APAR - Sales Office
05-090 Raszyn, ul. Gałczyńskiego 6, Poland
tel. (+48) 22-101-27-31, 22-853-48-56, 22-853-49-30
fax (+48) 22-101-27-33
Internet: www.apar.pl, email: automatyka@apar.pl

User instruction

UNIVERSAL DISPLAYS
two-channel
with alarms and clock

AR540

AR751

AR753

Version 2.0.4
2016.02.16

Thank you for choosing our product.
This instruction is intended to facilitate correct operation, safe use, and taking full advantage of the display's functionalities.
Before you start the device, please read and understand this instruction.
In the event of any additional questions, please contact our technical adviser.

CONTENTS


Please pay particular attention to the text marked with this sign.

The manufacturer reserves the right to make changes to the design and the software of the device without any deterioration of the technical parameters (some functions may not be available in older versions).

1. *SAFETY PRINCIPLES*

- before you start to use the device, become familiar with the present instructions
- in order to avoid electrocution or damage to the device, its mechanical and electrical installation must be performed by qualified workers
- before switching on the power supply, make sure that all cables and wires are properly connected
- before making any modifications to the wire and cable connections, switch off the voltage supplied to the device
- ensure proper operating conditions compliant with the technical specification of the device (chapter 5, power supply voltage, humidity, temperature)

2. INSTALLATION GUIDELINES

The device is designed so as to ensure an appropriate level of immunity to most interferences that may occur in industrial environments. In environments of unknown level of interferences, it is recommended to implement the following measures so as to prevent potential interference with the operation of the device:
a) do not supply the device from the same lines as high-power equipment without using appropriate power line filters
b) use shielded supply, sensor, and signal cables, whereby the earthing of the shield should be single-point and located as close to the device as possible
c) avoid running measurement (signal) cables in the direct vicinity of and parallel to power and supply cables
d) it is recommended to use twisted pair signal cables
e) avoid proximity of remotely controlled devices, electromagnetic meters, high power loads, loads with phase or group power control, and other devices that cause high impulse disturbances
f) ground or zero metal rails on which rail-mounted devices are installed

Make sure to remove the protective film from the LED display before the first use of the device.

3. GENERAL CHARACTERISTICS OF THE DISPLAY

- monitoring of temperature and other physical values (humidity, pressure, level, speed, etc.) processed to a standard electrical signal (0/4÷20mA, 0÷10V, 0÷60mV, 0÷2.5kΩ)
- 2 universal measurement inputs (thermoresistance, thermocouple, and analog) with additional functions:
  - mathematical (difference, total, and average values of measurements from two inputs)
  - with minimum and maximum memory of the measured value
  - with remote display of data (via the RS485 interface, MODBUS-RTU protocol, slave)
- real time clock shown alternately with measured values
- programmable 4 colors for the measurement channels show, the clock, the LED indicators and the alarms
- 2 independent alarm outputs of the on/off type (ON-OFF, heating, cooling, relative alarms, manual mode)
- alarm signaling with diode indicators and with programmable color of the display
- BIN digital input to change the operation mode:
  - start/stop for outputs
  - manual/automatic mode for outputs
  - stepwise change of the preset value (day/night) for alarms
  - stop of display indications for the measurements (HOLD function)
  - change or stop of switching of channels to be displayed
  - keypad block
  - unconditional preview of values measured from the inputs (when mathematical functions are displayed)
- analog output 0/4÷20mA or 0/2÷10V (alarm, retransmission)
- possibility to convert the input signals into the analog output standard in the retransmission mode;
- selection of the value controlling the operation of each output (any input, subtraction, addition, average of measurements)

manual mode (open control loop) available for binary outputs and the analog output, which makes it possible to set the value of the output signal in the range of 0-100%; possibility of self-activation in the event of sensor failure

- an integrated 24 V DC power supply supplying the field transducers
- RS485 serial interface (galvanically isolated, MODBUS-RTU protocol, SLAVE)
- compensation of line resistance for resistance sensors and of temperature of cold thermocouple tips
- programmable values be displayed (measurements, mathematical functions or remote), types of inputs, indication ranges (for analogue inputs), alarm, communication, access and display options and other parameters
- possibility to protect access to the configuration parameters with a user password
- parameter configuration methods:
  - from the film keypad located on the front panel of the device
  - through the RS485 or the AR956 (AR955) programmer and the free ARSOFT-CFG-WZ1 software (Windows Vista/7/8/10) or a user's application, MODBUS-RTU communication protocols
- software and the AR956 (or AR955) programmer that enables viewing measured values and quick configuration of single or ready sets of parameters that were saved earlier on the computer for future use, e.g. in other devices of the same type (copying of configuration);
- AR540 - an industrial housing made of polycarbonate ..... 222x146x55, protection rating IP65
  AR751 - wall mounted housing made of aluminum ..... 300x106x50, protection rating IP51
  AR753 - wall mounted housing made of aluminum ..... 500x166x35, protection rating IP51
- options to be selected (in the ordering method): 24 V AC/DC power supply, SSR alarm outputs, 0/2-10 V analogue output
- high accuracy, long-term stability, and immunity to interferences
- available accessories:
  - AR956 or AR955 programmer
  - RS485/USB converter

NOTE: 

Before you start working with the recorder, make sure to become familiar with this operating instruction and perform proper electrical and mechanical installation, as well as configuration of the parameters.

4. CONTENTS OF THE SET

- display
- user instruction
- warranty card

5. TECHNICAL DATA

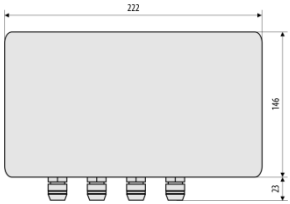
2 universal inputs (set with parameters inP1, inP2)	**measurement range**			
- Pt100 (RTD, 3- or 2-wire)	-200	÷	850	°C
- Ni100 (RTD, 3- or 2-wire)	-50	÷	170	°C
- Pt500 (RTD, 3- or 2-wire)	-200	÷	620	°C
- Pt1000 (RTD, 3- or 2-wire)	-200	÷	520	°C
- thermocouple J (Fe-CuNi)	-40	÷	800	°C
- thermocouple K (NiCr-NiAl)	-40	÷	1,200	°C
- thermocouple S (PtRh 10-Pt)	-40	÷	1,600	°C
- thermocouple B (PtRh30PtRh6)	300	÷	1,800	°C
- thermocouple R (PtRh13-Pt)	-40	÷	1,600	°C
- thermocouple T (Cu-CuNi)	-25	÷	350	°C
- thermocouple E (NiCr-CuNi)	-25	÷	820	°C
- thermocouple N (NiCrSi-NiSi)	-35	÷	1,300	°C
- current (R_{in} = 50 Ω)	0/4	÷	20	mA
- voltage (R_{we} = 33 kΩ)	0	÷	10	V

