LUMEL

NUMERICAL DISPLAY PANEL

DL21 Type

Service manual

CE

CONTENTS:

1. APPLICATION

DL21 numerical display panels are destined to display numerical values read out from a connected device or assigned value through the programming interface in the selected colour by the user.

Considering the luminosity of display segments and the housing design they are destined for indoor applications. These display panels find application to display numerical quantities in office rooms, production halls in management points as information about production parameters, machine state, device working state, etc.

The displayed value on the display can originate from external devices operating in MODBUS standard, and at the same time it is possible to configure the display to work as “Master” or “Slave”.

Moreover, the display enables to connect 10 slave devices to it, and this make possible to fulfill the task of a local point of data acquisition. All data read out from slave devices can be read out through the RS-485 interface.

The value can be displayed in the chosen colour (green, red or orange) by the user or the display colour can be changed depending on the indicated value. Moreover, the minimal and maximal indicated value is defined by the user.

DL21 display panels are equipped with two RS-485 communication interfaces operating in the MODBUS RTU standard. One of the interfaces is destined to connect slave devices, whereas the second interface is destined to configure the display or to introduce the displayed value (the display fulfills the part slave in the MODBUS network).

The basic display execution includes three digits and the place destined to locate the unit. It is possible to make a display composed of DL21 digits in the configuration defined by the user.

2. DISPLAY PANEL SET

The display panel is composed of:

- DL21 numerical display panel 1 pc
- Suspension (fixing) holders 2 pcs
- User’s manual 1 pc
- Guarantee card 1 pc

When unpacking the display panel, please check whether the type and execution code on the data plate correspond to the order.

3. BASIC REQUIREMENTS, OPERATIONAL SAFETY

In the operational safety range the DL21 display panel meets the requirements of the EN 61010 -1 standard.

Remarks concerning the operator safety:

1. General

- The DL21 numerical display panels are destined to be mounted in accordance with customer’s requirements.
- Non-authorized removal of the required housing, inappropriate use, incorrect installation or operation, create the risk of injury to personnel or damage to equipment. For more detailed information, please study the User’s Manual.

- All operations concerning transport, 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.
- According to this basic safety information, qualified, skilled personnel are persons who are familiar with the installation, assembly, commissioning, and operation of the product and who have qualifications necessary for their occupation.

2. Transport, storage

- Please observe the notes on transport, storage and appropriate handling.
- Observe the climatic conditions given in Technical Data.

3. Installation and electrical connections

- The DL21 display panel must be installed according to the regulation and instructions given in this User's Manual.
- Ensure proper handling and avoid mechanical stress.
- Do not bend any components and do not change any insulation distances.
- Do not touch any electronic components and contacts.
- Do not connect the display panel to the mains through an autotransformer.
- The electrical installation must be carried out according to the appropriate regulations (cable cross-sections, fuses, PE connection).
- When working on live devices, the applicable national regulations for the prevention of accidents must be observed.
- Do not install the panel display outside buildings.
- The housing must be closed during operation.
- The protection degree ensured by the housing is defined as IP40 and IP10 from the terminal side.
- The display panel must be used acc. to its appropriation.
- The removal of the housing during the guarantee period can cause its cancellation.
- Before opening the housing, disconnect the display panel from the supply. Inside the panel there are live terminals hazardous for life and health.
- Before switching the supply on, one must remember that in the building (room) installation should be installed a breaker switch or a cut-out. This element should be installed near the device, easily accessible for the operator and marked as an instrument disconnecting the display panel.

4. DESIGN DESCRIPTION AND INSTALLATION

The DL21 display panel is closed in a housing made of aluminium sections ensuring the protection grade IP40 (IP10, from the terminal side). The view of the display panel and dimensions are presented on the fig. 1.

The housing design of the display panel enables the mounting on a wall or by suspension. There is also the possibility to adjust the display panel fixing angle.

