LUMEL

DIGITAL PANEL METER
N20ZPLUS

USER MANUAL

CE

1. APPLICATION and DESIGN of the METER 2
2. METER SET 3
3. Basic requirements, operational safety 3
4. Fitting 3
4.1. Connection diagrams 4
5. Operation 5
5.1. Display description 5
5.2. Messages after Switching the Supply on 5
5.3. Configuration of the meter 5
5.4. Parameter description 6
5.4.1. Display 6
5.4.2. Measurement parameters 6
5.4.3. Alarm parameters 8
5.4.4. Communication parameters 9
5.5. Factory parameters 9
6. MAP OF MODBUS REGISTERS 10
7. ERROR CODES 14
8. TECHNICAL DATA 14
9. ORDERING CODES 17

1. APPLICATION and DESIGN of the METER

The N20Z*PLUS* meter is a digital programmable panel instrument designed for measurements of a.c. voltages, a.c. currents, or frequency. The readout display is a LED display which enables the presentation of measurements results in red, green or orange color

The N20Z*PLUS* meter has a built-in RS-485 interface and the MODBUS RTU protocol provided, by means of which it is possible to configure the meter or read the measured values. The meter is compatible with free E-Con software available for download on the manufacturer's website. The meter should be connected to a PC via the RS-485 to USB converter, e.g. PD10. Parameters that can be reprogrammed are as follows:

- display color, individually in three colour versions,
- thresholds of displayed exceedings,
- result display precision (decimal point);
- backlight;
- rtype of the measured signa, AC or AC+DC (True RMS);
- averaging time of the measurement;
- recounting of indications (individual characteristic);
- operation modes of two OC type outputs, 6 operating modes to choose;
- RS-485 transmission parameters
- MODBUS bus settings

The meter is equipped with two OC type outputs. The activation of the output is signaled by the backlight of the triangular alarm indicator on the left side of the display with the corresponding alarm digit. The backlight color is always different from the color of the displayed measured value.

The degree of protection of the meter from the front side is IP65. Dimensions 96 x 48 x 64 mm (including terminals). The housing is made of self-extinguishing plastic.

Fig.1. View of N20Z*PLUS* meter.

2. METER SET

Complete set of the Analyzer includes:

- N20Z*PLUS* meter 1 pc.
- clamps to fix the meter in the panel 4 pcs.

3. Basic requirements, operational safety

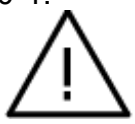
Meaning of the symbols used in this manual:

Warning!
Warning of potentially dangerous situations. It is especially important to read and understand these instructions before connecting the device. Failure to meet the instructions that are marked with this symbol can result in serious injury of personnel and damage to the device.

Caution!
Generally useful notes. Following these instructions ensures easy operation of the device. The user must take them into account when the operation of the device does not meet the user's expectations.
Possible consequences when these instructions are not followed!

In terms of operational safety the meter meets the requirements of EN 61010-1.

Safety instructions:



- The assembly and the installation of the electrical connections may be carried out only by a duly qualified electrician.
- Before turning on the meter verify the connections.
- Removal of the meter housing during the warranty period voids the warranty.
- The device is intended for installation and use in industrial electromagnetic environments.
- A switch or a circuit-breaker should be installed in the building or facility. It should be located near the device, easily accessible to the operator, and suitably marked.

4. Fitting

The meter has separable strips with screw terminals which enable the connection of external wires of 2.5 mm2 cross-section. In the version for current measurement, the plug enables a permanent fixing to the socket by means of screws.

A cut-out of $92^{+0,6}$ x $45^{+0,6}$ mm must be made in the panel The thickness of the material from which the panel is made must not exceed 6 mm. The meter should be inserted from the front of the panel with the voltage supply disconnected. Before the insertion into the panel, one must check the correct placement of the seal. After inserting into the hole, fix the meter by means of clamps (Fig. 2)

