Remarks/Description	Factory value
1	Input signal	INPUT VALUE	table 6	(see table 6)	ACTIVE POWER

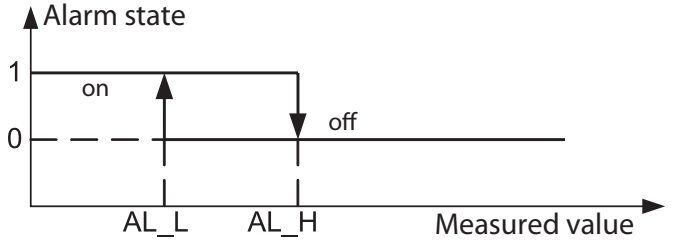
2	Type of alarm output	OUTPUT TYPE	n-on n-off on off h-on h-off	Setting the alarm type. The alarm types n-on, n-off, on and off are presented graphically in Figure 8. The h-on type turns the alarm on permanently, the h-off turns the alarm off permanently. Alarm 1 controls the first meter relay output. Alarm 2 controls the second meter relay output (in case of meter with two relay outputs) or only indicates the alarm occurrence on the display.	n-on
3	Low value of input signal	LOW LEVEL IN	-144,0... 144,0 [%]	Low value of the meter-controlled parameter. In Figure 8 this value is marked as AL_L	99.0 [%]
4	High value of input signal	HIGH LEVEL IN	-144,0... 144,0 [%]	High value of the meter-controlled parameter. In Fgure 8 this value is marked as AL_H	101.0 [%]
5	Alarm turn-on delay	DELAY ON	0...3600 [s]	Alarm turn-on delay in seconds.	0 [s]
6	Alarm turn-off delay	DELAY OFF	0...3600 [s]	Alarm turn-off delay in seconds.	0 [s]
7	Blocking next alarm activation	LOCK TURN ON	0...3600 [s]	The next activation of the alarm is blocked for the specified time in seconds. Before this time expires, the next alarm will be ignored.	0 [s]

8	Keeping the alarm signal indication	SIGNAL MAINT	NO YES	Keeping the alarm signal. If this option is activated, when the alarm condition disappears, the display shows flashing alarm number. This option is particularly useful as a memory of short alarms. To cancel the alarm indication, press and hold simultaneously DOWN and UP buttons (▼, ↵) for about 2 s.	NO

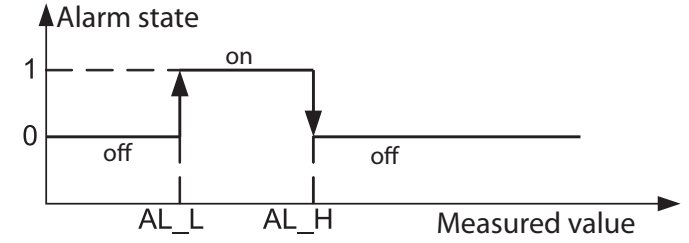
a) n-on



b) n-off



c) on



d) off

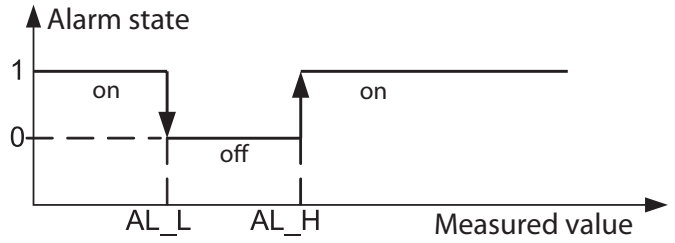


Figure 8. Alarm types

Selecting the output values:

Table 6

Item/ value in the 4024, 4032, 4040 register	Displayed parameter	Value type	Value for per cent calculations (100 %)
00	OFF	No value /output off/	disabled
01	VOLTAGE	Voltage	Un [V] *
02	CURRENT	Current	In [A] *
03	ACTIVE PWR.	Active power	Un x In x cos(0°) [W] *
04	APPARENT PWR.	Reactive power	Un x In x sin(90°) [Var] *
05	MOC POZORNA	Apparent power	Un x In [VA] *
06	POWER FACTOR	Power factor PF	1
07	TANGENT	tangent	1
08	FREQUENCY	frequency	100 [Hz]
09	AVG ACTIVE PW	Averaged active power	3 x Un x In x cos(0°) [W] *
10	10MIN VOLTAGE	Averaged 10-minute voltage	Un [V] *
11	10SEC FREQ.	Averaged 10-second frequency	100 [Hz]
12	CURRENT /3	One third of the current	In [A] *
13	DEMAND POWER	Demand power	3 x Un x In x cos(0°) [W] *

Alarm settings, example 1:

Set alarm of n-on type for active power, nominal ranges: 5 A, 400 V. Alarm turning-on at 2100 W, turning-off below 1900 W.