- voltage (R_{in} > 2 MΩ)		0 ÷ 60 mV
- resistance (3- or 2-wire)		0 ÷ 2,500 Ω
- remote data display (through RS485 or PRG port)		-1999 ÷ 9999
Response time (10 ÷ 90%)		0.5 ÷ 4 s (programmable with parameters F.d.1, F.d.2)
Resistance of leads (RTD, Ω)		R_d < 25 Ω (for each line)
Resistance input current (RTD, Ω)		400 µA (Pt100, Ni100), 200 µA (others)
Processing errors (at ambient temperature of 25 °C):		
- basic	- for RTD, mA, V, mV, Ω	0.1% of the measurement range ±1 digit
	- for thermocouples	0.2% of the measurement range ±1 digit
- additional for thermocouples		<2 °C (temperature of cold tips)
- additional from ambient temperature changes		< 0.003% of the input range /°C
Resolution of measured temperature		programmable, 0.1 °C or 1 °C
Range of indications (resolution of analog inputs)		-1999 ÷ 9999, programmable
Position of the decimal point for analog inputs		programmable, 0 ÷ 0.000
Binary input BIN (contact or voltage <24 V)		bistable, active level: short circuit or <0.8 V
Communication interfaces (RS485 and PRG, do not use at the same time)	- RS485 (galvanically isolated)	- speed 2.4-57.6 kb/s, - format 8N1 (8 data bits, 1 stop bit, no parity bit) - MODBUS-RTU protocol (SLAVE)
	- PRG programming connection (no isolation), standard	
Bi-state outputs (2-relays or SSR)	- relay (P1, P2), standard	5A / 250 VAC (for resistance loads), 1 main (SPDT-NO), 1 additional (SPST-NO)
	- SSR (SSR1, SSR2), option	transistor type NPN OC, 24 V, internal resistance 850 Ω
Analogue output (1 current or voltage)	- current 0/4 ÷ 20 mA (standard)	maximum resolution 1.4 µA (14 bit)
		load capacity of the output Ro < 1,000 Ω
	- voltage 0/2 ÷ 10 V (option)	maximum resolution 0.7 mV (14 bit)
		load capacity of the output Io < 3.7 mA (Ro > 2.7 kΩ)
	- output basic error	< 0.1% of the output range
7-segment LED display (4 digits, with adjustment of control and brightness)		AR540 - 57 mm, AR751 - 57 mm, AR753 - 100 mm, 4 colors (red, orange, yellow, green)
Signaling	- relay active	LED diodes, 4 colors (the same as for the display)
	- number of channel shown	
	- messages and errors	LED display
Power supply (Usup)	- 230 VAC (standard)	85-260 VAC/5VA
	- 24 VAC/DC (option)	20-50 VAC/ 5 VA, 22-72 VDC/ 5 W
Power supply of field transmitters		24 VDC / 50 mA
Rated operating conditions		0-50 °C, <100% RH (non-condesing)
Operating environment		air and neutral gases
Enclosure protection rating and mounting method		AR540 - IP65, industrial enclosure, wall-mounted AR753, AR751 - IP51, aluminum enclosure
Weight		AR540 - 800 g, AR751 - 1,100 g, AR753 - 2,300 g
Electromagnetic compatibility (EMC)		immunity: according to the PN-EN 61000-6-2
		emissivity: according to the PN-EN 61000-6-4

6. ENCLOSURE DIMENSIONS AND INSTALLATION DATA

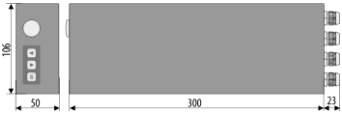
a) general data and dimensions of AR540

Enclosure type	industrial IP65, Gainta G218
Material	polycarbonate
Dimensions	222 x 146 x 55 mm (W x H x D)
Fixing methods	4 holes, dia. 4.3 mm, distance 210x116 mm, accessible after the front cover is removed
Conductor cross-sections	2.5 mm^2 (supply and bi-state outputs), 1.5 mm^2 (others)



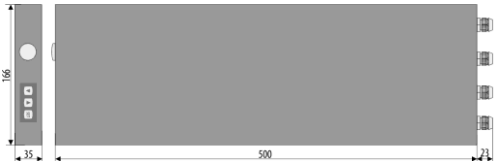
b) general data and dimensions of AR751

Enclosure type	wall-mounted IP51, DELTA-BOX
Material	aluminum
Dimensions	300 x 106 x 50 mm (W x H x D)
Fixing methods	in horizontal guide rails on the back of the enclosure (e.g. with M4 or M5 screws into nuts inserted into the guide rails)
Conductor cross-section	2.5 mm^2 (supply and bi-state outputs), 1.5 mm^2 (others)



c) general data and dimensions of AR753

Enclosure type	wall-mounted IP51, DELTA-BOX
Material	aluminum
Dimensions	500 x 166 x 35 mm (W x H x D)
Fixing methods	in horizontal guide rails on the back of the enclosure (e.g. with M4 or M5 screws into nuts inserted into the guide rails)
Conductor cross-sections	2.5 mm^2 (supply and bi-state outputs), 1.5 mm^2 (others)



d) AR540 - installation of the cabling

- isolate the power supply before making any changes to the cabling

- remove 6 screws in the front cover and take it off the device
- the electric cables must be inserted into the enclosure through cable glands
- in order to achieve the IP65 rating, the nuts of the cable glands and the enclosure cover must be tightened precisely

e) AR751 and AR753- installation of the cabling

- isolate the power supply before making any changes to the cabling

- unscrew the screws fastening the left side of the enclosure (the one with the keyboard) and move it away from the enclosure
- in order to gain access to the connections, slide the front panel (Plexiglas) to the left out of the guide rail
- in order to make installation easier, the printed circuit board with the connections can also be moved a few centimeters to the left
- the electric cables must be inserted into the enclosure through cable glands

- the power supply should be provided through the upper gland; the earthing/zero wire (most often yellow-green) should be connected to the protective terminal (PE)

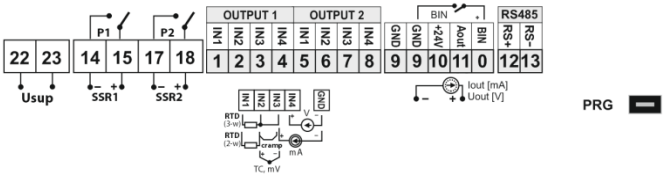
7. DESCRIPTION OF TERMINAL STRIPS AND ELECTRICAL CONNECTIONS

The wire terminals are accessible after the front cover has been removed; see chapter 6.

