LUMEL
EVERYTHING COUNTS

TRANSDUCER OF TEMPERATURE AND STANDARD SIGNALS P30U TYPE

User's manual

CE

Contents

1. Application

The P30U programmable transducer is designed to convert temperature, resistance, voltage, standard voltage and current signals into a standard DC voltage or DC current signal. The output signal is galvanically isolated from the input signal and the power supply.
The transducer display is a 2x8 LCD.
Features of the P30U transducer:

- conversion of the measured value into any output signal on the basis of the individual liner characteristics,
- conversion of the measured value by means of one of five implemented mathematical functions,
- conversion of the measured value on the basis of 21-point individual characteristics,
- one or two relay alarms with a closing contact working in 6 modes,
- additional 24V DC 30mA power supply switched on/off by a program (option)
- indication of exceeding the alarm values set,
- programming the alarm and analog outputs with a reaction to the selected input value (main input or RTC clock),
- real time clock with a clock power supply backup function in case of a transducer power supply loss,
- recording the signal input in programmed time periods in the internal memory and on an SD/SDHC card (option),
- archive internal memory with the capacity of 534336 records,
- automatic decimal point setting,
- view of parameters set,
- locking entered parameters by a password,
- supporting RS-485 interface with the MODBUS protocol in RTU mode,
- programming the measurement averaging time,
- supporting SD/SDHC cards – FAT and FAT32 file system is supported,
- RS-485 Master mode – an option to poll a single device,
- RS-485 Monitor mode – an option to monitor transmission on RS-485 interface and react to the value of the selected register.

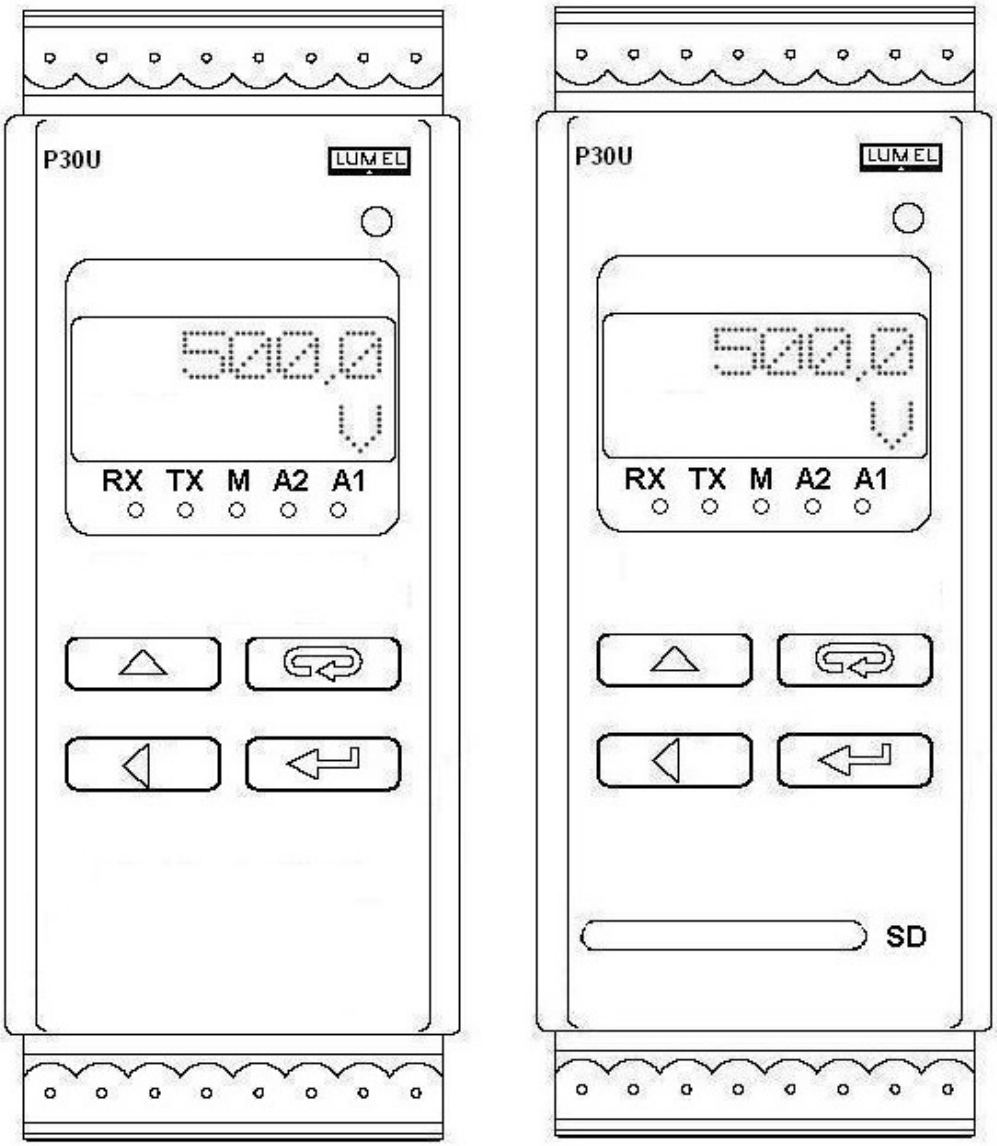


Fig. 1. P30U view.

2. Set of the P30 transducer

- P30U transducer 1 pc.
- Brief service manual 1 pc.
- Guarantee card 1 pc.
- Plug with screw terminals 4 pcs.

3. Basic requirements, operational safety

The transducer meets the requirements of EN 61010-1 in terms of operational safety.

Remarks concerning the operator safety:

- Installation and electric connections should be carried out by a person holding licenses to perform electric device installation.
- Connection correctness should be checked before switching the transducer on.
- The transducer is designed to be installed and used in industrial electromagnetic environment.
- The system inside the building should be provided with a circuit breaker or an automatic circuit breaker placed nearby the device, being easily accessible for the operator and appropriately marked.
- Removal of the transducer housing during the contractual warranty period may cause its invalidation.

4. Installation

4.1. Fixing the P30U transducer

The P30U transducers are designed to be installed on a 35 mm rail acc. to PN-EN 60715. Overall dimensions and method of fixing are shown in the Fig. 2.

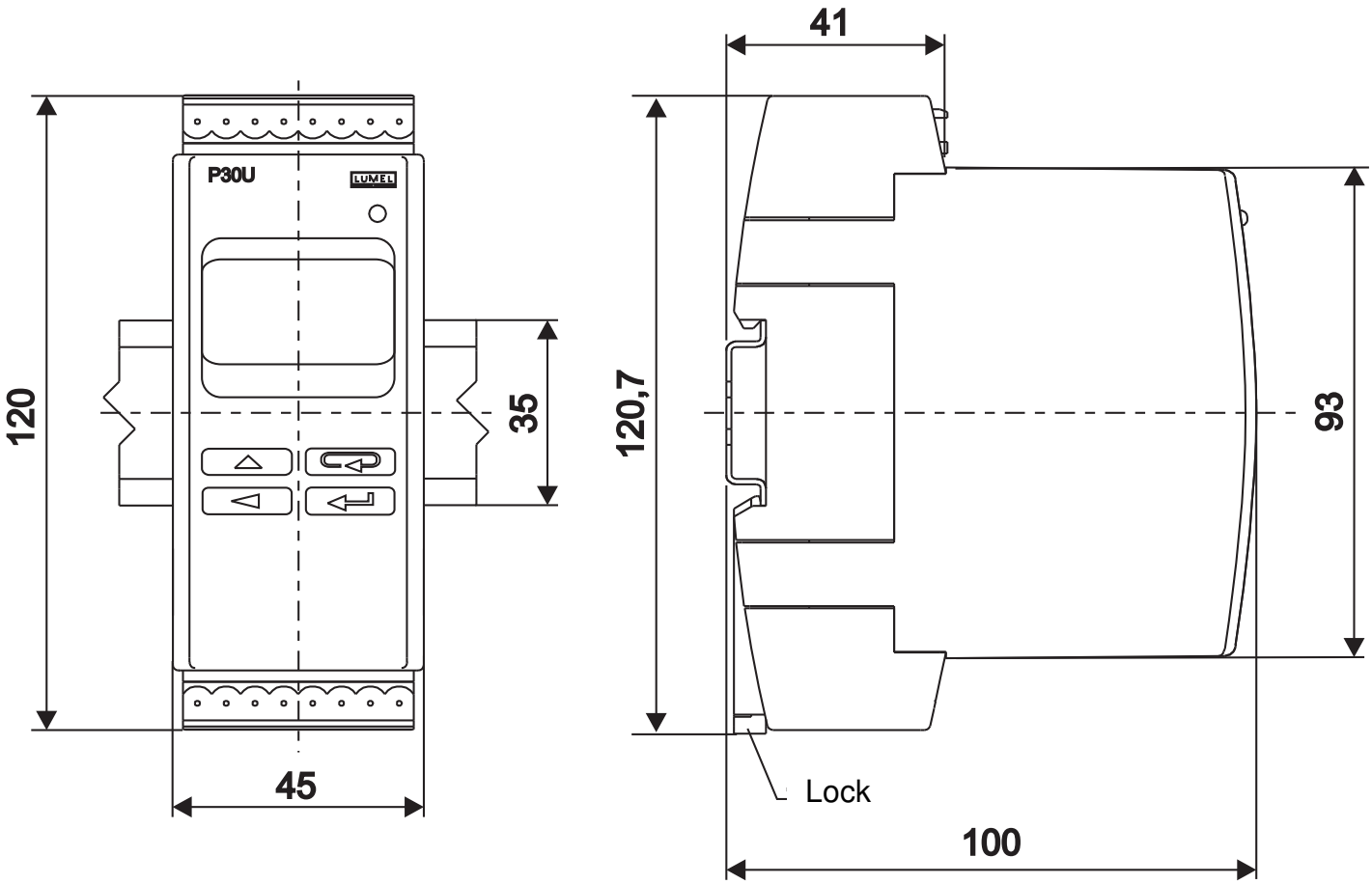
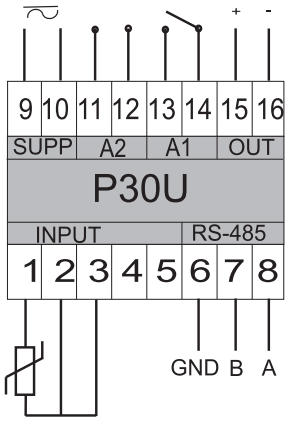
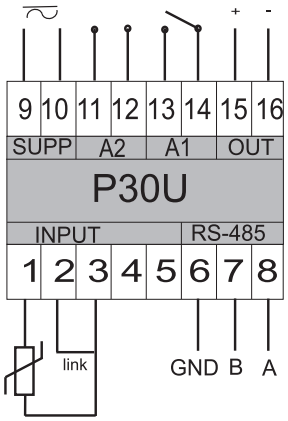
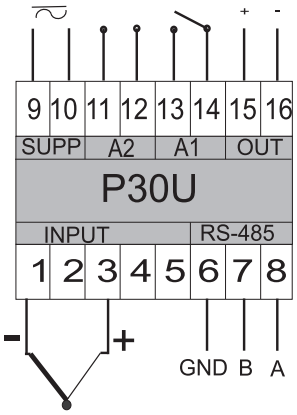


