








# Installation, Operation & Maintenance Instructions



**Programmable Controller**  
Model DMCU800

## SAFETY INSTRUCTIONS

-  **Information** ..points out useful tips, recommendations and information for efficient and trouble-free operation.
-  **CAUTION!** ..indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.
-  **WARNING!** ..indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.
-  **WARNING!** ..identifies hazards caused by electric power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.
-  **WARNING!** ..indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.
-  **WARNING!** ..indicates a potentially dangerous situation in the hazardous area that can result in serious injury or death, if not avoided.
-  **Ex applications** ..special instructions for Ex applications.

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## FOREWORD

The unit is manufactured, checked and supplied in accordance with our published specification, and when installed and used in normal or prescribed applications, with the lid in place and within the parameters set for mechanical and electrical performance, will not cause danger or hazard to life or limb.

**Warning:** Units must be selected and installed by suitably trained and qualified personnel in accordance with appropriate codes of practice so that the possibility of failure resulting in injury or damage caused by misuse or misapplication is avoided.

**Warning:** before installation check that the instrument characteristics comply with process and plant requirements.

**Warning:** The users attention is drawn to the fact that, when the unit is 'live' with respect to electrical or pressure supplies, a hazard may exist if the unit is opened or dismantled

**Warning:** where any special condition of the product has been required as identified by the last 4 digits of the part number, follow the necessary safety instruction for a correct installation.

If the equipment is likely to come into contact with aggressive substances, suitable precautions should be taken that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised. Aggressive substances: e.g. acidic liquids or gases that may attack metals or solvents that may affect non-metallic materials. Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

## OVERVIEW

Indicator DMCU800 is a low multifunctional programmable controller. Its universal input accepts the most common RTDs, thermocouples and linear signals. The device can be equipped with up to 5 relays outputs, which can control various actuators using ON/OFF control algorithm. The controller can be equipped with an additional analog output operating in retransmission mode and the optional RS485 interface enables networking. Indicator 37003754 allows adjusting of the built-in digital filters and the programmable output delay, resulting in increased operation reliability in case of industrial interferences. In addition, the device performs a specific function such as a linear-segment transformation with up to 30 points. The functionality has also been improved with regard to the diagnostics of failures with programmable states of the relays and analog outputs, depending on the type of the errors - measuring or parametric system .

## PROGRAMMING

### Controller parameters

The device is a programmable device whose service behavior is determined by a set of parameters. All the parameters, along with their names, symbols, and value ranges, are given in **Table 1** below

Value	Unit	Notes
Pyh or Pyt	-	Pt100: -100...850 °C or Pt1000: -100...600 °C
Ptx1 or Ptx2	-	PTC 1k or 2k: -50...150 °C
R)1	-	resistive linear: 0...1 kΩ
yc-b	-	T/C "B": 200...1800 °C
yc-J	-	T/C "J": -20...1000 °C
yc-"	-	T/C "K": -20...1300 °C
yc-r	-	T/C "R": 0...1700 °C
yc-S	-	T/C "S": 0...1700 °C
yc-t	-	T/C "T": -40...400 °C
u	-	voltage linear: 0...100 mV
l)20 or l\$20	-	current linear: 0...20 mA or 4...20 mA
w)10	-	voltage linear: 0...10 V
.Cor .F	-	°C or °F
x1, x0.1, x0.01, x0.001	-	when indicating values with the input-signal measurement unit ( <b>ISU</b> )
-1999 ... 9999	ISU	These parameters make sense <b>ONLY</b> in case of a linear input signal!
-1999 ... 9999	ISU	OFFSET
1...254	-	
!2, @4, \$8, (6	bps	1200, 2400, 4800 (factory-set), or 9600 bps
0 ... 9999	ISU	used for input peak filtration; Value '0' cancels the filtration.
0 ... 9999	-	This parameter and the following one define a low-pass input filter.
0 ... <b>M</b>	ISU	temperature: whole part of <b>M</b> £ 100; linear: <b>M</b> = 25% of input range
within input range	ISU	These parameters keep the Set point in safe limits, preserving it from random changes.
cool, hEAt	-	('cooling' , 'heating')
These parameters are accessible in the presence of the corresponding relay.		
0 ... 9999	ISU	lower than (High input range - <b>Set Point 1</b> )!
0 ... 9999	ISU	lower than ( <b>Set Point 1</b> - Low input range)!
0 ... 9999	sec.	Value '0' disables Pulse mode.
0 ... 9999	sec.	
These parameters are accessible in the presence of the corresponding relay.		
within input range	ISU	