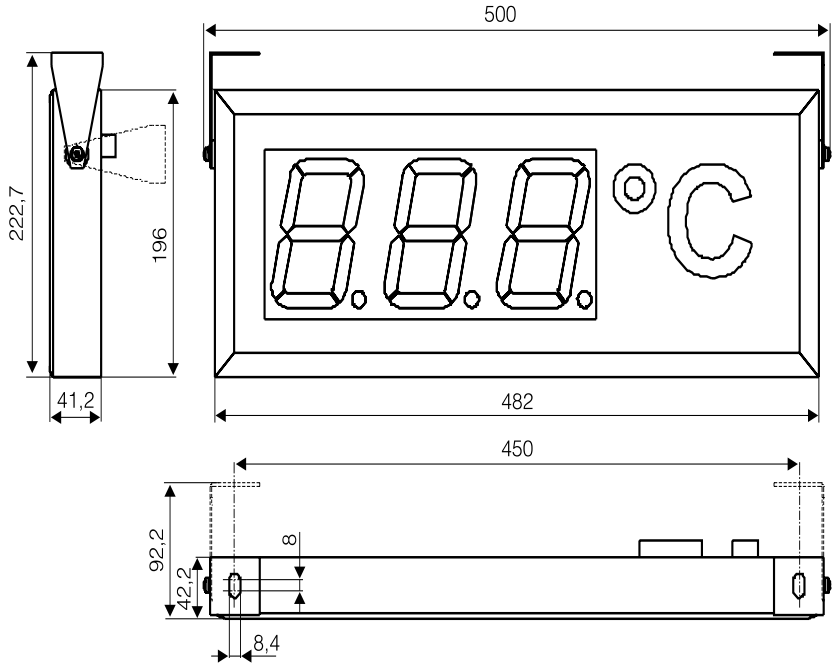


Fig. 1. View and dimensions of the display panel

5. ELECTRICAL CONNECTIONS

The connection supply and interface wires should be carried out only acc. to the user's manual. In case of connections inconsistent with terminal data, the display panel can be damaged. One must use a shielded strand to connect control signals. In case of an environment with a low noise emission, one can accept unshielded strands.

Note:

In case of an impetuous change of ambient temperature when the rise of drizzle is possible, one must not switch the display panel to the mains. It is recommended, before mounting the panel, which have changed the ambient temperature in an impetuous way, to wait at least 60 minutes before switching the first time.

Terminals to connect the display panel are led out on the rear wall. The description of signals on the connector is presented on the figure 2.

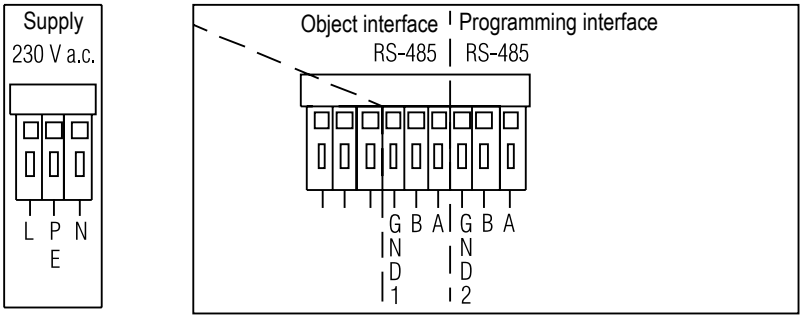


Fig. 2. Connection of the display panel.

The object interface and the programming interface are galvanically separated. The object interface is destined to connect slave devices, whereas the programming interface is destined to connect the display to the RS-485 bus (the display panel fulfils the part of a slave device), e.g. to the PLC controller, computer, data concentrator, etc.

After switching the supply on, a display test will be carried out on the display, and next the display transits to display the value placed in the register 7500 (value read out from the device number 1). The change of the displayed value is possible through the modification of the display configuration.

6. DISPLAY PANEL CONFIGURATION

The configuration of the display panel parameters is carried on by means of the programming interface. To program required display parameters, one can use the LPCcon software or any other program enabling the readout and modification of device registers working in MODBUS RTU standard.

The display panel is configured by default on following transmission parameters:

- Address: 1
- Baud rate: 9600 bit/sec
- Transmission mode: RTU 8n2

The register map and their descriptions are presented in the chapter 7 - INTERFACE.

6.1 Modification of transmission parameters

The modification of connection parameters is possible through the modification of controller registers 4000..4003. One must introduce required values in registers 4000..4002 and next, write the value 1 in the register 4003, what occasions the acceptation of new parameters and switch the display panel to the work with introduced parameters.

Before introducing modification, it is recommended to memorize previous parameters and given new transmission parameters.

We do that in case of some problems to restore the transmission.

Note:

After the modification of connection parameters, it is necessary to modify transmission parameters in the software co-operating with the display panel. Additionally, it may be necessary to reconfigure transmission converters, if they have been applied in the connection between the computer and the display panel.

6.2 Display configuration

The DL21 display panel enables the display of the numerical value in the selected colour and chosen format (in the defined accuracy) and set thresholds of colour change depending on the displayed value. Before displaying, the value can be rescaled acc. to the linear function and the calculated value is placed in the register, which can be read out by means of the programming interface. The modification of display parameters is carried out through the modification of display controller configuration registers.

A precise description of the display configuration modification for the display panel composed of one row is presented below. In case of displays composed of more than one row, the configuration modification looks in a similar way (see the register map in the chapter INTERFACE).

6.2.1 Display format

The displayed numerical value can be displayed with a definite accuracy – number of places after the decimal point. The modification of display format is carried on through the modification of the register 4008 for the row one, 4014 for the row two, etc. The value written in the register means the displayed number of places after the decimal point.

6.2.2 Displayed value - displayed register

The displayed register is the basic configuration parameter of the display panel. It defines which value will be displayed on the display panel. As the display register, one understand the index defining the register number of float type, which the value is to be displayed, e.g. the write of the value 140 in the register 4009 will cause, that in the first display row, the contents of the register 7640 will be displayed (the value written in the register is the shift in relation to the value 7500).

The user can configure the display panel to display values:

- read out from added devices (index 0...99),
- time and date (index 138, 139),
- value placed in general registers memorized after a supply decay (100..109),
- value placed in general registers not memorized after a supply decay (140...149),
- value measured from the analog input (only when occurs).

