microsyst

COMPETENCE IN MEASUREMENT

CE

Process Meter

with Tricolor Bargraph and Universal Input

MS6026

v 2.2

TECHNICAL DESCRIPTION AND INSTRUCTION FOR USAGE

PLOVDIV 2013

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Programming by keyboard or by RS485

1. Sensor and input signal selection:

Variant 1 – RTD or TC selection with linearization in the device.
Linearization is up to 9th stage in 4 sub-ranges. In RTD it is necessary its connection to be selected In TC it is necessary the automatic correction of the cold end to be enabled or disabled. The dimension have to be set - º C or º F.
The sensor range is set by parameters.
Variant 2 – The input signal is linear current or voltage.
The transmitter range is set by parameters
Variant 3 – The sensor is non-standard nonlinear – it can be linearized by request or by the user by RS485, MODBUS RTU protocol, by entering polynomial up to degree three coefficients.
Variant 4 - At sensor/transmitters with unknown transmission characteristics it is possible to be set linear by two points by physical change of the technological quantity and setting of two limit values in the device.

2. **Setting of decimal point and lower and upper limit of the range, set-points parameters, alarms, bargraph etc.**
3. **Selection of analogue output and range setting – if it is available / ordered /.**
4. **System setting of analogue inputs – if it is necessary.**
5. **System setting of analogue outputs – if it is necessary.**
6. **Setting of communication parameters – if RS485 is available.**

* *It is possible to begin with this procedure*

⚠	To restore the factory settings – page 20

⚠	After changing the decimal point all the parameters related with PV – process variable, influencing on the range, bargraph, set-points etc. have to be changed

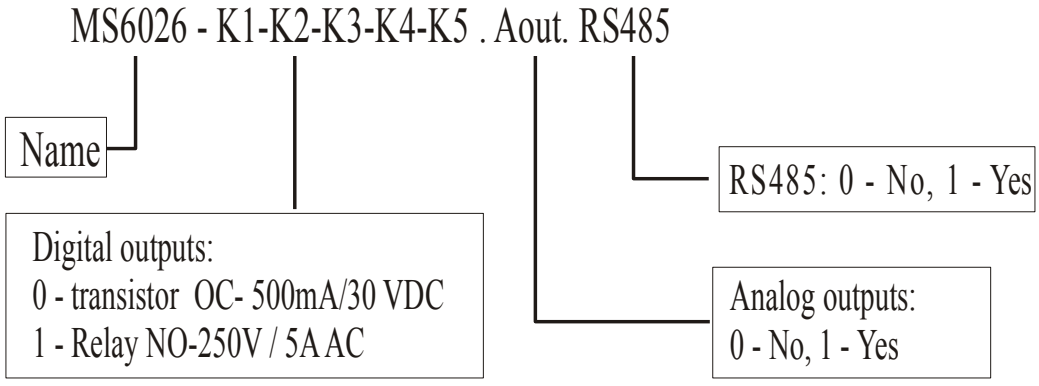
⚠	**For controller programming Microsyst offers:** • ***USB / RS485 Convertor*** • ***Base software for setting for operating systems Windows***

- MOST COMMONLY USED ABBREVIATIONS:

- RTD - resistance temperature detector
- TC - thermocouple
- ATC - automatic temperature correction
- PV - process variable
- SP - set point – set point for regulating of the measured process variable
- OFFSET- offsetting the indication of input or output value
- Aout - analog output

CONTENT

I. ORDER CODE



II. TECHNICAL DATA

Analog input (universal, user selectable)	Resolution - 16bits
Current	0 ÷ 20 mA DC; 4 ÷ 20 mA DC
Voltage	0 ÷ 1V; 0 ÷ 10 V DC
Resistance temperature detector - RTD	Pt385-10,50,100,200,500,1000; Pt391-100, Pt392-100; Cu482-100; Ni617-100; Ni672-120
Current through RTD sensor	420µA for 2 wire and 4 wire connection; 210 µA for 3 wire
Thermocouple – TC	Range ±73,125 mV.....J, K, S, B, T, E, N, R, C, ХК(L) GOST
TC-compensation of the cold end	Pt100 Cl.B: EN 60751
User programmable inputs in ranges	0 ÷ 400 Ω and 0 ÷ 4 kΩ
	±73,125 mV for thermocouple with ATC
	0 ÷ 20 mA DC
	0 ÷ 1 V DC and 0 ÷ 10 V DC
Temperature drift	< 10 ppm / °C
Measurement time	0.5 sec;
Auxiliary power supply	***Insulated*** 24 VDC ± 3 %; 40 mA max
Digital outputs 5	
K1÷K4 – ON/OFF	Relay 5A /250V AC or OC- 500 mA/30 VDC
K5 –Alarm HI, LO	Relay 5A /250V AC or OC- 500 mA/30 VDC
Analogue output 2	Resolution - 10bits
Measurement accuracy	0. 1 % from range for 0 ÷ 10V DC and 0 ÷ 20 mA
Time to refresh	0.5 sec
Lower and upper limit - NAMUR level detection	-1,56% ÷ +105,4% from the range i.e. for 4÷20 mA – orp. 3,75÷20,86 mA
Auxiliary power supply	***Insulated*** 21 ÷ 24 VDC ; 40 mA max
Indication and keypad	
Display	4 LED seven-segment indicators with h = 14mm
Display range	-1999 ÷ 9999
Display format	X▪XXX XX▪XX XXX▪X XXXX
Keypad	полусензорна
Bargraph	32 броя LED - Trocolor - green, red or orange 64 броя LED – Monochrome – red or green
Power supply	
Power supply	90 ÷ 250 VAC, 9VA max
Communication (option)	
RS485 – ***insulated***	RS485 2WIRE MODBUS RTU SLAVE 9600, 19200bps; parity – NONE, EVEN ; 1 , 2 stop bit
Operating conditions	
Operating temperature Operating relative humidity	0 ÷ 50 °C 20 ÷ 85 % rh
Dimensions	
Overall dimensions (WxHxL)	According to DIN IEC 61554 - 96x 96 x 128 mm
Mounting	Panel in a hole 92 x 92 mm
Weight	max 300g
Storage	
Storage temperature Relative humidity	-10 ÷ 70 °C 20 ÷ 90 % rh