Calculating: nominal active power: P = 400 V x 5 A = 2000 W
2000 W – 100 % 2000 W – 100 %
2100 W – AL_H % 1900 W – AL_L %
So: AL_H = 105.0 % AL_L = 95 %

Set: INPUT VALUE: ACTIVE POWER, OUTPUT TYPE: n-on, LOW LEVEL IN: 95.5 %, HIGH LEVEL IN: 105 %

Alarm settings, example 2:

Set early warning of the possibility of exceeding ordered power equal 1MW on the level 90 % settled with 15 minutes. Current transformer 2500: 5 A, nominal voltage 400 V. Maximal momentary power 1.5 MW.

Calculating: nominal active power of N27P meter: P = 400 V x 2500 A (500 x 5 A) = 1 MW (500 x 2000 W) – 100 %;
90.0 % of demand power / nominal power = 90.0 % x 1 MW / 1 MW = 90.0 % of nominal range;
Ordered power (power to use): 1 Mwh / 4 quarters of the hour = 900 Mws, 90 % - 810 Mws, the remaining 10 % at maximal power consumption would be used in time: 900 MWs / 1.5 MW = 10 % x 900 MWs / 1.5 MW = 60 s.
Figure 9 shows example of using demand power parameter to turn on the alarm. Delay is set to 0 seconds.
In the example above for remaining 10 % of demand power at maximal power consumption, a device could operate 60 s without exposing the recipient to penalties. With alarm turn on delay set to 60 seconds, alarm would not be turned on.

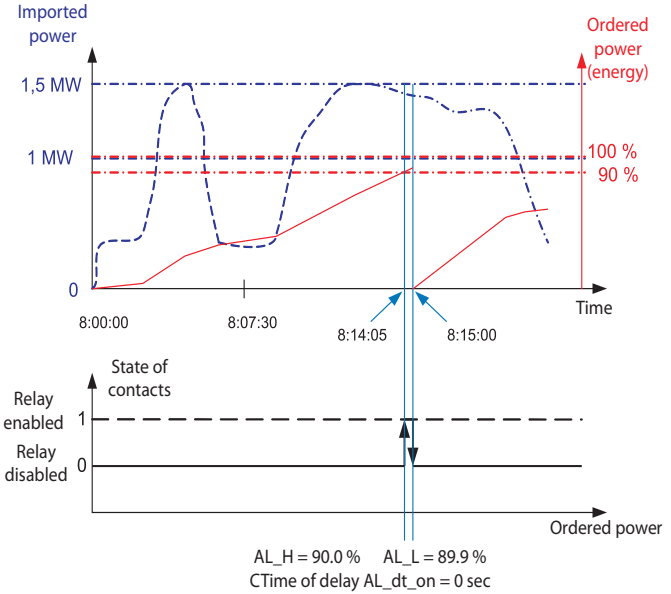


Figure 9. Measurement of demand active power, synchronized with the clock for 15 minutes, with alarm set at 90 % of utilization

Set: U INPUT VALUE: DEMAND POWER, OUTPUT TYPE: n-on, LOW LEVEL IN: 90.0 %, HIGH LEVEL IN: 89.9 %, CURRENT RATIO: 500, PW AVG SYNCH: MOVING WINDOW or CLK 15 MIN, DELAY ON: 0 s or 60 s.

6.7 Programming the outputs

The outputs can be programmed in the OUTPUT menu according to table 7.

Table 7

OUTPUT					
Item	Parameter	Parameter symbol	Range	Remarks/Description	Factory value
1	Input parameter of analogue output	INPUT VALUE	table 6	(code acc. to table 6)	ACTIVE POWER
2	Type of analogue output	OUTPUT TYPE	0..20 mA 4...20 mA	The output range can be selected	0...20 mA
3	Low value of input parameter	LOW LEVEL IN	-144.0...144.0 [%]	Low value of input parameter (LV in fig. 9). Corresponds to LOW LEVEL in the analogue output.	0.0 [%]
4	High value of input parameter	HIGH LEVEL IN	-144.0...144.0 [%]	High value of input parameter (HV in fig. 9). Corresponds to HIGH LEVEL in the analogue output.	100.0 [%]
5	Low level of analogue output	LOW LEV OUT	0,00...22,00 [mA]	Low signal on analogue output (LL in fig. 9).	0.00 [mA]
6	High level of analogue output	HIGH LEV OUT	0,00...22,00 [mA]	High signal on analogue output (HL in fig. 9).	20.00 [mA]

7	Manual settings	MAN SETTING	NORMAL REG. 4044 REG. 4045	Manual control of analogue output. The NORMAL option controls the output on the basis of the perfformacne specified by the values set in LOW VALUE, HIGH VALUE, LOWE LEVEL, HIGH LEVEL (fig. 9). In REG. 4044 or REG. 4045 options the analogue output is permanently controlled by the value set in LOW LEVEL or HIGH LEVEL respectively.	NORMAL
8	Value at error	ERROR VALUE	0,00... 22,00 [mA]	Value set at the analogue output in case of error occurrence.	22.00 [mA]
9	Device address	ADDRESS	1...247	Device address in the MODBUS protocol	1
10	Transmission mode	MODE	RTU 8n2 RTU 8e1 RTU 8o1 RTU 8n1	Selection of transmission mode for the RS485 interface	RTU 8n2
11	Baudrate	BAUDRATE	4800 [bit/s] 9600 [bit/s] 19200 [bit/s] 38400 [bit/s] 57600 [bit/s] 115200 [bit/s]	Speed of the RS485 interface	9600 [bit/s]