Below the list of all the standard parameters:

## Standard Configuration Parameters

These parameters are part of the configuration level

Input Type	<b>inP</b>	Type of signal that can be connected to the device input
Unit	<b>unit</b>	Temperature measurement unit
Point Position	<b>MPnt</b>	Display decimal point position
Input Low	<b>ILo</b>	Display value at low limit of the linear input range
Input High	<b>IHi</b>	Display value at high limit of the linear input range
Input Correction	<b>Icorr</b>	Constant to be added to the measured input value
Address	<b>Addr</b>	Device address
Baud Rate	<b>bAud</b>	Serial interface rate
Gradient	<b>GrAd</b>	Maximum input signal change during the sampling period (120 ms)
Filter Time	<b>\t</b>	Relative time constant of the input filter
Filter Band	<b>\b</b>	Zone around the measured value, within which the filter is active
SP limit Low	<b>%[L</b>	Set-point Low limit
SP limit High	<b>%[H</b>	Set-point High limit
Direction 1	<b>diR1</b>	Control action direction of output <b>K1</b>
Direction 2	<b>diR2</b>	Control action direction of output <b>K2</b>

## Standard Parameters of the control algorithm

These parameters are part of Parametric level

+ Differential 1	<b>[e1</b>	Positive Differential of output <b>K1</b>
- Differential 1	<b>me1</b>	Negative Differential of output <b>K1</b>
Time On 1	<b>ym1</b>	ON duration of output <b>K1</b>
Time Off 1	<b>y\1</b>	OFF duration of output <b>K1</b>
Hold 1	<b>HLe1</b>	Holds the output reaction of output <b>K1</b>
The same 5 parameters, but with index 2 - for output <b>K2</b>		

## Standard Parameters of Basic

These parameters are part of the operating level

Set Point 1	<b>%[1</b>	Set-point value of output <b>K1</b>
Set Point 2	<b>%[2</b>	Set-point value of output <b>K2</b>

## Additional Parameters Values

This version with 5 contact, has additional parameters that can be settled in different levels:

- CONFIGURATION (**Conf**)
- TRANSFORMATION TABLE
- CONTROL ALGORITHM
- ACCESS CONTROL PARAMETERS
- BASIC
- CALIBRATION

See dedicated page after ERROR MESSAGING for the details

## Error Messaging

In some cases, the device finds non-conformities in parameter values that must be corrected before operating at Basic level.

The device indicates such kind of problems by displaying error messages as given in the table below.

If **FAiL** appears on the display, try debugging by turning the power off/on.

If the problem persists, press and hold or send command error 0 via the communication interface to restore the default (factory) settings.

Message	Parameters	Error type
<b>FAiL</b>	all	Incorrect memory
<b>br"</b>	-	Service required
<b>ER01</b>	<b>GrAd</b>	Out of range
<b>ER02</b>	<b>\t</b>	Out of range
<b>ER03</b>	<b>\b</b>	Out of range
<b>ER04</b>	<b>%[L</b>	Out of range
<b>ER05</b>	<b>%[H</b>	Out of range
<b>ER06</b>	<b>cAiL</b>	<b>%[L &gt; %[H</b>
<b>ER07</b>	<b>cAiH</b>	<b>cAiL &gt; cAiH</b>
<b>ERx1</b>	<b>ymx</b>	Out of range
<b>ERx2</b>	<b>y\ x</b>	Out of range
<b>ERx3</b>	<b>hLex</b>	Out of range
<b>ERx4</b>	<b>[sx</b>	Out of range <b>[sx &lt; 0</b>
<b>ERx5</b>	<b>msx</b>	Out of range <b>msx &lt; 0</b>
<b>ERx6</b>	<b>5.p.x</b>	Out of range <b>%[L ... %[H</b>
<b>ERx7</b>	<b>%[.x - msx</b>	Lower than Input Low Range Limit
<b>ERx8</b>	<b>%[.x + [sx</b>	Exceeds Input High Range Limit
<b>ER29</b>	<b>Addr</b>	Out of range 1...255
<b>ER39</b>	<b>[iON</b>	Broken sequence of arguments of piece-wise linear transformation