- **The version of the device is visible when exiting menu ‘PARAMETERS’**

MEASUREMENT RANGE AND ACCURACY					
Sensor	**Standard**	**Range**		**Accuracy**	**Drift, µV / °C**
TC	**-**	**°C**	**µV without ATC**	**°C with ATC**	
J	EN 60584	-210 ÷ 1200	-8095÷ 69553	0.3	1
K	EN 60584	-200 ÷ 1372	-6458÷ 54886	0.4	1
S	EN 60584	-50 ÷ 1768	-236 ÷ 18693	0.5	1
B	EN 60584	44 ÷ 1820	0 ÷ 13820	0.5	1
T	EN 60584	-200 ÷ 400	-5603 ÷ 20872	0.4	1
E	EN 60584	-200 ÷ 1000	-8825 ÷ 76373 *	0.3	1
N	EN 60584	-200 ÷ 1300	-3990÷47513	0.4	1
R	EN 60584	39 ÷ 1768	226 ÷ 21103	0.5	1
C	EN 60584	0 ÷ 2320	0 ÷ 37107	0.5	1
XK – GOST – L	GOST P.585-2001	-200 ÷ 800	-9488 ÷ 66466	0.3	1
RTD	**-**	**°C**	**Ω**	**°C**	**mΩ /°C**
Pt10_385	EN 60751	-200 ÷ 850	1,852÷39,048Ω	0.7	0.04
Pt50_385	EN 60751	-200 ÷ 850	9,26÷195,24Ω	0.3	0.04
Pt100_385	EN 60751	-200 ÷ 850	18,52÷390,48Ω	0.15	0.04
Pt200_385	EN 60751	-200 ÷ 850	37,04÷780,96Ω	0.15	0.04
Pt500_385	EN 60751	-200 ÷ 850	92,6÷1950,24Ω	0.15	0.04
Pt1000_385	EN 60751	-200 ÷ 850	185,2÷3904,8Ω	0.15	0.04
Pt100_391	GOST	-200 ÷ 850	17,24 ÷ 395,16Ω	0.15	0.04
Pt100_392	JIS C1604-81	-200 ÷ 660	17,08 ÷337,03Ω	0.15	0.04
Cu100_482	GOST	-180 ÷ 260	20,53 ÷ 185,6Ω	0.15	0.04
Ni100_617	DIN 43760	-70 ÷ 180	69,29 ÷ 223,21Ω	0.15	0.04
Ni120_672	Edison Curve	-80 ÷ 260	66,60 ÷ 380,31Ω	0.15	0.04
TC non-standard	User Curve	-	**±73,125 mV**	-	1 **µV / °C**
Current input	**-**	**mA DC**	**Limits, mA**	**%**	**ppm/°C**
0.000 ÷ 20.000	-	0.000 ÷ 20.000	0.000 ÷ 20.860 mA	0.01	10
4.000 ÷ 20.000	-	4.000 ÷ 20.000	3.750 ÷ 20.860 mA	0.01	10
Voltage input	**-**	**V DC**	**V DC**	**%**	**ppm/°C**
0.000 ÷ 10.000 V	-	0.000 ÷ 10.000		0.01	10
0.000 ÷ 1.000 V	-	0.000 ÷ 1.000		0.01	10
Resistance input	**-**	**Ω**	**Ω**	**%**	**ppm/°C**
0 ÷ 400 Ω	-	0 ÷ 400	0.1 ÷ 400	0.01	10
0 ÷ 4000 Ω	-	0 ÷ 4000	0.1 ÷ 4000	0.01	10

- Table value. In the cold end temperature 25°C the upper limit for TC - E type is 950°C.
- Accuracy is defined electrically as % from the range and without influence of sensors and their connection.

III. FEATURES

- In the device is embedded linearization for 11 RTDs and 10 thermocouples, four linear inputs - 0÷20mA, 4 ÷20 mA, 0 ÷ 1 V and 0 ÷ 10 V for connection of transmitters.
- The device allows linearization with polynomials up to degree three, which can be set via RS485 with MODBUS RTU protocol, of another 6 types of sensors. To do this you have to select an appropriate non-standard for the device sensor.
- The correction of the cold end temperature of all thermocouples is performed automatically by a built-in to terminals thermoresistor Pt100, Class B. It is possible this function to be disabled.
- The device measures electrical resistance up to 4kΩ, DC voltage in three subranges - ± 73 mV, 1 V and 10V, direct current in one range up to 26mA.
- The analogue output transmits the input linearized signal in the range limits
- Programming is on 3 levels - System parameters, Hidden system parameters and Service Parameters.
- The bargraph is configured as a tricolor, monochrome green and monochrome red.
- The measurement accuracy of the input electrical signals is better than 0.01% from range, while that of the analog output is 0.1% from the range of the output signal.
- The device allows two communication speeds - 9600 or 19200 bps

IV. ADVANTAGES

- High measurement accuracy – 0.01%. Temperature stability - drift < 10 ppm/°C
- Universal input with 31 types of sensors, 6 of which customer adjustable
- Universal power supply 90 ÷ 250 VAC
- Tricolor bargraph – 7 zones that can be configured by the customer as levels and color – green, red or orange
- Five digital outputs that can be controlled with individual set-points
- Simultaneously output galvanically isolated current and voltage outputs
- Simultaneously output active and passive current output
- Galvanically isolated communication port - RS485 MODBUS RTU
- Precise temperature correction of the cold end of thermocouples - Pt100, Cl. B
- Programmable exponential low frequency filter
- Programmable filter for peaks in the measurement circuit
- Deep filter for noise rejection from power supply NMRR 80dB at 50Hz or NMRR 65dB for use at 50/60Hz – universal power supply