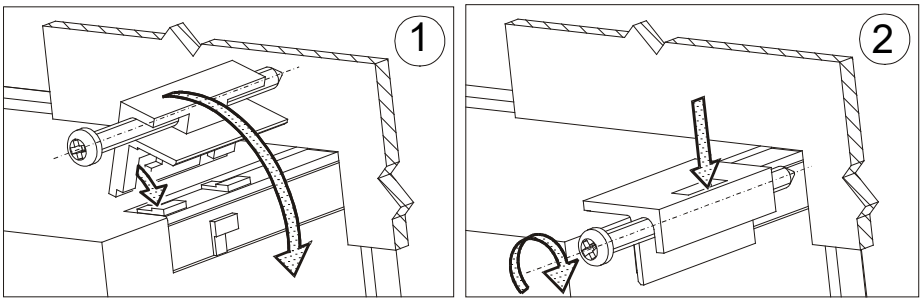


Fig. 2: Meter fitting

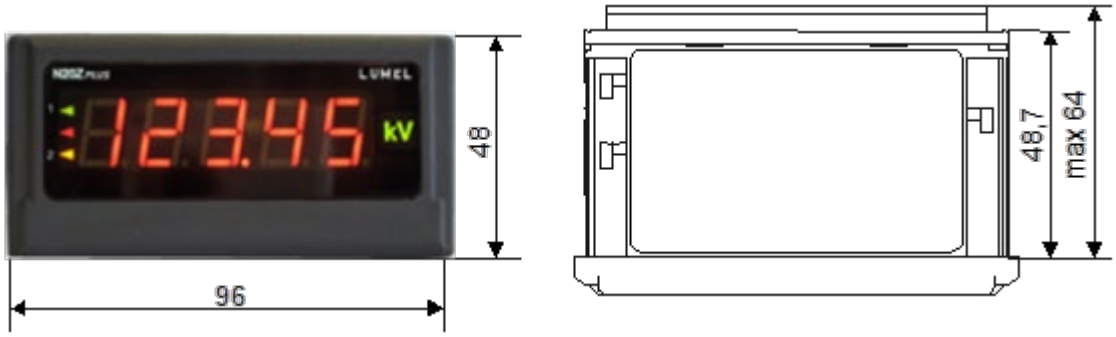


Fig. 3: Meter overall dimensions

4.1. Connection diagrams

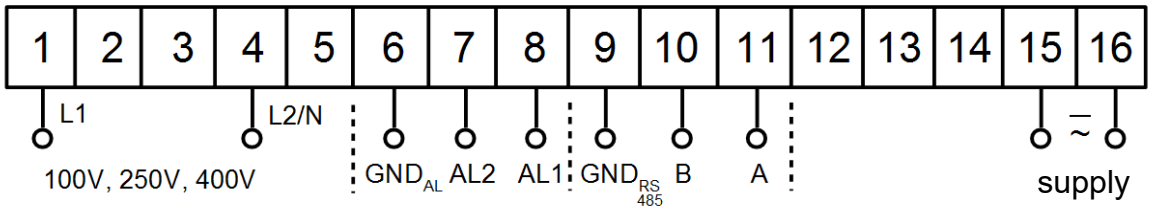


Fig. 4: Electrical connections of the N20Z*PLUS* meter for voltage and frequency measurements