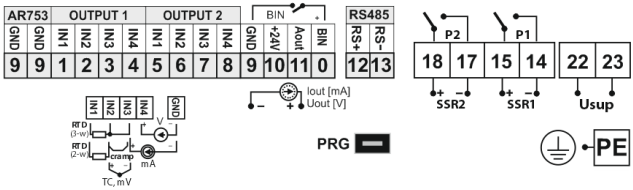
Table 7. Numbering and description of terminal strips

Terminals	Description
IN1- IN2- IN3	input Pt100, Ni100, Pt500, Pt1000, resistance, (2- and 3-wire)
IN2- IN3	thermocouple input TC (J, K, S, B, R, T, E, N) and voltage input 0÷60 mV
IN3- GND (9)	current input 0/4÷20 mA
IN4- GND (9)	voltage input 0÷10 V
10	output +24 V (in relation to 9-GND) of the integrated power supply of field transducers
11- GND (9)	analogue current output (0/4-20 mA) or voltage output (0/2-10 V)
0 - GND (9)	binary input BIN (contact or voltage <24 V)
PRG	programming connection for cooperation with the programmer **(only AR956 or AR955)**
12-13	RS485 serial interface (MODBUS-RTU transmission protocol)
22-23	power supply input 230 VAC or 24 VAC/DC
14-15	relay output P1 or SSR1
17-18	relay output P2 or SSR2
PE	protective terminal

a.1) **AR540** - numbering of connections and method of connecting sensors and measurement signals (described in Table 7)



a.2) **AR751, AR753** - numbering of connections and method of connecting sensors and measurement signals (described in Table 7)

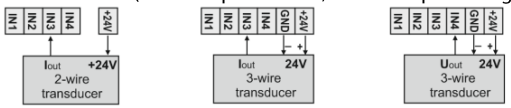


NOTE:

- **AR751 and AR753 have metal enclosure which must be earthed/zeroed by connecting earthing/zero wire (most often yellow-green) to the protective terminal (PE) (inside the enclosure next to the upper gland).**
- For connecting the device to a computer through the PRG socket, use only the AR956/955 programmer, a connection made with a regular USB cable may cause damage to the equipment.

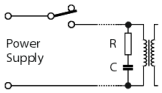
In the AR540, the programming connection is accessible after the front panel has been removed; in the AR751 and AR753, the programming connection is accessible after the plug is unscrewed in the left side (next to the keyboard).

b) connection of a 2- and 3-wire transducer (Iout - output current, Uout - output voltage)



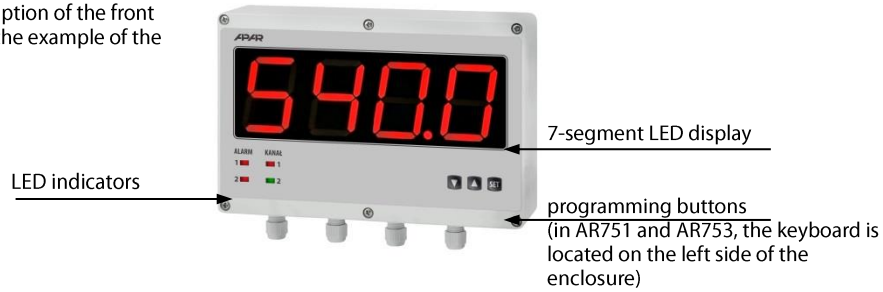
8. IMPORTANT COMMENTS PERTAINING TO OPERATION - *use of fire suppression systems*

If an induction load is connected to the transmitter's contacts (e.g. a contactor coil or a transformer), when the contacts open up there are frequent overvoltages and electrical arcs caused by the discharge of the energy gathered in the induction. The particularly negative consequences of such overvoltages include reduced service life of contactors and transmitters, damage to semiconductors (diodes, thyristors, and triacs), damage to or interference with the control and measurement systems and emission of electromagnetic field that interferes with local devices. In order to avoid such consequences overvoltages must be reduced to a safe level. The simplest method is to connect an appropriate suppression module **directly** to the terminals of the inductive load. Generally speaking, appropriate types of suppression circuits must be selected for each type of inductive load. Modern contactors are generally fitted with appropriate factory-made suppression circuits. If such circuits are lacking, a contactor with an integrated suppression system must be purchased. Temporarily, the load can be shunted with RC system, e.g. R=47 Ω/1 W and C=22 nF/630 V. The fire suppression circuit must be connected to the inductive load terminals. The use of suppression circuit limits burning of relay contacts in controller and reduces likelihood of their sticking.



9. FUNCTIONS OF BUTTONS AND LED INDICATORS. MINIMUM AND MAXIMUM VIEW

Fig. 9. Description of the front panel using the example of the AR540



a) button functions in measurement display mode

Button	**Description** [and marking in contents of the instructions]
▲ lub ▼	**[UP]** or **[DOWN]**: changes the preset value for output 1 (parameter 27: SEt 1 when output 1 works as an alarm, or 41: HSEt when output 1 in the manual mode, chapters 10 and 12.4)
SET	**[SET]** : - input in the quick access menu (chapter 11) when outputs 1 or 2 are active
▲ + ▼	**[UP]** and **[DOWN]** (at the same time): input in the parameter configuration menu (after hold time longer than 1 s). If parameter 44: PPro = on (password protection is activated) enter the access code (chapter 10)
SET + ▲	**[SET]** and **[UP]** : - displays the saved **MAXIMUM VALUE** of the measurement of the current channel - deletes the maximum value of the measurement (after hold time > 6 s)
SET + ▼	**[SET]** and **[DOWN]** : - displays the saved **MINIMUM VALUE** of the measurement of the current channel - deletes the minimum value of the measurement (after hold time > 6 s)
[UP], [DOWN], [SET]	when any button is pressed, the channels of the display are switched

b) button functions in the parameter configuration menu and the quick access menu (chapters 10 and 11)

Button	Description [and marking in the contents of the instructions]
SET	**[SET]**: - selects the item displayed in the configuration menu (entering a lower level) - edits the current parameter (the value blinks on the display) - approves and saves the edited parameter value
▲ lub ▼	**[UP]** or **[DOWN]:** - moves to the next or previous parameter (submenu) - changes the value of the edited parameter
▲ + ▼	**[UP]** and **[DOWN]** (simultaneously): - returns to the previous menu (higher level) - cancel changes to the edited value (the blinking stops) - returns to the measurement display mode (only **[UP]** and **[DOWN]** after hold time >0.5 s)

c) functions of the LED signaling indicators

Diode [marking]	Description
1 [A1] 2 [A2]	**ALARM**: signals switching on of outputs P1/SSR1 and P2/SSR2
1 [K1] 2 [K2]	**CHANNEL**: signals the number of the currently shown channel of the display (when the clock is displayed, both indicators are off)

9.1. BINARY INPUT

Binary input **BIN** performs a function that is programmable with parameter 39: Func (chapter 10). The **BIN** input works with the bi-stable signal i.e. the supplied signal (voltage or switch) must be permanent (on/off type). Activation or deactivation of the function is indicated by appropriate messages on the lower display (described below). The **BIN** input is in the active state for a short circuit or a voltage <0.8 V.

Table 9.1. Available **BIN** input functions

Source	Description (depending on the value of parameter 39: Func)		Message
BIN	Func = nonE	the **BIN** input is inactive (factory setting)	-
	Func = SEt2	discrete change of set value for P1/SSR1 output (day = parameter 27: SEt1 /night = 32: SEt3, Table 10)	SEt1 / SEt2
	Func = bLoc	keypad block	bLoc / boFF
	Func = hAn1	unconditional manual mode for the P1/SSR1 output (chapter 12.4)	hAnd / hoFF
	Func = hAn2	unconditional manual mode for the P2/SSR2 output	hAnd / hoFF
	Func = hAnA	unconditional manual mode for the analogue output	hAnd / hoFF
	Func = StSP	start/stop for alarms (applies to all outputs)	StAr / StoP
	Func = inPu	unconditional view of the measured values from inputs 1 and 2	inoF / inPu
	Func = nonE	stop/change of the channel to be displayed	noch / nEch
	Func = hoLd	stop of display indications for the measurements (HOLD function)	hdoF / hoLd

10. SETTING OF THE CONFIGURATION PARAMETERS

All configuration parameters of the meter are contained in the non-volatile (permanent) internal FLASH memory (data is saved in the memory only when the power supply is being switched off and provided that the settings were changed).