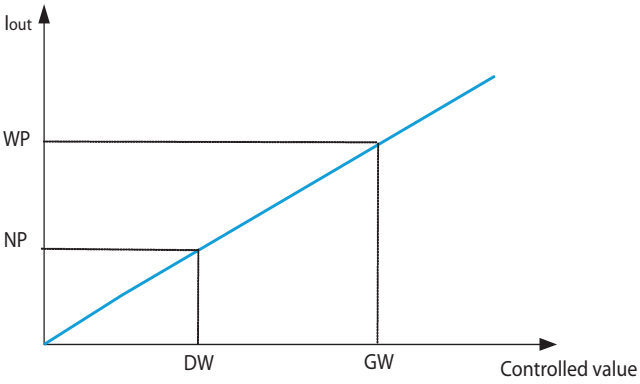


Figure 10. Control of the analogue output

6.8 Service settings

The service settings can be programmed in the SERVICE menu according to table 8.

Table 8

SERVICE					
Item	Parameter	Parameter symbol	Modification range	Remarks/Description	Factory settings
1	Restore default settings	DEFAULT PARAM	NO YES	Option to restore the default factory settings for the meter configuration parameters acc. to table 1.	NO

2	Access password	PAS-SWORD	0... 30000	Password preventing access to modify the meter settings. When this option is activated, any attempt to access the meter menu results in the password request. When an incorrect password is entered the user may use the menu in the read-only mode. Clearing the password is described in section 6.2. The 0 setting means that the password protection is disabled.	0
3	Time	TIME	GG – 00...23 MM – 00...59	Set the time in the HH:MM format. When you confirm the time, the seconds will zero.	
4	Date	DATE	DD – 01..31 MM – 01...12 RRRR – 2000...2099	Set the date in the DD:MM:YYYY format.	
5	Language	LANGUAGE	ENGLISH POLSKI	Set menu language	EN-GLISH

7. SERIAL INTERFACES

7.1 RS485 – list of parameters

- Identifier: 209 (0xD1)
- device address: 1..247
- baud rate: 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbit/s
- transmission mode: Modbus RTU
- unit of information: 8N2, 8E1, 8O1, 8N1
- maximal time to start response: 100 ms when reading
  1000 ms when writing
- maximal registers amount to read in one query: 56 x 4-bytes registers
  105 x 2-bytes registers
- implemented functions
  03 – read registers
  04 – read input registers
  06 – write 1 register
  16 – write n registers
  17 – device identification

Factory settings: address 1, baud rate 9600, mode RTU 8N2.
Broadcasting address: 253

7.2 USB – list of parameters

Interface USB is dedicated only for meter configuration.

- Identifier: 209 (0xD1)
- device address: 1
- baud rate: 9.6 kbit/s,
- transmission mode: Modbus RTU,
- unit of information: 8N2
- maximal time to start response: 100 ms when reading
  1000 ms when writing
- maximal registers amount to read in one query: 56 x 4-bytes registers
  105 x 2-bytes registers
- implemented functions
  03 – read registers
  04 – read input registers
  06 – write 1 register
  16 – write n registers
  17 – device identification

Broadcasting address: 253

7.3 Map of N27P meter registers

In the N27P meter, the data are placed in 16-bit and 32-bit registers. The process variables and meter parameters are placed in the address space of registers in the method which depends on the variable type. Bits in the 16-bit registers are numbered from the least significant to the most significant bits (b0-b15). The 32-bit registers include the float-type numbers in the IEEE-754 standard. The registers ranges are presented in table 9. The 16-bit registers are shown in table 10.

The 32-bit registers with their equivalent 2x16-bit registers are presented in table 11. The registers addresses in tables 10 and 11 are physical addresses.

Table 9

Address range	Value type	Description
4000 - 4083	Integer (16 bits)	Meter configuration. The value is placed in one 16-bit register.
6000 - 6143	Float (2x16 bits, byte order 3210)	The value placed in two successive 16-bit registers. The registers contain the same data as the 32-bit registers from the 7500 area. Read-only registers.
7000 – 7143	Float (2x16 bits, byte order 1032)	The value placed in two successive 16-bit registers. The registers contain the same data as the 32-bit registers from the 7500 area. Read-only registers.
7500 – 7571	Float (32 bits)	The value placed in one 32-bit register. Read-only registers.