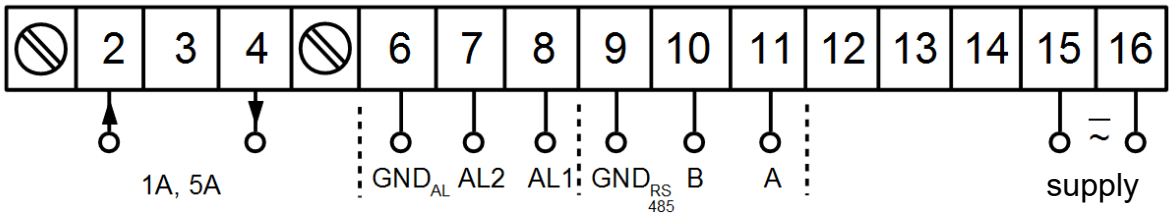


Fig. 5: Electrical connections of the N20Z*PLUS* meter for current measurements

5. Operation

5.1. Display description

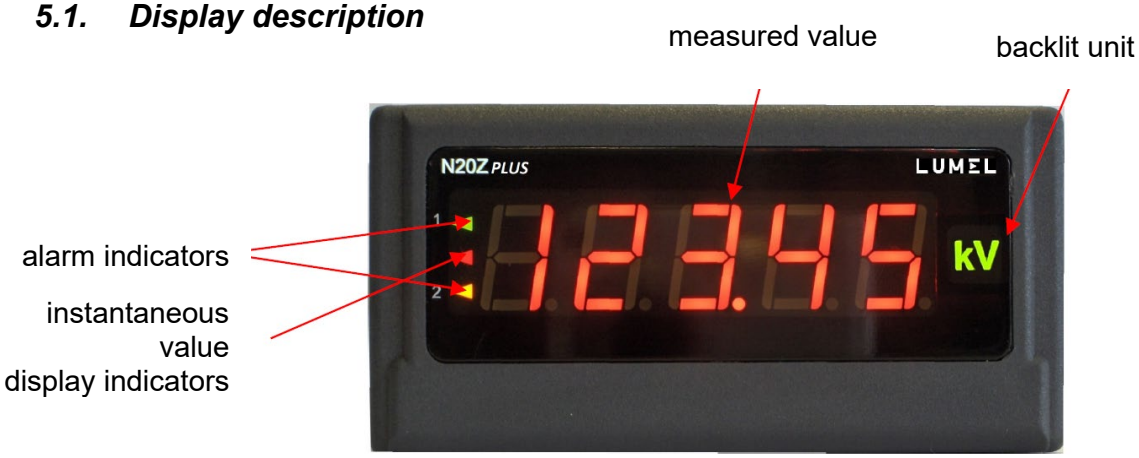


Fig. 6: Frontal panel

5.2. Messages after Switching the Supply on

After turning the power on, the meter displays the name of the N20Z PLUS X meter - where X is the letter denoting the version: U - voltage measurement, I - current measurement, F - frequency measurement, S - cutom-made version. Then the program version is displayed in the form r x.xx - where x.xx is the number of the current program version or the cutom-made version number.

Until the required number of correct measurements is obtained (according to table 1), the instantaneous value from 1 measurement is displayed, signaled by the backlit indicator of instantaneous value.

In the event of an error or exceeding the range value, the display will show the message described in point 6. Exceeding the measurement range is additionally signaled by the instantaneous value indicator.

5.3. Configuration of the meter

To configure the N20ZPLUS meter the user can use free eCon software available for download on the manufacturer's website (www.lumel.com.pl). The meter should be connected to a PC via a USB to RS-485 converter, e.g. PD10, and then in the E-Con program, the transmission parameters in accordance with those set in the meter should be selected.

CAUTION! Programming the meter parameters should be done with measuring circuits disconnected !

5.4. Parameter description

5.4.1. Display

The display can be configured by changing the settings of the following parameters:

a) display colors of the measured value. The display range is divided into three areas separated by threshold values KpL and KpH (respectively lower threshold KpL and upper threshold KpH of the change of the display color - Fig. 7). The color of displayed numbers for each area is selected from three available colors: green, orange and red. The KpL and KpH values are set by the user and refer to the displayed value (i.e. also include individual characteristics). By default, the KpL value is equal to 100% of the nominal value, while KpH is equal to 110% of the nominal value, e.g.: for the 400 V meter: for KpL - 400 V and for KpH - 440 V respectively.

Caution! After setting the individual characteristic, KpL and KpH are not automatically updated.

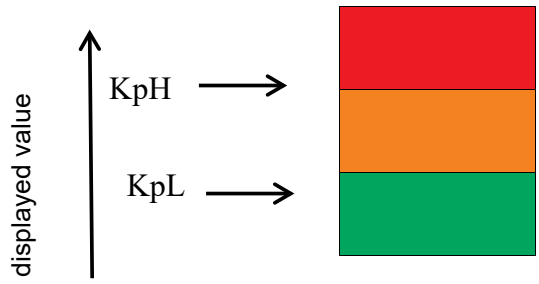


Fig. 7. display color configuration

b) decimal point - measurement precision. There are 5 possible display configurations to choose from, but you should take the accuracy of the measurement into account, for example: for the 400 V range - the measurement error is 2 V, so choosing a precision with two decimal places does not give you more accurate measurements. For version with voltage measurement the factory setting of precision is 0000.0; for version with current measurement - 00,000.

c) unit backlight. Unit backlight can be turned on or off. It is on by default.