The display of a numerical value originating from the master system and constantly writing data to the display should be realized utilizing registers 7640...7649 (indexes 140...149). then the value cannot be memorized, and after switching the supply on, the upper exceeding till the moment to obtain a new value will be displayed. This approach tends towards the protection of the non-volatile memory against a too frequent write.

Example:

We would like to display the third register read out from the device number 2. For this aim, one must write the value 12 in the register 4009 (the controller register with address 7512 will be displayed).

6.2.3 Rescaling of values to display – individual characteristic.

Ech value before displaying can be recounted in relation to the given linear characteristic. Coefficients to recount values are located in registers 7614 and 7615 (for the first row). In order to recount values before displaying, one must give coefficients a and b, where the display value will be calculated on the base of the formula:

$$ww = wr \cdot a + b$$

where: **a** and **b** – coefficients of the equation,
ww – indicated value
wr – value located in the register to display.

Additionally, the result of the ww operation will be located in the register 7634, which can be read out through the master system.

6.2.4 Minimal and maximal display value

The minimal and maximal displayed value by the display panel can be limited by the user through the introduction of required limiting values to registers 7610 and 7611 (for the first row). In case when the value which is to be displayed is smaller than the value placed in the 7610 register (for the first row), the message of lower exceeding will be displayed on the display.

This message will be also displayed if the value will not have enough room in the display – too low value. If the value to display is higher than the upper exceeding (register 7611 for the first row), a message of upper exceeding will be displayed. This message will be also displayed if the value to display have not enough room in the display – too higher value. Thanks to the minimal and maximal value, the user can limit the indication range in any way.

Note:

Badly matched minimal and maximal limiting values can lead to the situation in which the display panel permanently displays an error message. One must also remember that the minimal and maximal value which can be displayed is also related to the chosen format.

6.2.5 Display colours

DL21 display panels are destined to display numeral values in the chosen colour. The colour can change depending on settled thresholds. The user have three colours at choice and three partitions of obliged colours. The colour for each partition is settled individually.

Following colours are accessible: green, red and orange – green and red can be lit simultaneously. The configuration of displayed colours consists to define one of three colours for each partition (registers 4010...4012 for the first row) and define thresholds of colour modification (registers 7612 and 7613 for the first row).

Example

We would like to display values lower than 350 in green colour, values between 350 and 630, in orange colour, whereas values higher than 630 in red colour.

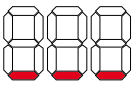
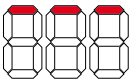
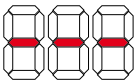
For this aim, one must fulfill registers:

- 4010 = 0 (colour for the first partition).
- 4011 = 2 (colour for the second partition).
- 4012 = 1 (colour for the third partition).
- 7612 = 350 (first threshold of colour modification) .
- 7613 = 630 (second threshold of colour modification).

6.2.6 Error messages

The DL21 display panel have implemented the display of errors, which causes that the required value cannot be displayed.

Types of signaled warnings are presented below.

Name of warning	Symbol	Warning description
Lower exceeding		The value is lower than the programmed minimal value or too small to be displayed (too high number of characters and the value cannot be located in the display field, e.g. – 850.
Upper exceeding		The value is higher than the programmed maximal value or too higher to be displayed (too high number of characters and the value cannot be located in the display field, e.g. – 1253.
Communication error with the slave device		The value to display originates from a device which there is not communication with.The device cannot answers in a correct way, or the communication with the device is badly configured. The message appears in case when 5 successive trials to readout the value ended with an error.

6.3. Setting of display luminosity

Display panels of DL21 type are equipped with an hourly luminosity control. This control operates on the base of a real time clock. By default, the maximal luminosity level is set for all the day. To change luminosity parameters, one must modify the contents of registers 4034...4037.The beginning level is defined in percentage and can be included in limits: 1...100. The beginning of the day and beginning of the night are defined by periods which assigned luminosity levels will be obligatory in. Assigned luminosity levels are expressed as: time = gg.100 + mm, where gg – hour, mm – minute.

Example:

We assume 100% for the luminosity level in the day and 10% for the luminosity level in the night, the beginning of the day at 6:30 and the beginning of the night at 15:45.

We must place following values in registers:

- 4034 = 100;
- 4035 = 20;
- 4036 = 630;
- 4037 = 1545.

6.4 Setting of time and date

In order to set the correct internal time of the RTC clock utilized for the hourly luminosity control, one must carry out the write for the current time in registers: 4031..4033.

Note: the write of time in the register 4043 causes the reset of seconds. For this raison, in order to obtain a precise time setting, the write of hours and minutes should be carry on in the zero second of the current time

Example:

We assume the current time as 2008-03-18, 15:15. Following values should be written in registers:

- 4031 = 8;
- 4032 = 318;
- 4033=1515.

6.5 Panel configuration to readout data from additional devices

The DL21 display panel can be configured to data readout and display from external devices working in the MODBUS RTU mode.

All added devices and the DL21 display panel should have set the same baud rate and the same transmission mode. Added devices should have different addresses.

