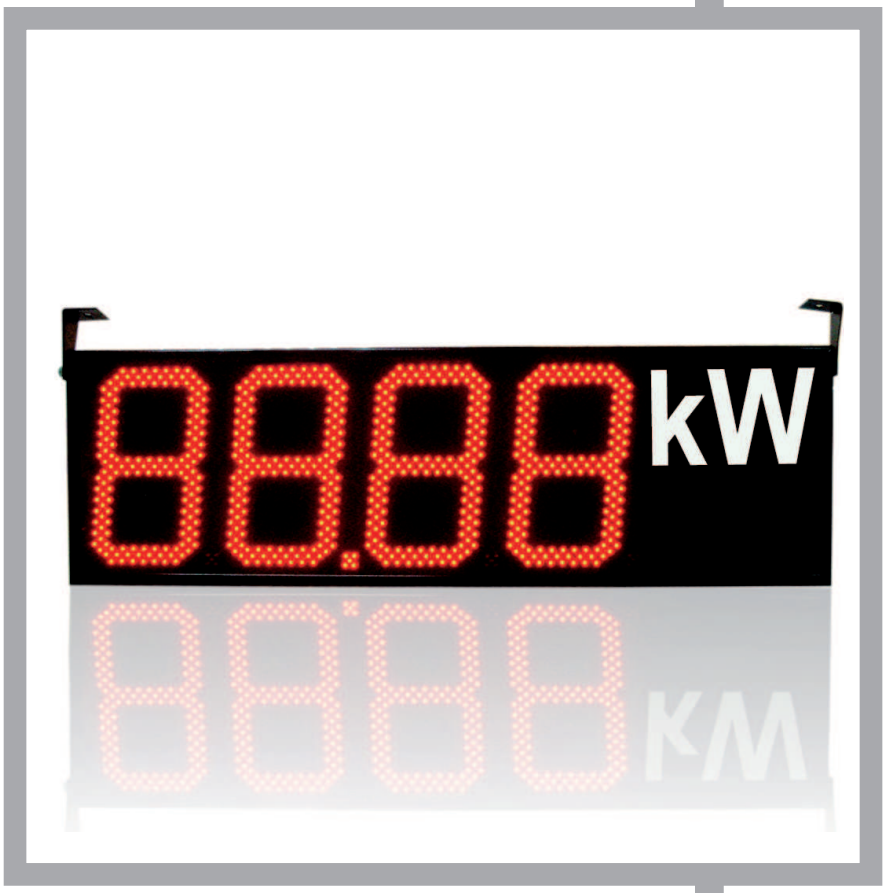
LUMEL

NUMERICAL DIGITAL DISPLAY PANEL DNL2 AND DNL3 TYPE



USER'S MANUAL

CE

Contents

1 Application

LED DNL digital display panels are designed for display of digital values indoor: offices, manufacturing plants or production supervision points, providing information such as production parameters, machine condition, device operational status etc. DNL display panels can be configured with LPCon software application available for free on the website www.lumel.com.pl.
DNL display panels are equipped with two RS485 communication interfaces using MODBUS RTU standard. First interface (programming interface) is used for the configuration of the display panel settings or for the input of displayed value (the display panel is a Slave device in MODBUS RTU network) e.g. from the SCADA application or PLC drivers Second interface (object interface) is used for plugging slave devices (the display panel is a Master device in MODBUS RTU network) the display panel gets displayed data from.
Display panel configuration allows reading up to 100 registers from slave devices (up to 10 registers per each of 10 devices, see Table 5), so the display panel can act as the local data collection point All data received from slave devices can be accessed as internal registers of the display panel for the SCADA application or PLC drivers via RS485 MODBUS RTU Slave interface. It is possible to define minimum and maximum displayed value for the display panels.
Additionally, the display panel may be equipped with auxiliary measurement input for the measuring of standard analog signal 4..20 mA used in automatics and with output powering external measurement transducers.
Basic configuration of the display panel includes one or two fields for readings (4 digits each) and space for the unit placement.

2 Display panel set

Complete set of the meter includes:

- DNL digital display panel 1 pc
- Fitting brackets 2 pcs
- Instructions manual 1 pc
- Warranty card 1 pc

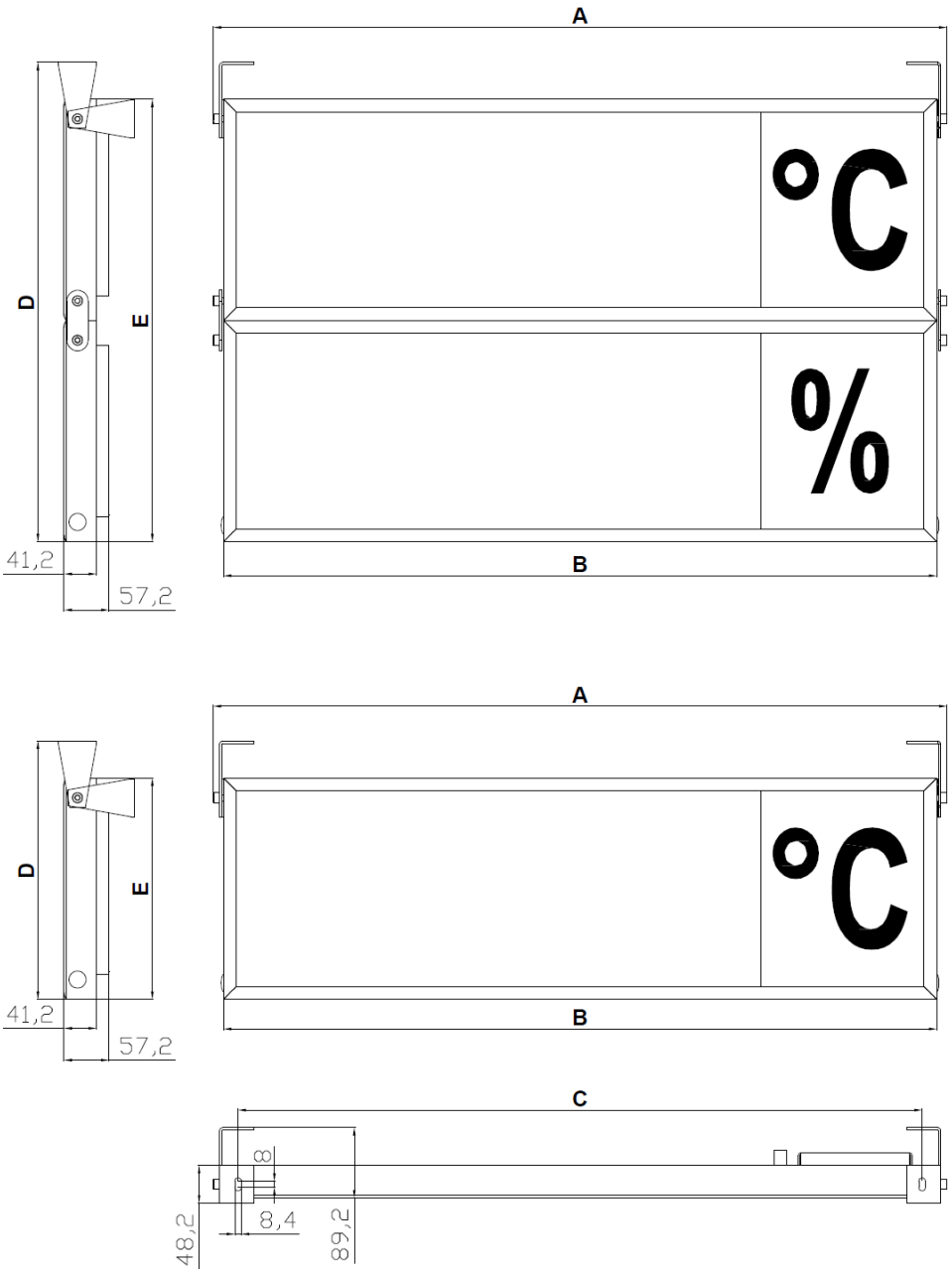
3 Basic requirements, operational safety