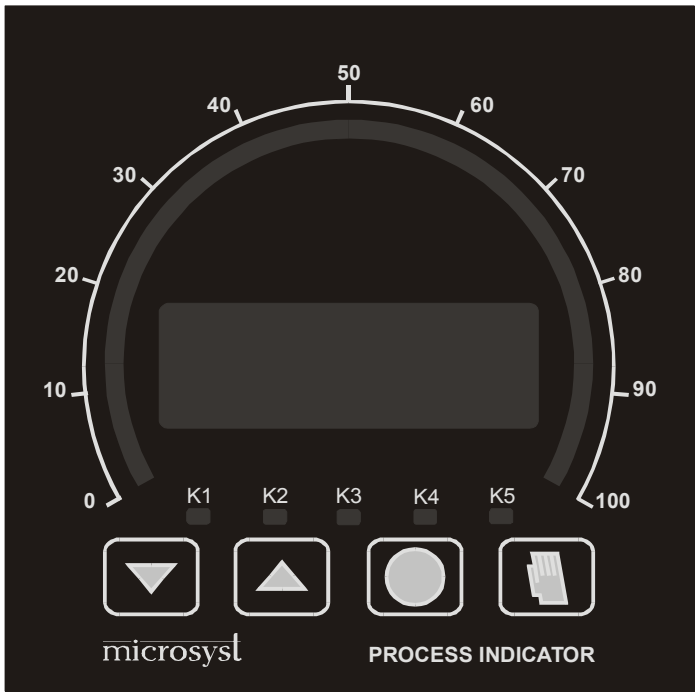
V. DESIGNATION

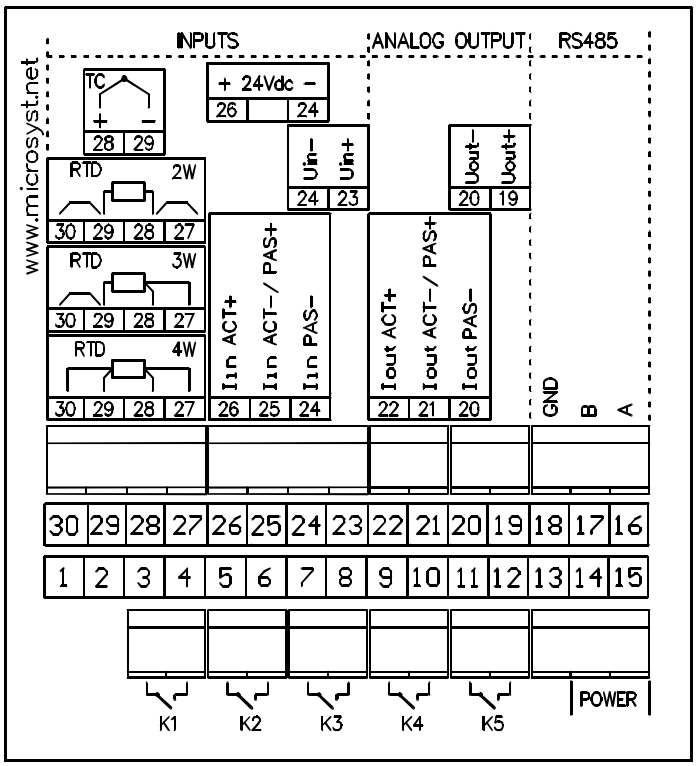
MS6026 is designed for mesurement and control of different process parameters. The measured value is displayed on LED display and LED bargraph.
The device supports MODBUS RTU protocol by isolated RS485 serial channel. The analogue output is transmitting and galvanically isolated from the other channels.
The presence of a programmable by color and range bargraph ensures easy and rapid differentiation of normal, warning or critical situations.

The device is applicable as:

- Stage ON/OFF controller – up to 4 stages and one alarm output
- Process meter with bargraph and five digital outputs
- Converter of a technological quantity in unified analogue signal or its transmition by serial MODBUS RTU protocol

VI. FRONT PANEL AND TERMINALS





VII. ELECTRICAL CONNECTION OF INPUTS AND OUTPUTS

ANALOG OUTPUTS		Marking	Terminal
Active current output	Positive terminal	Iout ACT+	22
	Negative terminal	Iout ACT-	21
Passive current output	Positive terminal	Iout PAS+	21
	Negative terminal	Iout PAS-	20
Voltage output	Positive terminal	Uout+	19
	Negative terminal	Uout-	20

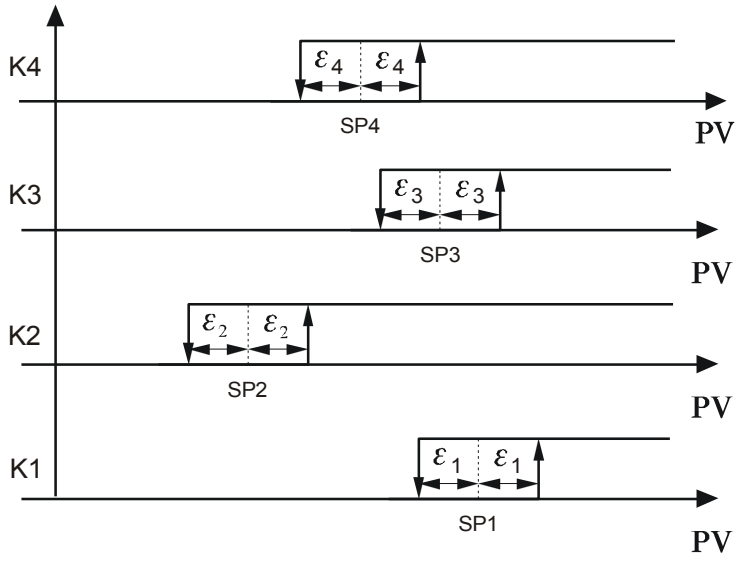
ANALOG INPUTS – CURRENT AND VOLTAGE		Marking	Terminal
Power supply for transmitters	Positive terminal	24 Vdc+	26
	Negative terminal	24 Vdc-	24
Current input from 2-wire transmitter, supplied from the device	Positive terminal	Iin ACT+	26
	Negative terminal	Iin ACT-	25
Current input	Positive terminal	Iin PAS+	25
	Negative terminal	Iin PAS-	24
Voltage input 0.000 ÷ 10.000 V	Positive terminal	U in +	23
	Negative terminal	U in -	24
Voltage input 0.000 ÷ 1.000 V	Positive terminal	TC +	28
	Negative terminal	TC -	29

INPUT – RTD, Ω and kΩ		Marking	Terminals
4-wire connection	Two wires, shorted to one end of the sensor	4W	27,28
	Two wires, shorted in the other end of the sensor		29,30
3-wire connection	Two wires, shorted to one end of the sensor	3W	27,28
	Connection between terminals 29 and 30		29
2-wire connection	Connection between terminals 27 and 28	2W	28
	Connection between terminals 29 and 30		29

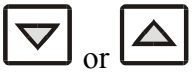
INPUT – THERMOCOUPLE		Marking	Terminal
2-wire connection	Positive terminal	TC +	28
	Negative terminal	TC -	29

VIII. OPERATING MODE

MS6026 controls up to 4 /four/ digital outputs with ON/OFF logic by independent set-points and hysteresis. When specifying a negative set-point is inverted the control logic. Fifth digital output is used for alarm functions for lower and upper level with programmable delay and time for action.