## Additional Parameters Values

This version with 5 contact, has additional parameters that can be settled in different levels: CONFIGURATION (**ConF**), TRANSFORMATION TABLE (**tRtb**), CONTROL ALGORITHM (**Par**), ACCESS CONTROL PARAMETERS, BASIC CALIBRATION (**cAL**). See below:

Parameter	Symbol	description	Value	Unit	Notes
<b>Configuration parameters</b> (These parameters are part of Configuration level) – <b>ConF</b>					
Input approximation	<b>trAn</b>	Piecewise linear approximation	<b>Lin or [ltr</b>	-	Transformation signal or not
Output low	<b>OLo</b>	Display value at low limit of the linear output range	-1999...9999	ISU	These parameters make sense <b>ONLY</b> in case of a linear input signal
Output high	<b>OHi</b>	Display value at high limit of the linear output range			
Input error	<b>OERi</b>	Output state at input error	<b>bLo, AHi, or both</b>	-	to low or high limit or according to measured value
System error	<b>OERS</b>	Output state at system error	<b>bLo, AHi</b>	-	to low or high limit
Direction x	<b>dir.x<sup>[1]</sup></b>	Control action direction of output x	<b>coolor hEAT</b>	-	('cooling', 'heating' )
<b>Parameters of the transformation table</b> (These parameters are part of tRtb level)					
Transformation points	<b>mPnt</b>	number of transformation value	N=2...30	-	See on 13. Additional information for linear ...
measured point	<b>[I01... I0N</b>	Input measured value	-1999...9999	ISU	<b>[I0N-1 &lt; p.i.0N</b>
transformation point	<b>[O01... O0N</b>	Desired output points	-1999...9999	ISU	
<b>Parameters of the control algorithm</b> (These parameters are part of Parametric level) - <b>PAr</b>					
+Differential x	<b>[e.x</b>	Positive Differential of output Kx	0...9999	ISU	lower than (High input range - <b>Set Point x</b> )!
-Differential x	<b>mex</b>	Negative Differential of output Kx	0...9999	ISU	lower than ( <b>Set Point x</b> - Low input range)!
Time On x	<b>ym.x</b>	ON duration of output Kx	0...9999	sec	Value '0' disables Pulse mode.
Time Off x	<b>yl x</b>	OFF duration of output Kx	0...9999	sec	
Hold x	<b>hLe x</b>	Holds the output reaction of output Kx	0...9999	sec	By value 0 hold is off
Error state x	<b>WSy x</b>	Relay state at measurement error Kx	Off,On	-	
<b>Parameters of Basic</b> (operating) level – <b>L1</b>					
Set Point x	<b>S[ x</b>	Set-point value of output Kx	-1999...9999	ISU	within the range <b>SP Limit Low ... SP Limit High</b>
<b>Access-Control Parameter</b> (parameter of Hidden level)					
Access Control Level	<b>QxL</b>	Controls the access to device parameters	<b>FuLL, l1 or no,</b>	-	<b>FuL</b> (full access), <b>L1</b> (access only to parameters of level <b>L1</b> ), <b>no</b> (no access),
<b>Parameters of calibration level cAL</b>					
Calibration Low	<b>cAIL</b>	Calibration of analog output at low limit	0...4095	-	By setting parameter the output changes according to it.
Calibration High	<b>cAIH</b>	Calibration of analog output at high limit			
Manual output	<b>Qout</b>	Manual output set-point	0...100%		

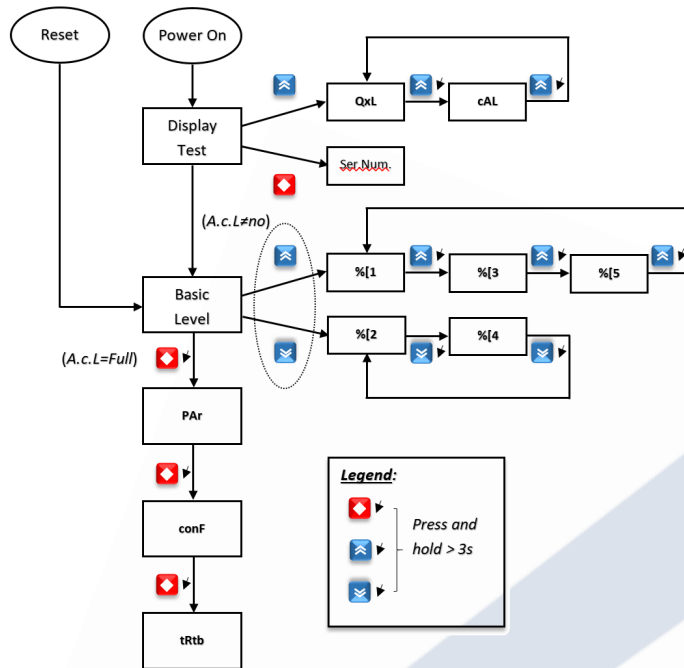
## PROGRAM LEVELS

Program levels are shown below

### Basic Level

At **Basic** level, the device indicates the measured input value (PV) with a resolution, according to the **Point Position** parameter.