The device address, register type, register address which begins the readout from (basic register, the number of registers and the scrolling period are individually programmed for each added device.

The readout configuration from the external device (devices) consists on the configuration of:

- transmission parameters of the object port: baud rate, frame type should be identical for the object interface and added devices to the display panel. The waiting time for answer should be matched to the maximal time after which the answer follows for the slowest device added to the object interface. Transmission parameters are configured in registers 4004... 4006.
- the device address (register 4300 for the first device): one must give the device address which the readout is to follow from. The write of the value zero as the address from the device

  Note: all added devices must have a unique address – two or more devices with the same - address cannot be in the same network.
- The basic address (register 4301 for the first device: the register address which the data readout is to begin from (acc. to the register map of the added address).

- the number of registers (register 4302 for the first device): defines the number of registers which have to be read out from the device.
- The type of register (register 4303 for the first device): defines what types of data are located in registers which will be read out. The DL21 display panel services following register formats: char, unsigned char, integer, unsigned integer, long, unsigned long, float.
- the scrolling period (register 4304 for the first device): defines the readout periodicity from the device can causes the readout switching off from the device.

The display panel questions all configured and connected devices and locates read out data in its registers (7500...7599). The data readout is carried on acc. to the programmed polling period. In case when the display questions free devices it can occur, that the polling period of devices will be longer than the programmed period, what results from the fact of waiting for the device answer.

In case when the given device does not answer to the question five times in succession, the communication error flag with the given device will be set (register of device status 4044), and registers of read out values from the given device will be fulfilled with values IE+20 till the moment to obtain the correct communication with the device.

Example

A humidity and temperature transducer of P18 type is connected to the object interface with address 1, transmission parameters: frame type RTU 8n2, baud rate 9600, which we would like to carry out the temperature and humidity readout from.

To configure the transducer, one must set following registers:

- 4004 = 5 (writing time for answer 500 ms);
- 4005 = 1 (type of frame on RTU 8n2);
- 4006 = 2 (baud rate on 9600);
- 4300 = 1 (device address);
- 4301 = 7501 (basic address);
- 4302 = 2 (number of registers – we read out the temperature and humidity)
- 4303 = 6 (type of registers: float);
- 4304 = 1 (scrolling period – every second).

For such a configured display, the temperature and humidity value will be read out from the P18 transducer every second and located in registers 7500 (temperature) and 7501 (humidity). To display read out values, e.g. in the first row, one must write in the register 4007, the value 0 for the temperature or 1 for the humidity.

7. INTERFACE

The DL21 display panel is equipped with two RS-485 communication interfaces working in MODBUS RTU standards:

- programming interface – destined to connect the display to the device fulfilling the master part in the network, e.g. to the computer, PLC controller, etc. This interface is utilized to configure the display and can be additionally utilized to write values to display (use of general registers).
- object interface – destined to add additional devices to the display, as e.g. meters, transducers, controllers, etc. which the value is to be read out and eventually displayed from. In this interface, the display fulfills the part of a master device.

The DL 21 display panel utilizes following MODBUS functions for communication:

- Fonction 3 – readout of n registers (where n is the number of read out registers).
- Fonction 16 – write of n registers , (where n is the number of written registers).
- Fonction 17 – device identification.

The data readout from additional devices is carried on with the utilization of the fonction MODBUS number 3.

7.1 Registers 4000... 4046

Hexadecimal registers of unsigned integer type – configuration of display parameters.

Register address	Opera-tions	Range	Description
4000	RW	1... 247	Address of the interface nr 1 – user's interface
4001	RW	0... 3	Working mode of the interface nr 1: 0: RTU 8N1 1: RTU 8N2 2: RTU 8E1 3: RTU 8O1
4002	RW	0... 9	Baud rate of the interface nr 1 [b/s]: 0 – 2400; 1 – 4800; 2 – 9600; 3 – 14400; 4 – 19200; 5 – 28800; 6 – 38400; 7 – 57600; 8 – 76800; 9 – 115200
4003	RW	0, 1	Apply changes. The write of the value 1 causes the change of transmission parameters.
4004	RW	1... 50	The waiting time to the answer of the slave device for the port 2 is expressed as the multiple of 100 ms.
4005	RW	0... 3	Working mode of the interface nr 2: 0: RTU 8N1 1: RTU 8N2 2: RTU 8E1 3: RTU 8O1
4006	RW	0... 9	Baud rate of the interface nr 2 [b/s]: 0 – 2400; 1 – 4800; 2 – 9600; 3 – 14400; 4 – 19200; 5 – 28800; 6 – 38400; 7 – 57600; 8 – 76800; 9 – 115200
Configuration of display rows			
Row nr I			
4007	RW	1... 20	Number of digits of the first row
4008	RW	0... 4	Display format – number of places after the decimal point
4009	RW	0... 157	Register number to display, as the shift in relation to the address 7500.
4010	RW	0... 2	Colour for the first interval: 0 – green, 1 – red, 2 – orange.
4011	RW	0... 2	Colour for the second interval
4012	RW	0... 2	Colour for the third interval.
Row nr II			
4013	RW	0... 20	Number of digits of the second row.
4014	RW	0... 4	Display format, number of places after the decimal point.
4015	RW	0... 157	Register number to display, as the shift in relation to the address 7500.:
4016	RW	0... 2	Colour for the first interval
4017	RW	0... 2	Colour for the second interval
4018	RW	0... 2	Colour for the third interval.
Row nr III			
4019	RW	0... 20	Number of digits of the third row.
4020	RW	0... 4	Display format, number of places after the decimal point.
4021	RW	0... 157	Register number to display, as the shift in relation to the address 7500.