1. EDIT OF THE SET-POINTS (SP)

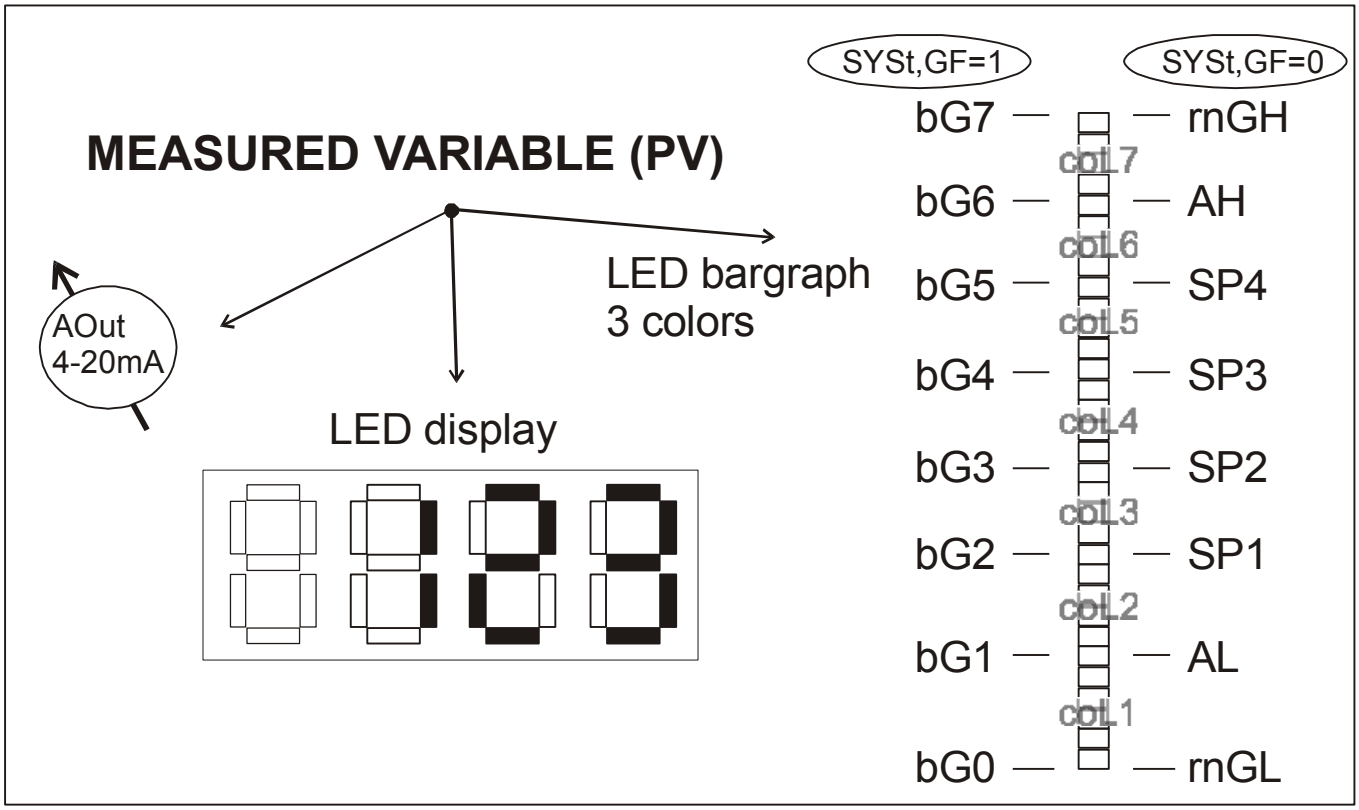
	**[PV]** → **[SP1]** → **[SP2]** → **[SP3]** → **[SP4]** → **[PV]**. • By successively pressing – viewing and editing of the set-points
	• Value editing **[SP1] [50]** → **[49]** → **[48]** → **[49]...**
	• Adoption of the new value (this can be done automatically too, 5 sec. after the last pressed button). **[SP1] [49]** → ок

2. LOCK / UNLOCK THE KEYPAD

When the keypad is locked no possibility to change the parameters, only to view the set-points. The values of the set-points do not blink.

	**[Loc] ↔ [UnLc]** • Switch unlocked <=> locked state

3. BARGRAPH – PRINCIPLE OF OPERATION



- The bargraph indication is connected with parameters **bG0 ÷ bG7** or with **rnGL,AL,SP1 ÷ SP4,AH** and **rnGH** (range, alarm levels and set-points) . This can be specified by **Syst,GF** parameter. In both cases, in order to function properly the indication are given descending and ascending values. For example at **Syst,GF=1 - bG0≤bG1≤bG2.... ≤bG7 / bG0≥bG1≥bG2.... ≥bG7**. The device does not check layout. If necessary points of AH and AL are automatically exchanged (at rnGL> rnGH) in the order shown in the figure.

- For each zone between the set values can be specified color by parameter **coL1 ÷ 7**. It can be color of a zone – there will be a colorful view or color of a column - as a whole will change its color according to PV (parameter **Syst, GC**).

- By **SySt.GP** parameter the mode 'lighting column' / 'lighting point' is determined.

- When a LED is between two color zones when changing PV it would change its color, thereby slightly expands one zone at the expense of the other. This can be enabled / disabled by **SySt.G1**.

- Monochrome bargraph functions as a color bargraph with two possible colors.

- **ConF, Gh=0** or **Gh=1** from menu „**OTHER SERVICE PARAMETERS“** indicates color or monochrome bargraph will be used.

- The bargraph can be switched off by **bLEd=0** from menu „**Service parameters**“

- The display is limited in the range -1999 ÷ +9999, beyond which blinks (┌ - - ┐ or └ - - ┘).
  If the process variable is within the measurement limits but is out of range (**par. rnGL, rnGH**) values alternate with ┌ - - ┐ - over the range or └ - - ┘ - below the range.

IX. PARAMETERS

	■ Enter menu 'PARAMETERS SETTING' - Press and hold the button (**SP** appears on the display) for 4 sec. while **ProG** appears on the display. ■ Release this button in order to access menu „SYSTEM PARAMETERS". ■ To access "HIDDEN" or „SERVICE PARAMETERS" without releasing button, press the button . **COdE** appears on the display. Release the buttons. **0** appears on the display. By buttons select the code of the desired parameters group. Through special codes here you can activate some controller functions – setting of the input, offset and others. Press button to confirm.
	■ Enables changing the value, the display flashes.
	■ Changes the value of the selected parameter. ■ Scroll in the parameters list.
	■ Confirms the value change. ■ Exit from parameters menu (should not be in value change). Press and hold this button for 4 sec. while **v1_5** appears on the display. **v1_5** is the software version of the device.
● *2 minutes after the last pressed button the device automatically returns in operating menu*	

SYSTEM PARAMETERS				
Parameter	**Description**	**Range of change**	**RS485 communication** HOLD REG ADDRESS, TYPE, SCALE.Where not specified the scale depends on the decimal point **-dP**	Default value
*** Parameters bG0÷7 and coL1÷7 are not included in the menu if the device is without bargraph (bLEd=0).**				
● Zones of LED bargraph at **Syst,GF=1**. ● Parameters **bG0÷7** are included only at **Syst,GF=1**		-1999 ÷ 9999 (Dimension as PV)		
bG0	Beginning of the LED ladder ***at PV < bG0 – there is no lighting LED***		43, Sint	
bG1	Zone 1		44, Sint	
bG2	Zone 2		45, Sint	
bG3	Zone 3		46, Sint	
bG4	Zone 4		47, Sint	
bG5	Zone 5		48, Sint	
bG6	Zone 6		49, Sint	
bG7	End of the LED ladder		50, Sint	