Fig. 2. Overall dimensions and method of fixing P30 transducers

4.2. External connection diagrams

Measured signal	Thermoresistor or resistance measurment in 3 wire system	Thermoresistor or resistance measurment in 2 wire system	Thermocouple or voltage -5...20mV, -75...75mV, -200...200mV
Connection diagram			

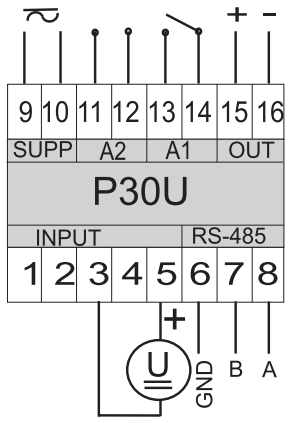
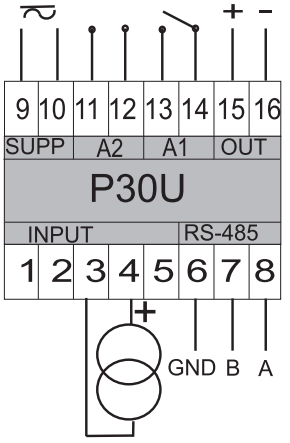
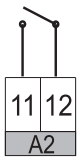
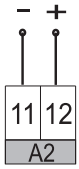
Measured signal	Voltage -24...24V -10...10 V	Current -20...20 mA	SUPP- power supply A1 - NO relay no. 1 OUT - voltage or current analog output INPUT - measuring input RS- 485 - RS-485 interface
Connection diagram			P30U-XX1XXXXX  A2 - NO relay no. 2 P30U-XX2XXXXX  A2 - auxiliary supply 24 V d.c. 30 mA

Fig. 3. Diagram of electric connections of the P30U transducer

To connect the input signals within the environments with a high level of interference, a shielded cable should be applied.

Note: The memory card (option) should be placed in the transducer with its contacts facing downwards.

5. Servicing

5.1. Description of the P30U transducer front panel

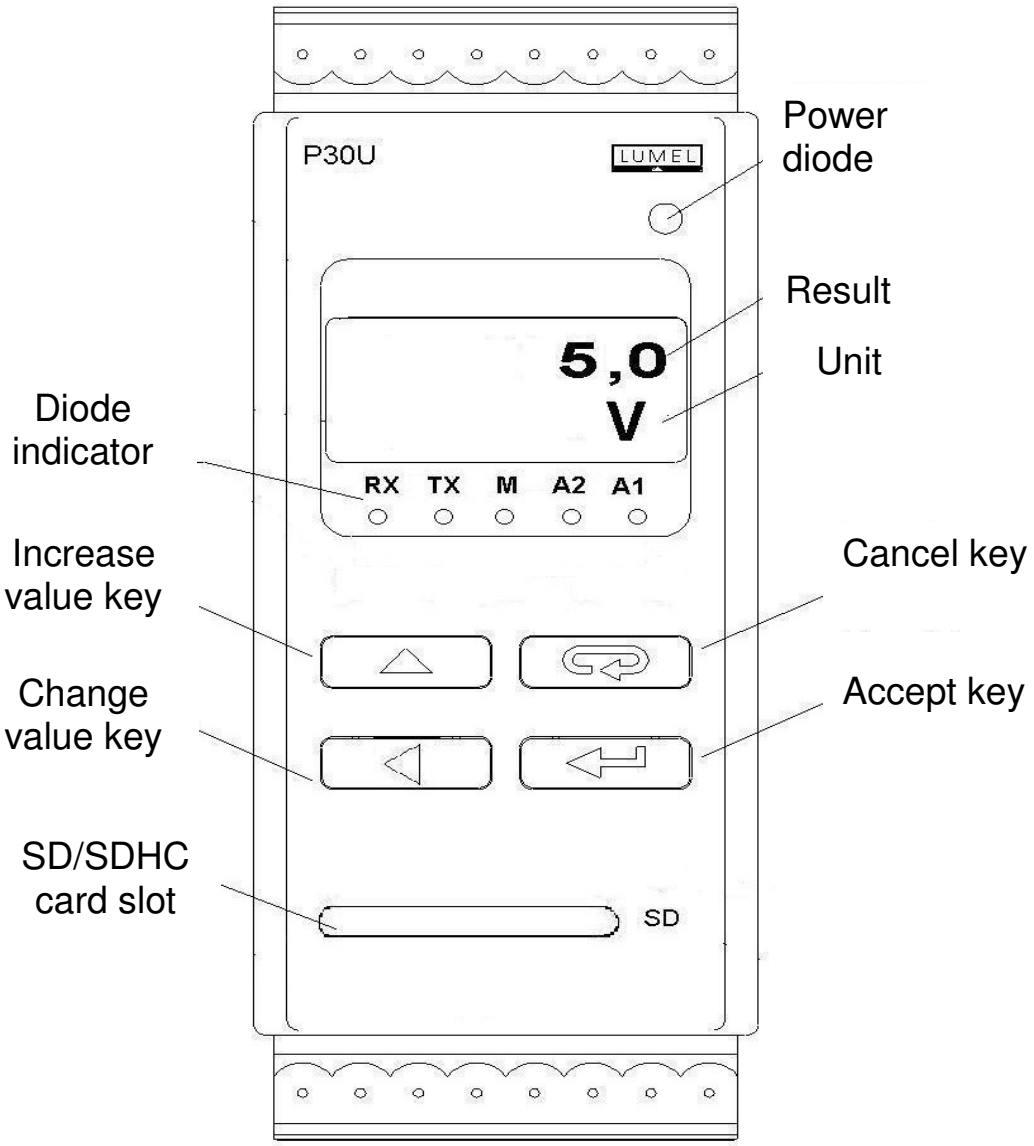


Fig. 4. Description of the transducer front panel

Led indicator description:

RX – green diode –data receiving indicator on RS-485 interface,
TX – yellow diode – data transmission indicator on RS-485 interface,
M – red diode – indicator of full internal memory of the archive and indicator of recording data on SD/SDHC indicator - when the internal memory usage exceeds 95%, the diode is lit continuously, if the

transducer uses the installed memory card, then when recording the data on the card, the diode blinks till the end of writing the data to the file.

A1 – red diode – indicator of switching on the first alarm

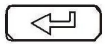
A2 – red diode– indicator of switching on the second alarm or 24V DC power supply

Power supply indicator – green diode

5.2. Messages after switching on the power

After connecting the external signals and switching the power on, which is indicated by the green diode (power supply indicator), the transducer displays the type, current program version and serial number.
After about three seconds the transducer is automatically switched to working mode, in which it measures and converts signal to an analog output signal. It displays the value being displayed in the upper line of the display, and the additional information in the lower line of the display (par. 5.4.9).
The transmission state on the RS-485 interface, internal memory usage and alarm states are shown on the diode indicator.

5.3. Key functions:

 - accept key

- entry into the programming mode (hold for about 3 seconds),
- navigating through the menu – selection of the level,
- entry into the parameter change value mode,
- accepting the modified parameter value,
- changing the content displayed in the lower line of the display.

 - increase value key

- displaying the maximum value,
- entry into the parameter group level,
- navigating through the selected level,
- modification of the selected parameter value – increasing the value.

 - change digit key

- displaying the minimum value.
- entry into the parameter group level,
- navigating through the selected level,
- modification of the selected parameter value – moving to the next digit.

- cancel key

- entry into the transducer parameter view menu (hold for about 3 seconds),
- exit from the transducer parameter view menu,
- changing the content displayed in the lower line of the display,
- parameter change resignation,
- ultimate leaving the programming mode (hold for about 3 seconds).

Pressing the combination of keys and holding them for about 3 seconds erases the alarm indication. This operation works only, when the backup function is activated. Pressing the combination of erases the minimum value. Pressing the combination of erases the maximum value.

Pressing the combination of keys uninstalls the SD/SDHC card, enabling its safe removal. Pressing the combination of keys makes that the archive from internal memory is copied to the SD/SDHC card.

Pressing and holding down key enables entry into the programming matrix. The programming matrix may be protected by a security code.