5.4.2. Measurement parameters

We can configure the measurement by changing the following:

a) input type: AC measurement, AC+DC measurement (True RMS), AC measurement is factory default,

b) averaging time: until the required number of correct measurements is obtained (according to table 1), the instantaneous value from 1 measurement is displayed. After measuring a certain number of measurements, the arithmetic mean of the measured measurements is displayed. Subsequent measurements are added on the

principle of "rolling window", i.e. the earliest measurement is discarded and the most recently measured one is put in its place. Measuring values outside the measurement range results in displaying the exceeding and starting to count correct measurements from the beginning. The factory time is set to 1s

Table 1

Time of measurement	Number of averaged measurements	Updating the displayed value (duration of 1 measurement)
0.5 s	1	every 0.5 s
1 s	2	every 0.5 s
3 s	6	every 0.5 s
5 s	10	every 0.5 s
10 s	20	every 0.5 s
15 s	30	every 0.5 s
30 s	60	every 0.5 s
1 min	100	every 0.6 s
2 min	100	every 1.21 s
5 min	100	every 3 s
7 min	100	every 4.2 s
12 min	100	every 6 s
15 min	100	every 9.1 s

c) Thresholds for displayed exceedings: You can narrow the limits beyond which the exceedings will be displayed, taking into account individual characteristics. If the measured value is outside the measurement range 0 ... 120% of the nominal value (e.g. for the 400 V version the range is 0 ... 480 V) an exceeding is displayed, the range is factory set to
-19999 ... 99999.

d) Enabling the individual characteristics. The factory default is off. The configuration of the individual characteristics consists in defining the points of the linear characteristics used to convert the measured value into the displayed value (Figure 8).

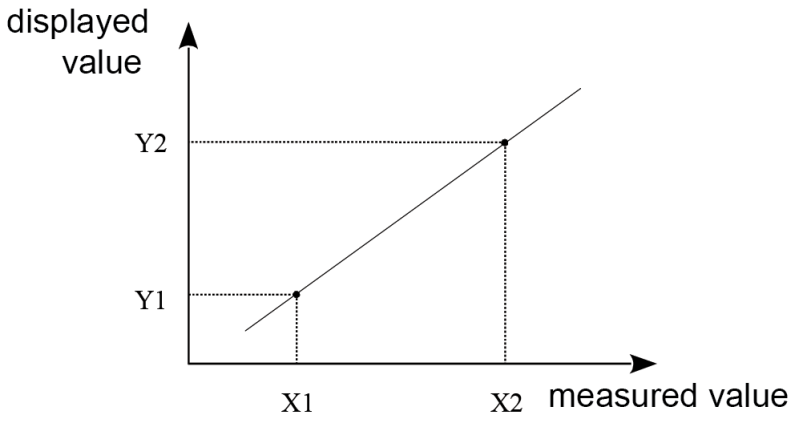


Fig. 8. Individual characteristics

For example, to get displayed values in kV, set points X1, X2, Y1, Y2 as follows:

X1 = 0, Y1 = 0, X2 = 1000, Y2 = 1

This record means that for each measured value in the range 0 ... 1000, the displayed value in the range 0 ... 1 will be calculated.
After setting the points X1, Y1, X2, Y2, the coefficients A and B of the straight line should be determined using the equation

$$y = A \cdot x + B$$

according to the rule:

$$A = \frac{Y1 - Y2}{X1 - X2} \qquad B = Y1 - \frac{Y1 - Y2}{X1 - X2} \cdot X1$$

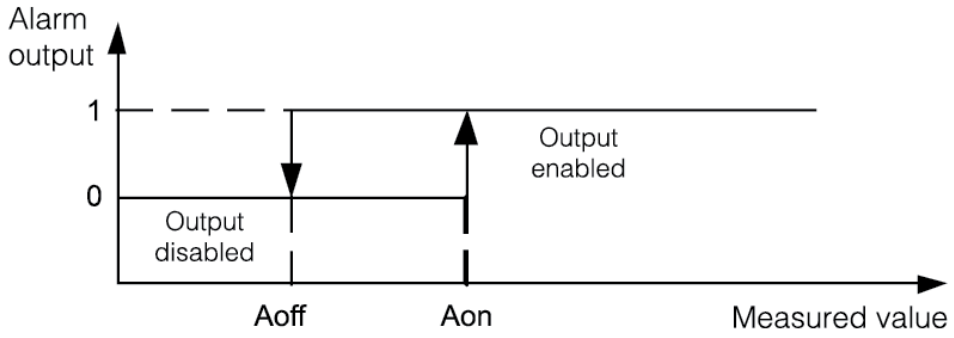
Coefficients A and B are individual characteristics parameters.