Color of each zone of the LED bargraph			**Color bargraph:** 0-DOES NOT LIGHT; 1-RED; 2-GREEN; 3-ORANGE **Monochrome bargraph:** 0-DOES NOT LIGHT; 1,2,3-LIGHT;		
Color	**Zone depending on a parameter**				
	Syst,GF=1	**Syst,GF=0**			
coL1	bG0 ÷ bG1	rnGL ÷ AL*		51, Uint, *1	
coL2	bG1 ÷ bG2	AL* ÷ SP1		52, Uint, *1	
coL3	bG2 ÷ bG3	SP1 ÷ SP2		53, Uint, *1	
coL4	bG3 ÷ bG4	SP2 ÷ SP3		54, Uint, *1	
coL5	bG4 ÷ bG5	SP3 ÷ SP4		55, Uint, *1	
coL6	bG5 ÷ bG6	SP4 ÷ AH*		56, Uint, *1	
coL7	bG6 ÷ bG7	AH* ÷ rnGH		57, Uint, *1	
	**** If it is necessary points of AH and AL are automatically exchanged (at rnGL>rnGH)***				
Hysteresis at K1-K4 outputs operation *A negative value inverts the corresponding output*			-1999 ÷ 9999 (Dimension as PV)		
HST1	Hysteresis for K1			33, Sint	
HST2	Hysteresis for K2			34, Sint	
HST3	Hysteresis for K3			35, Sint	
HST4	Hysteresis for K4			36, Sint	
AL	Lower limit of alarm		rnGL÷ rnGH (Dimension and decimal point are according to process variable)	41, Sint	
AH	Upper limit of alarm			42, Sint	
t0AL	Time to activate an alarm under AL		0 ÷ 100 Sec.	58, Uint, *1	
t0AH	Time to activate an alarm above AH		0 ÷ 100 Sec.	59, Uint, *1	

HIDDEN SYSTEM PARAMETERS **Accessible at CODE= 12**

To change with extreme caution!
Improperly setting leads to incorrect operation of the device!

SCALE OF AN ANALOG OUTPUT AOut

Through the next 2 parameters are set limits and slope of the analog output.

OtrL	PV, corresponding to the lower limit of Aout. (for example 0°C for 4mA)	-1999 ÷ 9999 (Dimension as PV)	18, Sint	
OtrH	PV, corresponding to the upper limit of Aout. (for example 100°C for 20mA)	-1999 ÷ 9999 (Dimension as PV)	19, Sint	

MEASUREMENT RANGE

- Limit the set-point and alarm levels at absolute alarm. Set rnGL < rnGH.
- In TC / RTD can be used as warning levels but do not participate in the measurement. When measuring below rnGL- display changes in 1 sec. PV↔ └ - - , above rnGH - PV↔ ┌ -- ┐ .
- Parameters adjust the measurement in linear ranges (if **Syst,Et=0**) 0-1V, 0-10V, 4-20mA and 0-20mA.

rnGL	Measurement range – lower limit. Indication for 0V/ 0mA/4mA, if (Syst ,Et=0).	-1999 ÷ 9999 (Dimension as PV)	20, Sint	
rnGH	Measurement range – upper limit Indication for 1V/10V/20mA, ако (Syst ,Et=0).	-1999 ÷ 9999 (Dimension as PV)	21, Sint	
	OTHER			
dPnt	Decimal point * After a change it is necessary to be checked / corrected all parameters with the dimension of PV. ** For built-in temperature sensors and linear inputs, when changing the dPnt, PV automatically switches in the selected format. For non-standard inputs the point is decorative – Coefficients 'non-standard input' have to be scaled through RS485	**0 ÷ 4** 0-xxxx; 1-xxxx.; 2-xxx.x; 3-xx.xx; 4-x.xxx (for RTD and TC-standard or non-standard, 0, 1 and 2 are possible)	29, Uint, *1	
	SOFTWARE FILTER			
A db	Filter zone of ADC	0 ÷ 9999 (Dimension as PV)	24, Uint	
Adbt	Time to perception of a value outside of **A db** zone	0 ÷ 255 sec.	25, Uint, *1	
FILt	Filter coefficient	1 ÷ 100	26, Uint, *1	

SYST - Configuration options

LED Bargraph:

The field **GF** determines to which parameters group to connect LED zones. Possible groups:
(0 - RnGL,AL,SP1,2,3,4,AH,RnGH) and
(1 – LED zones G0,1,2,3,4,5,6,7)

Field **GC:** at **GC=0** all LED column will be with one color, which will change depending on zone in which is PV. At **GC=1**, every zone will be with its own color. At bargraph type 'lighting point' is irrelevant.

Field **GP=0**, bargraph type 'column';
or **GP=1**, bargraph type 'lighting point'.

Field **G1=0**, the last lighting LED from bargraph can change its color;
or **G1 =1**, the last lighting LED from bargraph can't change its color. It is about a situation where inside the LED zone has a boundary between two colors. If G1 = 1, the color does not reflect exactly PV, but color zones visual are with fixed sizes. Otherwise may vary by 1 LED.

Analog output Aout – (proportional to the input parameter PV).: The values that correspond to the analog output range are in parameters **OtrL**, **OtrH**. Field **ob (out band)** determines if this values refer to 0-100% current output or to 20-100% (it is used for easy transition from 0-20mA ↔ 4-20mA).

Et –Enabled function 'linear input setting by two reference points'. If changed, the current setting will remain valid until such new **(Et = 1)** or until range correction **rnGL, rnGH (Et = 0)**

BackUp options:
For Input / Output settings, and some parameters (Note 2) keep a backup. By **rE = 1** these settings and parameters return default values and lose current values.

OPTIONS ACCESS:

SYST ◎→ GF ◎→ GC ◎→.... t1AL

OPTION CHANGE:

with ▽ or △, for example:GF=0 △→ GF=1

GF=0 – LED zones RnGL,AL,SP1 ÷ SP4,AH,RnGH
GF=1 - LED zones bG0 ÷ bG7

GC=0 – Bargraph color - column
GC=1 – Bargraph color – zone

GP=0 – Bargraph - column
GP=1 – Bargraph – lighting point

G1 Permitted color change last lighting LED
G1=0 – YES; **G1=1** – NO

ob=0 – Aout 0-100% (for example 0-20mA)
ob=1 – Aout 20-100% (for example 4-20mA)

Et=0-Forbidden setting of a linear input by two reference points. The setting is by range **rnGL ÷ rnGH** at prior known parameters of the connected transmitter.
Et=1- Range **rnGL÷ rnGH** is just for warning when measuring outside these limits**.**

rE=1- Restores the default values and after that **rE=0** automatically. ***Attention – current settings are lost!***

St=1 – Creates a buckup of the settings (the default copy is lost), and **St=0** automatically**.**

The option is visible on the display only after a special service code ***in*** COdE.

MODBUS HOLDING REGISTER ADDRESS
(REG №= REG ADDRESS+1) 30, Uint, *1 .