Display panel conforms to a safety standard EN 61010-1.

- Display panel should be installed and connected only by a qualified personnel. All relevant safety measures should be observed during installation.
- Always check electric connections before turning the device on.
- Do not mount a display panel outside of the buildings.
- Display panel must be used only for intended purposes.
- Removing the outer housing of the display panel during warranty period voids the warranty.
- When connecting panel to the power source, make sure that the electric system of the building includes manual or automatic circuit breaker. This element should be close to the device, within the reach of an operator and marked as a breaker for switching the device off.

4 Design description and installation

DNL digital display panels are enclosed in a housing made of aluminium profiles providing IP40 protection (IP10 on the terminals side). Overview and dimensions of the display panels are presented on the Fig. 1



	One row version		Two rows version	
	DNL-2 [mm]	DNL-3 [mm]	DNL-2 [mm]	DNL-3 [mm]
A	931	1091	931	1091
B	905	1065	905	1065
C	868	1027	868	1027
D	328	414	609	781
E	281	367	562	734

Fig. 1. Overview and dimensions of one row and two rows display panel.

The housing allows the display panel to be fitted to a wall or suspended from a ceiling, angle of suspended panel may be adjusted.

5 Electrical connections

Connection of the power and interface wires should only be done according to the manual.
Shielded stranded cable should be used for control signals connections. It is allowed to use unshielded stranded cable if the surroundings are characterized by low interference level.
Caution! In the case of rapid temperature change that may cause water condensation, a display panel should not be connected to a supply. It is recommended to wait at least 60 minutes before installation of the display panel that was subjected to the rapid temperature shift.
Connectors are located on the back side of the display panel. Description of the connector signal is shown on the fig. 2.

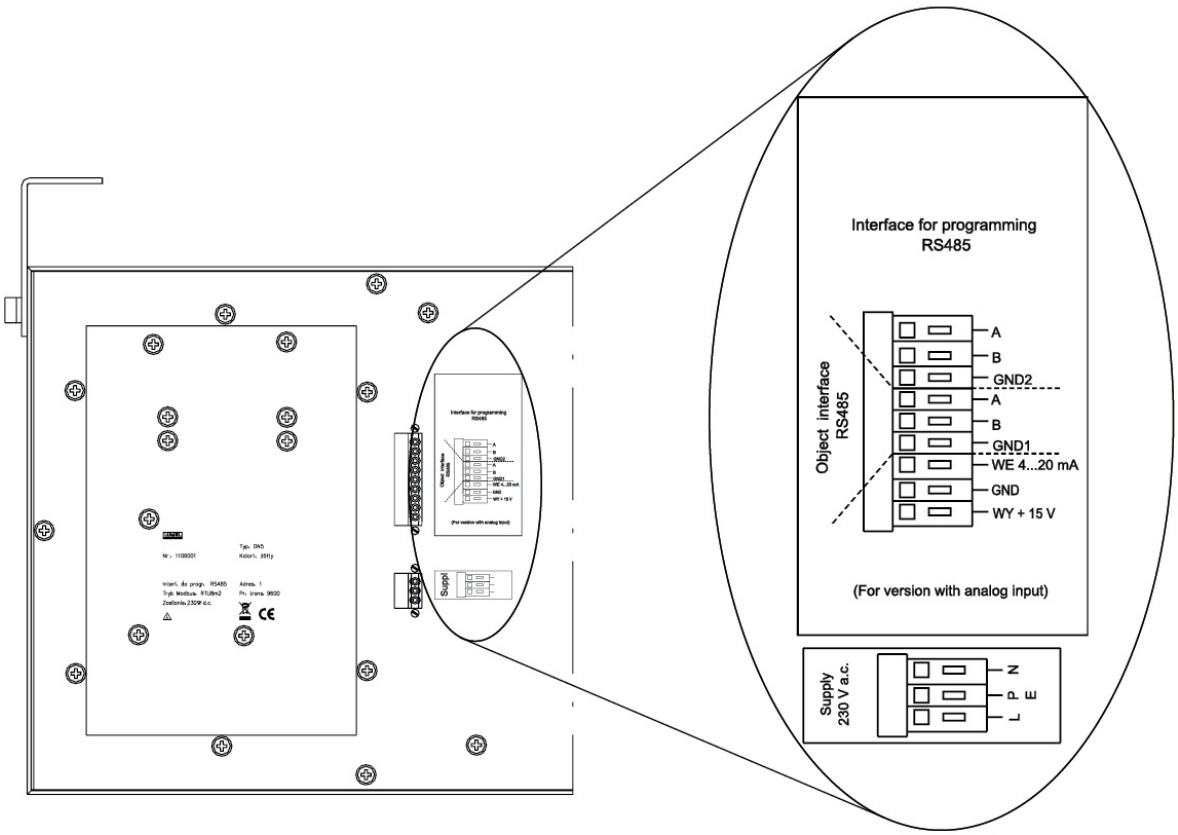


Fig. 2. Display connection diagram

Object interface and programming interface are galvanically separated. Object interface is used to connect slave devices and programming interface is used to connect the display panel to RS485 bus (with a display panel used as a slave device), i.e. to PLC driver, PC, data concentrator etc. Analog input 4..20 mA is used for connecting external signal, i.e. from measurement transducer. Additionally, board with analog input has +15 V power connector supplying power to external measurement transducers.
After switching a device on, a panel performs a display test and then proceeds to display the value found in the register 7500 (value readout from the device 1). It is possible to change the displayed value by changing a panel configuration.