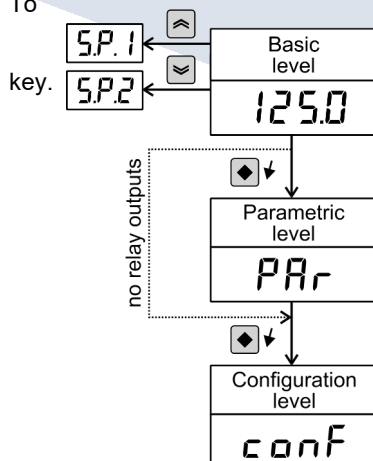
If the whole part of PV cannot be entirely displayed, the unit generates blinking 'overflow' messages (oL or -oL, depending on PV sign).



- If PV is out of its operating range (the input range according to Table 1, extended by 5% on both sides), the device displays blinking symbolic messages: <\_> (under-range) or {++} (over-range). When PV is out of physical range, the unit displays ----.
- Upon entering Basic level, the device may display the **init** message, indicating that some time is necessary for filter initialization.
- The **noIS** message may appear as a result of the peak filter operation (see 'Input filtration').
- To enter parameter value adjustment mode for **Set**

**Point 1**, press and hold **Set** until **%[1]** appears on the display.

To view the Set-point value, release the **Set** key.



- To enter parameter value adjustment mode for **Set Point 2**, follow the same procedure, but start with the **Set** key until **%[2]** appears on the display. To view the Set-point value, release the key.

### Parametric Level

This level contains the control algorithm parameters. If no relay output is installed, this level does not show up.

- Enter from Basic level by pressing

and holding **Set** until **PAr** appears on the display. Release the key. If the key is not released on time, the device enters Configuration level.

- Choose a parameter using **Left** and **Right**.
- To enter parameter value adjustment mode, press **Set**.
- If no key has been pressed for a while, the device automatically returns to Basic level, storing all confirmed changes.
- For quick exiting and saving, use key combination **Set** + **Left**.

### Configuration Level

This level contains the configuration parameters of the device.

- Enter from Basic level by pressing and holding **Set** until **conF** appears on the display.
- To access and adjust the configuration parameters, follow the algorithm described in 'Parametric level'.

### Setting numerical parameter value

Enter parameter value adjustment mode (see 'Program Levels').

- The whole part of the value together with the left zeroes appears on the display, and the rightmost digit blinks.
- To select another digit, press **Left** or **Right**.
- The 3 rightmost digits can accept values from 0 to 9, and the leftmost digit can also accept the values - and `.
- To increase or decrease the blinking digit value, use **Up** or **Down** respectively.
- Confirm the adjusted value by pressing simultaneously **Set** + **Left** or **Set** + **Right**.

If the new value has not been confirmed and no key has been pressed for a certain period of time, value adjustment automatically ceases, and the parameter retains its initial value

**WARNING!** Some parameters are accessible only when the respective functionality is installed. (see 'Specifications').

**WARNING!** Changing Point Position value reflects the real value of all parameters with **ISU!**

E.g.: changing Point Position value from (x1) to (x0.1) would change a Set-point value of 100 to 10.0!!!



### Setting symbolic parameter value

- Enter parameter value adjustment mode (see 'Program Levels').
- Read the blinking parameter value.
- To change the value, use  $\leftarrow$  or  $\rightarrow$ , and to confirm, press  $\rightarrow$  +  $\rightarrow$  or  $\leftarrow$  +  $\leftarrow$ .
- If the new value has not been confirmed and no key has been pressed for a certain period of time, value adjustment automatically ceases, and the parameter retains its initial value.