When the device is switched on for the first time, an error message may be shown in the display due to the lack of a sensor or the fact that the sensor that is connected is not one that is factory-programmed. In such an event, the proper sensor or analog signal must be connected and the configuration must be programmed.

There are two parameter configuration methods:

1. From the film keypad located on the front panel of the device:

- from the mode where the input measurements are displayed in the configuration menu (press the **[UP]** and **[DOWN]** buttons simultaneously for more than 1 second) If parameter 44: PrOt = on (password protection is on) the display will show the message CodE, and then 0000 with the first digit blinking, use the buttons **[UP]** or **[DOWN]** to enter the password (default parameter 43: PASS = 1111), to move to successive items and to approve the code, use the **[SET]** button
- after entering the main configuration menu (with the message ConF) the display shows a mnemonic name of the submenu (parameter groups: diSP <-> in1 <-> in2 <-> etc.)
- use the **[UP]** or **[DOWN]** button to move to the relevant submenu and then use the **[SET]** button to approve the selection (the mnemonic name of the parameter is now displayed)
- by pressing the **[UP]** button, you can move to the next parameter, and by pressing the **[DOWN]** button - to the previous parameter (e.g. inP <-> FiLt <-> dot <-> etc., the list of the configuration parameters is presented in Table 10)
- to change the value of the current parameter, press briefly the **[SET]** button (the parameter blinks in the edition mode)
- use buttons **[UP]** or **[DOWN]** to change the value of the edited parameter
- approve the changed value of the parameter by pressing the **[SET]** button or cancel it by pressing the **[UP]** and **[DOWN]** buttons (briefly press them simultaneously) - by pressing the **[UP]** and **[DOWN]** buttons again, you will return to the main configuration menu (one level above)
- to exit the configuration: press the **[UP]** and **[DOWN]** buttons for a long moment or wait approx. 2 minutes

2. Use the RS485 or the PRG port (AR956/955 programmer) and the ARSOFT-CFG-WZ1 software (chapter 14):

- connect the display to a computer port and start and configure the ARSOFT-CFG-WZ1 application
- after the connection has been established, the current measured value is displayed in the window of the software
- setting and viewing of the device parameters is possible in the parameter configuration window
- new parameter values must be approved with the ***Approve changes*** button
- the current configuration can be saved in a file or set using values read from a file

NOTE: 

- before disconnecting the device from a computer, press the ***Disconnect device*** button (ARSOFT-CFG-WZ1)
- in the event of no response:
  - in the ***Program options*** check the configuration of the port and the ***MODBUS Address of the device***
  - make sure that the serial port drivers on the computer have been properly installed for the RS485 converter or the AR956 (AR955) programmer
  - disconnect for a few seconds and then reconnect the RS485 converter or the AR956 (AR955) programmer
  - restart the computer

In the event of indications different from the actual value of the input signal, the zero and the sensitivity of a sensor can be tuned: parameters 15: cAo1 and 22: cAo2 (zero), and 16: cAG1 and 23: cALG (sensitivity).

To restore the factory settings, when the power supply is switched on press buttons **[UP]** and **[DOWN]** and hold them until the password menu appears (CodE), and then enter the following code 0112. As an alternative, a file with default configuration can be used in the ARSOFT-CFG-WZ1 software.

NOTE:

Do not perform configuration of the device with the keypad and through the serial interface (RS485 or PRG connection) at the same time.

Table 10. List of configuration parameters

Parameter	Range of variability of the parameter and description		Default settings
DISPLAY OPTIONS – submenu dISP			
0: dIS1 value to be displayed for the 1st channel	inP1 = measurement from input 1 (present only in dIS1), inP2 = measurement from input 2, Subt = difference between measurements (1-2), Add = sum of measurements (1+2), Aurg = average value of measurements (sum of measurements from two inputs divided by 2), SEt1 = set value of output 1 (27: SEt1 or 41: HSEt in the manual mode), oFF = the channel of the display is switched off (present only in dIS2)		inP1
1: dIS2 value to be displayed for the 2nd channel			oFF
2: dIS3 a real time clock (as the 3rd channel)	oFF	display of the real time clock (RTC) is switched off	tiME
	tiME	display of the real time clock (RTC) is switched on	
3: dPEr display channels switching period	3 ÷ 60 sec.	single channel display time	5 sec.
4: coL1 color of the 1st channel	GrEE = green, YELL = yellow, orAn = orange, rEd = red, coLo = no alarm signalized by a changed color of the display (applies only to parameter 7: AcoL - the color of the display for the activated alarm, can be seen when the channel triggering that alarm)		rEd
5: coL2 color of the 2nd channel			GrEE
6: coL3 color of the 3rd channel (RTC)			YELL
7: AcoL alarm color			coLo
8: LcoL color of the LED diodes			rEd
9: brig illumination brightness	1 ÷ 3	level of illumination brightness of the display (3 = 100%)	3
CONFIGURATION OF MEASUREMENT INPUTS (submenu in1 for input 1 and, analogously, in2 for input 2) – the parameters for input 1 (the number and name of the parameter for input 2 are given in the parenthesis) are shown below			
10: inP1 (17: inP2) type of measurement input	Pt	thermoresistance sensor (RTD) Pt100 (-200 ÷ 850 °C)	Pt
	ni	thermoresistance sensor (RTD) Ni100 (-50 ÷ 170 °C)	
	Pt5	thermoresistance sensor (RTD) Pt500 (-200 ÷ 620°C)	
	Pt10	thermoresistance sensor (RTD) Pt1000 (-200 ÷ 520°C)	
	tc-J	thermoelectric sensor (thermocouple) type J (-40 ÷ 800°C)	
	tc-K	thermoelectric sensor (thermocouple) type K (-40 ÷ 1,200°C)	
	tc-S	thermoelectric sensor (thermocouple) type S (-40 ÷ 1,600°C)	
	tc-b	thermoelectric sensor (thermocouple) type B (-300 ÷ 1,800°C)	
	tc-r	thermoelectric sensor (thermocouple) type R (-40 ÷ 1,600°C)	
	tc-t	thermoelectric sensor (thermocouple) type T (-25 ÷ 350°C)	
	tc-E	thermoelectric sensor (thermocouple) type E (-25 ÷ 820°C)	

