EUROTEC
TECNOLOGIE IMPIANTISTICHE - AUTOMAZIONE - TELECONTROLLO

LUMEL
EVERYTHING COUNTS

DIGITAL PANEL METER

N20HPLUS



USER'S MANUAL

CE

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1. APPLICATION AND METER DESIGN

The N20HPLUS meter is a digital programmable panel instrument destined for measurements of d.c. voltages or d.c. currents: unipolar or bipolar.

The readout field is a LED display which enables the exposition of results in red, green or orange colours. The N20HPLUS meter has a built-in RS-485 interface and the MODBUS RTU protocol provided on it, which can be used to configure the meter or read the measured values from it. The meter works with free eCon software available for download on the manufacturer's website. The meter should be connected to a PC via an RS-485 to USB converter, e.g. PD10.

Following parameters can be reprogrammed:
– display colour, individually in three intervals,
– thresholds of displayed overflows
– display precision of the result (decimal point),
– highlight of the unit,
– averaging time of the measurement,
– recalculation of indications (individual characteristic),
– two alarms of OC type operating in six working modes,
– RS-485 transmission parameters,
– MODBUS bus settings.

The meter is equipped with two OC type outputs. The alarm output switching on is signaled by the highlight of the triangular alarm index situated at the left display side, for the suitable alarm digit. The highlight colour is always different from the colour of the displayed (measured) value. The meter has a galvanic separation between the supply, measuring inputs and the RS-485 interface.

The protection level from the frontal side is IP65.
Meter overall dimensions: 96 × 48 × 64 mm (including terminals). The meter housing is made of self-extinguishing plastic.



Fig. 1. view of the N20HPLUS meter

2. METER SET

The set is composed of:
- N20HPLUS meter..... 1 pc
- user's manual..... 1 pc
- clamps to fix in the panel..... 4 pcs

3. BASIC REQUIREMENTS AND OPERATIONAL SAFETY

The symbols in the manual mean:



Warning!
Warning about potentially risky situations. It is especially important to read before connecting the device. Non-compliance with the instructions marked with this symbol may result in serious injury to personnel and damage to the device.



Caution!
Generally useful notes. Familiarizing yourself with them facilitates using the device. Pay attention to them when the device does not work as expected.
Possible consequences if you disregard the information!

In the safety service scope, the N20HPLUS meter meets the requirements of the EN 61010-1 standard.



Observations concerning the operational safety:

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

4. INSTALLATION

The meter has separable strips with screw terminals which enable the connection of external wires of 2.5 mm^2. In the current measurement version, the plug enables permanent attachment to the socket with screws.

One must prepare a hole of $92^{+0.6} \times 45^{+0.6}$ mm in the panel which the thickness should not exceed 6 mm. The meter must be introduced from the panel front with disconnected supply voltage. Before the insertion into the panel, one must check the correct placement of the seal. After the meter insertion into the hole, fix the meter by means of the clamps (fig. 2.).

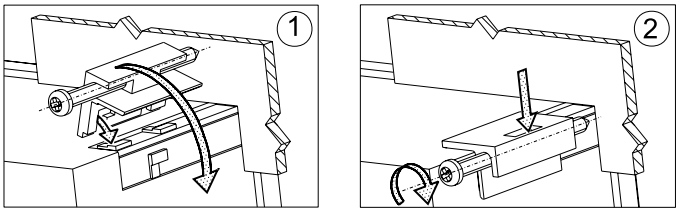


Fig. 2. Meter fixing.

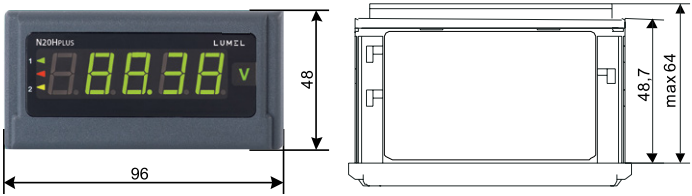


Fig. 3. Meter overall dimensions

4.1. Connection Diagrams

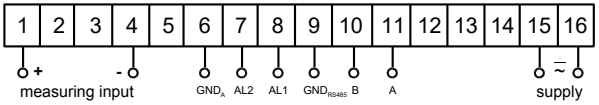


Fig. 4. Electrical connections of the N20HPLUS meter

The supply must be connected by a two-wire cable, of a suitable wire diameter, ensuring its protection by means of an installation cut-out.