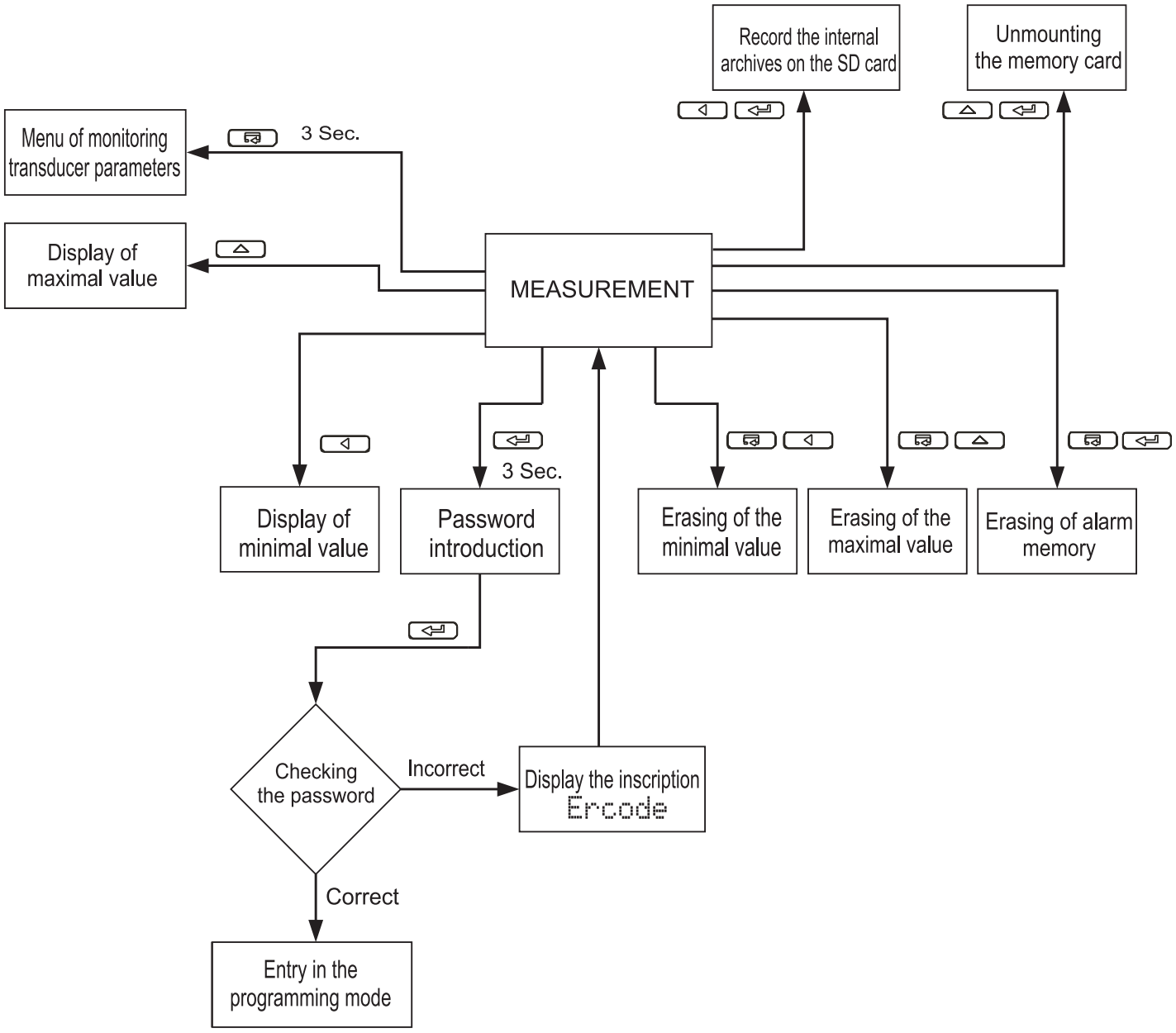


Fig. 5. Operation algorithm of the P30U transducer

5.4. Programming the transducer parameters

Pressing [↵] key and holding it down for about 3 seconds enables entry into the programming matrix. If the entry is protected by a password, then the message informing that password must be entered will be displayed. If an incorrect password is entered, the message Incorrect code will be displayed. Entering a correct password enables entry into the programming matrix. The Fig. 6 shows the transition matrix in the programming mode. Selecting the menu level and navigation through the parameters of the specific sublevel is done by means of [△] or [◁] key. The parameter symbol is displayed in the upper line of the display,

while the parameter is displayed in the lower line of the display. In order to enter edition of the specific parameter, press key. To exit from the edition and specific parameter, key should be used. To exit from the programming matrix for measurement, key should be pressed and held down. In case the transducer is left in the parameter programming mode, after 30 seconds the programming mode will be left automatically, and the device will be switched to display the displayed value.

	Settings Input Parameters of main input	Input Measured value type	AvgTime Averaging time of measured value	Compens. Compensation type	Comp.Val Manual compensation value	No.of Err Admissible number of incorrect requests for the input RS485 Master	Math Fun Operation of mathematical function on the measured value				
	Settings Ind. Char Parameters of the individual characteristic	Point No Number of points of the individual characteristic	X1 First point of the individual characteristicPoint x.	Y1 First point of the individual characteristic. Point y.	....	X21 Last point of the individual characteristic	Y21 Last point of the individual characteristic				
	Settings Display Display parameters	DecimalP Minimum decimal point of displayed value	Unit Displayed unit	OverLo Lower threshold of display range	OverHi Upper threshold of display range	Backlight Backlight time of display	Bckl. Int. Backlight intensity of LCD display	Disp. Reg. Number of register displayed in the lower line of the display	Dec.P 2 Minimum decimal point Of the second displayed value		

	Settings Alarm 1 Parameters of alarm 1	Param.A1 Type of input quantity of alarm 1	TypeA1 Type of alarm 1	OverLoA1 Lower threshold of alarm 1	OverHiA1 Upper threshold of alarm 1	DlyOnA1 Delay of switching on the alarm 1	DlyOffA1 Delay of switching off the alarm 1	OnLockA1 Delay of reswitching on the alarm 1	SgKeepA1 Support of alarm 1 indication		
	Settings Alarm 2 Parameters of alarm 2	Param.A2 Type of input quantity of alarm 2	TypeA2 Type of alarm 2	OverLoA2 Lower threshold of alarm 2	OverHiA2 Upper threshold of alarm 2	DlyOnA2 Delay of switching on the alarm 2	DlyOffA2 Delay of switching off the alarm 2	OnLockA2 Delay of reswitching on the alarm 2	SgKeepA2 Support of alarm 2 Fig.		
	Settings Output Output parameters	Param.An Type of input quantity for the analog output	AnInLo Lower threshold of the input	AnInHi Upper threshold of the input	AnOut Lo Lower threshold of the output	AnOutHi Upper threshold of the output	OvrServ Overflow options turning on	OvrIn Lo Lower overflow of input	OvrInHi Upper overflow of input	OvrOutLo Value expected on the output during lower overflow of input	OvrOutHi Value expected on the output during upper overflow of input
	Settings Modbus RS-485 interface parameters	Address Device address	Protocol Kind of frame	BaudRate Baud rate	Reg. No Register address to be read out (Master mode)	No.of Reg. Number of read out registers (Master mode)	TypeReg Type of read out register (Master mode)	Interval Read out interval (Master mode)	AnswTime Maximal time of reply (Master mode		

	Settings Archive Archiving parameters	Arch. Val Selection of archived volumes	Param.Ar Type of value which will turn on conditional archiving	Ar.Mode Archiving type	OverLoAr Lower threshold of archiving	OverHiAr Upper threshold of archiving	Ar.Time Archiving time	Ar.Erase Erasing of internal archive	Rec.ToSD Manual copying of internal archive to the SD/SDHC card	Param.SD Fulfillment percentage of internal archive, which will turn on automatic record on the SD/SDHC card	
	Settings Service Service parameters	ParFact Write standard parameters	Security Enter the password	Time Setting the actual time	Date Setting the actual date	AutoTime Automatic change of time - summer/winter and inversely	DispTest Test of the LCD display and diodes	Language Selection of menu language			

Fig. 6. Programming matrix

5.4.1. Method of changing the selected parameter value

In order to increase the selected parameter value, press key. Pressing the key once increases the value by 1. Increasing the value when the digit 9 is displayed, sets 0 on this digit. The digit is changed, once key is pressed. Pressing key while editing the most important digit enables edition of the digit character – the character is changed by means of key.

In order to accept the parameter set, press key. Then the parameter will be saved. Pressing key when changing the parameter value will cancel saving operation.

5.4.2. Changing the floating point values

This change is performed at two stages (switching to the next stage follows pressing ⏎ key).

- Setting the dot position (00000., 0000.0, 000.00, 00.000, 0.0000); ◁ key moves the dot to the left, and △ moves the dot to the right. Pressing ⏎ key when changing the parameter value will cancel saving operation.
- Setting the value from the range -19999…99999 is similar as for the integers.

5.4.3. Programmable transducer parameters

The below table shows the programmed parameters and their value range.

Table 1

Settings Input			
Parameter symbol	Description	Range of changes	
Input	Type of the connected input signal.	Symbol on the display	
		Voltage -10..10V	Voltage -10V … 10V
		Voltage -24..24V	Voltage -24V … 24V
		Current -20..20mA	Current -20mA … 20mA
		Resist. 400Ω	Resistance 0 … 400Ω
		Resistance 2000Ω	Resistance 0...2000Ω
		Resistance 5500Ω	Resistance 0...5500Ω
		Pt100 -200..850°C	Pt100 -200...850 ºC
		Pt250 -200..600°C	Pt250 -200...600 ºC
		Pt250 -200..850°C	Pt250 -200...850 ºC
		Pt500 -200..180°C	Pt500 -200...180 ºC
		Pt500 -200..850°C	Pt500 -200...850 ºC
		Pt1000 -200..250°C	Pt1000 -200...250 ºC
		Pt1000 -200..850°C	Pt1000 -200...850 ºC
		Ni100 -60..180°C	Ni100 -60...180 ºC
		Ni1000 -60..150°C	Ni1000 -60...150 ºC