5.4.3. Alarm parameters

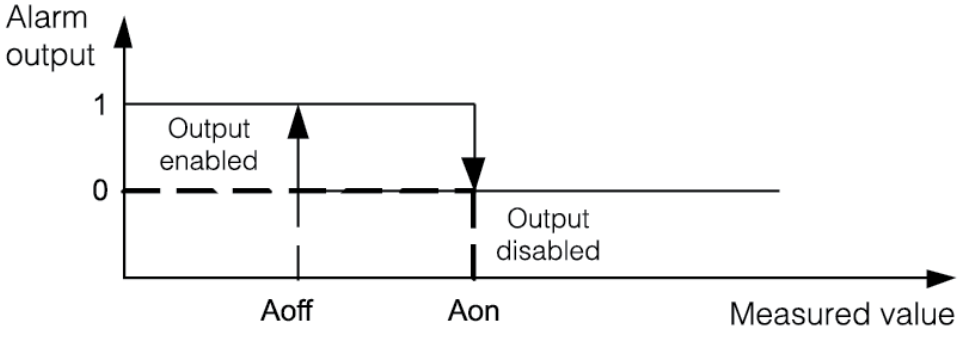
Two alarms are available in the N20Z*PLUS* meter. Both work independently and each of them has 6 operating modes: n-on, n-off, on, off, hon and hoff, which are shown in Figure 9. The alarm thresholds Aoff and Aon are set in the values of the measured value, taking into account the individual characteristics. By default, both alarms are set in the n-on mode.

Additionally, for each alarm, you can set the parameter for the delay of alarm state switching.

a) **n-on**



b) **n-off**



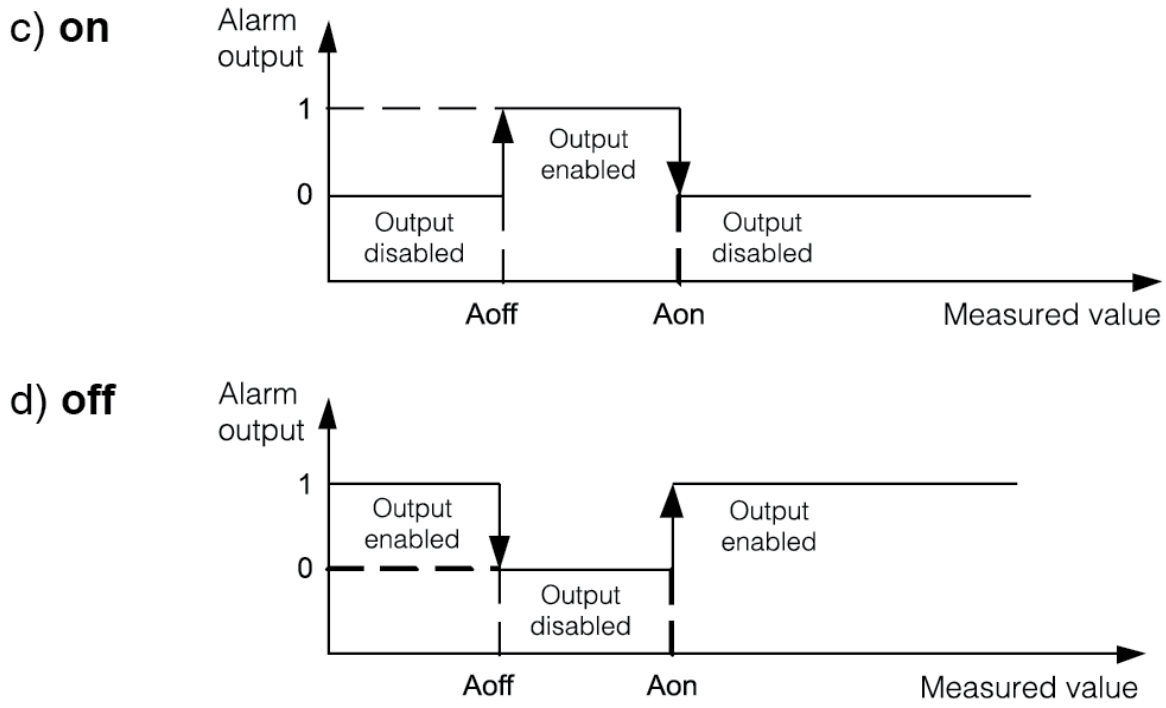


Fig. 9. Types of alarms: a) n-on; b) n-off; c) on; d) off.