Table 10

Register address	Read/Write	Range	Description	Default
4000	RW	0..30000	Password	0
4001	RW	0,1	Input voltage range: 0 – range 100 V 1- range 400 V	1
4002	RW	0,1	Input current range 0 - range 1 A/32 A* 1 - range 5 A/63 A*	1
4003	RW	1..40000	Voltage transformer ratio x 10	10

4004	RW	1..10000	Current transformer ratio	1
4005	RW	0,1	Input synchronization: 0 – measurement of all values 1 – measurement of current only	0
4006	RW	0,1	0 – triangle $Q = \sqrt{S^2 - P^2}$ 1 – sine $Q = \sum_{i=1}^{k} U_i \cdot I_i \cdot \sin(\measuredangle U_i, I_i)$ k – harmonic number (21 for 50 Hz, 18 for 60 Hz)	0
4007	RW	0,1	Reactive energy calculation method: 0 – inductive and capacitive 1 – positive and negative	0
4008	RW	0..3	Synchronization of averaged power 0 – 15 minutes walking window 1 – 15 minutes 2 – 30 minutes 3 – 60 minutes	0
4009	RW	-1440...1440	Demand power x10	1000
4010	RW		Reserved	
4011	RW	0..4	Reseting energy counters: 0 – no change 1 – active energy 2 – reactive energy 3 – apparent energy 4 – all energy counters	0
4012	RW		Reserved	
4013	RW	0,1	Reseting average power counter 0 – no change 1 – reset	0

4014	RW	0,1	Reseting 10-minutes average voltage 0 – no change 1 – reset	0
4015	RW	0,1	Reseting minimal and maximal values 0 – no change 1 – reset	0
4016	RW	0,1	Reseting turning-on counter 0 – no change 1 – reset	0
4017	RW	0,1	Reseting alarm indications	0
4018	RW	0...5	Upper displayed value 0 – voltage 1 – current 2 – active power 3 – Power Factor 4 – tangent φ 5 - frequency	0
4019	R		Reserved	
4020	R		Reserved	
4021	RW	0...13	Bargraph – input signal 0 – off 1 – voltage 2 – current 3 – active power 4 – reactive power 5 – apparent power 6 – Power Factor 7 – tangent φ 8 – frequency 9 – average active power 10 – 10-minutes average voltage 11 – 10-seconds average frequency 12 – current /3 13 – demand power	1
4022	RW	0,1	Bargraph – bargraph style 0 – normal (0...120 %) 1 – symmetrical (-120 %...120 %)	0

4023	RW	0...1200	Bargraf – procent wejścia bargrafu (1000 – 100 %)	1000
4024	RW	0...13	Alarm 1 output – input signal 0 – off 1 – voltage 2 – current 3 – active power 4 – reactive power 5 – apparent power 6 – Power Factor 7 – tangent φ 8 – frequency 9 – average active power 10 – 10-minutes average voltage 11 – 10-seconds average frequency 12 – current /3 13 – ordered power	3
4025	RW	0...5	Alarm 1 output – output type 0 – n-on 1 – n-off 2 – on 3 – off 4 – h-on 5 - h-off	0
4026	RW	-1440...1440	Alarm 1 output - low input value x10	990
4027	RW	-1440...1440	Alarm 1 output - high input value x10	1010
4028	RW	0...3600	Alarm 1 output - turning-on delay [s]	0
4029	RW	0...3600	Alarm 1 output – turning-off delay [s]	0
4030	RW	0...3600	Alarm 1 output - next turning-on blocking time[s]	0
4031	RW	0,1	Alarm 1 output - indication keeping 0 – no 1 – yes	0

4032	RW	0...13	Alarm 2 output – input signal 0 – off 1 – voltage 2 – current 3 – active power 4 – reactive power 5 – apparent power 6 – Power Factor 7 – tangent φ 8 – frequency 9 – average active power 10 – 10-minutes average voltage 11 – 10-seconds average frequency 12 – current /3 13 – ordered power	3
4033	RW	0...5	Alarm 2 output – output type 0 – n-on 1 – n-off 2 – on 3 – off 4 – h-on 5 - h-off	0
4034	RW	-1440...1440	Alarm 2 output – low input value x10	990
4035	RW	-1440...1440	Alarm 2 output - high input value x10	1010
4036	RW	0...3600	Alarm 2 output – turning-on delay [s]	0
4037	RW	0...3600	Alarm 2 output – turning-off delay [s]	0
4038	RW	0...3600	Alarm 2 output – next turning-on blocking time [s]	0
4039	RW	0,1	Alarm 2 output – indication keeping 0 – no 1 – yes	0

4040	RW	0...13	Analogue output 1 – input signal ** 0 – off 1 – voltage 2 – current 3 – active power 4 – reactive power 5 – apparent power 6 – Power Factor 7 – tangent φ 8 – frequency 9 – average active power 10 – 10-minutes average voltage 11 – 10-seconds average frequency 12 – current /3 13 – demand power	3
4041	RW	0,1	Analogue output 1 – output type ** 0 – 0...20 mA 1 – 4...20 mA	1
4042	RW	-1440...1440	Analogue output 1 – low input value x10	0
4043	RW	-1440...1440	Analogue output 1 – high input value x10	1000
4044	RW	0...2200	Analogue output 1 – low output value x100	0
4045	RW	0...2200	Analogue output 1 – high output value x100	2000
4046	RW	0...2	Analogue output 1 – output mode 0 – normal 1 – register 4044 2 – register 4045	0
4047	RW	0...2200	Analogue output 1 – value at error	2200
4048	RW	1...247	Device address	1