	tc-n	thermoelectric sensor (thermocouple) type N (-35÷ 1,300°C)	
	4-20	current signal 4 ÷ 20 mA	
	0-20	current signal 0 ÷ 20 mA	
	0-10	voltage signal 0 ÷ 10 V	
	0-60	voltage signal 0 ÷ 60 mV	
	rES	resistance signal 0 ÷ 2,500 Ω	
	rEAd	remote input from the RS485 or PRG port, chapter 16, Table 16.6	
11: Filt (18: Flt2) filtration **(1)**	1÷20	digital filtration of measurements (response time)	4
12: dot1 (19: dot2) position of the point/resolution	0	no point **(2)** or 1°C for temperature	1 (0.1 °C)
	1	0.0 **(2)** or resolution 0.1 °C for temperature	
	2	0.00 **(2)**	
	3	0.000 **(2)**	
13: Lo1 (20: Lo) lower limit or bottom of the indication range (**2**)	-199.9 ÷ 1800	lower setting limit for the preset value 20: SEt1 or 25: SEt2	-199.9 °C
	-999 ÷ 9999	indication 0/4 mA, 0 V, 0 Ω - start of the input scale (**2**)	
14: Hi1 (21: Hi1) upper limit 1 or top of the indication range	-199.9 ÷ 1800	upper setting limit for the preset value 20: SEt1 or 25: SEt2	850.0 °C
	-999 ÷ 9999	indication for 20 mA, 10 V, 60 mV, 2.5 kΩ - end of the input scale **(2)**	
15: cAo1 (22: cAo1) calibration of the zero	zero offset for measurements: -50.0 ÷ 50.0 °C or -500 ÷ 500 units (2)		0.0 °C
16: cAG1 (23: cAG1) gain	850 ÷ 1150 %	calibration of inclination (sensitivity) for measurements	1000 %
MAIN OUTPUT CONFIGURATION (P1/SSR1) – submenu out1 - chapter 12 (12.2)			
24: Cos1 control signal for output 1 (assignment of input)	inP1 = measurement from input 1, inP2 = measurement from input 2, Subt = difference between measurements (1-2), Add = sum of measurements (1+2), Aurg = average value of measurements (sum of measurements from two inputs divided by 2)		inP1
25: Fto1 failure status of output 1 **(3)**	output status in the case of lack of or damage to the measurement sensor (signal): noCh = no change, oFF = switched off, on = switched on, hAnd = manual mode with set output signal level (parameter 26: HSEt, chapter 12.4)		noCh
26: Fun1 function of output 1	oFF = off, hAnd = manual mode, inv = heating, dir = cooling		oFF
27: SEt1 preset value 1	applies to output 1, changes in scope 6: Lo1 ÷ 7: Hi1 or 13: Lo2 ÷ 14: Hi2 (only when 17: Cos1 = inP2)		1000 °C
28: Hy1 hysteresis of output 1 or PID tuning zone	hysteresis or insensitivity zone of PID tuning in mode Auto, chapter 12.5 0.0 ÷ 999.9 °C or 0 ÷ 9999 units **(2)**		1.0 °C
CONFIGURATION OF THE AUXILIARY OUTPUT (P2/SSR2) – submenu out2 - chapter 12			
29: Cos2 control signal for output 2 (assignment of input)	inP1 = measurement from input 1, inP2 = measurement from input 2, Subt = difference between measurements (1-2), Add = sum of measurements (1+2), Aurg = average value of measurements (sum of measurements from two inputs divided by 2)		inP1

30: FtoE failure status of output 2 **(3)**	output status in the case of lack of or damage to the measurement sensor (signal): noCh = no change, oFF = switched off, on = switched on, HAnd = manual mode with set output signal level (parameter 26: HSEt, chapter 12.4)	noCh
31: Fun2 function of output 2 (chapter 12.2)	oFF = off, HAnd = manual mode, inU = heating, d ir = cooling, bAon or bAoF = band 2* SEt2 (SEt3 for output 3) around SEt 1, dEoF or dEon = deviation from SEt 1	oFF
32: SEt2 preset value 2	applies to output 2, changes in scope 13: Lo2 ÷ 14: H i2 or 6: Lo 1 ÷ 7: H i1 (only when 22: toS2 = inP 1)	1000 °C
33: H2 hysteresis of output 2	0.0 ÷ 999.9 °C or 0 ÷ 9999 units **(2)**	1.0 °C
ANALOG OUTPUT CONFIGURATION – submenu outA - (chapter 12.3)		
34: toSA control signal for the analogue output assigned inputs)	inP 1 = measurement from input 1, inP2 = measurement from input 2, Subt = difference between measurements (1-2), Add = sum of measurements (1+2), Aurg = average value of measurements (sum of measurements from two inputs divided by 2)	inP 1
35: AtyP type of analog output	depending on the order code: for current output 0-20 or 4-20 mA, for voltage output 0-10 or 2-10 V	0-20 mA (0-10 V)
36: FunA function of analogue output	oFF = off, HAnd = manual mode, rEtr = retransmission of measurement, cont = control output, a detailed description is provided in chapter 12.3	oFF
37: A-Lo lower indication for retransmission	start of the output scale - for output signal value 0/4 mA or 0/2 V (the parameter is active only for measurement retransmission when 36: FunA = rEtr)	0.0 °C
38: A-H upper indication for retransmission	end of the output scale - for output signal value 20 mA or 10 V (the parameter is active only for measurement retransmission when 36: FunA = rEtr)	100.0 °C
CONFIGURATION OF THE BINARY INPUT BIN AND THE MANUAL MODE – submenu binM		
39: Func binary input **BIN** function (chapter 9.1) 	nonE	the **BIN** input is inactive
	SEt2	change of the preset value (day/night) for output 1
	bLoc	keypad block
	HAn1	unconditional manual mode for output 1 (P1/SSR1)
	HAn2	unconditional manual mode for output 2 (P2/SSR2)
	HAnA	unconditional manual mode for the analogue output
	StSP	control start/stop (applies to all outputs)
	inPu	unconditional view of the measured values from inputs 1 and 2
	honE	stop/change of the channel to be displayed
	hoLd	stop of indications for the measurements (HOLD function)
		nonE
40: tc impulse period	3 ÷ 360 s	period of switching of the status of outputs 1 and 2 in the manual mode	5 s
41: HSEt preset value of the manual mode	0 ÷ 100 % 1% step	control value for outputs in the manual mode, applies to all outputs (1, 2, and the analogue output), chapter 12.4	50.0 %
ACCESS OPTIONS – submenu AccE		
42: bSEt value change	oFF = no blocks, SEt 1 = block of parameter 27: SEt 1, SEt2 = block 25:	oFF

block SEt1, SEt2	SEt2, both = simultaneous block of changes to parameters 27: SEt1 and 32: SEt2		
43: PASS password	0000 ÷ 9999	password for the parameter configuration menu	1111
44: PPro protection of the configuration with a password	oFF	entry into the configuration menu is **not** password-protected	on
	on	entry into the configuration menu is password-protected	
COMMUNICATION OPTIONS AND SETING OF THE REAL TIME CLOCK– submenu trCL			
45: Addr MODBUS-RTU address	1 ÷ 247	individual address of the device in the RS485 network (chapter 16)	1
46: br communication speed for RS485 and the PRG connection	2.4 kbit/s, 4.8 kbit/s, 9.6 kbit/s, 19.2 kbit/s, 38.4 kbit/s, 57.6 kbit/s		19.2 kbit/s
47: t.mE clock time	00:00 ÷ 23:59	setting the time of the clock (RTC) in the hh:mm format	current

Notes: **(1)** – for F.tL = 1 the response time is equal to 0.5 s, for F.tL = 20 it is equal to at least 4 s.
Higher degree of filtration means a "smoother" measured value and a longer response time, which is recommended in the case turbulent measurements (e.g. water temperature in the boiler).
(2) – applies to analog inputs (mA, V, mV, Ω)
(3) – the parameter also defines the state of the output outside of the measurement range

11. QUICK ACCESS MENU

In the measurement mode (when the measured values are displayed), it is possible to immediately access certain configuration parameters and functions without the need to enter a password. This possibility is offered by the quick menu, which can be accessed by pressing the **[SET]** button. The parameter is selected and edited in the same way as described above (in chapter 10).