		Ni100-LG -60..180°C	Ni100-LG -60...180 ºC
		Ni1000-LG -60..180°C	Ni1000-LG -60...180 ºC
		Cu100 50..180°C	Cu100 -50...180 ºC
		Voltage -5..20mV	Voltagee -5...20mV
		Voltage -75..75mV	Voltagee -75...75mV
		Voltage -200..200mV	Voltagee -200...200mV
		Thermocouple J 0..400°C	Thermocouple J 0...400ºC
		Thermocouple J -200..1200°C	Thermocouple J -200...1200ºC
		Thermocouple K 0..400°C	Thermocouple K 0...400ºC
		Thermocouple K -200..1370°C	Thermocouple K -200...1370ºC
		Thermocouple S 0..600°C	Thermocouple S 0...600ºC
		Thermocouple S -50..1760°C	Thermocouple S -50...1760ºC
		Thermocouple N -20..420°C	Thermocouple N -20...420ºC
		Thermocouple N -200..1250°C	Thermocouple N -200...1250ºC
		Thermocouple E -40..260°C	Thermocouple E -40...260ºC
		Thermocouple E -200..1000°C	Thermocouple E -200...1000ºC
		Thermocouple R -50..1760°C	Thermocouple R -50...1760ºC
		Thermocouple T -200..400°C	Thermocouple T -200...400ºC
		Thermocouple B 400..1800°C	Thermocouple B 400...1800ºC
		RS-485 Master	RS-485 Master Modbus
		RS-485 Monitor	RS-485 Monitor Modbus
AvgTime	Measurement time expressed in milliseconds. The result on the display represents the average value calculated during the AvgTime.	200 ... 20000	

Compens.	Selection of compensation and measured value. It refers only to the work in the temperature or resistance measurement mode. For the resistance sensors it determines resistance of the cables connecting the transducer with a sensor, and for the thermo-electric sensors it indicates the temperature of free ends of a thermocouple.	Automat. - automatic compensation Manual - manual compensation	
Comp.Val	Manual compensation value. For the resistance sensors it is the cable resistance value, for the thermo-electric sensors it is the terminal temperature value.	-99999 ... 99999	
No.ofErr	Admissible number of incorrect requests of the transducer working in the RS-485 Master mode.	0...10	
Math Fun	Operation of mathematical function on the measured value	Off	Mathematical functions are off.
		x2	Square of the measured value
		√x	Square root of the measured value
		1/x	Inverse of the measured value
		1/x2	Inverse square of the measured value
		1/√x	Inverse square root of the measured value

Table 2

Settings Ind.Char		
Parameter symbol	Description	Range of changes
Point No	Number of points of the individual characteristic. Number of segments is the number of points reduced by one.	1...21
X1	Value of the measured value for which we will expect Yn (n - point number).	-99999...99999
Y1	Expected value for Xn.	-99999...99999

Table 3

Settings Display				
Parameter symbol	Description	Range of changes		
DecimalP	Minimum position of the point when displaying the displayed value – display format.	0.0000 - 0 00.000 - 1 000.00 - 2 0000.0 - 3 00000 - 4		
Unit	Displayed unit.		kVAh	pc.
		V	MVAh	imp
		A	Hz	rps
		mV	kHz	m/s
		kV	Ω	l/s
		mA	kΩ	rpm
		kA	°C	rpm
		W	°F	mm/min
		kW	K	m/min
		MW	%	l/min
		var	%RH	m^3/min
		kvar	pH	pc./h
		Mvar	kg	m/h
		VA	bar	km/h
		kVA	m	m^3/h

		MVA	l	kg/h
		kWh	s	l/h
		MWh	h	Own, defined by the user
		kVarh	m^3	
		MVarh	rev.	
Over Lo	Lower threshold of display range.	-99999...99999		
Over Hi	Upper threshold of display range.	-99999...99999		
Bcklight	Backlight time of display.	On - switched on permanently Off - switched off permanently 1 - switched on for X seconds 2 ... 60		
Bckl.Int.	Backlight intensity of LCD display	10% - backlight of LCD display 10% of maximum backlight 20% - backlight of LCD display 20% of maximum backlight ... 100% - backlight of LCD display 100% of maximum backlight		
Disp.Reg.	Number of register displayed in the lower line of the display	0...65535		
Dec.P 2	The minimal position of the point by displaying the second displayed value - display format.	0.0000 - 0 00.000 - 1 000.00 - 2 0000.0 - 3 00000 - 4		

Table 4

Settings Alarm 1,Alarm 2			
Parameter symbol	Description	Range of changes	
Param.A1 Param.A2	Type of input quantity controlling the alarm	Disp.Val	displayed value
		Time	time
		2nd val	second displayed value
Type A1 Type A2	Alarm type. Fig.9 shows graphical illustration of the alarm types.	n-on	normal (change from 0 to 1).
		n-off	normal (change from 1 to 0).
		on	switched on
		off	switched off

		h_on	manual switched on; up to the time of change of alarm type the alarm output is permanently switched on.
		h_off	manual switched off; up to the time of change of alarm type the alarm output is permanently switched off.
OverLoA1 OverLoA2	Lower threshold of alarm	-99999...99999	
OverHiA1 OverHiA2	Upper threshold of alarm	-99999...99999	
DlyOnA1 DlyOnA2	Delay of switching on the alarm (s)	0...900	
DlyOffA1 DlyOffA2	Delay of switching off the alarm (s)	0...900	
OnLockA1 OnLockA2	Delay of reswitching on the alarm (s)	0...900	
SgKeepA1 SgKeepA2	Support of alarm 1 indication	Off	no indication of occurrence of switching on the alarm
		On	indication, by blinking led diodes A1, A2, of occurrence of switching on the alarm is switched on

Table 5

Settings Output			
Parameter symbol	Description	Range of changes	
Param.A1	Type of input quantity controlling the analog output	Disp.Val	displayed value
		Time	time
		2nd val	second displayed value
AnIn Lo	Individual characteristic of analog output - Lower threshold of input	-99999...99999	
AnIn Hi	Individual characteristic of analog output - Upper threshold of input	-99999...99999	
AnOut Lo	Individual characteristic of analog output - Lower threshold of output	-24...24	
AnOut Hi	Individual characteristic of analog output - upper threshold of output	-24...24	

OvrServ	Turning on overflow options for analog output	Off	Overflow options is switched off
		On	Overflow options is switched on
OvrIn Lo	Lower overflow of input for including overflows of output	-99999...99999	
OvrIn Hi	Upper overflow of input for including overflows of output	-99999...99999	
OvrOutLo	Value expected on the output during lower overflow	-24...24	
OvrOutHi	Value expected on the output during upper overflow	-24...24	

Table 6

Settings Modbus			
Parameter symbol	Description	Range of changes	
Address	Address in MODBUS network. Entering the value 0 switches of the interface.	0...247	
Protocol	Kind of baud rate frame of the RS-485 interface	r8n2 r8e1 r8o1 r8n1	
BaudRate	Baud rate of the RS-485 interface	4800	4800 bit/s
		9600	9600 bit/s
		19200	19200 bit/s
		38400	38400 bit/s
		57600	57600 bit/s
		115200	115200 bit/s
		230400	230400 bit/s
		256000	256000 bit/s
Reg.No	Number of read out/monitored register in the RS-485 Master / RS-485 Monitor modes	0 ... 65536	
No.ofReg.	Number of read out registers in RS-485 Master mode	0 ... 50	
TypeReg	Type of read out/monitored registers mode RS-485 Master / RS-485 Monitor	char 8	*char* register (8 bits and a sign)
		uchar 8	*unsigned char* register (8 bits without a sign)
		short 16	*short* register (16 bits and a

			sign)
		ushort16	*unsigned short* register (16 bits without a sign)
		long 32	*slong* register (32 bits without a sign)
		ulong 32	*unsigned long* register (32 bits without a sign)
		flt 32	Register type *float* (32 bits, floating point and a sign)
		sflt2x16	swapped *float* register, value stored in two sixteen-bit registers (sequence of bytes 3,2,1,0)
		flt 2x16	*float* register, value stored in two sixteen-bit registers (sequence of bytes 1,0,3,2)
		lng 2x16	Register type *long*, value stored in two sixteen-bit registers (sequence of bytes 1,0,3,2)
		slng2x16	Register type *swapped long*, value stored in two sixteen-bit registers (sequence of bytes 3,2,1,0)
		ulng2x16	Register type *unsigned long*, value stored in two sixteen-bit registers without a character (sequence of bytes 1,0,3,2)
		uSln2x16	Register type *swapped unsigned*, value stored in two sixteen-bit registers without a character (sequence of bytes 3,2,1,0)
Interval	Read out interval of the device in the RS-485 Master mode	1...36000	[0.1s]
AnswTime	Maximal time of reply of the device in the RS-485 Master mode	10...5000	[ms]

Table 7

Settings Archive			
Parameter symbol	Description	Range of changes	
Arch.Val	Selection of archived values **Note:** *change of the register value erases archive in the internal memory !!!*	Disp.Val	only displayed value
		+2nd val.	measured value and the second displayed value
		Queried	All queried registers
Param.Ar	Type of input value controlling archiving conditional	Disp.Val	displayed value
		Time	time
Ar.Mode	Condition to switch on archiving. Fig.9 shows graphical illustration of types of conditions of switching on archiving (similarly to the alarm types).	n-on	normal (change from 0 to 1).
		n-off	normal (change from 1 to 0).
		on	switched on
		off	switched off
		h_on	manual switched on; up to the time of change of alarm type, alarm output is permanently switched one
		h_off	manual switched off; up to the time of change of alarm type, alarm output is permanently switched off.
OverLoAr	Lower threshold of archiving	-99999...99999	
OverHiAr	Upper threshold of archiving	-99999...99999	
Ar.Time	Period archiving (s)	1...3600	
Ar.Erase	Erasing of internal archive	Yes	erasing of internal archive
		No	do nothing
Rec.ToSD	Manual copying of internal archive to the SD/SDHC card	Yes	copying the internal archive to the SD/SDHC card
		No	do nothing
Param.SD	Fulfillment percentage of internal archive, which will turn on automatic record on the SD/SDHC card	5 ... 100	

Table 8

Settings Service			
Parameter symbol	Description	Range of changes	
ParFact	Write standard parameters. Setting the value Yes enters standard parameters into the transducer. Values of standard parameters are shown in the table 13.	No	do nothing
		Yes	enters standard setpoints.
Security	Entering new password. Entering the value 0 switches the password off.	-99999...99999	
Time	Setting the actual time. Entering incorrect time cancels entering the time. The entered value will not be taken.	00:00...23:59	
Date	Setting the date - month+day. Entering incorrect date cancels entering the date. The entered value will not be taken.	01-01-10...31-12-99	
AutoTime	Automatic change of time - summer/winter and inversely	No	without automatic change of time
		Yes	with automatic change of time
DispTest	Test of the LCD display and indication diodes	No	do nothing
		Yes	starts the test
Language	Selecting the current language menu	Polish	selection of Polish language
		English	selection of English language
		Deutsch	selection of German language
		Francais	selection of French language

5.4.4. Mathematical functions

The P30U transducer is able to convert the measured value by applying one of five implemented mathematical functions:

- Square of the measured value;
- Root of the measured value;
- Inverse of the measured value;

- Inverse square of the measured value;
- Inverse square root of the measured value.