### Output Control

#### Control output operation

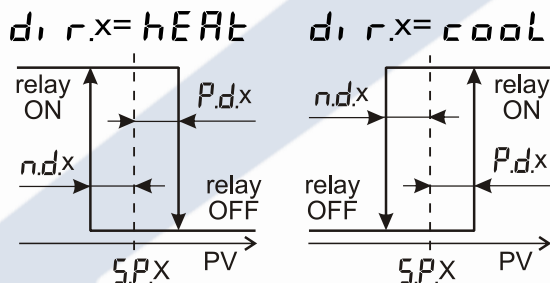
The control outputs operate according to the control algorithm parameters. The outputs deactivate with the value change of one of the following configuration parameters :

- **Point Position**
- **Input Low**
- **Input High**
- **Input Correction**

and remain inactive until Basic level is entered. The outputs deactivate also when an error has been detected (see 'Error messaging').

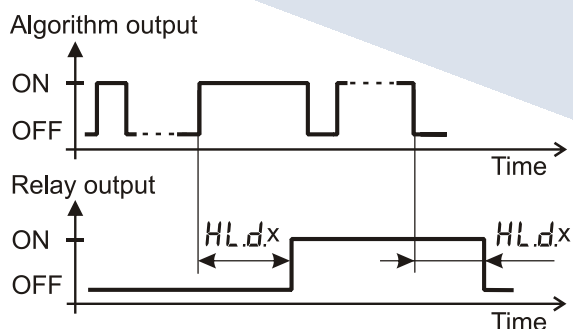
#### ON/OFF control algorithm

The static characteristic of a relay controlled by an ON/OFF algorithm is shown on the below drawing:



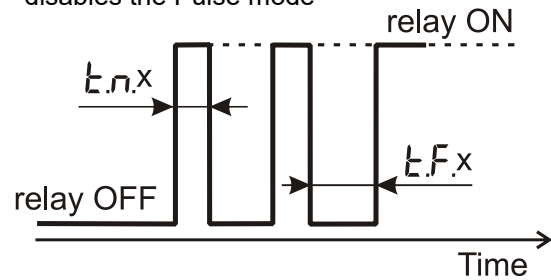
#### Output hold

For eliminating undesirable switches of the relay output, additional parameter (Hold) is assigned to hold the output reaction for certain period of time



### Output pulse mode

When a relay is forced to ON by the control algorithm, it can either stay ON or pulse depending on **Time On** and **Time Off** parameter values. Setting any of these parameters to '0' disables the Pulse mode



### ANALOG output setting

Features when setting the lower limit, in case the output range starts from 0 - the value of the cALL increases by 1 until the output reading becomes greater than 1 mA (0,5 mV). It is set up in the same way through the serial interface.

### Input Filtration

#### Peak filter

This filter is intended for eliminating pulse spikes (peaks), which can appear in the input signal, in the following way:

- The device measures the input signal value every 120 ms (sample time).
- The measured values are compared subsequently. The filter checks the difference between the last two samples. If it does not exceed Gradient value, the device accepts the signal as normal.
- If the last measured value differs from the previous one by more than the Gradient value, the filter output is held until the device determines a presence of a normal signal. It is possible only if the input signal has not been changed with more than the Gradient value for four subsequent samples.
- If the device has not determined a normal signal for 20 subsequent samples, **noIS** appears on the display (see 'Basic level').

#### Low-pass filter

This first-order filter acts ONLY within a certain band around filter output value. This has been designed to cut periodic noises outside the communication signal spectrum. Filter operation is defined by two parameters:

- **Filter Time** (defines filter time constant)
- **Filter Band** (defines filter active band around filter output value).

If the newly measured value differs from the filter output by more than **Filter Band**, the filter resets with a new initial output value (newly measured value).

## COMMUNICATION PROTOCOL

### Protocol architecture

The protocol is based on UART protocol with:

- Baud Rate - as defined by parameter : **Baud Rate**.
- Data bits - 8;
- Parity Control - Even;
- Stop bit - 1.

ASCII protocol is used for communicating and the information is exchanged in frames.

Each frame consists of 1, or 2 words separated by byte 32 (SPACE), and ends with bytes 13 (CR) and 10 (LF). The first word in the frame denotes a parameter 'Symbol' as taken from Table 2 and the second word (if needed) is the parameter 'Value', both spelled with only small Latin letters, digits, dots, and/or the '-' sign.

### Device activating

To respond to commands, the device should be active.

For a device to be activated, it must receive a Ux command, where 'x' is the value of the parameter Address or the value '255' (if device address is unknown), and respond to it with ok.