Table 11. Complete list of elements accessible in the quick configuration menu.

Element	Description
SEt1	preset value 1 (parameter 27: SEt1), optional element - unavailable when parameter 26: Fun1 = HAnd, changes blocked at the time of change of the preset value 1 to SEt2 (chapter 9.1)
SEt2	preset value 2 (32: SEt2), optional element - unavailable when parameter 31: Fun2 = oFF or HAnd
HSEt	preset value of the manual mode (41: HSEt), optional element - available for outputs in the manual operation mode

12. OUTPUTS CONFIGURATION

The programmable architecture of the display enables using it in many fields and applications. Before the operation of the device starts, it is necessary to set the parameters according to specific requirements (chapter 10). A detailed description of configuration of the operation of outputs is given in chapters 12.1÷ 12.4. The default (factory) configuration is the following: outputs 1 is related to input 1 and output 2 is related to input 2, control mode ON/OFF with hysteresis, output 3 and the analog outputs are switched off (Table 10, *Factory settings* column).

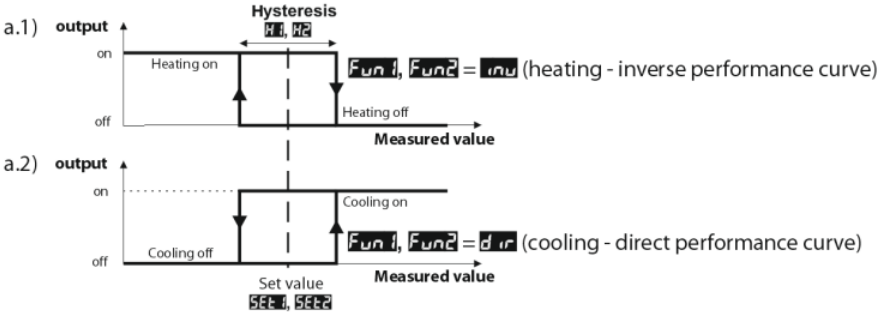
12.1. CHANGING THE OUTPUT SET VALUES

The simplest way to change the preset value for output 1 (parameter 27: SEt1 or 41: HSEt when output 1 is in the manual mode) is to use the **[UP]** button or the **[DOWN]** button. In the case of the other outputs, the quick menu can be used (chapter 11). As an alternative, it is possible to change the preset value in the parameter configuration mode (using the methods described in chapter 10).

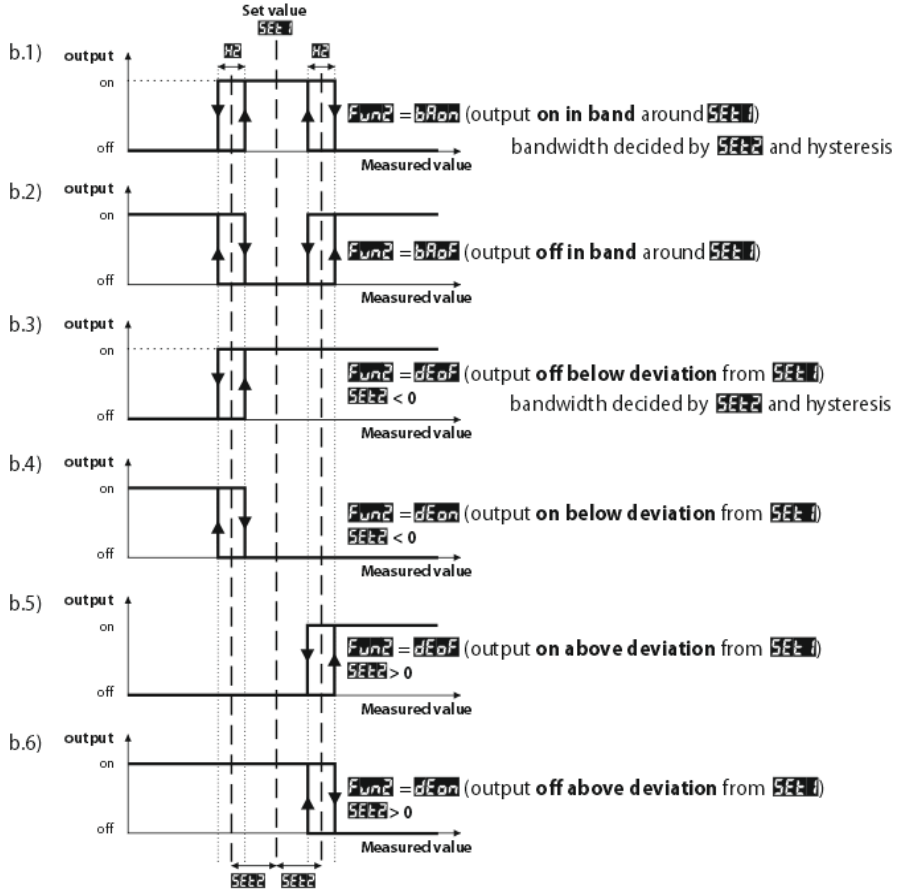
12.2. TYPES OF OUTPUT CHARACTERISTICS

The type of operation of each output is programmed using parameters 26: Fun1 and 31: Fun3, chapter 10, Table 10.

a) basic operating characteristics of outputs



b) additional operating characteristics of outputs (applies only to output 2)



12.3. ANALOG OUTPUT

The standard of the output signal is determined by parameter 35: AtyP (chapter 10, Table 10). The analogue output can work in one of the following modes: retransmission of measurement (parameter 36: outA = rEtr), manual mode (36: outA = hAnd) and as an automatic control output (36: FunA = out1).
In the mode of retransmission of a selected measurement (34: coSA) the output signal is proportional to the signal measured in the range set by parameters 37: A-Lo and 38: A-H1 (e.g. 0 mA for the measured value 0 °C when A-Lo = 0 °C, 20 mA for 100 °C when A-H1 = 100 °C and, as appropriate, 10 mA for the half of the range, i.e. 50 °C).
Manual operation (chapter 12.4) enables smooth change of the output signal in the range of 0-100% with an increment of 1% and the initial value equal to the last value in the automatic mode (measurement retransmission or alarm mode).
In the alarm output mode, the alarm parameters and their functions are identical as in the case of output 1 (the applicable parameters are 24: coS1, 25: Fto1, 26: Fun1, 27: SEt1, 28: H1) . In the alarm mode (type ON-OFF with hysteresis), the output assumes limit values (lower or upper value, e.g. 0mA or 20mA) without the intermediate values, which may be used to switch on, e.g. the SSR relay.