Switching on and selection of a mathematical function is possible from the menu level in the Input → Math Fun. group and via the RS-485 interface. The method of impact of the mathematical function on the transducer work is presented in the Fig. 7.

5.4.5. Individual characteristics of input

P30 transducers perform the function of conversion of the measured value to any value due to implemented function of individual characteristics of the input. The individual characteristics rescale the input signal being measured according to the characteristics set. The impact of the individual characteristics on the transducer work is presented in the Fig. 7.

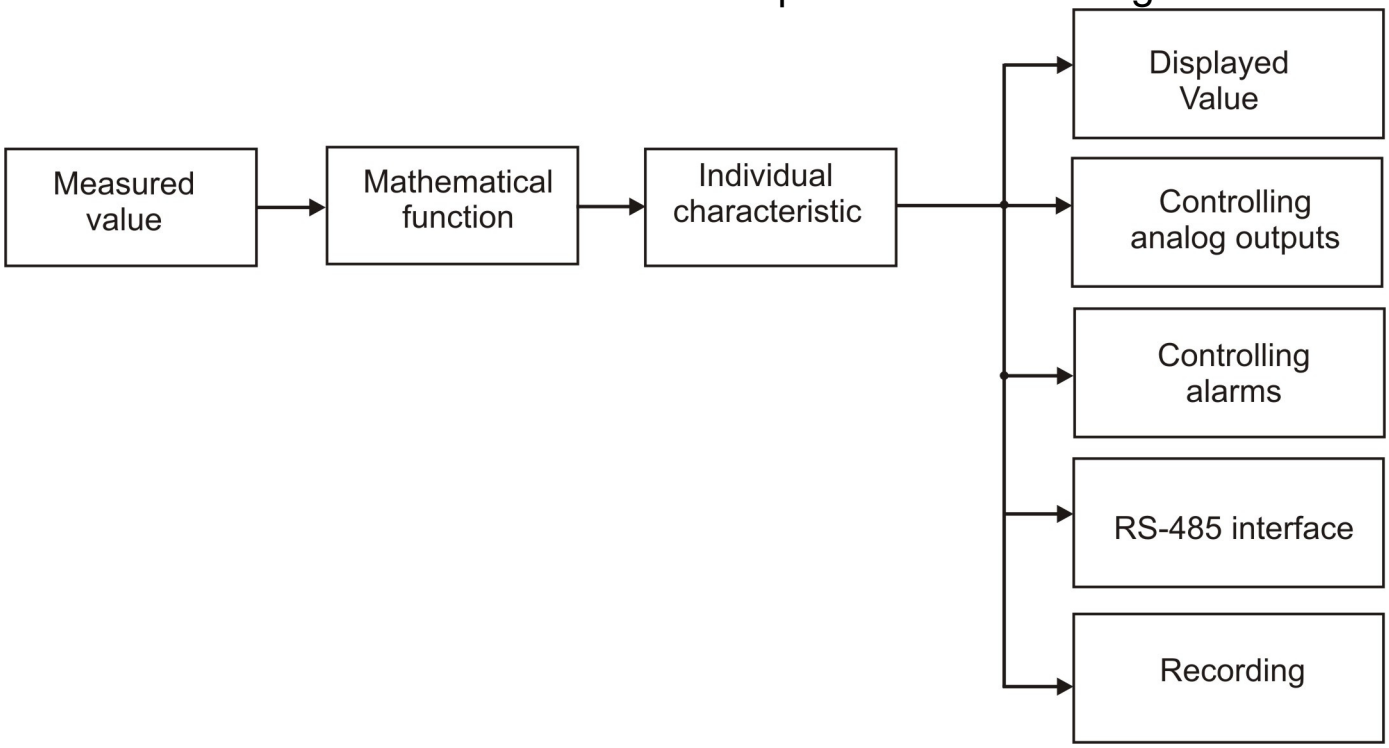


Fig. 7. Individual characteristics work

The user may enter twenty functions at the maximum by entering the points determining the intervals and the expected values for the next points.

Programming the individual characteristics is to determine the number of

the points to linearize the input function. You should remember that the number of linearizing functions is by one lower than the number of the points. Next you should program the next points by adding the measured value Xn and the expected value corresponding to it which is to be displayed (Yn). Graphic interpretation of the individual characteristics is presented in the Fig. 8.

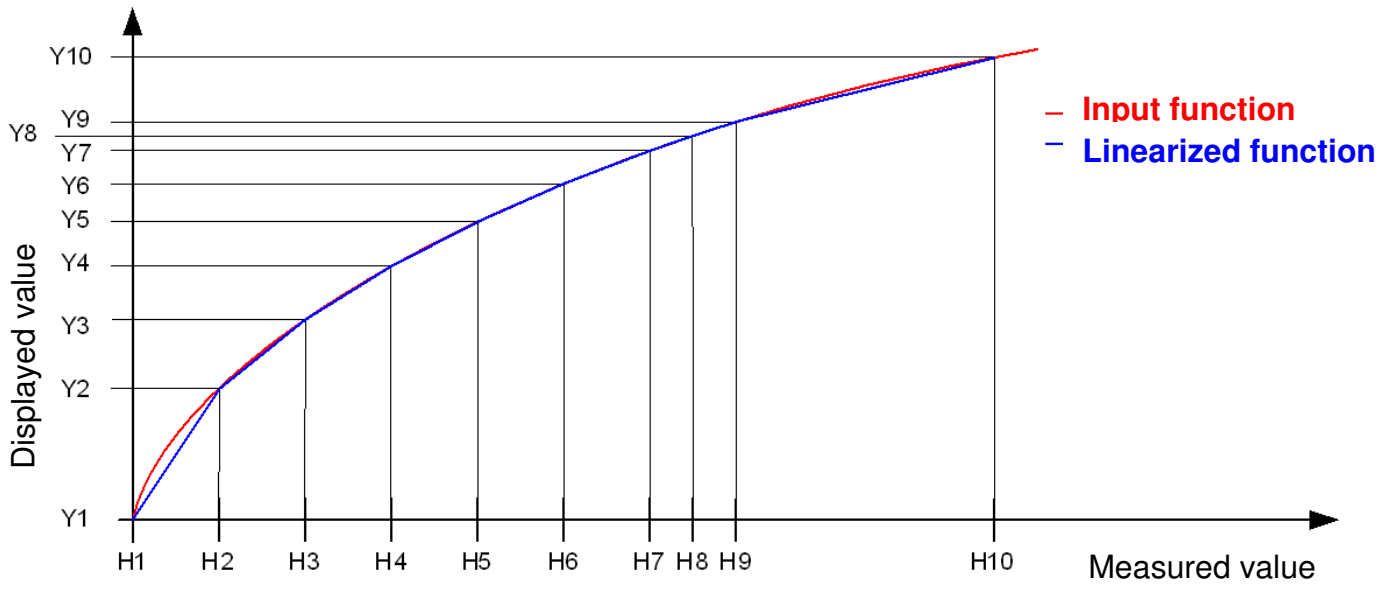


Fig. 8. Individual characteristics of the input

When approximating the function you should remember that for approximation of the curves which significantly deviate from the liner characteristics, the larger number of linerizing segments, the smaller error related to linearization.

If the measured values are smaller than X1, then the conversions are performed on the basis on the first straight line calculated on the basis of the points (X1,Y1) and (X2,Y2). However, for the values larger than Xn (where n – is the last declared measured value), the value to be displayed will be calculated on the basis of the last determined liner function.

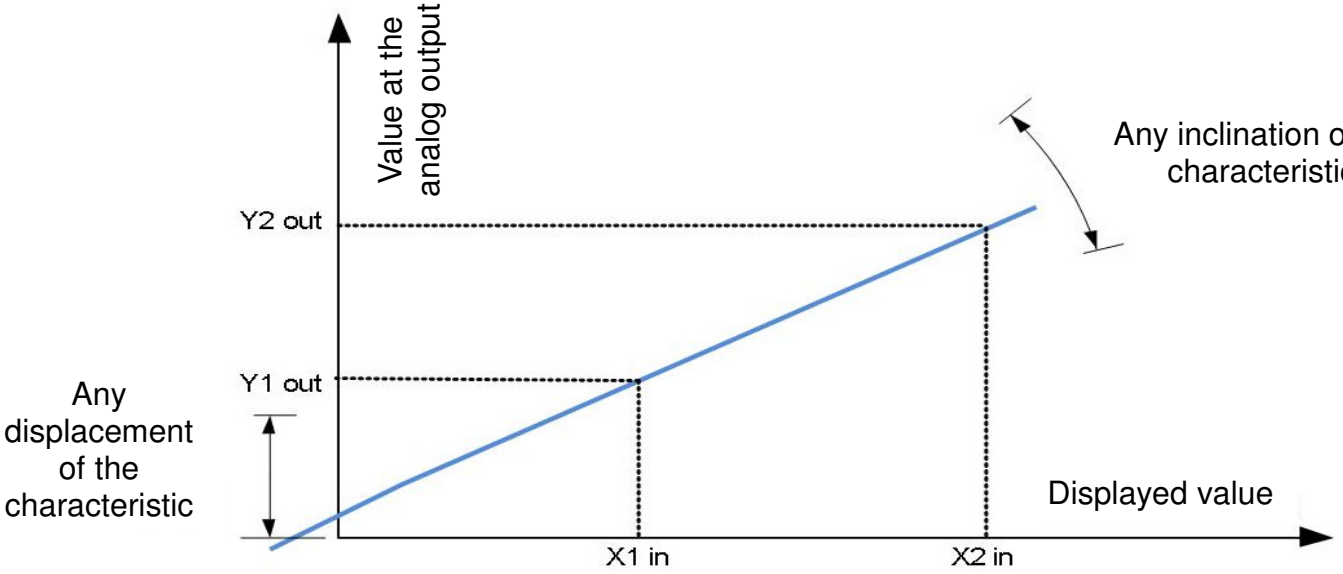
Note: All the entered points of the measured value (Yn) must be arranged in ascending order, so that there is the relationship:

X1<X2<X3…<Xn

If the above condition is not met, the function of the individual characteristics will be automatically switched off (it will not be performed) and a diagnostic flag will be set in the status register.