4049	RW	0...3	Transmission mode 0 – 8N2 1 – 8E1 2 – 8O1 3 - 8N1	0
4050	RW	0...5	Baud rate 0 – 4800 bit/s 1 – 9600 bit/s 2 – 19200 bit/s 3 – 38400 bit/s 4 – 57600 bit/s 5 – 115200 bit/s	1
4051			Reserved	
4052	RW	0,1	Update transmission parameters 0 – no changes 1 – update	0
4053	RW	0,1	Language 0 – english 1 - polish	0
4054	RW	0,1	Set default values 0 – no changes 1 – set default values	0
4055	RW	0...59	Time - seconds	-
4056	RW	0...2359	Time (hh*100 + mm)	-
4057	RW	101...1231	Date (mm*100 + dd)	-
4058	RW	2000...2099	Date yyyy	-
4059			Reserved	
4060	R	0..65535	Active energy consumed 2 most significant bytes	
4061	R	0..65535	Active energy consumed 2 least significant bytes	
4062	R	0..65535	Active energy supplied 2 most significant bytes	

4063	R	0..65535	Active energy supplied 2 least significant bytes	
4064	R	0..65535	Reactive energy inductive 2 most significant bytes	
4065	R	0..65535	Reactive energy inductive 2 least significant bytes	
4066	R	0..65535	Reactive energy capacitive 2 most significant bytes	
4067	R	0..65535	Reactive energy capacitive 2 least significant bytes	
4068	R	0..65535	Apparent energy 2 most significant bytes	
4069	R	0..65535	Apparent energy 2 least significant bytes	
4070	R		Reserved	
4071	R		Reserved	
4072	R		Reserved	
4073	R		Reserved	
4074	R		Reserved	
4075	R		Reserved	
4076	R	0..65535	Status 1 register	
4077	R	0..65535	Status 2 register	
4078	R	0..65535	Serial number 2 most significant bytes	
4079	R	0..65535	Serial number 2 least significant bytes	
4080	R	0..65535	Software version (x100)	
4081	R	0..65535	Reserved	
4082	R	0..65535	Reserved	
4083	R	0..65535	Reserved	

*) version for direct measurement
**) version with analogue output

Energy values are in kilowatt-hours (kilo VAR-hours) in double 16-bit registers, so the values from relevant registers need to be divided by 10, as follows:

Active energy consumed = (value of register 4060 x 65536 + value of register 4061) / 10 [kWh]
Active energy supplied = (value of register 4062 x 65536 + value of register 4063) / 10 [kWh]
Inductive reactive energy = (value of register 4064 x 65536 + value of register 4065) / 10 [kVarh]
Capacitive reactive energy = (value of register 4066 x 65536 + value of register 4067) / 10 [kVarh]
Apparent energy = (value of register 4068 x 65536 + value of register 4069) / 10 [kVA]

Status 1 register (address 4076, R):

Bit 15 - „1" - non-volatile memory failure
Bit 14 - „1" - inputs calibration error
Bit 13 - „1" - analogue output calibration error
Bit 12 - „1" - parameters error
Bit 11 - „1" - energy value error
Bit 10 - „1" - reserved
Bit 9 - „0" - version with 2 relays
„1" - version with 1 relay and 1 analogue output
Bit 8 - „0" - 1 A/5 A~ current range
„1" - 32 A/63 A~current range
Bit 7 - „1" - reserved
Bit 6 - „1" - reserved
Bit 5 - „1" - reserved
Bit 4 - „1" - USB connected
Bit 3 - „1" - measured voltage value is out of range for frequency measurement

Bit 2 - „1” - frequency averaging time in progress
Bit 1 - „1” - voltage averaging time in progress
Bit 0 - „1” - active power averaging time in progress

Status 2 register (address 4077, R)

Bits 15..7 – reserved
Bit 8 - „1” - result of active power substraction is positive
Bit 7 - „1” - result of reactive power substraction is positive
Bit 6 - „1” - capacitive reactive power max
Bit 5 - „1” - capacitive reactive power min
Bit 4 - „1” - capacitive reactive power
Bit 3 - „1” - alarm 2 indication
Bit 2 - „1” - alarm 1 indication
Bit 1 - „1” - alarm 2 active
Bit 0 - „1” - alarm 1 active

Table 11

Address of 16-bit registers	Address of 32-bit registers	Read/Write	Description	Unit
6000/7000	7500	R	Voltage U	V
6002/7002	7501	R	Current I	A
6004/7004	7502	R	Active power P	W
6006/7006	7503	R	Reactive power Q	var
6008/7008	7504	R	Apparent power S	VA
6010/7010	7505	R	Active power factor	-
6012/7012	7506	R	Active/reactive power ratio	-
6014/7014	7507	R	Frequency	Hz
6016/7016	7508	R	Average active power PAV 15, 30, 60-minute	W
6018/7018	7509	R	Reserved	
6020/7020	7510	R	Reserved	
6022/7022	7511	R	Cosine of angle between U and I	-
6024/7024	7512	R	Angle between U and I	°
6026/7026	7513	R	Consumed active energy (number of register overflows 7514, zeroed after 99999999,9 kWh is exceeded)	100 MWh
6028/7028	7514	R	Consumed active energy (meter measuring up to 99999,9 kWh)	kWh
6030/7030	7515	R	Supplied active energy (number of register overflows 7516, zeroed after 99999999,9 kWh is exceeded)	100 MWh