5. SERVICE

5.1. Display Description

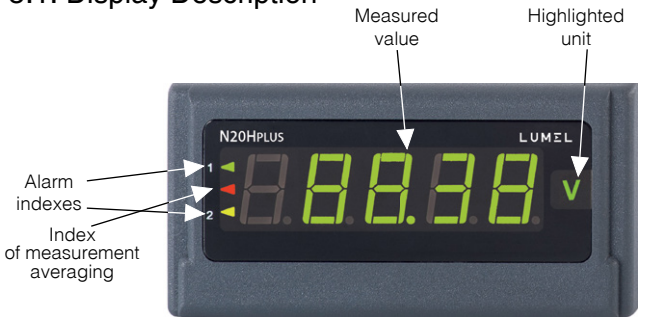


Fig. 5. Frontal panel

5.2. Messages after the Supply Connection

After connecting the supply, the meter displays the n20H PLUS meter name. Next, the program version is displayed in the shape r x.xx – where x.xx is the number of the actual program version or the number of the custom-made execution.

Till the time to obtain the required number of correct measurements (acc. to the table 1), the actual value from the measurement 1 is displayed, signaled by the highlighted index of avaraging measurement.

In case of an error occurrence or an overflow of the range value, a message described in the section 6 will be displayed on the display. Overflows of the measuring range are additionally signaled by the actual value signal index.

5.3. Meter Configuration by Means of the eCon software

The eCon software - available at www.lumel.com.pl - is destined for the N20HPLUS meter configuration.
The meter should be connected to a PC via a USB to RS-485 converter, e.g. PD10, and then in the eCon program select transmission parameters in accordance with those set in the meter.

CAUTION! One must carry out the programming of meter parameters when measuring circuits are switched off!

5.4. Parameters description

5.4.1. Display settings

Following elements are possible to be configured:

a) display colours of the measured value. The displayed range is divided into three zones separated by KpL and KpH values (suitably the lower threshold KpL and the upper threshold KpH of display colour change – fig.6). The colour of displayed numbers for each zone is selected from three accessible colours: green, orange and red. KpL and KpH values are set by the user and concern the displayed value (i.e. taking also into consideration the individual characteristic). The manufacturer value KpL is equal 100% of the rated value, however KpH is equal 105% of the rated value, e.g. for a 10 V meter execution they are respectively: for KpL – 10 V and for KpH – 10.5 V.

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

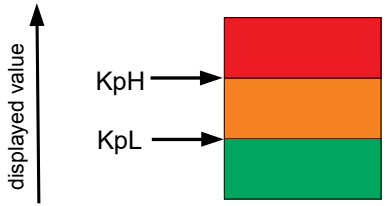


Fig. 6. Display color configuration

b) decimal point – measurement precision. We have 5 possible display configurations at choice.

When choosing, one must follow the measurement precision, e.g.: for the 100 V range – the measurement error is 0.2 V, so the choice of precision with two places after the decimal point does not give more precise measurements.

c) unit highlight. The unit highlight can be enabled or disabled. When manufacturing it is enabled.

5.4.2. Measurement settings

We can configure the measurement by changing the following elements:

a) Averaging time: till the time to obtain the required number of correct measurements (according to the table 1), the actual value from 1 measurement is displayed. After measuring a definite number of measurements, the arithmetic mean of 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. The measurement of a value beyond the measuring range causes the display of overflow and the start to count correct measurements from the beginning. The time is set on 1 s by the manufacturer.

Table 1

Averaging time	Number of averaging time	Updating of displayed values
0.5 s	2	every 0.5 s
1 s	7	every 0.5 s
3 s	20	every 0.5 s
5 s	33	every 0.5 s
10 s	67	every 0.5 s
15 s	100	every 0.5 s
20 s	133	every 0.5 s

b) thresholds of displayed overflows: one can narrow limits beyond which overflows will be displayed, taking into consideration the individual characteristic.When the measured value is beyond 0…110% of the rated value (e.g. for the 100 V execution, it is the range -1…120 V), the overflow is displayed. In manufacturing conditions, the range –19999…99999 is set.

c) switching the individual characteristic on. In manufacturing conditions the characteristic is switched off.
The configuration of the individual characteristic consists in defining the points of the linear characteristic used to convert the measured value into the displayed value (Figure 7).