5.4.6. Individual characteristics of output

The P30U transducer makes it possible to convert the displayed value into the output signal on the basis of the individual liner characteristics of the analog output. On the basis of the coordinates of two points entered by the user the transducer determines (from the system of equations) coefficients of the individual characteristics, a and b.



where *X1 in* and *X2 in* – the displayed value, *Y1 out* and *Y2 out* – expected value on the analog output

Fig. 9. Individual characteristics of the analog output

5.4.7. Overflow options of analog output

In the P30U transducer the user may additionally configure behavior of the analog output after the occurrence of an excess of the displayed value. By default the overflow options are switched off – then, when the displayed value is exceeded the output is still controlled proportionally to the displayed value beyond the basic range of the output. After switching on the overflow options the user may define the value to control the output after occurrence of upper or lower excess of the displayed value.

Example 1:

The transducer is set to measure the temperature via a thermocouple J – input :Thermoc.J -200..1200°C. The individual characteristics of the analog current output are set as follows:

Table 9

Register No.	Parameter symbol in menu	Register value	Symbol of parameter value in menu
4040	Param.An	0	Disp.Val
4041	OvrServ	0	Off
7610	AnIn Lo	0	0.0
7611	AnIn Hi	1000	1000.0
7612	AnOut Lo	4	4
7613	AnOut Hi	20	20.0

The Fig. 10 shows the way of reaction of the analog output when overflow options of the analog output are switched off – standard work of the analog output.

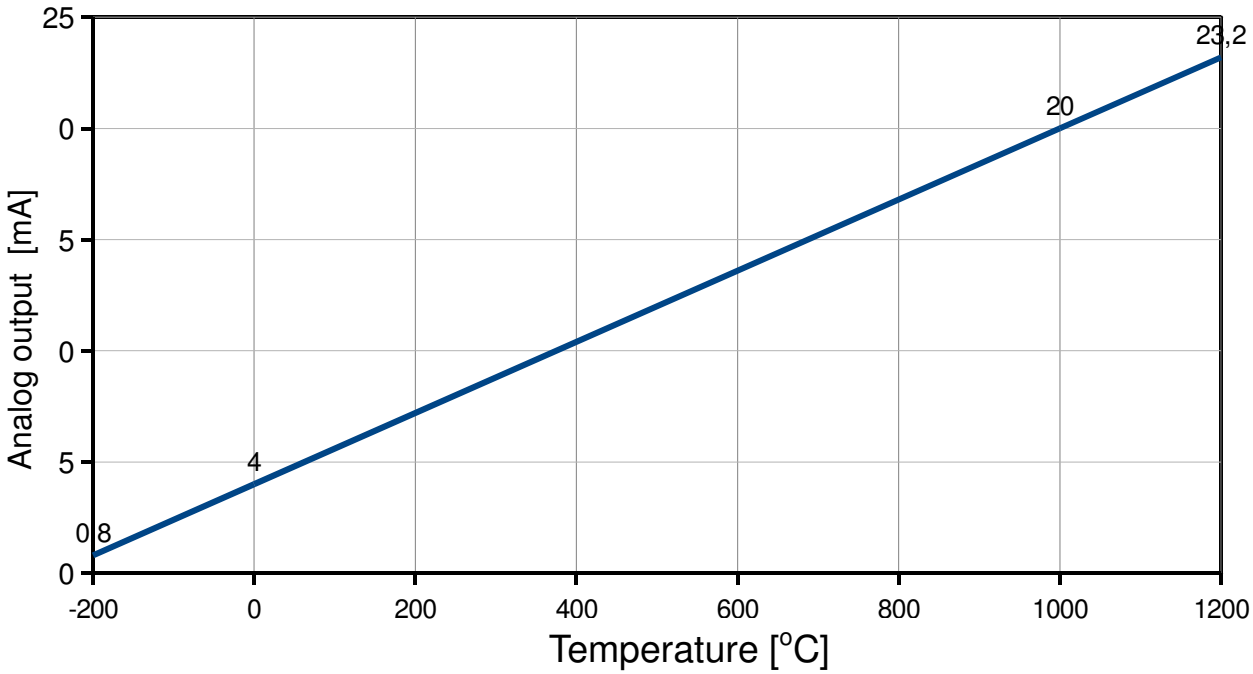


Fig. 10. Work of the analog output when overflow options are switched off

If the overflow options of the transducer analog output are switched on in the same case (the parameters are set according to the table 10), then the reaction of the analog output will look like as shown in the Fig. 11.

Table 10

Register No.	Parameter symbol in menu	Register value	Symbol of parameter value in menu
4040	Param.An	0	Disp.Val
4041	OvrServ	1	On
7610	AnIn Lo	0	0.0
7611	AnIn Hi	1000	1000.0
7612	AnOut Lo	4	4
7613	AnOut Hi	20	20.0
7664	OvrIn Lo	0	0
7665	OvrIn Hi	1000	1000
7666	OvrOutLo	1,5	1,5
7667	OvrOutHi	3,5	3,5

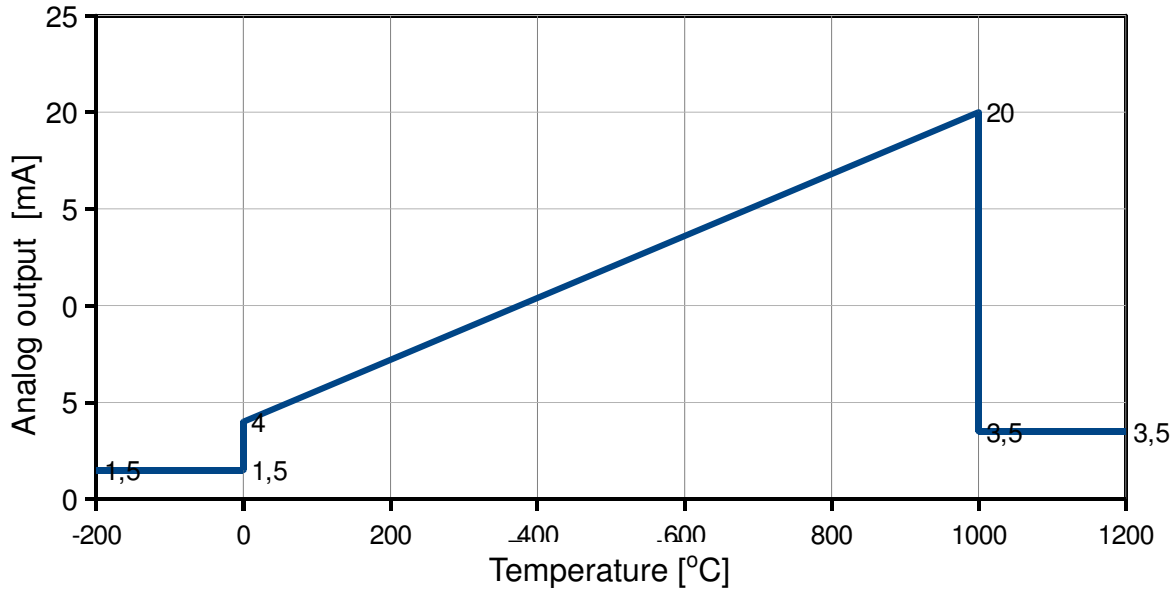


Fig. 11. Work of the analog output when overflow options are switched on

Example 2:

The transducer is set to measure the temperature via a thermocouple J – input J – input :Thermoc.J -200..1200°C. The individual characteristics of the analog current output are set in such a way so that the output reacts to the actual time (hour*100+ minute), it means for the

time 00:00 the expected value is 4 mA, for the time 23:59 the expected value is 20mA :

Table 11

Register No.	Parameter symbol in menu	Register value	Symbol of parameter value in menu
4040	Param.An	0	Time
4041	OvrServ	1	Off
7610	AnIn Lo	0	0.0
7611	AnIn Hi	2359	2359
7612	AnOut Lo	4	4
7613	AnOut Hi	20	20.0

5.4.8. Alarm types

The P30U transducer is equipped with two alarm outputs with a normally open contact or with one output with a normally open contact and one 24V DC power supply output (depending on the version code). Each alarm (24V DC power supply output should be treated similarly to the alarm) may work in one of six modes. The Fig. 12 shows the work of the alarm in the following modes: n-on, n-off, on, off. Two remaining modes: h-on and h-off stand, respectively, for always switched on and always switched off. Those modes are intended for manual simulation of the alarm states.
In case of the transducer with 24V DC output, the mode of the second alarm should be set to h-on, then the output of the additional power supply will be permanently switched one.