		MODBUS COIL ADDRESS IN RS485 COMMUNICATION (COIL №= COIL ADR+1) St: 495 | rE: 494 | Et: 493 | ob: 492 | G1: 491 | GP: 490 | GC: 489 | GF: 488	
t1AL	Time for action of alarm output after its switching on below the AL. When the time run, the output is off, the LED AL is flashing while PV is below AL.	1÷100 sec., **0-permanently on** MODBUS HOLD.REG. ADDRESS 60, Uint, *1	**0**
t1AH	Time for action of alarm output after its switching on above the AH. When the time run, the output is off, the LED AL is flashing while PV is above AH.	1 ÷ 100 sec., **0-permanently on** MODBUS HOLD.REG. ADDRESS 61, Uint, *1	**0**

SERVICE PARAMETERS **Accessible at CODE=23**

To change with extreme caution!
Improperly setting leads to incorrect operation of the device!

Para-meter	Description	Values, MODBUS HOLD. REG. ADR , TYPE , SCALE.	Default value
	SERVICE SETTING OF AN ANALOG OUTPUT. ◆ The analog outputs are factory set ! ◆ This setting scales the analog outputs to correspond to 0 ÷ 20 mA and 0÷ 10 V. This requires an reference mA meter or V-meter with accuracy higher than 0.1% to be connected to the respective output. ◆ ***In unsuccessful set up it is possible the factory settings to be restored by parameter Syst, rE=1 from menu "Hidden system parameters".*** ◆ **When changing the value by buttons on front panel Aout enters in calibration mode which is different from operating mode. This should be considered in connected control and measurement equipment.** ◆ Settings are made at **Syst,ob=1**, **i.e. for points 4 ÷ 20 mA DC and 2 ÷ 10 VDC** ◆ In advance have to be specified which type of analog output (voltage or current) is set by parameter **AtYP** ◆ In need of a user change scaling parameters OtrL/H have to be used.		
PA0	Offset for Aout1. Adjust to indication AOut1=4mA (current output)	-1999 ÷ 9999 MODBUS HOLD.REG. ADDRESS I-23, U-123 Sint, *1	
PA1	Slope for Aout1. Adjust after PA0 until indication AOut1=20mA.	-1999 ÷ 9999 MODBUS HOLD.REG. ADDRESS I-22, U-122 Sint, *1	

OTHER SERVICE PARAMETERS

SenS — Choice of sensor — MODBUS HOLD.REG. ADDRESS 28, Uint, *1

№	input	display	№	input	display	№	input		display
0	TC J	**tc J**	10	4-20 mA linear	**4-20**	14	Pt10	385	**Pt10**
1	TC K	**tc ├**	11	0-20 mA linear	**0-20**	15	Pt50	385	**Pt50**
2	TC S	**tc S**	12	0-1V linear	**0-1v**	16	Pt100	385	**P100**
3	TC B	**tc b**	13	0-10 V linear	**010v**	17	Pt200	385	**P200**
4	TC T	**tc t**				18	Pt500	385	**P500**
5	TC E	**tc E**	25	TC non-standard	**nStc**	19	Pt1000	385	**1000**
6	TC N	**tc n**	26	RTD_4KΩ non-standard	**nSr ├**	20	Pt100	392	**P392**
7	TC R	**tc r**	27	RTD 400Ω non-standard	**nSr0**	21	Pt100	391	**P391**
8	TC C	**tc C**	28	0-20mA non-standard	**nS20**	22	Cu100	482	**C100**
9	TXK (L)	**tc L**	29	0-1V non-standard	**nS01**	23	Ni100	617	**n100**
			30	0-10V non-standard	**nS10**	24	Ni120	672	**n120**

virE — Connection RTD 3 / 4 wire (appears only for RTD sensor) — 3÷ 4 MODBUS HOLD.REG. ADDRESS 32, Uint, *1

nEtA — MODBUS address of the device — 1 ÷ 255 MODBUS HOLD.REG. ADDRESS 127, Uint, *1 — 1

ConF — System settings

Field **1u** indicates analog type used (hardware related)..

Field **rr** – Normal Mode Rejection Ratio

BAUDRATE, PARITY, STOP BIT are communication parameters in RS485 network.

Gh-service setting – bargraph type.

□**F**-**°C**/**°F**

- It affects only on built-in temperature sensors and for ATC(in Sens=nStc).
- It does not affect on linear or non-standard input.

ACCESS TO THE OPTIONS:

Conf ◯ → 1u ◯ → rr ◯ → ....

□**F** → bLEd

OPTION CHANGE:

by ▽ or △

1u=0– Aout1 CURRENT;
1u=1- Aout1 VOLTAGE
rr=0– NMRR 80dB 50Hz;
rr=1- NMRR 65dB 50/60Hz;
br=0 BAUDRATE 9600 bps;
br=1-19200 bps
Pr=0 PARITY NONE;
Pr=1-EVEN
Sb=0 - 1 stop bit; =1 - 2stop bits
bC=0 Performing of BROADCAST queries (queries to address of the device 0).
bC=1-Not perform BROADCAST queries
Gh=0-color bargraph **Gh=1**- monochrome bargraph
□**F=0** -°C
□**F=1** -°F

rr=0

Br=0, Pr=0, Sb=0, bC=0

MODBUS COIL ADDRESS ПРИ RS485

°F	Gh	bC	Sb	Pr	br	rr	1u-
4	**4**	**4**	***4***	***4***	***4***	***4***	***4***
4	**4**	**4**	***4***	***4***	***4***	***4***	***4***
7	**6**	**5**	***4***	***3***	***2***	***1***	***0***

MODBUS HOLDING REG ADDRESS 27, Uint, *LSByte,**1

<table>
<tr><td>CnF2</td><td>System settings 2

cd – enabled/disabled automatic temperature correction of the cool end of the thermocouples

do – enable/disable the indication of value out of the range rnGL ÷ rnGH

◆ ACCESS TO THE OPTIONS as in the previous parameter</td><td>cd = 0 –enabled temperature correction of TC.
(PV = T hotend + T cold end)

cd = 1- disabled temperature correction of TC
(PV=T hotend)

do = 0 – values out of range are displayed.
The display blinks:
[NUMBER] ↔ [┗ - - ┛ or ┌ -- ┐]

do =1- values out of range are not displayed.
The display blinks [ ] ↔ [┗ - - ┛ or ┌ -- ┐]

MODBUS COIL ADDRESS ПРИ RS485
<table><tr><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>do</td><td>cd</td></tr><tr><td>4
3
9</td><td>4
3
8</td><td>4
3
7</td><td>4
3
6</td><td>4
3
5</td><td>4
3
4</td><td>4
3
3</td><td>4
3
2</td></tr></table>
MODBUS HOLDING REG ADDRESS 27, MSByte, *1</td><td>cd=0
do=0</td></tr>
<tr><td>bLEd</td><td>Number of LEDs in bargraph
Service setting</td><td>0 ÷ 100
0 – the device is without bargraph
MODBUS HOLD.REG. ADDRESS
62, Uint, *1</td><td></td></tr>
</table>

Abbreviations: Uint – UNSIGNED INT, Sint – SIGNED INTEGER

X. OFFSET OF THE ANALOG INPUT – [CodE= 47]

In this mode can be entered value which will be added when measuring the input parameter (offset), if there is disparity between the displayed value and measured value with other reference equipment.