4022	RW	0... 2	Colour for the first interval
4023	RW	0... 2	Colour for the second interval
4024	RW	0... 2	Colour for the third interval.
Row nr IV			
4025	RW	0... 20	Number of digits of the forth row.
4026		0... 4	Display format, number of places after the decimal point.
4027	RW	0... 157	Register number to display, as the shift in relation to the address 7500.
4028	RW	0..2	Colour for the first interval
4029	RW	0..2	Colour for the second interval
4030	RW	0..2	Colour for the third interval.
Time and date			
4031	RW	1... 99	Current in format YY
4032	RW	101... 1231	Current date in format MMDD
4033	RW	0000... 2359	Current time in format GGMM
Luminosity			
4034	RW	1...100	Luminosity for the day
4035	RW	1...100	Luminosity for the night
4036	RW	0000... 2359	Beginning of the day
4037	RW	0000... 2359	Beginning of the night
Auxiliary registers			
4038	RW	0... 65535	The write of value to the register causes the location of data in the register 7640.
4039	RW	0... 65535	The write of value to the register causes the location of data in the register 7641.
4040	RW	0... 65535	The write of value to the register causes the location of data in the register 7642.
4041	RW	0... 65535	The write of value to the register causes the location of data in the register 7643.
4042	RW	0... 65535	The write of value to the register causes the location of data in the register 7644.
Systemic registers			
4043	RW	n.c.	Status – successive bits are flags informing about events. Bit 15 – Work in the service mode –requires service authorization. Bit 14 – Memory EEPROM error– manufacturer settings restored. Bit 13 – Error of RTC clock settings or settings unreliable. Bit 12 – Summer/winter time changed or inversely. Bit 11 – Not used. Bit 10 – Break of supply. Bit 9 – Not used. Bit 08 – not used. Bit 07 – Measurement error in channel 2 – value behind the range. Bit 06 – Measurement error in channel 1 – value beyond the range. Bits 05... 00 – not used– always value 0.

Memory error 4044	RW	n.c.	Status of devices added to the display, successive bits inform about the status of transmission with slave devices. Bit 15 – Transmission error occurred. Bit 09 – Error of the device nr 10. Bit 08 – Error of the device nr 9. Bit 07 – Error of the device nr 8. Bit 06 – Error of the device nr 7. Bit 05 – Error of the device nr 6. Bit 04 – Error of the device nr 5. Bit 03 – Error of the device nr 4. Bit 02 – Error of the device nr 3 Bit 01 – Error of the device nr 2. Bit 00 – Error of the device nr 1.
4045	RW	n.c.	Access password for calibration data and some configuration settings. To change calibration coefficients, one must introduce the correct password.
4046	RW	n.c.	Instruction (required calibration password): 0x8000 – restore manufacturer settings ; 0x4000 – carry on the display test.

n.c. – no concerns

7.2 Registers 4300...4349

Hexadecimal registers of unsigned integer type – readout configuration from added devices.

Register address	Operations	Range	Description
Device number 1			
4300	RW	0,1... 247	Address of the slave device. 0 switch the device off.
4301	RW	0... 65535	Basic address.
4302	RW	1... 10	Number of being read out registers:
4303	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4304	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 2			
4305	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4306	RW	0... 65535	Basic address.
4307	RW	1...10	Number of read out registers.

4308	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4309	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 3			
4310	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4311	RW	0... 65535	Basic address.
4312	RW	1...10	Number of read out registers.
4313	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4314	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 4			
4315	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4316	RW	0... 65535	Basic address.
4317	RW	1... 10	Number of read out registers.
4318	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4319	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 5			
4320	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4321	RW	0... 65535	Basic address.
4322	RW	1... 10	Number of read out registers.

4323	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4324	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 6			
4325	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4326	RW	0... 65535	Basic address.
4327	RW	1... 10	Number of read out registers.
4328	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4329	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 7			
4330	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4331	RW	0... 65535	Basic address.
4332	RW	1...10	Number of read out registers.
4333	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4334	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 8			
4335	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4336	RW	0... 65535	Basic address.
4337	RW	1...10	Number of read out registers.