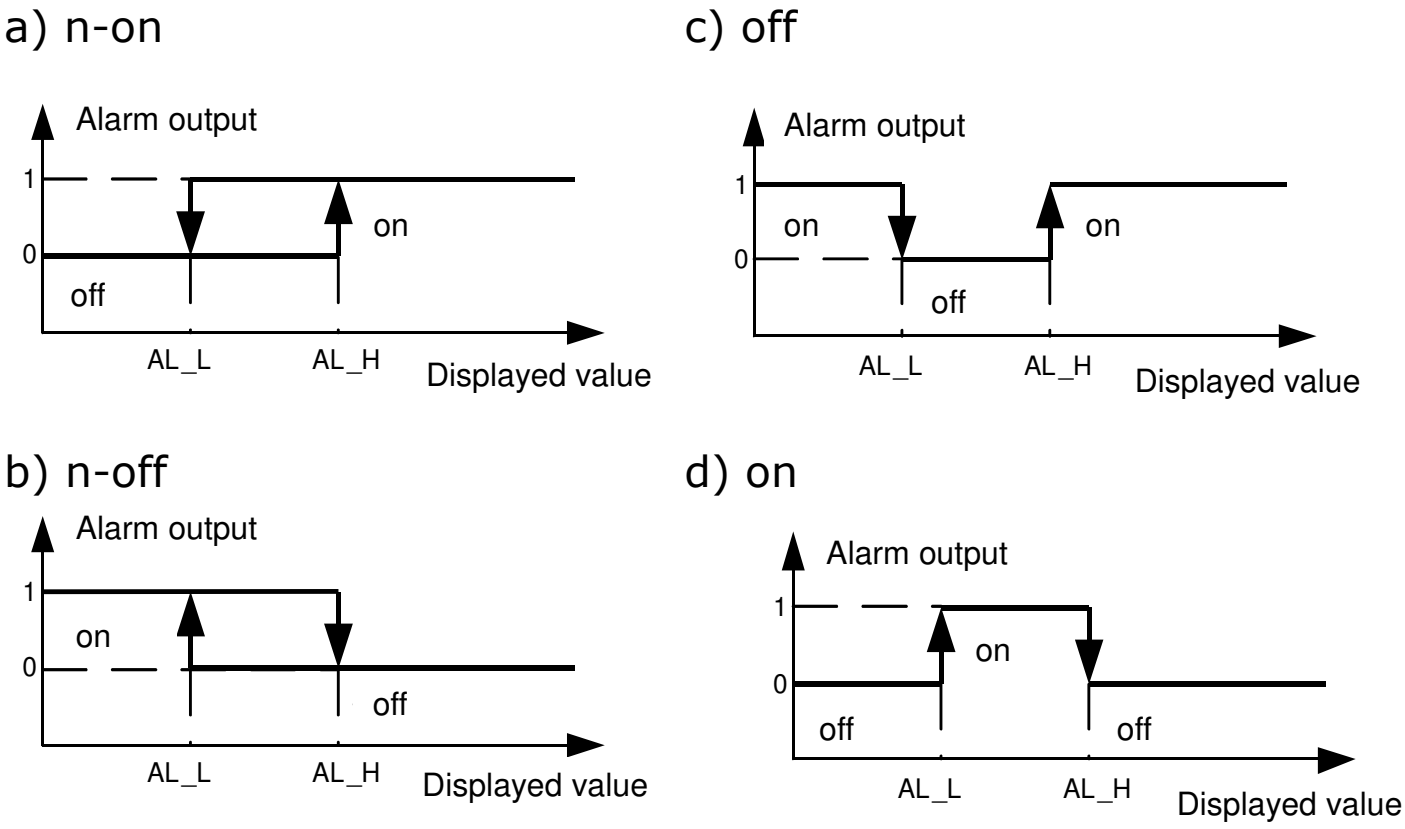


Fig. 12. Alarm types: a) n-on; b) n-off; c) on; d) off

AL_L - Lower threshold of alarm
AL_H – Upper threshold of alarm

Note: In case of n-on, n-off, on, off alarms, entering PrL>PrH will switch the alarm off.

5.4.9. Display format

The P30U transducer is equipped with backlight LCD display consisting of two lines, with 8 characters in each. The upper line of the display is used to show the value displayed in floating-point format (5 digits) and to display pictograms of the SD/SDHC card status, or after pressing ⏶ or ◁ keys, to display pictograms of the maximum or minimum value.

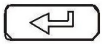
Table 12

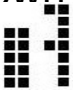
Symbol	Displaying mode	Meaning
	constant	SD/SDHC card is installed and ready to work
	blinking	SD/SDHC is uninstalled and ready to be removed
	blinking	SD/SDHC card is protected against writing
	blinking	SD/SDHC card is full
	constant	Displaying the maximum value
	constant	Displaying the minimum value

The P30U transducer automatically adjusts the format (accuracy) of displaying to the value of the displayed parameter. To use this function to the maximum, you should select from the menu `Settings Display → DecimalP →0.0000` or enter the value "0" into the register 4021, then the transducer will be displaying the displayed value with the maximum possible accuracy. You should remember that displaying with higher resolution is not always desired, as it may deteriorate stability of indications.

If exceeding the measurement ranges it is indicated by displaying special characters in the upper line of the LCD display:

– `vvvvvvv` – lower overflow of the input signal range
– `^^^^^^^` - upper overflow of the input signal range

The lower line of the display of the P30U transducer is multi-functional. After pressing  or  key, the functions of the lower line of the display are switched in cycles:

- unit (selected from the defined units or your own unit (par. 5.4.11)) including the internal memory usage indicator  par. 7.1. Table 16.)
- time in HH:MM:SS format
- date in DD:MM:YY format
- bar graph showing percentage control of the analog output
- second displayed value  - value of any transducer register

projected on a floating-point number – number of the register to be displayed should be entered into the register 4024 (if you want to display the float register value stored in the 16-bit registers, e.g.. register 7000, you should enter the number of the corresponding 32-bit register - > 7500.)

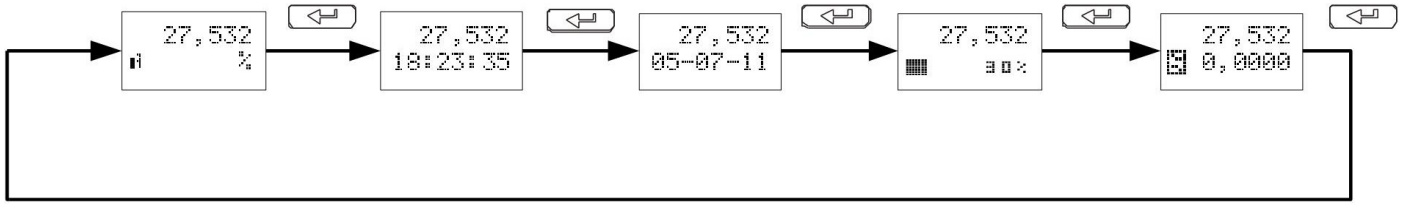


Fig.13 . Diagram of switching information displayed in the lower line of the display.

The function selected for the lower line of the display is stored in memery after a power supply loss.

5.4.10. Standard parameters

The table 13 shows standard settings of the P30U transducer. Those setpoints may be restored by means of the transducer menu by selecting the option Settings Service → ParFact → Yes or via the RS-485 interface after entering the value “1” into the register 4055.

Table 13

	Parameter symbol	Standard value
Input	Input	Therm. J 0..400°C
	AvgTime	1000
	Compens.	Automat.
	Comp.Val	0
	Il.Dop.B	2
	Math Fun	Off

Ind.Char	Point No	1
	X1	100
	Y1	100
	...	
	Xn	(n-1)*100
	Yn	(n-1)*100
Display	DecimalP	0.0000
	Unit	mA
	Over Lo	-99999
	Over Hi	99999
	Bcklight	On
	Bckl.Int.	70,00%
	Disp.Reg	7509
	Dec.P 2	0.0000
Archive	Param.A1 Param.A2	Disp.Val
	Type A1 Type A2	n-on
	OverLoA1 OverLoA2	0
	OverHiA2 OverHiA2	20
	DlyOnA1 DlyOnA2	0
	DlyOffA1 DlyOffA2	0
	OnLockA1 OnLockA2	0
	SgKeepA1 SgKeepA2	On
Output	Param.An	Disp.Val
	AnIn Lo	0
	AnIn Hi	20
	AnOut Lo	0
	AnOut Hi	20
	OvrServ	Off
	OvrIn Lo	0
	OvrIn Hi	20
	OvrOutLo	0
	OvrOutHi	0
Modbus	Address	1
	Protocol	r8n2
	BaudRate	9600

	Reg.No	7510
	No.ofReg.	1
	TypeReg	flt 32
	Interval	10
	AnswTime	1000
Archive	Arch.Val	Disp.Val
	Param.Ar	Disp.Val
	Ar.Mode	h_off
	OverLoAr	0
	OverHiAr	0
	Ar.Time	10
	Ar.Erase	No
	Rec.ToSD	No
	Param.SD	99.9
Service	ParFact	No
	Security	00000
	Time	Not identified
	Date	Not identified
	AutoTime	No
	DispTest	No
	Language	Polish (for version P30U-XXXXXXPX) English (for version P30U-XXXXXXEX)

5.4.11. Defining your own unit

In the transducers of the P30 family, apart from the defined standard units, it is possible to define your own unit to be displayed in the lower line of the LCD display. The maximum size of the unit field is 5 characters, each character consists of 8 lines which makes 5x8 = 40 fields (registers) that define the unit. The standard solution is that own unit was defined in the transducers in the form of the LUMEL sign. In order to display your own unit, you should enter the value “57” into the register 4020 or choose the unit from the transducer menu.
To define your own unit you should use the registers from the range 4400 … 4440. The definition method is shown on the below illustration.

Line No. 1 of the character			Character No. 1 of the unit	Character No. 2 of the unit	Character No. 3 of the unit	Character No. 4 of the unit	Character No. 5 of the unit
Line No. 1 of the							

Fig.14 . Field intended for the unit in the lower line of the LCD display.

Register	Value	Character No. n					
4400+(n-1)*8	0x1F		1	1	1	1	1
4401+(n-1)*8	0x10		1				
4402+(n-1)*8	0x14		1		1		
4403+(n-1)*8	0x14		1		1		
4404+(n-1)*8	0x14		1		1		
4405+(n-1)*8	0x17		1		1	1	1
4406+(n-1)*8	0x10		1				
4407+(n-1)*8	0x1F		1	1	1	1	1

Fig.15 . Method of coding your own unit on a single field of the display.