Other alarm types: hon - always enabled; hoff - always disabled.

5.4.4. Communication parameters

The N20Z*PLUS* meter is equipped with an isolated RS-485 interface and the communication takes place via the Modbus RTU protocol. The following parameters are available to configure the correct communication:

- address on the Modbus, can take values from the range 1 ... 247
- baudrate, available options: 4800, 9600, 19200, 38400, 57600, 115200 bps
- transmission mode, available options: 8N2, 8E1, 8O1, 8N1

5.5. Factory parameters

Table 2

Parameter description	Range / Value	Default value
The display color of the upper measured value	red, green, orange	red (U, I, f)
The display color of the middle measured value	red, green, orange	orange (U, I), green (f)
The display color of the lower measured value	red, green, orange	green (U, I), orange (f)

Upper threshold - KpH	-19999…99999	110% of the nominal value Un, In, or 51 Hz
Lower threshold - KpL	-19999…99999	100 % of the nominal value Un, In, or 49 Hz
Decimal point	00000, 0000.0, 000.00, 00.000, 0.0000	0000.0 for U,f or 00.000 for I
Backlight of the measuring unit	off, on	enabled
Input type	AC, AC+DC	AC
Averaging time	0.5 s; 1 s; 3 s; 5 s; 10 s; 15 s; 30 s; 1 min; 2 min; 5 min; 7 min; 12 min; 15 min	1 s
Upper exceeding of the measurement	-19999…99999	99999
Lower exceeding of the measurement	-19999…99999	-19999
Individual characteristic	off, on	disabled
Parameter A of individual characteristics	-19999…99999	1
Parameter B of individual characteristics	-19999…99999	0
Function of the alarm output 1	n-on; n-off; on; off; h_on; h_off;	n-on (U,I), off (f)
Upper switching value of alarm 1 - Aon	-19999…99999	110% of the nominal value Un, In, or 51 Hz
Lower switching value of alarm 1 - Aon	-19999…99999	100 % of the nominal value Un, In, or 49 Hz
Alarm 1 switching delay	0…120	0 seconds
Function of the alarm output 2	n-on; n-off; on; off; h_on; h_off;	n-on (U,I), off (f)
Upper switching value of alarm 2 - Aon	-19999…99999	110% of the nominal value Un, In, or 51 Hz
Lower switching value of alarm 2 - Aon	-19999…99999	100 % of the nominal value Un, In, or 49 Hz
Alarm 2 switching delay	0…120	0 seconds
Address of Modbus device	1...247	1
Baud rate	4800, 9600, 19200, 38400, 57600, 115200	9600
Transmission mode	8N2, 8E1, 8O1, 8N1	8N2

6. MAP OF MODBUS REGISTERS

In N20Z*PLUS* meter the data is placed in 16- and 32-bit registers. Parameters and measured values of the meter are located in the address space of registers in a manner dependent on the type of the variable. Bits in 16-bit registers are numbered from the youngest to the oldest (b0-b15). 32-bit registers contain floating point numbers. The list of available registers is shown in Table 3. The ranges of changes in the value of registers are presented in tables 4 and 5.

Table 3.

Address range	Value type	Description
4000 - 4023	Integer (16 bits)	Configuration of meter operation parameters (fixed-point parameters). Value placed in one 16-bit register.
7600 - 7609	Float (32 bits)	Configuration of meter operation parameters (floating point parameters). Value placed in one 32-bit register.
7610 - 7611	Float (32 bits)	Measured values (floating point). Value placed in one 32-bit register.
7022	Float (2x16 bits)	Registers 7600-7611 in the form of 2x16 bits (Swapped float) in the bytes sequence 1032
6022	Float (2x16 bits)	Registers 7600-7611in the form of 2x16 bits (Floating point) in the bytes sequence 3210

Table 4.