4338	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4339	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 9			
4340	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4341	RW	0... 65535	Basic address.
4342	RW	1...10	Number of read out registers.
4343	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4344	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.
Device number 10			
4345	RW	0,1... 247	Address of the slave device. 0 – switch the device off.
4346	RW	0... 65535	Basic address.
4347	RW	1...10	Number of read out registers.
4348	RW	0... 6	Register type: 0 – variable of char type 1 – variable of unsigned char type 2 – variable of integer type 3 – variable of unsigned integer type 4 – variable of long type 5 – variable of unsigned long type 6 – variable of float type
4349	RW	1... 60	Scrolling period in seconds. Defines the polling frequency of the slave device.

7.3 Registers 7500...7661

Thirty-two bit registers of float type.

Register address	Opera-tions	Range	Description
Read out values			
7500	R	n.c.	Device 1 – First register read out.
7501	R	n.c.	Device 1 – Second register read out.
7502	R	n.c.	Device 1 – Third register read out.
7503	R	n.c.	Device 1 – Forth register read out.
7504	R	n.c.	Device 1 – Fifth register read out.
7505	R	n.c.	Device 1 – Sixth register read out.
7506	R	n.c.	Device 1 – Seventh register read out.
7507	R	n.c.	Device 1 – Eight register read out.
7508	R	n.c.	Device 1 – Ninth register read out.
7509	R	n.c.	Device 1 – Tenth register read out.
7510	R	n.c.	Device 2 – First register read out.
7511	R	n.c.	Device 2 – Second register read out.
7512	R	n.c.	Device 2 – Third register read out.
7513	R	n.c.	Device 2 – Forth register read out.
7514	R	n.c.	Device 2 – Fifth register read out.
7515	R	n.c.	Device 2 – Sixth register read out.
7516	R	n.c.	Device 2 – Seventh register read out.
7517	R	n.c.	Device 2 – Eight register read out.
7518	R	n.c.	Device 2 – Ninth register read out.
7519	R	n.c.	Device 2 – Tenth register read out.
7520	R	n.c.	Device 3 – First register read out.
7521	R	n.c.	Device 3 – Second register read out.
7522	R	n.c.	Device 3 – Third register read out.
7523	R	n.c.	Device 3 – Forth register read out.
7524	R	n.c.	Device 3 – Fifth register read out.
7525	R	n.c.	Device 3 – Sixth register read out.
7526	R	n.c.	Device 3 – Seventh register read out.
7527	R	n.c.	Device 3 – Eight register read out.
7528	R	n.c.	Device 3 – Ninth register read out.
7529	R	n.c.	Device 3 – Tenth register read out.
7530	R	n.c.	Device 4 – First register read out.
7531	R	n.c.	Device 4 – Second register read out.
7532	R	n.c.	Device 4 – Third register read out.
7533	R	n.c.	Device 4 – Forth register read out.
7534	R	n.c.	Device 4 – Fifth register read out.
7535	R	n.c.	Device 4 – Sixth register read out.
7536	R	n.c.	Device 4 – Seventh register read out.
7537	R	n.c.	Device 4– Eight register read out.
7538	R	n.c.	Device 4 – Ninth register read out.
7539	R	n.c.	Device 4 – Tenth register read out.

7540	R	n.c.	Device 5 – First register read out.
7541	R	n.c.	Device 5 – Second register read out.
7542	R	n.c.	Device 5 – Third register read out.
7543	R	n.c.	Device 5 – Forth register read out.
7544	R	n.c.	Device 5 – Fifth register read out.
7545	R	n.c.	Device 5 – Sixth register read out.
7546	R	n.c.	Device 5 – Seventh register read out.
7547	R	n.c.	Device 5 – Eight register read out.
7548	R	n.c.	Device 5 – Ninth register read out.
7549	R	n.c.	Device 5 – Tenth register read out.
7550	R	n.c.	Device 6 – First register read out.
7551	R	n.c.	Device 6 – Second register read out.
7552	R	n.c.	Device 6 – Third register read out.
7553	R	n.c.	Device 6 – Forth register read out.
7554	R	n.c.	Device 6 – Fifth register read out.
7555	R	n.c.	Device 6 – Sixth register read out.
7556	R	n.c.	Device 6 – Seventh register read out.
7557	R	n.c.	Device 6 – Eight register read out.
7558	R	n.c.	Device 6 – Ninth register read out.
7559	R	n.c.	Device 6 – Tenth register read out.
7560	R	n.c.	Device 7 – First register read out.
7561	R	n.c.	Device 7 – Second register read out.
7562	R	n.c.	Device 7 – Third register read out.
7563	R	n.c.	Device 7 – Forth register read out.
7564	R	n.c.	Device 7 – Fifth register read out.
7565	R	n.c.	Device 7 – Sixth register read out.
7566	R	n.c.	Device 7 – Seventh register read out.
7567	R	n.c.	Device 7 – Eight register read out.
7568	R	n.c.	Device 7 – Ninth register read out.
7569	R	n.c.	Device 7 – Tenth register read out.
7570	R	n.c.	Device 8 – First register read out.
7571	R	n.c.	Device 8 – Second register read out.
7572	R	n.c.	Device 8 – Third register read out.
7573	R	n.c.	Device 8 – Forth register read out.
7574	R	n.c.	Device 8 – Fifth register read out.
7575	R	n.c.	Device 8 – Sixth register read out.
7576	R	n.c.	Device 8 – Seventh register read out.
7577	R	n.c.	Device 8 – Eight register read out.
7578	R	n.c.	Device 8 – Ninth register read out.
7579	R	n.c.	Device 8 – Tenth register read out.
7580	R	n.c.	Device 9 – First register read out.
7581	R	n.c.	Device 9 – Second register read out.
7582	R	n.c.	Device 9 – Third register read out.
7583	R	n.c.	Device 9 – Forth register read out.
7584	R	n.c.	Device 9 – Fifth register read out.
7585	R	n.c.	Device 9 – Sixth register read out.