Enter COdE= 47 (see chapter IX. PARAMETERS). “OFSt” appears on the display. Press a button. The current offset appears on the display. By ▽ and △ is set the desired offset. Press ◯ button to confirm. (The device returns automatica in main menu 5 sec. after the last pressed button.

EXAMPLES FOR USER SETTING OFFSET

VII.Display indication: 129 Entered offset: 3.4
VIII.New display indication: 132 Entered offset: 0.6
IX. New display indication: 133 Entered offset: -1.0
X. New indication: 132

XI. RECOMMENDATIONS AGAINST INTERFERENCE

1. Recommendations for use of connecting wires

- Wires that transmit a similar type of signals can be packed together, but if the signals are different, the wires must be separated to prevent electromagnetic interaction.
- When there have to be crossed wires with different signal types this must be done at an angle of 90 degrees and a long distance.
- Wires, which carry weak signals and wires connecting the sensors to the controller must not be near contactors, motors, generators, radios and wires, which carry large currents.

2. Noise suppression using the built-in in the regulator filter

- If the input parameter fluctuates and is not stable it is necessary to reduce the filter coefficient **FILt.** As less value, as heavier filter and slowly change the input parameter.
- If the input parameter jumps periodically for short intervals it is necessary to increase the parameter **AdBt**. By increasing of this parameter the device reacts slowly with sharply change of the input parameter, but ignores short disturbances.

3. Programming of Normal-Mode Rejection Ratio (NMRR) filter

- Depending on the frequency of the power supply it is desirable to select appropriate (NMRR) filter for measurement by parameter from "**Service menu" - rr = 0** for NMRR 80dB 50Hz or **rr = 1** for NMRR 65dB 50/60Hz.

XII. SETTING OF ANALOG INPUTS

1. SERVICE SETTING - [CodE=81]

- ***This service mode is allowed to be used only from competent for that purpose person.***
- ***The setting is made in production and it is not necessary to be done by the user.***
- ***When setting should be used reference calibrator of electrical resistance, direct current and direct voltage with accuracy ≥ 0.01% .***
- ***In failure setting it is possible to restore the factory settings by parameter Syst, rE = 1 from menu "Hidden system parameters"***

- Can be calibrated only some of the inputs or an internal calibration to be made. This does not affect the others.
- Step [Pt 3] sets the measurement of all RTD (Pt, Ni, Cu) and the cold end of TC.
- If internal calibration is done, it is done first.

For access enter [**CodE=81**] (see chapter IX)→ ◯ → [Clbr End] appears on the display, then you have to continue along the table.

[Clbr End]	⊙ Returning in the operating mode, △▽ selecting of input Clbr End→ Clbr Intr → Pt 3 →10 v → 20 mA → Clbr End → ...	
[Clbr Intr]	Internal calibration. Compensation points of 3-wire RTD are shorted (terminals 27,28). After confirmation [Clbr Uait] appears on the display. Wait calibration to complete alone for ~ 10 s.	⊙ Confirms the reference, calibration is performed – [done] appears on the display. Transition to the next input. △▽ Select the next input without calibration
[Pt 3]	Reference resistance 3κΩ have to be connected, 4-wire.	
[10 v]	Reference voltage 10V have to be connected	
[20nA]	Reference current signal 20 mA have to be connected	

1. SETTING OF LINEAR INPUT BY TWO REFERENCE POINTS – [CodE=80]

- This setting destroys the service setting
- ***Restoring of factory setting is possible using the parameter Syst, rE=1 from menu "Hidden system parameters"***
- The type of setting is common for ranges **0-1V, 0-10V, 4-20mA** and **0-20mA**.
- In order the function to be available, the parameter ***Syst*,Et=1**,
- The range rnGL,rnGH does not set readings, it is only warming.

This type of setting is appropriate when the parameters of connected transmitter are unknown and could not be entered in **rnGL,rnGH**.

For access ***Syst*,Et=1**, otherwise returns automatically in operating mode.
Enter **[CodE=80]** → ⊙ → [tun1] appears on the display → ⊙ → on input is fed first reference v alue → ⊙→ with buttons △▽ is entered the fed value → ⊙ → [tun2] appears on the display → ⊙ → second reference value is fed → ⊙ → with buttons △▽ is entered the fed value → ⊙ → operating mode.

2. SETTING OF NON-STANDARD INPUT

In parameter **Sens**, equivalent to one of the non-standard inputs (name, starting with **nS**), the device uses polynomial calibration coefficients 'Non-standard input'. They convert normalized linear input 0-10000 **(0-1V, 0-10V, 0-20mA non-standard.), µV(TC non-standard), Ω (RTD400Ω non-standard), Ω/10 (RTD4KΩ non-standard),** ==>**measured quantity** by polynomial degree three. They are set only via RS485 communication with device, but in advance must be calculated according to the characteristics of the sensor.

- 'non-standard' means sensor input with nonlinear transfer characteristic, for which is not pre-defined in the device, i.e. it is absent from the values of parameter **Sens**. This does not mean that the sensor does not correspond to an industry standard.
- In sensor TC **non-standard**, the device measures the temperature of the cold end, as for all other thermocouples.

XIII. RETURNING OF FACTORY SETTINGS

- If calibration failed or incorrect configuration parameters it is possible to return the default settings, by SYST, rE = 1 (hidden system parameters).
- Function only applies to certain parameters – hidden, service, calibration of input / output.

XIII. MODBUS RTU RS485 COMMUNICATION (option)

The device is MODBUS RTU SLAVE with possibility for communication of 9600 or 19,200 bps by RS485 2WIRE line (parameter **ConF**). In standard performance without using repeaters, on a line can be connected up to 32 devices, with repeaters — up to 247. There is an option for a special performance for up to 128 devices without repeaters.

In the parameters table in column HOLDING REGISTER ADDRESS are the addresses of the relevant parameters. Here will be considered other communication options. When changing the parameter or operating mode there is an equality between change via the front panel buttons or change by network - ie the device can be influenced by two sources simultaneously. If the network is a priority you can lock the keypad (but it can be unlocked through the front panel).

IMPLEMENTED MODBUS FUNCTIONS	
MODBUS FUNCTION	COMMENT. RESTRICTIONS. Only specified with parameter and quantity names addresses can be used, and undescribed addresses in the manual should be considered as reserved addresses. The address fields in the table only indicate that the operation is feasible without EXEPTION (protocol error message).
01	Reading of single bits.
03	Reading of HOLDING REGISTERS, 0< REG ADR <127 – registers in the non-volatile memory, 128<REG ADR <256 – registers in RAM. When adding 512 - FLOAT calibration coefficients should be read in IEEE754 format (otherwise they are in format EXP, S.B0,B1,B2).
05	Record of single bit, 439<COIL ADR<512; 967<COIL ADR<976
06	Record of single HOLDING REGISTER, 0<REG ADR<127 – in non-volatile memory;
16	Record of many consecutive HOLDING REGISTERS. Action field as a function 06 plus addresses 512-640. In REG ADR>512 the function is to record the calibration coefficients FLOAT in IEEE754 format.