Address	Register type	Description	Scope of changes
4000	RW	Decimal point of the display (display precision)	0 - 00000 1 - 0000.0 2 - 000.00 3 - 00.000 4 - 0.0000
4001	RW	Unit backlight.	0 - off 1 - on
4002	RW	Display color for values below the KpL threshold (Fig. 7) set in register 7603	0 - orange 1 - red 2 - green
4003	RW	Display color for values between KpL and KpH thresholds (Fig. 7) set in registers 7602 and 7603	0 - orange 1 - red 2 - green
4004	RW	Display color for values above the KpH threshold (Fig. 7) set in register 7602	0 - orange 1 - red 2 - green
4005	RW	Alarm type 1 (point 5.4.3)	0 – n-on 1 – n-off 2 – on 3 – off 4 – hon 5 – hoff
4006	RW	Alarm 1 switching delay	0...120
4007	RW	Alarm type 2 (point 5.4.3)	0 – n-on 1 – n-off 2 – on

			3 – off 4 – hon 5 – hoff
4008	RW	Alarm 2 switching delay	0...120
4009	RW	Enabling the individual characteristics. Characteristics parameters placed in registers 7600 and 7601	0 – characteristics off 1 – characteristics on
4010	RW	Measurement results averaging time (pt. 5.4.2.b)	0 – 0.5 s 1 – 1 s 2 – 3 s 3 – 5 s 4 – 10 s 5 – 15 s 6 – 30 s 7 – 1 min 8 – 2 min 9 – 5 min 10 – 7 min 11 – 12 min 12 – 15 min
4011	RW	Measurement input type	0 – True RMS (AC+DC) 1 – AC
4012	R	Reserved	Not applicable
4013	R	The meter status, read only value, represents the current operating status.	
4014	RW	Reserved	Not applicable
4015	R	Reserved	Not applicable
4016	R	Reserved	Not applicable
4017	R	Reserved	Not applicable
4018	R	Serial number of the meter (older 16 bits of 32-bit value)	Not applicable
4019	R	Serial number of the meter (younger 16 bits of 32-bit value)	Not applicable
4020	RW	Address of the Modbus device (change requires acceptance by making an entry into the register 4023)	0...247
4021	RW	Baudrate (change requires acceptance by making an entry into the register 4023)	0 – 4800 1 – 9600 2 – 19200 3 – 38400 4 – 57600 5 – 115200
4022	RW	Transmission mode (change requires acceptance by making an entry into the register 4023)	0 – 8N2 1 – 8E1

			2 – 8O1 3 - 8N1
4023	RW	Application of transmission parameters.	0 – do nothing 1 - apply changes

Table 5.

Address	Address (2x16bits „1032")	Address (2x16bits „3210")	Register type	Description	Scope of changes
7600	7000	6000	RW	Parameter A of individual characteristics (pt. 5.4.2.d)	-19999…99999
7601	7002	6002	RW	Parameter B of individual characteristics (pt. 5.4.2.d)	-19999…99999
7602	7004	6004	RW	Value of the upper exceeding of displayed value	-19999…99999
7603	7006	6006	RW	Value of the lower exceeding of displayed value	-19999…99999
7604	7008	6008	RW	Upper threshold of alarm 1 triggering	-19999…99999
7605	7010	6010	RW	Lower threshold of alarm 1 triggering	-19999…99999
7606	7012	6012	RW	Upper threshold of alarm 2 triggering	-19999…99999
7607	7014	6014	RW	Lower threshold of alarm 2 triggering	-19999…99999
7608	7016	6016	RW	Upper threshold of the color change of the KpH display (pt. 5.4.1.a)	-19999…99999
7609	7018	6018	RW	Lower threshold of the color change of the KpL display (pt. 5.4.1.a)	-19999…99999
7610	7020	6020	R	Measured value of the input signal frequency	Not applicable
7611	7022	6022	R	Measured value of the input signal (U/I)	Not applicable

7. ERROR CODES

After switching the meter on, error messages may appear. The causes of the errors are listed below.

Exceeding the upper value of the programmed indication range.

Exceeding the lower value of the programmed indication range.