6032/7032	7516	R	Supplied active energy (meter measuring up to 99999,9 kWh)	kWh
6034/7034	7517	R	Inductive reactive power (number of register overflows 7517, zeroed after 99999999,9 kvarh is exceeded)	100 Mvarh
6036/7036	7518	R	Inductive reactive power (meter measuring up to 99999,9 kvarh)	kvarh
6038/7038	7519	R	Capacitive reactive power (number of register overflows 7520, zeroed after 99999999,9 kvarh is exceeded)	100 Mvarh
6040/7040	7520	R	Capacitive reactive power (meter measuring up to 99999,9 kvarh)	kvarh
6042/7042	7521	R	Apparent energy (number of register overflows 7522, zeroed after 99999999,9 kVAh is exceeded)	100 MVAh
6044/7044	7522	R	Apparent energy (meter measuring up to 99999,9 kVAh)	kVAh
6046/7046	7523	R	Reserved	
6048/7048	7524	R	Reserved	
6050/7050	7525	R	Reserved	
6052/7052	7526	R	Reserved	
6054/7054	7527	R	Reserved	
6056/7056	7528	R	Reserved	
6058/7058	7529	R	Control current for continuous output 1	mA
6060/7060	7530	R	Bargraph reading	-
6062/7062	7531	R	Energy consumption in % in the “Power Guardian” mode	%
6064/7064	7532	R	1/3 of the current	A
6066/7066	7533	R	Time – seconds	-

6068/7068	7534	R	Time – hours, minutes	-
6070/7070	7535	R	Date – month, day	-
6072/7072	7536	R	Date – year	-
6074/7074	7537	R	Reserved	
6076/7076	7538	R	Status 1	-
6078/7078	7539	R	Status 2	-
6080/7080	7540	R	Time when U >0 and / or I > 0	hours
6082/7082	7541	R	Time of work	hours
6084/7084	7542	R	Number of power activations	-
6086/7086	7543	R	Minimum voltage	V
6088/7088	7544	R	Maximum voltage	V
6090/7090	7545	R	Minimum current	A
6092/7092	7546	R	Maximum current	A
6094/7094	7547	R	Minimum active power	W
6096/7096	7548	R	Maximum active power	W
6098/7098	7549	R	Minimum reactive power	var
6100/7100	7550	R	Maximum reactive power	var
6102/7102	7551	R	Minimum apparent power	VA
6104/7104	7552	R	Maximum apparent power	VA
6106/7106	7553	R	Minimum active power factor	-
6108/7108	7554	R	Maximum active power factor	-
6110/7110	7555	R	Minimum active/reactive power ratio	-
6112/7112	7556	R	Maximum active/reactive power ratio	-
6114/7114	7557	R	Minimum frequency	Hz
6116/7116	7558	R	Maximum frequency	Hz

6118/7118	7559	R	Minimum average active power 15, 30, 60-minute	W
6120/7120	7560	R	Maximum average active power 15, 30, 60-minute	W
6122/7122	7561	R	Reserved	
6124/7124	7562	R	Reserved	
6126/7126	7563	R	Reserved	
6128/7128	7564	R	Reserved	
6130/7130	7565	R	Minimum cosine φ	-
6132/7132	7566	R	Maximum cosine φ	-
6134/7134	7567	R	Minimum φ shift angle	
6136/7136	7568	R	Maximum φ phase angle	
6138/7138	7569	R	Minimum 1/3 current	A
6140/7140	7570	R	Maximum 1/3 current	A
6142/7142	7571	R	Reserved	

In case of values below the lower limit the value is -1e20; in case of values above the upper limit or errors it is 1e20.

8. ERROR CODES

After turning the meter on some error codes can appear on display. Error reasons are described as follow.
Following error codes means:

Error Calibration – loss of meter calibration values. Please contact your service provider.

Error Memory – non-volatile memory failure. Please contact your service provider.

Error Parameters – invalid configuration values. Pressing ENTER () button disables the error message. Please restore factory settings.

Error Energy – invalid energy values. Pressing ENTER () button disables the error message. Values will be reset.

Error Intercommunication – firmware update finished with error. Please try again, if error remains – please contact your service provider.

During normal operation some error messages can appear. Error reasons are described as follow:

^^^^^ - exceeding the upper programmed value of the measuring range. In addition, this message may appear when the voltage and/or current is too low or too high to measure:

- Power factor, tangentgφ – bellow 5 % Un, 1 % In, or over 120 % Un, In
- f – bellow 5 % Un, or over 120 % Un

vvvvv – exceeding the lower programmed value of the measuring range.

9. FIRMWARE UPDATING

The implemented functions of N27P meter allows software updates from a PC with the software eCon. Free software eCon and update files are available on www.lumel.com.pl. Updating is done via the USB interface of N27P meter. N27P meter's software consists of two layers: L1 and L2. The update can be performed for one or both levels.