If a device does not respond even to U255, check the UART protocol settings, chiefly **Baud Rate** value.

Table 2

Parameter	Symbol	Value
Input Type	inp	pt100, pt1000, ptc1, ptc2, r.0.1k, t.c.b, t.c.j, t.c.k, t.c.r, t.c.s, t.c.t, u, u.0.10, i.0.20, i.4.20
Unit	unit	c, f
Point Position	pnt	0, 1, 2, 3
Input Low	i.hi	-1999...9999
Input High	i.lo	-1999...9999
Input Correction	i.cor	-1999...9999
Address	addr	1...254
Baud Rate	baud	1200, 2400, 4800, 9600
Gradient	grad	0...9999
Filter Time	f.t	0...9999
Filter Band	f.b	0...M
Input Value	p.v	*
Error Info	error	**
Manual control of analog output	manual	No, yes
Output setpoint in %	Mc	0...100
Low calibrating point	Min	0...4095
High calibrating point	Max	0...4095
Output state by input error	o.er.i	Below, above, both
Output state by system error	o.er.s	Below, above
Output Low	o.lo	-1999...9999
Output High	o.hy	-1999...9999
Current value of output	o.v	0...9999 sat.lo or sat.high
Input measured point	tr.i01...tr.i30	-1999...9999 typ. within
Output transform. point	tr.o01...tr.o30	range (i.lo...i.hi)
Number of transf. point	tr.p.c.	2...30
Method of transform.	Trans	Linear, p.l.tr

### \* Input value (read-only)

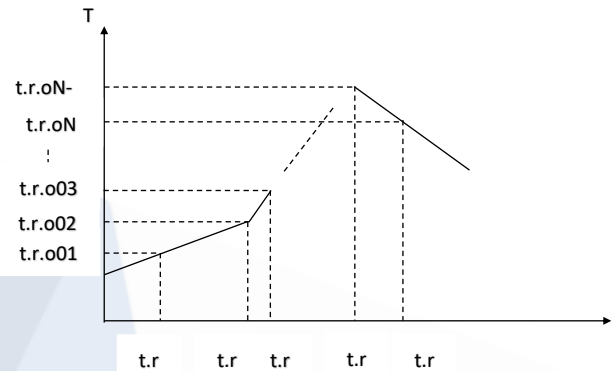
numerical value with ISU - measured input value  
 sat.lo - ADC under range  
 sat.hi - ADC over range  
 inp.br - sensor break  
 break - device failure  
 noise - noisy measurement

### \*\* Error info

0 - initializes non volatile memory  
 -1 - error FAiL (read only)  
 1....29 errors ER01....ER29 (read only)

### Additional information for linear transformation

The transformation set in the algorithm of operation of the controller is performed according to the following figure:



## SPECIFICATION

### ACCURACY

Measurement error 0.3% from span  
 Temperature drift 0.02% from span for 1°C  
 Cold junction compensation automatic -10...80 °C  
 RTD line compensation automatic, up to 2 x 25 Ω

### POWER SUPPLY

Mains supply voltage 230 VAC or 115 VAC  
 SMPS voltage 90...250 V  
 Isolated low voltage 12...24 V or 24 VAC  
 Non-isolated low voltage 12...24 V  
 External mains transformer 9(12) VAC  
 Consumption max. 2 VA

### INDICATION AND CONTROLS

Digital display 4 LED indicators  
 LEDs 5 LEDs for relay output status  
 Keyboard 3 membrane keys

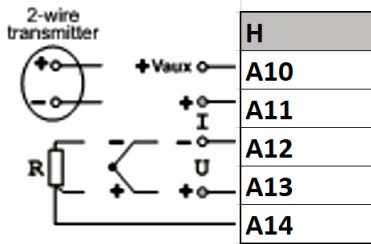
### OPERATING CONDITIONS

Panel mount IP54  
 Wall mount IP65  
 Ambient temperature -10...65 °C  
 Ambient humidity 0...85 %RH

## WIRING

### Input signal wiring

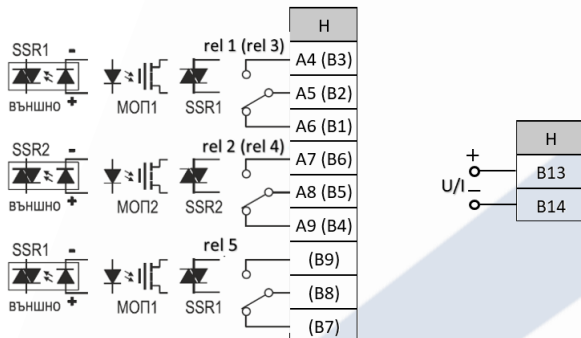
Connect the input with regard to its type through the respective and depending on the case type (see 'Specifications') terminals on the device back.