7586	R	n.c.	Device 9 – Seventh register read out.
7587	R	n.c.	Device 9 – Eight register read out.
7588	R	n.c.	Device 9 – Ninth register read out.
7589	R	n.c.	Device 9 – Tenth register read out.
7590	R	n.c.	Device 10 – First register read out.
7591	R	n.c.	Device 10 – Second register read out.
7592	R	n.c.	Device 10 – Third register read out.
7593	R	n.c.	Device 10 – Forth register read out.
7594	R	n.c.	Device 10 – Fifth register read out.
7595	R	n.c.	Device 10 – Sixth register read out.
7596	R	n.c.	Device 10 – Seventh register read out.
7597	R	n.c.	Device 10 – Eight register read out.
7598	R	n.c.	Device 10 – Ninth register read out.
7599	R	n.c.	Device 10 – Tenth register read out.
7600	RW	n.c.	General register nr 1 (The value is memorized)
7601	RW	n.c.	General register nr 2 (The value is memorized)
7602	RW	n.c.	General register nr 3 (The value is memorized)
7603	RW	n.c.	General register nr 4 (The value is memorized)
7604	RW	n.c.	General register nr 5 (The value is memorized)
7605	RW	n.c.	General register nr 6 (The value is memorized)
7606	RW	n.c.	General register nr 7 (The value is memorized)
7607	RW	n.c.	General register nr 8 (The value is memorized)
7608	RW	n.c.	General register nr 9 (The value is memorized)
7609	RW	n.c.	General register nr 10 (The value is memorized)
Row 1 – other parameters			
7610	RW	n.c.	Row 1 – Limitation of displayed lower value. Below this value the lower exceeding is displayed.
7611	RW	n.c.	Row 1 – Limitation of displayed upper value. Over this value the upper exceeding is displayed.
7612	RW		Row 1 – first threshold of colour change.
7613	RW		Row 1 – second threshold of colour change.
7614	RW		Row 1 – coefficient “a” of the individual characteristic.
7615	RW		Row 1 – coefficient „b” of the individual characteristic.
Row 2 – other parameters			
7616	RW	n.c.	Row 2 – Limitation of displayed lower value. Below this value the lower exceeding is displayed.
7617	RW	n.c.	Row 2 – Limitation of displayed upper value. Over this value the upper exceeding is displayed.
7618	RW		Row 2– first threshold of colour change.
7619	RW		Row 2 – second threshold of colour change.
7620	RW		Row 2 – coefficient “a” of the individual characteristic.
7621	RW		Row 2 – coefficient „b” of the individual characteristic.
Row 3 – other parameters			
7622	RW	n.c.	Row 3– Limitation of displayed lower value. Below this value the lower exceeding is displayed.
7623	RW	n.c.	Row 3 – Limitation of displayed upper value. Over this value the upper exceeding is displayed.

7624	RW		Row 3– first threshold of colour change.
7625	RW		Row 3 – second threshold of colour change.
7626	RW		Row 3 – coefficient “a” of the individual characteristic.
7627	RW		Row 3 – coefficient „b” of the individual characteristic.
Row 4 – other parameters			
7628	RW	n.c.	Row 4– Limitation of displayed lower value. Below this value the lower exceeding is displayed.
7629	RW	n.c.	Row 4 – Limitation of displayed upper value. Over this value the upper exceeding is displayed.
7630	RW		Row 4– first threshold of colour change.
7631	RW		Row 4 – second threshold of colour change.
7632	RW		Row 4 – coefficient “a” of the individual characteristic.
7633	RW		Row 4 – coefficient „b” of the individual characteristic.
Values to display			
7634	R		Value to display for the first row.
7635	R		Value to display for the second row.
7636	R		Value to display for the third row.
7637	R		Value to display for the forth row.
Time and data			
7638	R	n.c.	Time in format gg,mmss
7639	R	n.c.	Dte in format rr,mmdd
General registers			
7640	RW	n.c.	General register (value is not memorized). By default 1E+20.
7641	RW	n.c.	General register (value is not memorized). By default 1E+20.
7642	RW	n.c.	General register (value is not memorized). By default 1E+20.
7643	RW	n.c.	General register (value is not memorized). By default 1E+20.
7644	RW	n.c.	General register (value is not memorized). By default 1E+20.
7645	RW	n.c.	General register (value is not memorized). By default 1E+20.
7646	RW	n.c.	General register (value is not memorized). By default 1E+20.
7647	RW	n.c.	General register (value is not memorized). By default 1E+20.
7648	RW	n.c.	General register (value is not memorized). By default 1E+20.
7649	RW	n.c.	General register (value is not memorized). By default 1E+20.
Measured values			
7650	R		Measured value from the input 1.
7651	RW		Coefficient „a” rescaling for the input 1.
7652	RW		Coefficient „b” rescaling for the input 1.
7653	R		Measured value from the input 1 after rescaling.
7654	R		Measured value from the input 2
7655	RW		Coefficient „a” rescaling for the input 2.
7656	RW		Coefficient „b” rescaling for the input 2.
7657	R		Measured value from the input 2 after rescaling.