9.1 Software L1 level update

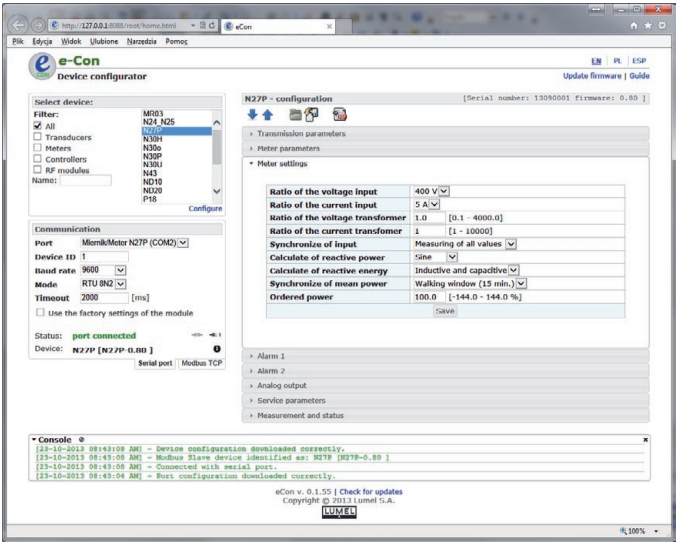


Figure 11. eCon main window

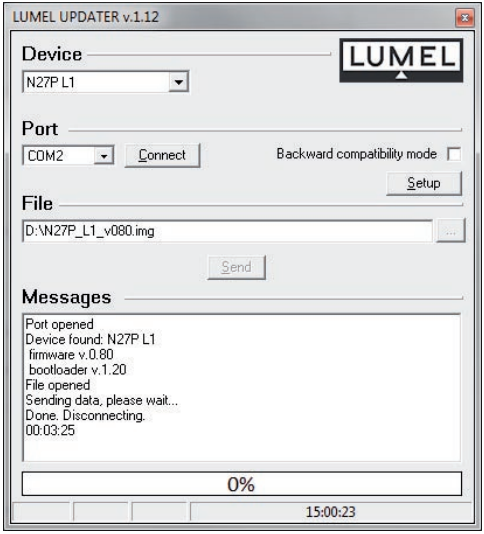


Figure 12. Main window of firmware updating software

Attention! After the firmware is updated, the factory configuration is set, so it is recommended to save actual configuration to file using eCon application.

When eCon is started (Figure 11), set the communication parameters on the left side of application main window and then click *Connect*. The meter will be automatically recognized.
In *N27P – configuration* region the meter configuration should be read and save to file for later restoration.
Then, from the menu at the top of the application, select Update Firmware. Application LUMEL UPDATER (LU) will appear (Figure 12). In this application, select the correct serial port on which N27P meter is installed and press the *Connect* button. In the *Message* window actual infor-

mations are posted. After successful connecting to the meter message *Port opened* will appear. The meter displays UPDATE message and a progress bar on its display. When LU properly detected the meter the application show information about software version and bootloader version. At this point you must specify the correct firmware file by clicking […] button. When file is corrected LU posts message *File opened*. Then press the *Send* button. During the software update, both, LU and the meter shows the progress bar. After a successfull finishing the meter reboots, sets factory settings and goes to normal operation. LU post message DONE and duration of updating process. In the next step the previously saved configuration should be restored from eCon menu.

Caution! Turning off the meter during update process may cause permanent damage of the meter!

9.2 Software L2 level update

Software L2 level update can be done via USB interface. To perform follow the procedure:

1. Turn off N27P meter
2. Plug USB cable to meters connector and to the PC on other side
3. Press and hold ENTER button and then turn the meter on
4. Release the button and wait till new removable disk drive, named CRP2 ENABLD, appear
5. Click left mouse button twice to open the disk drive and show its content
6. Remove existing file named *firmware.bin*
7. Copy the new file in place of prevoiusly deleted
8. Reboot the meter. Actual firmware version is displayed on the meters display while the meter is booting.

Caution! Turning off the meter during update process may cause permanent damage of the meter!

10. TECHNICAL DATA

Measuring ranges and admissible basic errors for indirect measurement version (table 12) and for indirect measurement version (table 13)

Table 12

Measured value	Measuring range	Basic error
Current In 1 A 5 A	0.005 .. 1.200 A~ 0.025 .. 6.000 A~	0.2 % of range
Voltage L-N 100 V 400 V	 5.0 .. 120.0 V 20.0 .. 480.0 V	0.2 % of range
Frequency	45.0 .. 66.0 … 100.0 Hz	0.2 % of measured value
Active power	-2.88 kW ..1.00 W .. 2,88 kW	0.5 % of range
Reactive power	-2.88 kvar ..1.00 var .. 2.88 kvar	0.5 % of range
Apparent power	1.00 VA .. 2.88 kVA	0.5 % of range
Power Factor	-1 .. 0 .. 1	0.5 % of range
Tangent φ	-1.2 .. 0 .. 1.2	1 % of range
Angle φ	-180 .. 180°	1 % of range
Active energy	0 .. 9 999 999.9 kWh	0.5 % of measured value
Reactive energy	0 .. 9 999 999.9 kvarh	0.5 % of measured value