12.4. MANUAL AND REMOTE CONTROL FUNCTION

The manual mode enables setting the value of the output signal in the entire range of its variability (0-100%), thus enabling operation in an open regulation loop (no automatic coupling between the measured value and the output signal). Manual operation is available individually for each output of the device and is programmed using parameters 26: Fun1, 31: Fun2, and 36: Fun3, chapter 10, Table 10. Also, outputs can be configured for quick (unconditional) manual mode controlled by:

- the **BIN** binary input, by programming as appropriate parameter 39: Func (chapter 9.1),
- measurement error of the sensor (range exceeded or a defect), when 25: Fto2, or 30: Fto3 is equal to hAnd

In the case of bi-state outputs (1, 2), the change of the output signal consists in setting the filling coefficient (using parameter 41: H5Et) with impulse period defined by parameter 40: tc. The preset value of the manual mode 41: H5Et = 0 stands for a permanently switched off output; value 100 stands for a permanently switched on output. The value can be set directly using the **[UP]** or **[DOWN]** button (only in the case of output 1, chapter 12.1) or using the quick menu (chapter 11) or alternatively in the parameter configuration mode (from the film keypad or remotely using the serial RS485 or PRG port, chapters 10, 14-16).

13. MESSAGE AND ERROR SIGNALING

a) measurement errors:

Code	Possible causes of error
---- ____	- the measurement range of the sensor is exceeded from the top (----) or from the bottom (____) - the sensor is broken - the sensor that is connected is different than the one that is set in the configuration (chapter 10, parameter 10: inP1 or 17: inP2)

b) temporary messages and errors (one-time and recurring):

Code	Description of message
CodE	mode of entering the password for access to the configuration parameters, chapter 10
Err	the password is invalid,
ConF	the parameter configuration menu was accessed,
StAr / StoP	control start/stop, chapter 9.1
SEt1 / SEt2	change of the preset value (day/night) for output 1, chapter 9.1
bLoc / boFF	keypad block on/off, chapter 9.1

HAnd / hoFF	unconditional manual mode on/off, chapter 9.1
inoF / inPu	unconditional view of the measured values from inputs 1 and 2, chapter 9.1
hoch / nEch	stop/change of the channel to be displayed, chapter 9.1
hdoF / hoLd	stop of display indications for the measurements (HOLD function), chapter 9.1
SAvE	saving of factory parameter values (chapter 10)

14. CONNECTING THE CONTROLLER TO A COMPUTER AND AVAILABLE SOFTWARE

It may be useful (or necessary) to connect the display to a computer in the following situations:
- remote monitoring and recording of current measurement data and process (status of the outputs) control;
- quick configuration of parameters, to include copying of settings to other displays of the same type

In order to establish communication over long distances, it is necessary to establish a connection in the RS485 standard with an available port in the computer (directly or using an RS485 converter), as described in chapter 15. Moreover, as a standard, the displays are equipped with PRG port which enables connecting to a computer using AR956/955 programmer (without galvanic separation, cable length approx. 1.2 m). Both the programmer and the RS485 converter require installation of the supplied serial port drivers on the computer. Communication with devices is effected using a protocol compatible with MODBUS-RTU (chapter 16). The following applications are available (on a CD delivered with the AR956/955 programmer or to be downloaded from the Internet at ***www.apar.pl***, *Download section*, for operating systems Windows Vista/7/8/10):

Name	Software description
ARSOFT-CFG-WZ1 (free)	- display of current measurement data from the connected device - configuration of the type of measurement input, the indication range, the alarm options, the display, the communication, etc. (chapter 10) - creation on the disk of a "cfg" file with the current configuration of the parameters for future use (copying of configuration) - the software requires communication with the display via the RS485 or PRG port (AR956/955)
ARSOFT-WZ2 (payable)	- display and recording of current measurement data from a maximum of 30 channels (only from devices made by APAR) - the software requires communication with the display via the RS485 or PRG port (AR956/955)

The detailed descriptions of the aforementioned applications can be found in the installation folders.

NOTE: 

Before establishing the connection, make sure that the MODBUS address of the device (parameter 45: Addr) and the speed of transmission (46: br) are the same as the settings of the software. Moreover, in the software options, set the number of the COM serial port in use (in the case of the RS485 converter or the AR956/955 programmer, this is the number assigned by the operating system during installation of the drivers).

15. RS485 COMMUNICATION INTERFACE (acc. to EIA RS-485)

The installation specification for the RS485 interface is the following:
- maximum cable length - 1 km (observe the installation guidelines, chapter 2, sub-items b, c, and d)
- maximum number of devices in a RS485 line - 30, in order to increase the number, use RS485/RS485 amplifiers
- termination and polarizing resistors when the MASTER is at the start of the line (Fig. 15):
  - at the start of the line - 2 x 820 Ω to the ground and +5 V of the MASTER and 150 Ω between lines
  - at the end of the line - 150 Ω between lines
- termination and polarizing resistors when the MASTER is in the centre of the line:
  - at the converter - 2 x 820 Ω, to the ground and +5 V of the converter
  - at both ends of the line - 150 Ω each between lines

Equipment from different manufacturers that form the RS485 network (e.g. RS485 converters/USB) may have integrated polarizing and terminating resistors; in such a case there is no need to use external elements.

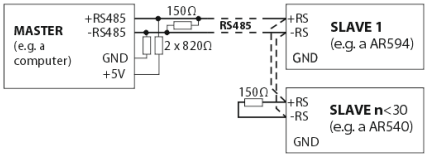


Fig. 15. Pictorial diagram of the RS485 network

16. MODBUS–RTU SERIAL TRANSMISSION PROTOCOL (SLAVE)

Character format : 8 bits, 1 stop bit, no parity bit
Available functions : READ - 3 or 4, WRITE - 6

Table 16.1. Claim frame format for the READ function (frame length - 8 bytes):

address of the device	function 4 or 3	read register address: 0 ÷ 75 (0x004B)	number of read registers: 1 ÷ 76 (0x004C)	CRC check sum
1 byte	1 byte	2 bytes (HB-LB)	2 bytes (HB-LB)	2 bytes (LB-HB)

Example 16.1. Reading of a register with address 0: 0x01 - 0x04 - 0x0000 - 0x0001 - 0x31CA

Table 16.2. Claim frame format for the WRITE function (frame length - 8 bytes):

address of the device	function 6	write register address: 0 ÷ 75 (0x004B)	write register value	CRC check sum
1 byte	1 byte	2 bytes (HB-LB)	2 bytes (HB-LB)	2 bytes (LB-HB)

Example 16.2. Entry in a register with address 10 (0xA) with the 0 value: 0x01 - 0x06 - 0x000A - 0x0000 - 0xA9C8

Table 16.3. Response frame format for the READ function (minimum frame length - 7 bytes):

address of the device	function 4 or 3	number of bytes in the data field (max. 76*2=152 bytes)	data field - register value	CRC check sum
1 byte	1 byte	1 byte	2 ÷ 140 bytes (HB-LB)	2 bytes (LB-HB)

Example 16.3. Response frame for register value equal to 0: 0x01 - 0x04 - 0x02 - 0x0000 - 0xB930

Table 16.4. Response frame format for the WRITE function (frame length - 8 bytes):

copy of the claim frame for the WRITE function (Table 16.2)

Table 16.5. Special answer (errors: function field = 0x84 or 0x83 in the case of the READ function and 0x86 in the case of the WRITE function):