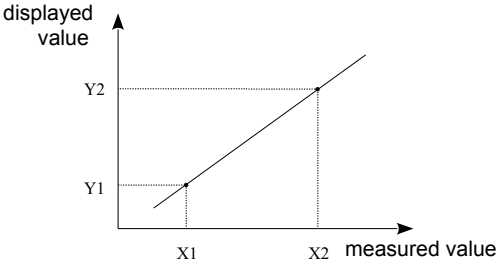


Fig. 7. Individual characteristic

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

X1 = 0, Y1 = 0, X2 = 10, Y2 = 1

This record means that for each measured value in the range 0 ... 10, the displayed value in the range 0 ... 1 will be calculated. Having the points X1, Y1, X2, Y2, the coefficients A and B of the straight line with the equation should be determined

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

according to the rule:

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

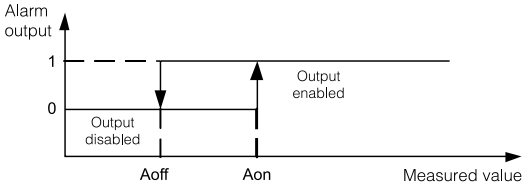
Coefficients A and B are individual characteristic parameters.

5.4.3. Setting of Alarm Parameters

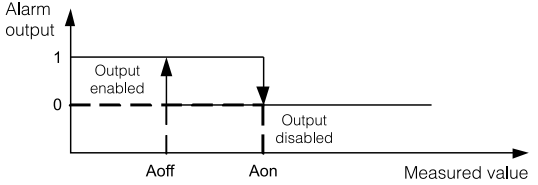
N20HPLUS meter has two alarms. Both alarms are working independently and each of them has 6 working modes: n-on, n-off, on, off, hon and hoff, which are presented on the fig. 8. Alarm thresholds Aoff and Aon are set in values of the measured quantity taking into consideration the individual characteristic. In manufacturing conditions both alarms are set on the n-on mode.

In addition, a status switching delay parameter can be set for each alarm.

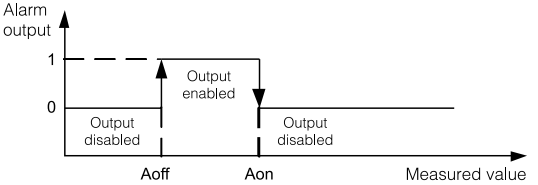
a) **n-on**



b) **n-off**



c) **on**



d) **off**

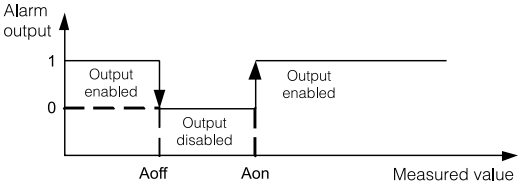


Fig. 8. Alarm types: a) n-on, b) n-off, c) on, d) off

Remaining types of the alarm: hon – always switched on;
hoff – always switched off.

5.4.4. Communication Parameters

The N20HPLUS meter is equipped with an isolated RS-485 interface and 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
- baud rate, are available: 4800, 9600, 19200, 38400, 57600, 115200 bps
- transmission mode, available for selection: 8N2, 8E1, 8O1, 8N1

5.5. Manufacturer Parameters

Table 2

Parameter description	Range/value	Manufacturer value
Display colour of the measured upper value	red, green, orange	red
Display colour of the measured middle value	red, green, orange	orange
Display colour of the measured lower value	red, green, orange	green
Upper threshold - KpH	-19999…99999	105% of rated value Un
Lower threshold - KpL	-19999…99999	100% of rated value Un
Decimal point	00000, 0000.0, 000.00, 00.000, 0.0000,	0000.00
Highlight of the measured unit	switched off, switched on	switched on
Averaging time	0.5 s, 1 s, 3 s; 5 s, 10 s, 15 s, 20 s,	1 s
Individual characteristic	switched off, switched on	switched off
Parameter ***A*** of the individual characteristic	-19999…99999	1
Parameter ***B*** of the individual characteristic	-19999…99999	0
Action mode of the alarm output 1	n-on, n-off, on, off, h_on, h_off	n-on