Below are listed addresses (starting from 0), as a number of registers should be added 1.

MEASURED PARAMETER PV: HOLDING REG ADR 210, TYPE SINT, READ ONLY, dimension according to parameter DP (decimal point). For example for device with whole C° indication, the register consists of whole degrees. In a device with indication in tenths of a C° (XXX.X C°), respectively the content of this register is in tenths of C°.

SET-POINTS SPI, II, III, IV: HOLDING REG ADR 37, 38, 39, 40 TYPE SINT, dimension according to DP.

LOCK / UNLOCK OF THE KEYPAD: COIL ADR 505.
Non-volatile flag. Effects and controlls the mode of the front panel buttons of the device. 0-unlocked, 1-locked. It is also accessible through HOLDING REG ADR 31, bit1. Also it should be manipulated manually through the front panel.

INDICATION	ALARM	K4	K3	K2	K1	UnderRange	OverRange
COIL ADR (READ ONLY)	3032 0-off, 1-on	3031 0-off, 1-on	3030 0-off, 1-on	3029 0-off, 1-on	3028 0-off, 1-on	3027 0-no, 1-yes	3026 0-no, 1-yes

FIRMWARE VERSION : HOLDING REG ADR 126, TYPE UINT.

LED BARGRAPH: HOLDING REG ADR 140,141,142,143, TYPE UINT. Bargraph state. A bit for a LED. REG 140.7 is the first, 143,0 is the last. In color bargraph – respectively by two bits of a LED.

CALIBRATION MODE (CLBR) HOLDING REG ADR 249, TYPE UINT. Values: 0 — operating mode; 1-internal calibration; 2 - Pt1000; 3 - 10V; 4 - 20mA; 5 — confirms connected reference. If set 2,3 or 4 should not be changed without going through 0 or 5.

CALIBRATION COEFFICIENTS:
HOLDING REG ADR 512 - 524, 626, 628, TYPE FLOAT 4 BYTE IEEE754
RSP3 -512; RSP2-514; RSP1 -516; RSP0-518 - Polynomial calibration coefficients
'Non-standard input'.
Convert normalized linear input **0-10000**, for ranges **(0-1V, 0-10V, 0-20mA non-standard), µV(TC non-standard) , Ω (RTD400Ω non-standard), Ω/10 (RTD4KΩ non-standard)**, in measured quantity by polynomial degree three.
Note: Conversions 'Нестандартен вход' are to value of the measured quantity without decimal point. In this mode, the point has a decorative role. If it is necessary the measurements to be indicated with more or less digits after the decimal point, parameter dPnt should be changed and RSP0-3 coefficients should be scaled.
Example: 'non-standard input' 0-10000==>PV 0-200 is converted into 0-10000==>PV 0.0-200.0 when set dPnt=2 and RSP0=10.RSP0; RSP1=10.RSP1; RSP2=10.RSP2; RSP3=10.RSP3 .
K-522,P-520: Polynomial coefficients that convert a normalized linear input **0-10000** in measured quantity
Ret-526: coefficient in the conversion **ADC==>Ω**
Offset-524 - offset of the measured value
K_C4, K_C3: K_C4- 630 normalize **0-20mA==>0-10000**; K_C3- 632 normalize **0-10V==>0-10000**;

OTHER FEATURES:

- The individual bits of the registers are accessible through MODBUS FUNCTION 01 (READ SINGLE COIL), as COIL ADR = HOLDING REG ADR * 16 + NUMBER OF BIT (in byte). Add 8 if it is least-significant byte
- You don't have to read or record in registers non-specified in the manual. When you chang a register you have to comply limits for the typical parameter.
- In advance you have to ensure uniqueness of the addresses in more than one device on a line (parameter - nEtA).

Table with addresses of HOLDING REGISTERS for MODBUS RTU RS485 communication										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0										
10							Aout1 %4	Aout1 %20	Aout1 PV4	Aout1 PV20
20	rnGL	rnGH	A1P1	A1P0	Adb	Adbt	Filt	Conf	Sens	DP
30	Syst			Hyst1	Hyst2	Hyst3	Hyst4	SPI	SPII	SPIII
40	SPIV	ALLo	ALLH	bG0	bG1	bG2	bG3	bG4	bG5	bG6
50	bG7	coL1	coL2	coL3	coL4	coL5	coL6	coL7	TALo	TAHi
60	T1AL	T1AH								
120							Ver	ADR	!	!
130	!	!	!	!	!	!	!	!	!	!
140	bGr1	bGr2	bGr3	bGr4	!	!	!	!	!	!
150	!	!	!	!	!	!	!	!	!	!
200	!	!	!	!	!	!	!	!	!	!
210	!	!	!	!	!	!	!	!	!	!
240	!	!	!	!	!	!	!	!	!	CLBR
250	!	!	!	!	!	!	!	!	!	!
510			RSP3		RSP2		RSP1		RSP0	
520	K		P		OFS		Ret			
630	K_C4		K_C3							

The device memory is RAM and non-volatile. Grey fields are part from RAM memory. In power supply failure and restoring the power supply, this quantities initialize (equate) their values from their respective (not colored) fields in non-volatile memory or are formed according to the controller action.

All parameters in non-volatile memory have a maximum number of records – 1000000.

Service setting	Parameter	The setting is made by	
		Initials	Signature
Internal calibration	**[Clbr Intr]**		
RTD input	**[Pt 3]**		
Voltage input - 10V	**[10 v]**		
Current input - 20 mA	**[20nA]**		
!!!			
Settings backup	**Syst,St=1**		

CODE	**K1**	**K2**	**K3**	**K4**	**K5**	**AOut**	**RS485**
MS6026							

WARRANTY CARD

Warranty Card № : .....

Warranty : ..... months

Serial number : .....

The product is bought by : .....

with invoice № : ...../..... ..... 20.....

WARRANTY CONDITIONS

The warranty is valid only if this warranty card is filled legibly in ink, signed and stamped.

The warranty consists of free repair of all manufacturing defects that can occur during the warranty period. **The repair is done by presenting of this warranty card in the service base with which is bought the product.** The warranty does not cover damage caused by poor transport, poor storage, incorrect usage, forces of nature, failure to follow instructions and when others made an attempt to remove the defects. In these cases the defect can only be removed for a fee.

Service during the warranty period and settlement of claims is done under the current legislation.

REPAIRS MADE IN THE SERVICE BASE

Service	Data of entry	Order number	Type of the repair	Date of delivery	Performer of the repair

Seller: .....

Buyer: .....

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