6 Display panel configuration

Panel display settings can be configured by the programming interface. To program the desired display parameters one may use the LPCon application of any program allowing for reading and modification of the registers of any MODBUS RTU device.
Default setting of the display panel:

- address: 1,
- baud rate: 9600 bits per second
- transmission mode: RTU 8n2.

Mapping and description of registers are presented in section 7 – “Interface”.

6.1 Turning the display panel on

After DNL display panel is turned on, display test is performed and the panel displays information regarding programming interface transmission parameters. Example of transmission parameters display is shown on the Fig.3.

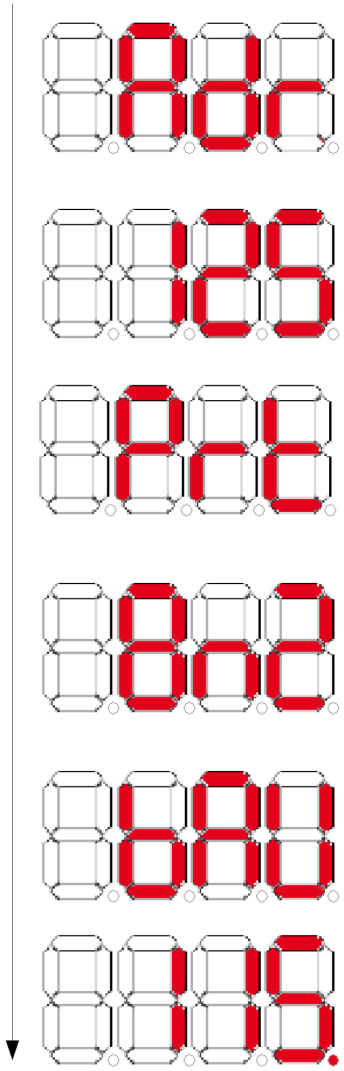


Fig. 3. Transmission parameters display.

6.2 Modification of transmission parameters

Transmission parameter may be changed through modification of the driver registers 4000..4002. Required values should be entered into the registers 4000..4002 and then a value of 1 should be entered into the register 4004. This stores the new parameters and allows the display panel to use all entered values. It is recommended to store old and new transmission parameters, so the

transmission might be restored in case of problems.
Caution! After the transmission parameters are changed, corresponding changes must be made in the software used together with the display panel. Additionally it might also be necessary to re-configure transmission transducer if they are connected between the computer and the display panel.

6.3 Display configuration

DNL display panel allows the display of numerical values in selected format (with a set accuracy). Prior to displaying, value might be rescaled according to the linear function. Rescaled value is inserted in the register that can be readout by the programming interface. Display parameters are changed by the modification of the configuration registers of the display panel driver. Below you can find detailed description of the display configuration for one row display panel. In the case of two rows display panel, configuration procedure is not changed (see register map in the 'Interface' section).

6.3.1 Display format

Displayed numerical value may be shown with the specified accuracy (decimal places). Display format is modified through changing of the register 4019 for the first row, register 4023 for the second row etc. Value entered into the register defines number of the decimal places.

6.3.2 Displayed value – displayed registers

Displayed registers are the basic configuration parameters of the display panel. They define values to be displayed in the separate rows of the display panel. DNL display panel can display values stored in registers 7500..7645.
Displayed register is changed through the modification of the 4020 register for the first row and register 4024 for the second row. These registers store the shift value in reference to the register 7500. Shift can calculated using this formula:

$$S = DR - 7500$$

where: S – shift, DR – displayed register (7500..7645).
Example
We want to display the third register readout from the device 2 (register 7512), thus DR = 7512.

$$S = 7512 - 7500 = 12$$

To achieve this, a value of 12 must be stored in the register 4020 (register of the display present at the 7512 address will be displayed).

User can configure the display panel to display following values:

- readout from the attached devices (registers 7500..7599);
- stored in the general registers stored after the power is turned off (registers 7600..7609);
- stored in general registers that are not saved after the power is turned off (registers 7610..7619);
- stored in registers of values to be displayed (registers 7636..7639);
- at the analog input 4..20 mA (registers 7642 or 7645).

Numerical value from the master continuously storing data in the display panel should be displayed using the registers 7610..7619 (shift 110..119). The value will not be stored. When panel is turned on, an upper limit overrun message will be displayed until a new value is entered. This feature protects the non-volatile memory from excessive number of writing operation.

6.3.3 Rescaling displayed value – individual characteristic

Prior to display, every value may be recalculated relative to the applied linear characteristic. Factors used in value recalculation are stored in the registers 7622, 7623 (for the first row) and 7626, 7627 (for the second row). To recalculate values prior to display, user must enter factors a and b. Displayed value will be calculated according to formula:

$$DV = RV * a + b$$

where: a and b are formula factors, DV – displayed value, RV – value stored in the displayed register.
Additionally, the result *(DV)* is stored in the register 7636 that can be readout by the master.

Example

Display panel is configured to readout data from P18 transducer. Temperature is readout in degrees Celsius, but it is needed to be displayed in degrees Fahrenheit. Using formula for temperature calculation we have:

$$°F = (°C \times 1.8) + 32$$

Thus factor a = 1.8 and factor b = 32.
So we must but the following values in the registers:

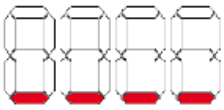
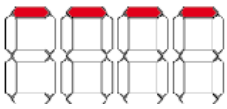
- 7622 = 1.8 (row 1 – factor „a" of the individual characteristic);
- 7623 = 32 (row 1 – factor „b" of the individual characteristic);

6.3.4 Minimum and maximum displayed value and alarms

User may set a limit for the minimum and maximum value displayed by the display panel by entering required limit values to the registers 7620, 7621 (for the first row) and 7624, 7625 (for the second row). Whenever the value to be displayed is lower than the value stored in the register 7620 (for the first row), the display panel will show lower overrun message ___ (see Table 1) . This message will also be displayed if the value is too low to be physically displayed. Whenever the value to be displayed is higher than the value of the upper limit (register 7621 for the first row), the display panel will show upper overrun message ‾‾‾ (see Table 1). This message will also be displayed if the value is too high to be physically displayed. Using minimum and maximum values, user can easily define range of indications.