Upper value of the alarm 1 switching - Aon	-19999…99999	105% of rated value Un
Lower value of the alarm 1 switching - Aoff	-19999…99999	100% of rated value Un
Delay of the alarm 1 switching time	0…120	0 second
Action mode of the alarm output 2	n-on, n-off, on, off, h-on, h-off	n-on
Upper value of the alarm 2 switching - Aon	-19999…99999	105% of rated value Un
Lower value of the alarm 2 switching - Aoff	-19999…99999	100% of rated value Un
Delay of the alarm 2 switching time	0…120	0 second
Modbus device address	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 the N20HPLUS meter, the data is placed in 16 and 32 bit registers. Parameters and measured values of the meter are placed in the address space in a way depending on the variable value type. In 16-bit registers, bits are numbered from the youngest to the oldest (b0-b15). 32-bit registers contain float numbers. The list of available registers is presented 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.

Table 4

Address	Register type	Description	Changes range
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. 6) set in register 7603	0 - orange 1 - red 2 - green

4003	RW	Display color for values between KpL and KpH thresholds (Fig. 6) set in registers 7602 and 7603	0 - orange 1 - red 2 - green
4004	RW	Display color for values above the KpH threshold (Fig. 6) set in register 7602	0 - orange 1 - red 2 - green
4005	RW	Alarm type 1 (section 5.4.3)	0 – n-on 1 – n-off 2 – on 3 – off 4 – hon 5 – hoff
4006	RW	Alarm 1 delay time	0...120
4007	RW	Alarm type 2 (section 5.4.3)	0 – n-on 1 – n-off 2 – on 3 – off 4 – hon 5 – hoff
4008	RW	Alarm 2 delay time	0...120
4009	RW	Switching on of individual characteristics.Characteristics parameters placed in registers 7600 and 7601	0 – individual char. off 1 – individual char. on
4010	RW	Averaging time (section 5.4.2 b)	0 – 0.5 s 1 – 1 s 2 – 3 s 3 – 5 s 4 – 10 s 5 – 15 s 6 – 20 s
4011		reserved	

4012	R	Restoring factory parameters of the meter	0 - do not do anything 1 - restore parameters
4013	R	The meter status, read only value, represents the current operating status.	
4014		reserved	Not applicable
4015		reserved	Not applicable
4016		reserved	Not applicable
4017		reserved	Not applicable
4018	R	Meter's serial number (older 16 bits of 32-bit value)	Not applicable
4019	R	Meter's serial number (younger 16 bits of 32-bit value)	Not applicable
4020	RW	Modbus device address (change requires approval by writing to register 4023)	0...247
4021	RW	Baud rate (change requires acceptance by writing to registry 4023)	0 – 4800 1 – 9600 2 – 19200 3 – 38400 4 – 57600 5 – 115200
4022	RW	Transmission mode (change requires acceptance by writing to registry 4023)	0 – 8N2 1 – 8E1 2 – 8O1 3 - 8N1
4023	RW	Application of transmission parameters.	0 - do not do anything 1 - apply changes

Table 5

Address	Register type	Description	Changes range
7600	RW	Parameter A of the individual characteristic (section 5.4.2.d)	-19999…99999
7601	RW	Parameter B of the individual characteristic (section 5.4.2.d)	-19999…99999
7602	RW	Value of exceeding the upper display value	-19999…99999
7603	RW	Value of exceeding the lower display value	-19999…99999
7604	RW	Upper alarm trigger threshold 1	-19999…99999
7605	RW	Alarm trigger lower threshold 1	-19999…99999
7606	RW	Upper alarm trigger threshold 2	-19999…99999
7607	RW	Alarm trigger lower threshold 2	-19999…99999
7608	RW	The upper threshold for the color change of the KpH display (section 5.4.1.a)	-19999…99999
7609	RW	The lower threshold for the color change of the KpL display (section 5.4.1.a)	-19999…99999
7610		reserved	
7611	R	Measured value of the input signal	Not applicable

7. ERROR CODES

After connecting the meter to the network, messages about errors may appear. Causes of errors are presented below:



Overflow of the upper value of the programmed indication range.