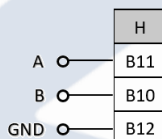
3-wire current transmitters can be supplied from **Vaux**. Voltage transmitters must be supplied externally!

### Output wiring

Connect the outputs with regard to their types (see 'Specifications') via the respective terminals.

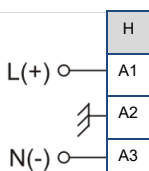


**RS485 wiring** Connect the unit to RS485 network line via the respective terminals (connector).



### Power supply wiring

Connect the right power supply voltage for your device (see 'Specifications').

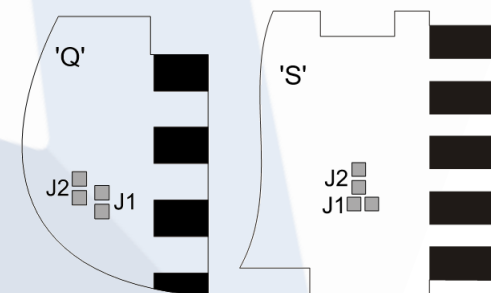
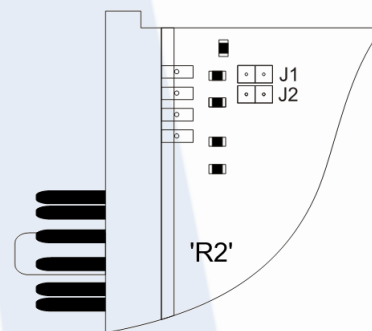
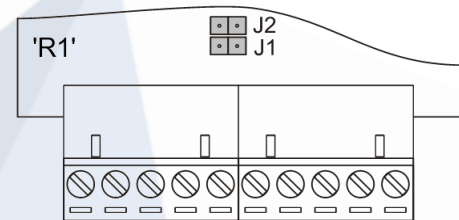
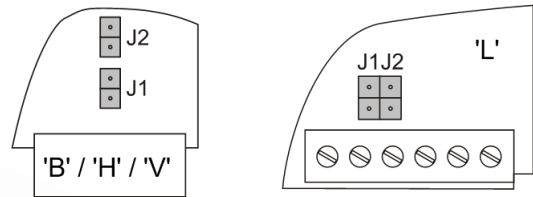


#### Important notes:

- Strictly observe the requirements for RS485 network building!
- With DC power supply, the polarity does not matter.
- In case of 90...250 VAC/DC power supply, grounding the device via separate wire is mandatory for covering safety standards

## INPUT SETTING

- Open the case.
- Follow the below diagrams to find the configuration jumpers J1 and J2, located on the main board (cases 'B', 'H', 'V', 'L', 'R1' and 'R1') or on the outer side of the right board (for cases 'Q' and 'S' not for this model with 5 relay outputs).
- To set input 0...10 V, short out J2.
- To set any of the other possible input types, short out J1. connect the input with regard to its type through the respective and depending on the case type (see 'Specifications') terminals on the device back.



## MOUNTING

### Panel mounting

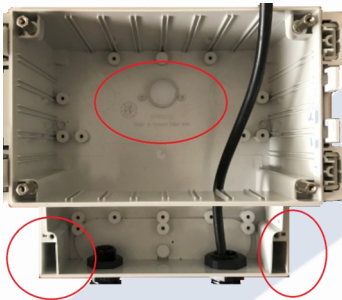
- Place THE Device into an appropriate panel cut-out.
- Tighten it into place using the enclosed mounting bracket(s).

### Wall mount

- Select an installation site offering space enough to open the window of the enclosure
- The wall mount enclosure has 3 fixing holes available accessible from inside the enclosure.
- Open the window and unscrew the 4 screw fixing the support panel of the display and remove the cover of the lower section of the enclosure with the cable glands holes



- The 3 fixing holes are shown below :



## WASTE DISPOSAL



Do not dispose of electronic devices together with household waste material!

If disposed of within European Union, this product should be treated and recycled in accordance with the laws of your jurisdiction implementing the WEEE Directive 2002/96 on the Waste Electrical and Electronic Equipment.

## Model Code