Caution! In case of incorrect values set for minimum and maximum limit it is possible that the display panel permanently displays an error message. It should be noted that minimum and maximum values that can be displayed also depend on the selected format.

Table 1

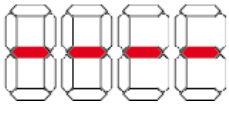
Warning	Symbol	Warning description
Lower overrun		Value is lower than the programmed minimal value or is too small to be displayed (too many digits to fit in the display panel, e.g. -9850).
Upper overrun		Value is higher than the programmed minimal value of is too large to be displayed (too many digits to fit in the display panel, e.g. 21253).

Overrun indication may be further emphasized by enabling alarm function for the separate rows (register 4021 for the first row and register 4025 for the second row). This causes overrun messages to pulse.

6.3.5 Error messages

DNL display panel implements a function of displaying an error preventing required value to be displayed. This message is presented below.

Table 2

Warning	Symbol	Warning description
Slave device communication error		Value to be displayed is acquired from a device which there is no communication with. The device does not respond properly or configuration of a communication with the device is incorrect. This message is displayed after 5 subsequent failed attempts to readout the value.

6.4 Display luminosity setting

DNL display panels are equipped with automatic luminosity control (build-in lighting sensor). With automatic luminosity control enabled (register 4013 = 1) it is possible to set maximum luminosity value (register 4014) and minimum luminosity value (register 4015). User can also set luminosity to change at specific hours. This setting uses internal real-time clock of the display panel. To change luminosity parameters it is necessary to modify registers 4013..4017. Luminosity level is set as a percentage, so its range is: 1..100 (registers 4013, 4014). Beginning of the day (register 4016, hour * 100 + minutes) and beginning of the night (register 4017, hour *100 + minutes) define the period of luminosity settings. Period from the register 4016 to 4017 sets the day luminosity and period from the register 4017 to 4016 sets the night luminosity.

Example

Setting the automatic luminosity control. Maximum luminosity is set to 100%, minimum luminosity is set to 20%. This means, that following values must be stored in registers:

- 4013 = 1 (0 – sensor off, 1 – lighting sensor on);
- 4014 = 100 (maximum luminosity in the automatic luminosity mode);
- 4015 = 20 (minimum luminosity in the automatic luminosity mode).

Example

Day luminosity is set to 100%, night luminosity is set to 10% with day begins at 6:30 am and night beginning at 3:45 pm So we must but the following values in the registers:

- 4013 = 0 (0 – sensor off, 1 – lighting sensor on);
- 4014 = 100 (day luminosity);
- 4015 = 10 (night luminosity);
- 4016 = 630 (beginning of the day 4016 = hour * 100 + minutes);
- 4017 = 1545 (beginning of the night 4017 = hour * 100 + minutes);

6.5 Date and time settings

To set proper internal RTC clock used for timed luminosity regulation, an actual time must be stored in the registers: 4008..4012. Daylight saving time may be also enabled, if necessary.

Example

It is 2011-03-18, 15:15:00 with daylight saving time enabled. Following values must be stored in respective registers:

- 4008 = 1 (0 – DST off, 1 – DST on);
- 4009 = 0 (seconds);
- 4010 = 1515 (4010 = hour * 100 + minutes 0);
- 4011 = 318 (4011 = month * 100 + day);
- 4012 = 2011 (year);

6.6 Display panel configuration for readout data from analog input

DNL display panel with an analog input may be configured to measure current signal 4..20mA, e.g. from the external temperature transducer. DNL display panel is equipped with an additional function allowing for rescaling the measurement acquired from the analog input. To enable it, proper values must be stored in registers 7643 and 7644.

Example

Assume that temperature transducer is connected to the measurement input of the display panel. The -10°C signal corresponds to the 4 mA current and the 150°C signal corresponds to the 20 mA. To show actual temperature and not the transducer current value, it is necessary to define rescaling factors a and b of the Y=aX+b function

X1 = 4 mA (measured value) X2 = 20 mA (measured value)
Y1 = -10°C (measured value) Y2 = 150 °C (measured value)

a = (Y2-Y1)/(X2-X1) = (150-(-10))/(20-4) = 10
b = y1 – a * x1 = -10-10*4 = -50

So, following values must be entered into respective registers:

- 7643 = 10 (rescaling factor „a” for input 1);
- 7644 = -50 (rescaling factor „b” for input 1);

Additionally, it is necessary to set displayed value limits for a given row. For the first row: registers 7620 and 7621 :

- 7620 = -10(row 1 – lower displayed value limit. For values lower than this value a lower overrun message is displayed).
- 7621 = 150(row 1 – upper displayed value limit. For values higher than this value an upper overrun message is displayed).

To display the measured value after rescaling in the first row, a following value should be entered into register 4020:

- 4020 = 145 (number of registry to display, as a shift relative to 7500 address).

6.7 Display panel configuration for readout data from additional devices

DNL display panel may be configured to display and readout data from additional devices working in MODBUS RTU mode. All additional devices and DNL display panel should have the same transmission parameters, i.e. speed and mode. Additional devices should have different addresses. Device address, register type which a readout starts from (base register), number of registers and query frequency are individually programmed for any additional device.
Configuration of data readout from external devices means setting:

- object interface transmission parameters: baud rate and frame mode should be identical for object interface and devices connected to the display panel. Response waiting time should be adjusted for the longest response time of the slowest device connected to the object interface. Transmission parameters are configured in registers 4005..4007;
- device address (register 4300 for the first device): it is necessary to enter address of the device which data are readout from. Entering 0 as an address disables readout from the device. Caution: All connected devices must have unique address, so no two devices in the network share the same address;
- base register (register 4301 for the first device): register address which should be readout from (according to the register map of additional device);
- register number (register 4302 for the first device): sets the number of registers to be readout from the device;
- register type (register 4303 for the first device): defines type of data in the registers to be readout. DNL display panel supports following register formats: char, unsigned char, integer, unsigned integer, long, unsigned long, float;
- query frequency (register 4304 for the first device); Defines time between subsequent readout for the device;
- readout function in the MODBUS mode (register 4305 for the first device): defines MODBUS command (03 or 04) used for querying register of an additional device.