Coefficients calibrating measuring inputs – calibration code required.			
7658	RW		Coefficient a for the input 1.
7659	RW		Coefficient bfor the input 1.
7660	RW		Coefficient a for the input 2.
7661	RW		Coefficient b for the input 2.

8 TECHNICAL DATA

Display dimensions 482 × 196 × 42 mm (see fig.1)

Display panel weight

Read-out field 3 digits, height = 100 mm

Power consumption < 15 VA

Communication:

- nterface 2 × RS-485, galvanically separated
- transmission protocol MODBUS RTU
- serviced functions 3,16, 17
- 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.
- maximal time to begin the answer < 100 ms.

Reaction against decays and supply recovery: preservation of configuration data

Protection grade ensured by the housing acc. EN 60529: IP40 and IP10 on terminal side

Environmental and rated operating conditions:

- working temperature - 20...23...50°C
- storage temperature - 25...75°C
- relative humidity 25...95%
- supply 100...230...253 V a.c.
- supply frequency 40...50...60 Hz
- working position any

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. EN 61010-1 standard:

- isolation ensured by the housing: basic
- isolation between circuits: basic
- installation category: III
- pollution grade: 2
- maximal phase-to-earth working voltage: 300 V for supply circuits 50 V for other circuits

NUMERICAL DISPLAY PANEL	DL21 -	XX	X

Display panel execution:
standard **00**
custom-made..... **XX**

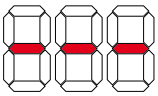
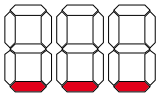
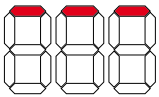
Acceptance tests:
without an extra quality inspection certificate **8**
with an extra quality inspection certificate **7**
acc. to customer's requirements..... **X**

X – the code number will be settled by the manufacturer.

EXAMPLE OF ORDER

Code: **DL21- 00 7** means:
DL21 – numerical display panel of DL21 type
00 – standard execution
7 – delivered with an extra quality inspection certificate

10 BEFORE A FAILURE WILL BE DECLARED

Problem	Solution
The display field is empty (lack of display).	On must check the correctness of carried out connections and check the set luminosity level.
Displayed symbol 	The value to display originates from a device which there is no communication with. The device does not answer in a correct way, or the communication is badly configured with the device. The message occurs in case when 5 successive trials to the value readout were finished with error. One must carry out correct connections of additional devices and check the introduced settings – see the chapter 6.5. *Panel configuration to readout data from additional devices*.
	The value is smallest than the programmed minimal value or is too small to display (a too great number of characters and the value cannot be contained on the display field). One must check the display configuration: the number of the displayed register, format, minimal and maximal value, and coefficients for rescalling the displayed value.
	The value is higher than the programmed maximal value or is too higher to be displayed (a too great number of characters and the value cannot be contained on the display field). One must check the display configuration: the number of the displayed register, format, minimal and maximal value, and coefficients for rescalling the displayed value.
A display test is continuously carried on the display.	Too low supply voltage. One must check the correctness of connections. If connections are carried out in a correct way, and the voltage is in concordance with technical data, one must switch the display panel off and contact the Service Department of L.Z.A.E. LUMEL S.A.

11. MAINTENANCE AND SERVICE

DL21 display panel do not require a periodical maintenance. To clean the panel, one must not use solvents, petrol, aggressive agents which can destroy painted panel surfaces or the frontal window. To clean the display panel the most suitable are cleaning antistatic foams.

During the display panel wash, one must take care to not moisturize the panel inside.

In case of abnormalities in the display panel operation, one must contact the Service Department of L.Z.A.E. LUMEL S.A.

MEASUREMENT
CONTROL
RECORDING

SALES PROGRAM

- DIGITAL and BARGRAPH PANEL METERS
- MEASURING TRANSDUCERS
- ANALOG PANEL METERS (DIN INSTRUMENTS)
- ANALOG and DIGITAL CLAMP-ON METERS
- INDUSTRIAL and HOUSEHOLD CONTROLLERS
- CHART AND PAPERLESS RECORDERS
- POWER CONTROL UNITS and INVERTERS
- AUTOMOTIVE DASHBOARD INDICATORS
- ACCESSORIES FOR MEASURING INSTRUMENTS
- MEASURING SYSTEMS (ENERGY, HEAT, CONTROL)
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- PRECISION ENGINEERING AND THERMOPLASTICS PARTS

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DL21-07

LUMEL

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