Error code (HB-LB in the data field)	**Error description**
0x0001	non-existing register address
0x0002	wrong write register value
0x0003	improper function number

Example 16.5. Error frame for a non-existing read register address:
0x01 - 0x84 - 0x02 - 0x0001 –0x5130

Table 16.6. Map of registers for the MODBUS-RTU protocol

Register address HEX (DEC)	**Value (HEX or DEC)**	**Description of register and access type** (R- read only register, R/W - read and write register)		
0x00 (0)	0	not used or reserved		**R**
0x01 (1)	540	device type identifier		**R**
0x02 (2)	10 ÷ 99	display software (firmware) version		**R**
0x03 ÷ 0x05	0	not used or reserved		**R**
0x06 (6)	0 ÷ 7	current status of outputs 1, 2: bits 0, 1, bit=1 means the output is switched on		**R**
0x07 (7)	0 ÷ 20000	current state of the analogue output (0 ÷ 20,000 µA or 0 ÷ 10,000 mV)		**R**
0x08 (8)	-100 ÷ 700	thermocouple cold tip temperature (resolution 0.1°C)		**R**
0x09 ÷ 0x0D	-1999 ÷ 19999	measured values (input 1, input 2, difference 1-2, sum 1+2, average)		**R**
0x09 ÷ 0x0A		values to be displayed for remote inputs (when parameters inP = rEMo) **(1)**		**R/W**
0x0E ÷ 0x0F	0	not used or reserved		**R**
0x10 ÷ 0x11	-1999 ÷ 19999	minimum values of the measurement channels of the display (channel 1 and 2)		**R**
0x12 ÷ 0x13	-1999 ÷ 19999	maximum values of the measurement channels of the display (channel 1 and 2)		**R**
0x14 ÷ 0x17	0	not used or reserved		**R**
0x18 (24)	0 ÷ 6	day of the week in the internal RTC clock (counted based on the date)		**R**
0x19 (25)	0x0101 ÷ 0x630C	years (HB) and months (LB)	internal real time clock (RTC) **(1)**	**R/W**
0x1A(26)	0x0100 ÷ 0x1F17	days (HB) and hours (LB)		**R/W**
0x1B (27)	0x0000 ÷ 0x3B3B	minutes (HB) and seconds (LB)		**R/W**
Configuration parameters (chapter 10)				
0x1C (28)	0 ÷ 5	parameter 0: d_S1 value to be displayed for the 1st channel		**R/W**
0x1D (29)	0 ÷ 5	parameter 1: d_S2 value to be displayed for the 2nd channel		**R/W**
0x1E (30)	0 ÷ 1	parameter 2: d_S3 a real time clock (as the 3rd channel)		**R/W**
0x1F (31)	3 ÷ 30	parameter 3: dPEr display channels switching period		**R/W**
0x20 (32)	0 ÷ 3	parameter 4: coL1 the color of the display for the 1st channel		**R/W**
0x21 (33)	0 ÷ 3	parameter 5: coL2 the color of the display for the 2nd channel		**R/W**
0x22 (34)	0 ÷ 3	parameter 6: coL3 the color of the display for the clock (RTC)		**R/W**
0x23 (35)	0 ÷ 4	parameter 7: AcoL the color of the display for alarms		**R/W**
0x24 (36)	0 ÷ 3	parameter 8: LcoL the color of the LED indicators		**R/W**
0x25 (37)	1 ÷ 3	parameter 9: br_d the brightness of the display		**R/W**
Configuration parameters for the measurement channel numbered **KP** = 0 ÷ 1 (0=channel 1, 1=channel 2)				
0x26 (38) +KP*7	0 ÷ 17	parameter 10+KP*7: inP type of measurement input (chapter 10)		**R/W**
0x27 (39) +KP*7	1 ÷ 10	parameter 11+KP*7: FiL digital filtration of measurements (response time)		**R/W**
0x28 (40) +KP*7	0 ÷ 3	parameter 12+KP*7: dot position of the point or resolution for temperature		**R/W**

0x29(41) +KP*7	-1999 ÷ 18000	parameter 13+KP*7: Lo lower limit or bottom of the indication range	**R/W**
0x2A (42) +KP*7	-1999 ÷ 18000	parameter 14+KP*7: H.I upper limit or top of the indication range	**R/W**
0x2B (43) +KP*7	-500 ÷ 500	parameter 15+KP*7: cAo zero offset for measurements	**R/W**
0x2C (44) +KP*7	850 ÷ 1150	parameter 16+KP*7: cAG calibration of inclination (sensitivity) for measurements	**R/W**
0x34 (52)	0 ÷ 4	parameter 24: Sos1 control signal for output 1 (assignment of input)	**R/W**
0x35 (53)	0 ÷ 3	parameter 25: Fto1 failure status of output 1	**R/W**
0x36 (54)	0 ÷ 3	parameter 26: Fun1 function of output 1	**R/W**
0x37 (55)	-1999 ÷ 18000	parameter 27: SEt1 preset value 1	**R/W**
0x38 (56)	0 ÷ 9999	parameter 28: H1 hysteresis of output 1	**R/W**
0x39 (57)	0 ÷ 4	parameter 29: Sos control signal for output 2 (assignment of input)	**R/W**
0x3A (58)	0 ÷ 3	parameter 30: Fo2 failure status of output 2	**R/W**
0x3B (59)	0 ÷ 10	parameter 31: Fn2 function of output 2	**R/W**
0x3C (60)	-1999 ÷ 18000	parameter 32: SEt2 preset value 2	**R/W**
0x3D (61)	0 ÷ 9999	parameter 33: H2 hysteresis of output 2	**R/W**
0x3E (62)	0 ÷ 1	parameter 34: AtyP type of analogue output	**R/W**
0x3F (63)	0 ÷ 4	parameter 35: SoSA control signal (input) for analog output	**R/W**
0x40 (64)	0 ÷ 3	parameter 36: FunA function of analogue output	**R/W**
0x41 (65)	-1999 ÷ 18000	parameter 37: A-Lo lower indication for retransmission	**R/W**
0x42 (66)	-1999 ÷ 18000	parameter 38: A-H.I upper indication for retransmission	**R/W**
0x36 (67)	0 ÷9	parameter 39: Funb binary input **BIN** function	**R/W**
0x3A (68)	3 ÷ 360	parameter 40: tc pulsation period for outputs 1, 2 in manual mode	**R/W**
0x3B (69)	0 ÷ 100	parameter 41: MSEt preset value of the manual mode	**R/W**
0x40 (70)	0 ÷ 3	parameter 42: bSEt value change block SEt1, SEt2	**R/W**
0x41 (71)	0 ÷ 9999	parameter 43: PASS password	**R/W**
0x42 (72)	1 ÷ 2	parameter 44: PPro protection of the configuration with a password	**R/W**
0x44 (73)	1 ÷ 247	parameter 45: Addr MODBUS-RTU address in the RS485 network	**R/W**
0x45 (74)	0 ÷ 5	parameter 46: br speed for RS485	**R/W**

Comments:

(1) The data is saved in the volatile (not subject to wear) memory of the SRAM type; other parameters are additionally saved in the non-volatile memory (subject to wear) of the FLASH type only at the time of power shutdown and provided that the settings have been changed.

17. USER'S NOTES