Display panel queries all configured and connected devices and puts all readout data in its registers (7500..7599). Data readout is performed according to set query frequency. When querying slow devices, querying time may exceed programmed value due to long device response time. In a case the device fails five subsequent queries, a communication error flag will be set for this device (Device status register 4045) and registers of readout values from this device will be reset to 1E+20 until communication with the device is resumed.

Example

Object interface has a P18 humidity and temperature transducer attached, transducer address is 1 and transmission parameters: RTU frame type 8n2, baud rate 9600, it is used for temperature and humidity readout. Transducer is configured as device no. 1.
To configure the device, registers must be configured as follows:

- 4005 = 1 (frame type: RTU 8n2);
- 4006 = 2 (baud rate at 9600);
- 4007 = 5 (response waiting time: 500ms);
- 4300 = 1 (device address);
- 4301 = 7501 (device base register);
- 4302 = 2 (number of registers – temperature and humidity readout)
- 4303 = 6 (register type: float);
- 4304 = 1 (query frequency – every second).

For transducer configured as above, temperature and humidity values will be readout from P18 transducer every second and then stored in registers 7500 (temperature) and 7501 (humidity). To display readout values e.g. in first row, it is necessary to enter 0 for temperature or 1 for humidity in register 4020.

7 Interface

DNL display panel is equipped with two MODBUS RTU RS485 communication interfaces:

- Programming interface – for connecting the display panel to the master device, e.g. computer, PLC driver etc. This interface is used for display panel configuration and may be used for string values for display (use of general registers).
- Object registers – for connecting additional devices, such as measuring devices, transducers, drivers etc. used as the source for data to be readout and displayed if needed. This interface uses the display panel as a master device.

DNL display panel uses following MODBUS function for communication:

- Function 03 – readout of n registers, where n is the number of registers to be readout.
- Function 06 – writing to a single register,
- Function 16 – writing to n registers, (where n is the number of registers to be written).
- Function 17 – device identification.

Data readout from additional devices uses 03 and 04 MODBUS functions.

7.1 RS485 programming interface

Parameters summary:

- identifier 0xCA,
- transducer address 1..247,
- baud rate 2.4, 4.8, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2. kbit/s,
- operation mode Modbus RTU,
- transmission mode 8N2, 8E1, 8O1, 8N1,
- maximum response time 400 ms,
- maximum number of readout registers in a single query: 56 – for 4-byte registers, 102 – for 2-byte registers,
- implemented functions 03, 06, 16, 17,
  - 03 register readout,
  - 06 single register writing,
  - 16 writing of n registers,
  - 17 device identification.

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

Table 2

Address range	Value type	Description
4000 – 4050	Integer (16 bits)	Value set in the 16-bit register. Description of registers is shown in Table 3. Registers for writing and readout.
4300 – 4359	Integer (16 bits)	Value set in the 16-bit register. Description of registers is shown in Table 4. Registers for writing and readout.
7000 - 7290	Float (2x16 bits)	Value is set in the two following 16-bit registers. Registers contain exactly the same data, as 32-bit registers of 7500 – 7641 range. Readout registers. Bit sequence (3-2-1-0)

7500 – 7645	Float (32 bits)	Value set in the 32-bit register. Description of registers is shown in Table 5. Readout registers.

7.2 Registers 4000..4050

16-bit unsigned integer registers – display panel configuration.

Table 3

Register address	Operations	Range	Description
4000	RW	1…247	Interface 1 address – programming interface
4001	RW	0…3	Interface 1 operation mode 0: RTU 8N1 1: RTU 8N2 2: RTU 8E1 3: RTU 8O1
4002	RW	0…9	Interface no. 1 baud rate [b/s]: 0 – 2400; 1 – 4800; 2 – 9600; 3 – 14400; 4 – 19200; 5 – 28800; 6 – 38400; 7 – 57600; 8 – 76800; 9 – 115200
4003	-	-	reserved
4004	RW	0..1	Update programming interface transmission parameters
4005	RW	0…3	Interface 2 operation mode 0: RTU 8N1 1: RTU 8N2 2: RTU 8E1 3: RTU 8O1
4006	RW	0…9	Interface no. 2 baud rate [b/s]: 0 – 2400; 1 – 4800; 2 – 9600; 3 – 14400; 4 – 19200; 5 – 28800; 6 – 38400; 7 – 57600; 8 – 76800; 9 – 115200
4007	RW	1…50	Response time for slave device on port 2 is a multiple of 100 ms
Time and date			
4008	RW	0..1	0 - DST off, 1 - DST on
4009	RW	0..59	Seconds
4010	RW	0...2359	Hour*100 + Minutes 0
4011	RW	101…1231	Month * 100 + day
4012	RW	2000...2100	Year
Display luminosity			
4013	RW	0..1	0 - off, 1 - lighting sensor on
4014	RW	1…100	Luminosity for the day, maximum luminosity (maximum luminosity in the automatic mode)
4015	RW	1…100	Luminosity for the night, minimum luminosity (minimum luminosity in the automatic mode)
4016	RW	0000…2359	Beginning of day hour*100 + Minutes
4017	RW	0000…2359	Beginning of night hour*100 + Minutes
Display panel row configuration			
Row no. I			
4018	RW	1…20	Number of digits in the first row
4019	RW	0…3	Display format – decimal places
4020	RW	0…145	Number of register for display as the shift relative to address 7500.
4021	RW	0.1	Alarm on.
Row no. II			
4022	RW	0…20	Number of digits in the second row
4023	RW	0…3	Display format – decimal places
4024	RW	0…145	Number of register for display as the shift relative to address 7500.
4025	RW	0.1	Alarm on.
4026...4033	R		Reserved registers
Auxiliary registers			
4034	RW	0..65535	Storing integer in the register puts the integer in