ErrCA Loss of calibration values of the meter. In this case, please contact the service.
ErrEE Incorrect values in the meter configuration data. The meter parameters should be set again

8. TECHNICAL DATA

Input measurement ranges:

Un voltage measurement range:

1 V…100 V…120 V
2,5 V…250 V…300 V } input resistance > 2 MΩ
4 V…400 V…480 V

In current measurement range:

0,01 A…1 A…1,2 A input resistance 50 mΩ ±10%

0,05 A…5 A…6 A input resistance 10 mΩ ±10%

Frequency measurement 20...500 Hz input resistance > 2 MΩ

(in the voltage range 24 ... 480 V)

Time of initial warm-up: 30 minutes

Intrinsic error (at factory settings):

- voltage and current: ±(0.5 % of the range + 1 digit) in the 20 ... 500 Hz frequency range
- frequency: ±(0.02 % of the range + 1 digit)

Additional errors in rated operating conditions:

- due to changes in ambient temperature (50 % of intrinsic error/10 K)

Averaging time:

- voltage, current (programmable) min 0.5 s (default 1 s)
- frequency (non-programmable) 1 s

Alarm outputs : OC output type (30 V, 20 mA), passive acc. to EN 62053-31

Serial interface

- RS-485, address 1..247
- modes 8N2, 8E1, 8O1, 8N1
- baud rate 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbit/s
- transmission protocol: MODBUS RTU
- response time: 100 ms

Nominal operating conditions:

- supply voltage: 85... 253 V a.c./d.c.
  20... 40 V a.c. or 20…60 V d.c.
- ambient temperature: -10...23...55 °C
- storage temperature: -25...+85 °C
- humidity <95% (condensation of water vapor unacceptable)
- operation position: any

Sustained overload capacity: 120 % Un, 120 % In

Short duration overload capacity (3 s): voltage input 2 Un (<1000 V)
current input: 10 In

Readout field: 5 three-colour LED displays:
digit height: 14 mm
colors: green, orange, red
Indication range: -19999...99999

Ensured degree of protection from frontal side IP 65 acc. to EN 60529

Dimensions: 96 x 48 x 64 mm (including terminals)

Weight: < 0.25 kg

Power consumption: < 6 VA

Electromagnetic compatibility

- immunity to electromagnetic interference according to EN 61000-6-2
- emission of electromagnetic disturbances according to EN 61000-6-4

Safety requirements according to EN 61010-1:

- insulation between circuits: basic,
- installation category III (for 400 V version – category II),
- degree of pollution 2,
- maximum operating voltage relative to earth:
  - for supply circuit 300 V,
  - for measuring input 480 V
  - for RS485 interface 50 V
- altitude < 2000 m.

9. ORDERING CODES

Ordering code for N20Z*PLUS* panel meter

Table 6

PANEL METER	**N20Z*PLUS***	**X**	**X**	**XX**	**XX**	**X**	**X**
Input							
100 V		**1**					
250 V		**2**					
400 V		**3**					
1 A		**4**					
5 A		**5**					
frequency 20...500 Hz		**6**					
Supply voltage							
85...253 V a.c./d.c.			**1**				
20..40 V a.c./20..60 V d.c.			**2**				
Unit							
code number of the unit acc. table 7				**XX**			
Version							
standard					**00**		
custom-made *					**XX**		
Language							
Polish / English						**M**	
Acceptance tests:							
without extra requirements							**0**
with quality inspection certificate							**1**
with calibration certificate							**2**
acc. to customer's requirements*							**X**

* - only after agreement with the manufacturer

Code of the highlighted unit Table 7.

Code	Unit	Code	Unit
00	without unit		
01	V	25	ms
02	A	26	s
03	mV	27	h
04	kV	28	N
05	MV	29	kN
06	mA	30	Pa
07	kA	31	hPa
08	MA	32	kPa
09	°C	33	MPa
10	°F	34	bar
11	K	35	rad
12	Hz	36	Ω
13	kHz	37	kΩ
14	Ah	38	%
15	kAh	39	r
16	m/s	40	rev.

17	µm	41	rps
18	mm	42	rpm
19	cm	43	rph
20	m	44	m/h
21	km	45	km/h
22	l	46	imp
23	l/s	XX	on request [1]
24	l/h		

[1] – After consultation with the manufacturer

SAMPLE ORDER:
N20ZPLUS-310100P0 means N20Z*Plus* meter with voltage input for the 400 V range, power supply 85..253 V a.c., Polish language version, version without additional requirements. Unit: "V".

LUMEL

LUMEL S.A.

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

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

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

ND31LITE-07B