Overflow of the lower value of the programmed indication range.

ErrCA — Loss of meter calibration values – In such a case, one must contact an authorized service workshop.

ErrEE — Incorrect values in meter configuration data. One must set up again meter parameters.

8. TECHNICAL DATA

Measuring ranges:

INPUTS:

Measuring ranges of Un voltage:

-1 V...0 V...100 V...120 V
-120 V...100 V...100 V...120 V
-1 V...0 V...400 V...480 V
-480 V...400 V...400 V...480 V

} input resistance > 2 MΩ

Preheating time: 30 min.

Intrinsic error (at manufacturer settings): ± (0.2% of the range ±1 digit)

Additional errors in rated operating conditions:
- from ambient temperature changes ± (0.1% of the range/10 K)

Averaging time: voltage , current (programmable) ≤ 0.5s (1s by default)

Alarm outputs: outputs of O/C type (30 V, 20 mA), passive outputs acc. to EN 62053-31

Serial interface: RS-485, address 1..247
mode: 8N2, 8E1, 8O1, 8N1
baud rate: 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbit/s
transmission protocol: modbus RTU
time to start the response: 100 ms

Rated operating conditions:

- supply voltage	85...253 V a.c. (45...65 Hz) or d.c. 20...40 V a.c. (45...65 Hz) / 20... 60 V d.c.
- ambient temperature	- 10...23...55°C
- storage temperature	- 25... + 85°C
- relative air humidity	< 95% (inadmissible condensation of water vapour)
- working position	any

Sustained overload capacity: 10%

Short duration overload capacity (3 s): 2 Un

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

Ensured protection grade from frontal side: IP 65 acc. EN 60529

Overall dimensions: 96 × 48 × 64 mm (with terminals)

Weight: < 0.25 kg

Power consumption: < 6 VA

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

Safety requirements acc. to EN 61010-1 standard:



– isolation between circuits: basic
– installation category: III (for version 400V - category II)
– pollution degree: 2
– maximal phase-to-earth working voltage:
  – for supply circuit 300 V (at supply 85...253 V),
  – for measuring input 600 V – cat. II (300 V – cat. III),
  – for interface RS485 50 V,
– altitude above sea level: < 2000 m

9. ORDERING CODES

Table 6

N20HPLUS	X	X	XX	XX	X	X
Input:						
0...100 V	1					
± 100 V	2					
0...400 V	3					
± 400 V	4					
Supply:						
85...253 V a.c./d.c.		1				
20..40 V a.c./ 20... 60 V d.c.		2				
Unit:						
unit code number acc. to table 7			XX			
Version:						
standard				00		
custom-made*				XX		
Language:						
Polish					P	
English					E	
Acceptance test:						
without additional quality requirements						0
with an extra quality inspection certificate						1
with an extra calibration certificate						2
acc.to customer's request						X

* -only after agreeing with the manufacturer

Codes of highlighted unit:

Table 7

Code	Unit	Code	Unit	Code	Unit
00	without unit	17	µm	34	bar
01	V	18	mm	35	rad
02	A	19	cm	36	Ω
03	mV	20	m	37	kΩ
04	kV	21	km	38	%
05	MV	22	l	39	°
06	mA	23	l/s	40	obr
07	kA	24	l/h	41	rps
08	MA	25	ms	42	rpm
09	°C	26	s	43	rph
10	°F	27	h	44	m/h
11	K	28	N	45	km/h
12	Hz	29	kN	46	imp
13	kHz	30	Pa	XX	on order[1)]
14	Ah	31	hPa		
15	kAh	32	kPa		
16	m/s	33	MPa		

[1)] -only after agreeing with the manufacturer

ORDERING EXAMPLE:

The Code N20HPLUS_410100E0 - means: N20HPLUS meter with voltage input on ±400 V, supply 85... 253 V a.c., standard version, user's manual in English, without aditional quality requirements. Unit„V"

LUMEL
EVERYTHING COUNTS

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