			the register 7610.
4035	RW	0..65536	Storing integer in the register puts the integer in the register 7611.
4036	RW	0..65537	Storing integer in the register puts the integer in the register 7612.
4037	RW	0..65538	Storing integer in the register puts the integer in the register 7613.
4038	RW	0..65539	Storing integer in the register puts the integer in the register 7614.
4039	RW	0..65540	Storing integer in the register puts the integer in the register 7615.
4040	RW	0..65541	Storing integer in the register puts the integer in the register 7616.
4041	RW	0..65542	Storing integer in the register puts the integer in the register 7617.
4042	RW	0..65543	Storing integer in the register puts the integer in the register 7618.
4043	RW	0..65544	Storing integer in the register puts the integer in the register 7619.
System registers			
4044	R	N/A	Status – subsequent bits are event flags: bit 15 – maintenance mode – requires maintenance authorization; bit 14 – EEPROM memory error – factory settings restored; bit 13 – RTC settings error or settings are ambiguous; bit 12 – Daylight saving time turned on or off; bit 11 – External light sensor error (only for a version with a sensor); bit 10 – Power outage; bit 09 – bus 2 measurement error – value out of range; bit 08 – bus 1 measurement error – value out of range; bits 07…00 – not used – value always set to 0.
4045	R	N/A	Status of the devices connected to the display panel, subsequent bits show slave devices transmission status: bit 15 - transmission errors occurred; bit 09 - device 10 error; bit 08 - device 9 error; bit 07 - device 8 error; bit 06 - device 7 error; bit 05 - device 6 error; bit 04 - device 5 error; bit 03 - device 4 error; bit 02 - device 3 error; bit 01 - device 2 error; bit 00 - device 1 error;
4046	RW	N/A	Safety password (4321)
4047	RW	N/A	Order (safety password required): 0x8000 – restore factory settings; 0x4000 – perform display panel test;
4048	R	0..65544	Serial number two older bytes
4049	R	0..65544	Serial number two younger bytes
4050	R	0..65544	Program version /100

N/A - not applicable

7.3 Registers 4300..4359

16-bit unsigned integer registers – configuration of readout from connected devices.

Table 4

Register address	Operations	Range	Description
Device no. 1			
4300	RW	0.1…247	Slave device address. 0 – turns device off
4301	RW	0…65535	Base register.
4302	RW	1…10	Number of readout registers
4303	RW	0…6	Register type: 0 – char variable 1 – unsigned char variable 2 – integer variable 3 – unsigned integer variable 4 – long variable 5 – unsigned long variable 6 – float variable 7 – long variable as 2x16bit (1234) 8 – long variable as 2x16bit (2143) 9 – long variable as 2x16bit (4321) 10 – long variable as 2x16bit (3412) 11 – u. long variable as 2x16bit (1234) 12 – u. long variable as 2x16bit (2143) 13 – u. long variable as 2x16bit (4321) 14 – u. long variable as 2x16bit (3412) 15 – float variable as 2x16bit (1234) 16 – float variable as 2x16bit (2143) 17 – float variable as 2x16bit (4321) 18 – float variable as 2x16bit (3412)
4304	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4305	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 2			
4306	RW	0.1…247	Slave device address. 0 – turns device off
4307	RW	0…65535	Base register.
4308	RW	1…10	Number of readout registers
4309	RW	0…6	Register type: (as per device 1)
4310	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4311	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 3			
4312	RW	0.1…247	Slave device address. 0 – turns device off
4313	RW	0…65535	Base register.
4314	RW	1…10	Number of readout registers
4315	RW	0…6	Register type: (as per device 1)
4316	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4317	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 4			
4318	RW	0.1…247	Slave device address. 0 – turns device off
4319	RW	0…65535	Base register.
4320	RW	1…10	Number of readout registers
4321	RW	0…6	Register type: (as per device 1)
4322	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4323	RW	0..1	Readout function in MODBUS mode:

			0 - function 03 1 - function 04
Device no. 5			
4324	RW	0.1…247	Slave device address. 0 – turns device off
4325	RW	0…65535	Base register.
4326	RW	1…10	Number of readout registers
4327	RW	0…6	Register type: (as per device 1)
4328	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4329	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 6			
4330	RW	0.1…247	Slave device address. 0 – turns device off
4331	RW	0…65535	Base register.
4332	RW	1…10	Number of readout registers
4333	RW	0…6	Register type: (as per device 1)
4334	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4335	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 7			
4336	RW	0.1…247	Slave device address. 0 – turns device off
4337	RW	0…65535	Base register.
4338	RW	1…10	Number of readout registers
4339	RW	0…6	Register type: (as per device 1)
4340	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4341	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 8			
4342	RW	0.1…247	Slave device address. 0 – turns device off
4343	RW	0…65535	Base register.
4344	RW	1…10	Number of readout registers
4345	RW	0…6	Register type: (as per device 1)
4346	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4347	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 9			
4348	RW	0.1…247	Slave device address. 0 – turns device off
4349	RW	0…65535	Base register.
4350	RW	1…10	Number of readout registers
4351	RW	0…6	Register type: (as per device 1)
4352	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4353	RW	0..1	Readout function in MODBUS mode: 0 - function 03 1 - function 04
Device no. 10			
4354	RW	0.1…247	Slave device address. 0 – turns device off
4355	RW	0…65535	Base register.
4356	RW	1…10	Number of readout registers
4357	RW	0…6	Register type: (as per device 1)
4358	RW	1…60	Query frequency in seconds. Determines query frequency for slave device.
4359	RW	0..1	Readout function in MODBUS mode: 0 – function 03 1 – function 04

7.4 Registers 7000..7282 and 7500..7645

32-bit float registers.