Table 13

Measured value	Measuring range	Basic error
Curren In 32A 63A	0.160 .. 38.40 A~ 0.315 .. 75.60 A~	0.2 % of range
Voltage L-N 100 V 400 V	 5.0 .. 120.0 V 20.0 .. 480.0 V	0.2 % of range
Frequency	45.0 .. 66.0 … 100,0 Hz	0.2 % of measured value
Active power	-36.28 kW...1.00 W...36.28 kW	0.5 % of range
Reactive power	-36.28 kvar...1.00 var...36.28 kvar	0.5 % of range
Apparent power	1.00 VA .. 36.28 kVA	0.5 % of range
Power Factor	-1 .. 0 .. 1	0.5 % of range
Tangent φ	-1,2 .. 0 .. 1,2	1 % of range
Angle φ	-180 .. 180°	1 % of range
Active energy	0 .. 9 999 999,9 kWh	0.5 % of measured value
Reactive energy	0 .. 9 999 999,9 kvarh	0.5 % of measured value

Typical processing time: 1.2 s

Maximum processing time: 2.2 s

Power consumption:

- in power supply circuit ≤ 5 VA
- in voltage circuit ≤ 0.2 VA
- in current circuit ≤ 0.05 VA for 1 A/5 A version
  ≤ 2.5 VA for 32 A/63 A version

Relay outputs:

NO type contacts
load capacity 250 V~/0.5 A~
number of cycles $1x10^5$

Analog output

programmable:
current (maximal range) 0..+22 mA
load resistance: 0...250 Ω
disposable voltage: 15V
basic error: 0.2 % of range
resolution: 0.05 % of range

Serial interfaces

RS485: address 1..247;
mode: 8N2, 8E1, 8O1,8N1;
baud rate: 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbit/s,
USB for configuration: 1.1 / 2.0,
address 1; tryb 8N2;
baud rate 9.6 kbit/s,
maximal USB wire length USB 3m

broadcasting address: 253
transmission protocoll: modbus RTU
time to start response:
100 ms (read)
1000 ms (write)

Voltage transformer ratio Ku

0.1 .. 4000.0

Current transformer ratio Ki

1 .. 10000

Test voltages:

power supply, alarm outputs	2.1 kV d.c.
measurement inputs	3.2 kV d.c.
RS485 and USB interfaces, analogue output	0.7 kV d.c.

Protection grade ensured by the casing:

from the frontal side	IP 50
from the terminal side	IP 00

Weight < 0.2 kg

Dimensions 53 X 110 X 60 mm

Mounting on rail 35 mm

Reference and rated operating conditions

- supply voltage 85..253 V a.c. 40..400 Hz; 90..300 V d.c.
- input signal 0...0.005...1.2 In; 0.05...1.2 Un
  for current, voltage
  0...0.01...1.2 In; 0..0.05..1.2 Un
  for power factors Pfi , tgφi
  frequency 45..66..100 Hz
  sinusoidal (THD < 8 %)
- power factor -1...0...1
- analog output 0...+20...22 mA
- ambient temperature -10...23...+55 °C
- ambient temperature - 25 .. +85 °C
- relative humidity < 95% (without condensation)
- admissible peak factor:
  - current 2
  - voltage 2
- external magnetic field 0..40 ..400 A/m
- short overload (1 s)
  - voltage input 2 Un (max.1000 V)
  - current input 10 In
- operating position vertical
- preheating time 15 minutes

Additional errors:
in % of the basic error
- from frequency of input signals < 50 %
- from ambient temperature changes < 100 % / 10°C

Electromagnetic compatibility:
- noise immunity acc. to EN 61000-6-2
- noise emissions acc. to EN 61000-6-4

Safety requirements:
according to EN 61010-1 standard
- isolation between circuits: basic,
- installation category III (for voltage above 300 V – cat. II),
- pollution level: 2,
- maximal phase-to-earth voltage:
  - for supply circuit 300 V
  - for measuring circuits 600 V - cat. II (300 V – cat. III)
  - for remaining circuits 50 V
- altitude above sea level < 2000 m.

11. ORDERING CODE

Table 14

N27P-	X	X	XX	X	X
Current measurement range:					
1 A/5 A a.c.	**1**				
32 A/63 A a.c.	**2**				
outputs:					
2 relay otputs		**1**			
1 relay output and 1 analog output 0/4...20 mA		**2**			
Version:					
standard			**00**		
custom-made*			**XX**		
Language:					
Polish				**P**	
English				**E**	
other*				**X**	
Acceptance tests:					
without extra requirements					**0**
with an extra quality inspection certificate					**1**
acc. to customer's request*					**X**

* must be agreed with the manufacturer

ORDER EXAMPLE:

The code **N27P-1100E0** means:

N27P - N27P meter,
1 - for indirect measurements in the 1 A/5 A range,
1 - two relay outputs,
00 - standard version,
E - English version,
0 - without extra requirements.

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N27P-09A