Table 5

Registers address 2 x 16 bits	32-bit register address	Operations	Description
Readout values			
7000	7500	R	Device 1 – First register readout.
7002	7501	R	Device 1 – Second register readout.
7004	7502	R	Device 1 – Third register readout.
7006	7503	R	Device 1 – Fourth register readout.
7008	7504	R	Device 1 – Fifth register readout.
7010	7505	R	Device 1 – Sixth register readout.
7012	7506	R	Device 1 – Seventh register readout.
7014	7507	R	Device 1 – Eighth register readout.
7016	7508	R	Device 1 – Ninth register readout.
7018	7509	R	Device 1 – Tenth register readout.
7020	7510	R	Device 2 – First register readout.
7022	7511	R	Device 2 – Second register readout.
7024	7512	R	Device 2 – Third register readout.
7026	7513	R	Device 2 – Fourth register readout.
7028	7514	R	Device 2 – Fifth register readout.
7030	7515	R	Device 2 – Sixth register readout.
7032	7516	R	Device 2 – Seventh register readout.
7034	7517	R	Device 2 – Eighth register readout.
7036	7518	R	Device 2 – Ninth register readout.
7038	7519	R	Device 2 – Tenth register readout.
7040	7520	R	Device 3 – First register readout.
7042	7521	R	Device 3 – Second register readout.
7044	7522	R	Device 3 – Third register readout.
7046	7523	R	Device 3 – Fourth register readout.
7048	7524	R	Device 3 – Fifth register readout.
7050	7525	R	Device 3 – Sixth register readout.
7052	7526	R	Device 3 – Seventh register readout.
7054	7527	R	Device 3 – Eighth register readout.
7056	7528	R	Device 3 – Ninth register readout.
7058	7529	R	Device 3 – Tenth register readout.
7060	7530	R	Device 4 – First register readout.
7062	7531	R	Device 4 – Second register readout.
7064	7532	R	Device 4 – Third register readout.
7066	7533	R	Device 4 – Fourth register readout.
7068	7534	R	Device 4 – Fifth register readout.
7070	7535	R	Device 4 – Sixth register readout.
7072	7536	R	Device 4 – Seventh register readout.
7074	7537	R	Device 4 – Eighth register readout.
7076	7538	R	Device 4 – Ninth register readout.
7078	7539	R	Device 4 – Tenth register readout.
7080	7540	R	Device 5 – First register readout.
7082	7541	R	Device 5 – Second register readout.
7084	7542	R	Device 5 – Third register readout.
7086	7543	R	Device 5 – Fourth register readout.
7088	7544	R	Device 5 – Fifth register readout.
7090	7545	R	Device 5 – Sixth register readout.
7092	7546	R	Device 5 – Seventh register readout.
7094	7547	R	Device 5 – Eighth register readout.
7096	7548	R	Device 5 – Ninth register readout.
7098	7549	R	Device 5 – Tenth register readout.
7100	7550	R	Device 6 – First register readout.
7102	7551	R	Device 6 – Second register readout.

7104	7552	R	Device 6 – Third register readout.
7106	7553	R	Device 6 – Fourth register readout.
7108	7554	R	Device 6 – Fifth register readout.
7110	7555	R	Device 6 – Sixth register readout.
7112	7556	R	Device 6 – Seventh register readout.
7114	7557	R	Device 6 – Eighth register readout.
7116	7558	R	Device 6 – Ninth register readout.
7118	7559	R	Device 6 – Tenth register readout.
7120	7560	R	Device 7 – First register readout.
7122	7561	R	Device 7 – Second register readout.
7124	7562	R	Device 7 – Third register readout.
7126	7563	R	Device 7 – Fourth register readout.
7128	7564	R	Device 7 – Fifth register readout.
7130	7565	R	Device 7 – Sixth register readout.
7132	7566	R	Device 7 – Seventh register readout.
7134	7567	R	Device 7 – Eighth register readout.
7136	7568	R	Device 7 – Ninth register readout.
7138	7569	R	Device 7 – Tenth register readout.
7140	7570	R	Device 8 – First register readout.
7142	7571	R	Device 8 – Second register readout.
7144	7572	R	Device 8 – Third register readout.
7146	7573	R	Device 8 – Fourth register readout.
7148	7574	R	Device 8 – Fifth register readout.
7150	7575	R	Device 8 – Sixth register readout.
7152	7576	R	Device 8 – Seventh register readout.
7154	7577	R	Device 8 – Eighth register readout.
7156	7578	R	Device 8 – Ninth register readout.
7158	7579	R	Device 8 – Tenth register readout.
7160	7580	R	Device 9 – First register readout.
7162	7581	R	Device 9 – Second register readout.
7164	7582	R	Device 9 – Third register readout.
7166	7583	R	Device 9 – Fourth register readout.
7168	7584	R	Device 9 – Fifth register readout.
7170	7585	R	Device 9 – Sixth register readout.
7172	7586	R	Device 9 – Seventh register readout.
7174	7587	R	Device 9 – Eighth register readout.
7176	7588	R	Device 9 – Ninth register readout.
7178	7589	R	Device 9 – Tenth register readout.
7180	7590	R	Device 10 – First register readout.
7182	7591	R	Device 10 – Second register readout.
7184	7592	R	Device 10 – Third register readout.
7186	7593	R	Device 10 – Fourth register readout.
7188	7594	R	Device 10 – Fifth register readout.
7190	7595	R	Device 10 – Sixth register readout.
7192	7596	R	Device 10 – Seventh register readout.
7194	7597	R	Device 10 – Eighth register readout.
7196	7598	R	Device 10 – Ninth register readout.
7198	7599	R	Device 10 – Tenth register readout.
7200	7600	RW	General register no. 1 (value is stored).
7202	7601	RW	General register no. 2 (value is stored).
7204	7602	RW	General register no. 3 (value is stored).
7206	7603	RW	General register no. 4 (value is stored).
7208	7604	RW	General register no. 5 (value is stored).
7210	7605	RW	General register no. 6 (value is stored).
7212	7606	RW	General register no. 7 (value is stored).
7214	7607	RW	General register no. 8 (value is stored).
7216	7608	RW	General register no. 9 (value is stored).
7218	7609	RW	General register no. 10 (value is stored).
7220	7610	RW	General register no. 11 (value is not stored) Writing the value into register puts the integer into register 4034.
7222	7611	RW	General register no. 12 (value is not stored)

			Writing the value into register puts the integer into register 4035.
7224	7612	RW	General register no. 13 (value is not stored) Writing the value into register puts the integer into register 4036.
7226	7613	RW	General register no. 14 (value is not stored) Writing the value into register puts the integer into register 4037.
7228	7614	RW	General register no. 15 (value is not stored) Writing the value into register puts the integer into register 4038.
7230	7615	RW	General register no. 16 (value is not stored) Writing the value into register puts the integer into register 4039.
7232	7616	RW	General register no. 17 (value is not stored) Writing the value into register puts the integer into register 4040.
7234	7617	RW	General register no. 18 (value is not stored) Writing the value into register puts the integer into register 4041.
7236	7618	RW	General register no. 19 (value is not stored) Writing the value into register puts the integer into register 4042.
7238	7619	RW	General register no. 20 (value is not stored) Writing the value into register puts the integer into register 4043.
Row 1 – remaining parameters			
7240	7620	RW	Row 1 – lower limit of displayed value If the value is lower that limit, a lower overrun message is displayed.
7242	7621	RW	Row 1 – upper limit of displayed value If the value is higher that limit, an upper overrun message is displayed.
7244	7622	RW	Row 1 – „a” factor of individual characteristic.
7246	7623	RW	Row 1 – „b” factor of individual characteristic.
Row 2 – remaining parameters			
7248	7624	RW	Row 2 – lower limit of displayed value If the value is lower that limit, a lower overrun message is displayed.
7250	7625	RW	Row 2 – upper limit of displayed value If the value is higher that limit, an upper overrun message is displayed.
7252	7626	RW	Row 2 – „a” factor of individual characteristic.
7254	7627	RW	Row 2 – „b” factor of individual characteristic.
7256...7270	7628...7635	R	Reserved registers.
Displayed values			
7272	7636	R	Value to be displayed in the first row.
7274	7637	R	Value to be displayed in the second row.
7276	7638	R	reserved
7278	7639	R	reserved
Time and date			
7280	7640	R	Time (hh,mmss)
7282	7641	R	Date (yy,mmdd)
Measured values			
7284	7642	R	Value measured at input 1
7286	7643	RW	Rescaling factor „a” for input 1.
7288	7644	RW	Rescaling factor „b” for input 1.
7290	7645	R	Value measured on input 1 after rescaling.

8 Technical data

Display panel dimensions: (see Fig. 1.)

Display panel weight: DNL-2 5.4 kg, one row
DNL-2 10.8 kg two rows
DNL-3 7.6 kg one row
DNL-3 15.2 kg two rows

Real Time Clock: ± 3s/day,
clock is retained up to 7 days without supply

Auxiliary measurement input: Range: 4..20 mA
Class: 0.1 %
Input resistance: 10 Ω
Error due to temperature shifts: 0.05 %/10 °C

Auxiliary power output: 15 V d.c./50 mA

Read-out field: DNL-2 - 4 digits, height 230mm (9”)
DNL-3 - 4 digits, height 305mm (12”)

Power consumption: < 55 VA

Communication:

2 x RS485 galvanically separated.
Transmission protocol: MODBUS RTU.
Serviced functions:
- Programming interface: 03, 06, 16, 17;
- Object interface 03, 04.

Data format: 8n1, 8n2, 8e1, 8o1.
Baud rate [kb/s]: 2.4, 4.8, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2.
Maximum response time: <400 ms.

Reaction to power outages: Configuration data storage.

Protection level provided by the housing acc. to EN 60529: IP40, IP10 on terminal side.

Reference conditions and rated working conditions:

- Working temperature: -20..23..50 °C
- Storage temperature: -25..75 °C
- Relative humidity: 25..95 %
- Supply: 100..240 V a.c.
- Supply frequency: 50..60 Hz
- Working position: any
- External magnetic field 0..40 ..400 A/m

Standards fulfilled by the display panel:

Electromagnetic compatibility:

- Noise immunity acc. to EN 61000-6-2.
- Noise emission acc. to EN 61000-6-4.
- Resistance against supply decays acc. to EN 61000-6-2.

Safety requirements acc. to EN 61010-1 standard:

- Isolation ensured by the housing: basic.
- Isolation between circuits: basic.
- Installation category: III.
- Pollution grade: 2.
- Maximum phase-to-earth working voltage: 300 V for power circuits and 50 V for other circuits.
- Altitude above sea level <2000m.

9 Order code

Table 6

DNL digital display panel	X	X	XX	X	XX	XX	X	X
Digit height:								
230 mm (9”)	2							
305 mm (12”)	3							
Color of digits in I row:								
red		R						
yellow		Y						
Unit of the I row:								
lack			00					
acc. to Table 7			XX					
Color of digits in II row:								
lack				0				
red				R				
yellow				Y				
Unit of the II row:								
lack					00			
acc. to Table 7					XX			
Version:								
standard						00		
I row with input 4..20 mA and output +15 V						01		
custom-made *						XX		
Language								
Polish							P	
English							E	
Other*							X	
Acceptance tests:								
Without extra quality requirements								0
with an extra quality inspection certificate								1
acc. to customer’s requirements*								X

* after agreeing with the manufacturer

X – numbering set by manufacturer

Order example

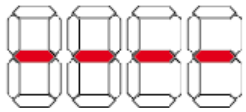
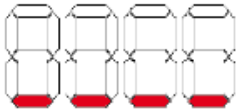
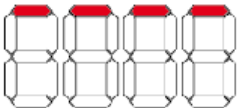
DNL-2.Y.01.0.00.00.E.1 – means display panel with one row, yellow digits, unit '%', standard version, English language, no additional requirements.

Table 7

Code	Unit
00	none
01	%
02	°C
03	szt.
04	imp.
05	kg
06	m/s
07	szt./h
08	m^3
09	obr
XX	on order

10 Before a failure will be declared

Table 8

Problem	Solution
Display field is empty (lack of display)	Check all connections.
	Value to be displayed is acquired from a device which there is no communication with. The device does not respond properly or configuration of a communication with the device is incorrect. This message is displayed after 5 subsequent failed attempts to readout the value. Check if the additional devices are connected correctly and check entered settings – see section *Display panel configuration for readout data from additional devices*.
	Value is lower than the programmed minimal value or is too small to display (too many digits for the display field). Check the display configuration: number of displayed register, format, minimum and maximum value and displayed value rescaling factors.
	Value is higher than the programmed minimal value or is too big to display (too many digits for the display field). Check the display configuration: number of displayed register, format, minimum and maximum value and displayed value rescaling factors.
Display panel constantly performs a test of the display.	Display panel supply voltage is too low. Check connections. If all connections are correct and the voltage does not comply with technical data, turn the display panel off and contact L.Z.A.E. Service Department LUMEL S.A.

11 Maintenance and service

DNL display panels do not require periodical maintenance. When cleaning the display panel do not use organic solvents, petroleum products or corrosive substances that may damage painted surfaces of the display panel or its front screen. Use anti-static cleaning foam whenever possible. When cleaning the panel prevent any liquid from entering the casing of the display panel.
In case of recurring malfunctions of the display panel contact L.Z.A.E. Service Department LUMEL S.A.

DNL2-09

LUMEL

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