5.4.12. RS-485 Master mode

The P30U transducer is equipped with the RS-485 Master mode, which when selected makes that the device may poll one slave device connected to it. Both devices must have the same communication parameters. The RS-485 Master mode is switched on by selecting the appropriate type of input from menu: Input → RS-485 Master or by entering the value “34” into the register 4000. In the master mode the following parameters should be configured in the Modbus menu:

Table 14

Item	Modbus	
1	Address	Address of the device being read out
2	Protocol	Transmission mode on the connection
3	BaudRate	Baud rate
4	Reg.No	Number of the first read out register
5	No.ofReg.	Number of read out registers
6	TypeReg	Type of read out registers
7	Interval	Read out interval [x100 ms]
8	AnswTime	Maximal time of reply [ms]

The parameters (4 - 6) may also be configured by RS-485 (registers 4048-4052) before the RS-485 Master mode is selected. After selecting the RS-485 Master mode it is impossible for other *Master* device to poll the transducer.
In the transducer Input menu there is the parameter No.ofErr, which is to define the admissible number of incorrect responses to the transducer request (number of repeated requests before an error is displayed). That parameter is also modified by RS-485 (register 4005) before the RS-485 Master mode is selected. The first register being polled is always treated as the value displayed in the RS-485 Master mode. If the request refers to a larger number of registers (parameter No.ofReg. > 1), then it is possible to display, in the lower line of the display, the value of other register than the first one being polled, because all the polled registers are copied to the block of registers from the range 8000...8049. For example, when we want to display additionally the value of the second register being polled, we should set the value “8001” in the menu of the parameter Display → Disp.Reg. (the first value being polled is in the register 8000 and it is treated as the main displayed value) or enter the value “8001” into the register 4024.
In order to make the transducer RS-485 interface work again in the *Slave* mode, you should select other type of the input than RS-485 Master and RS-485 Monitor from the device menu.

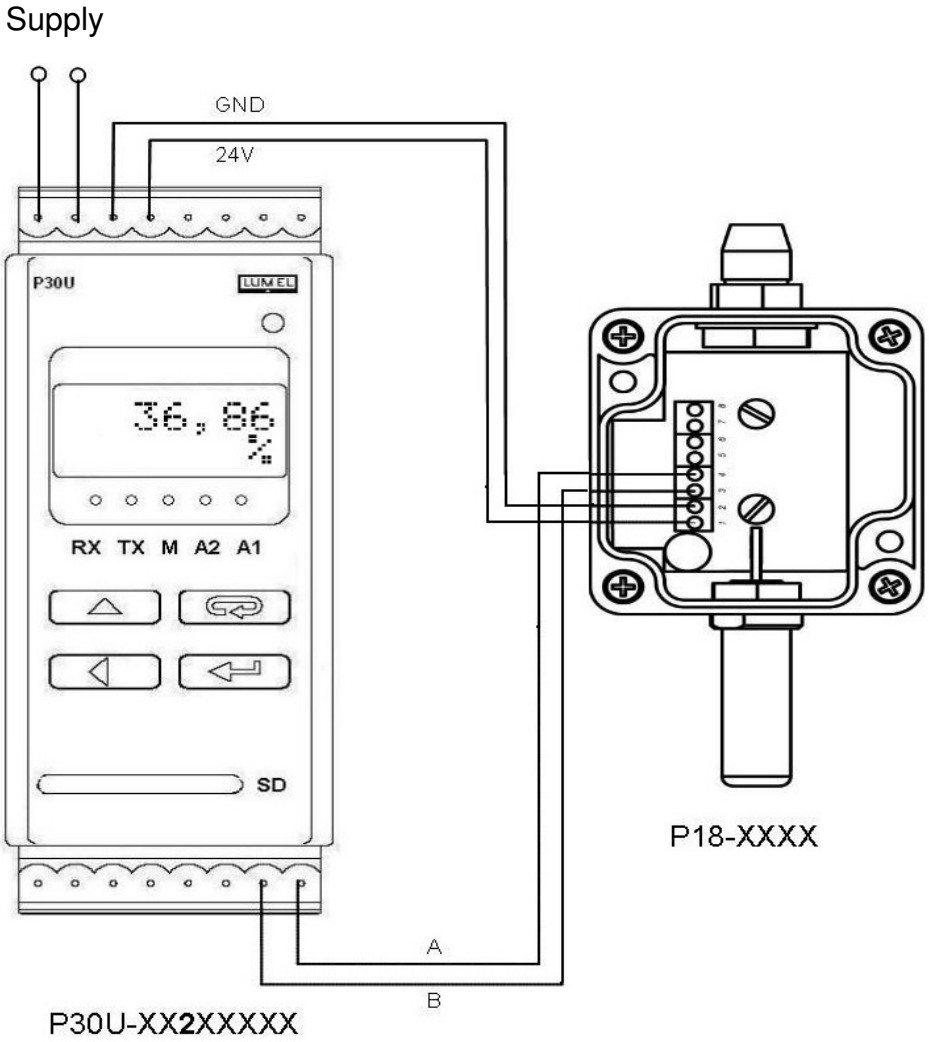


Fig.16 . Example of using a P30U transducer in the RS-485 Master mode to read and register relative humidity from a P18 transducer.

5.4.13. RS-485 Monitor mode

The P30U transducer is equipped with the RS-485 Monitor mode, which when selected makes that the device may listen to traffic in the RS-485 network and react to specific register of responses of the selected device. The P30U transducer must have the same communication parameters as the device being listened to. The RS-485 Monitor mode is switched on by selecting the appropriate input type of from menu: Input → RS-485 Monitor or by entering the value “35” into the register 4000. In the RS-485 Monitor mode the following parameters should be configured in the Modbus menu:

Table 15

Item	Modbus	
1	Address	Address of the device being monitored
2	Protocol	Transmission mode on the connection
3	BaudRate	Baud rate
4	Reg.No	Number of the register being monitored
5	TypeReg	Type of the register being monitored
6	AnswTime	Maximal time of reply of the device being monitored [ms]

The parameters (4 - 6) may also be configured by RS-485 (registers 4048-4052) before the RS-485 Monitor mode is selected. After selecting the RS-485 Monitor mode it is impossible for other *Master* device to poll the transducer.
Similarly as in the RS-485 Master mode the registers being listened to are copied to the register area from the range 8000...8049. The first register being listened to is copied to the register 8000 and it is treated as the main displayed value. If the parameter No.ofReg. > 1, then the values of the following registers being listened to reach the following registers from the range 8000...8049. For example, when we want to display additionally the value of the third register being listened to, we should set the value “8002” in the menu of the parameter Display → Disp.Reg. or enter the value “8002” into the register 4024.
In order to make the transducer RS-485 interface work again in the *Slave* mode, you should choose other type of input than RS-485 Master and RS-485 Monitor from the device menu.

6. Software updating

Function that facilitates updating software from a PC computer with the LPCon software has been implemented in the P30U transducers. Free LPCon software and updating files are available at www.lumel.com.pl. In order to update software the RS-485 converter on USB, such as PD10 converter must be connected to the computer.

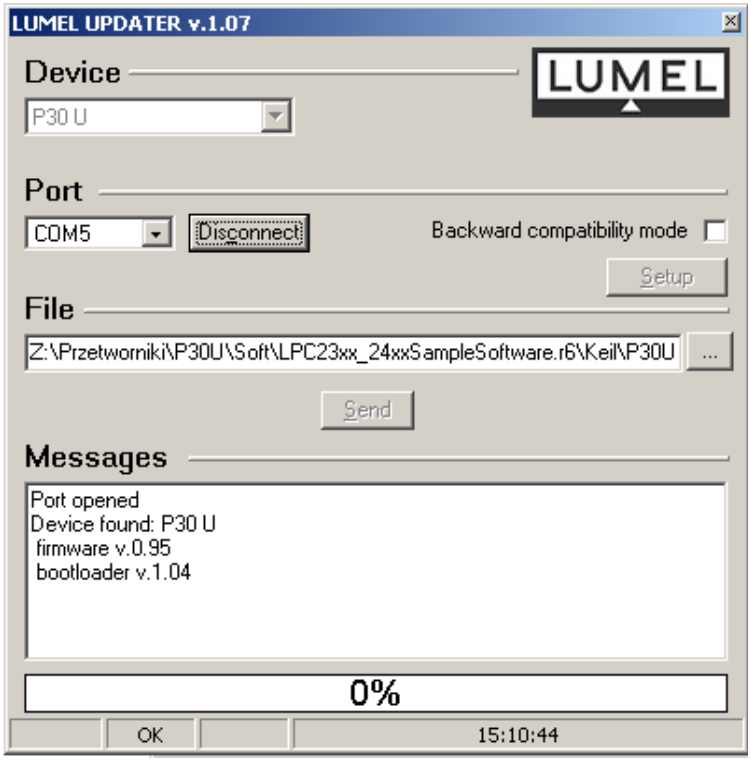


Fig.17b. View of the program to update the transducer software.

Note! After updating the software, standard transducer setpoints should be set, therefore it is recommended to save the transducer parameters before performing the updating process with the LPCon software.

After starting the LPCon program you should set the serial port, speed, mode and address of the transducer in the *Options*. Then you should select the P30U transducer from the menu of the Device and click the Read-out icon to read out all the parameters set (needed to be restored in the future). After selecting, from the ***Updating*** menu, the option ***Device software updating*** the Lumel Updater (LU) – Fig. 17 b window will be

opened. Press the ***Connect*** key. The information window **Messages** includes information on the updating process progress. If the port is correctly opened, the message ***Port opened*** will be displayed. Entry into the updating mode in the transducer is performed in two ways: remotely via LU (on the basis of the settings in LPCon – address, mode, speed, COM port) or by switching on the transducer power supply with pressed ⏎ key. In the case of entry into updating mode using the keyboard, is updated on a standard communication parameters, naudrate 9600 kb/s, 8N2 mode. When all the diodes light up and the message "Connect. UPDATER is displayed in the upper line of the display, it indicates readiness of the transducer to communicate with a PC computer. If the transducer starts to communicate with the LUMEL UPDATER program, the message ***Device found: P30U*** and the version of the main program and of the bootloader program of the connected device will be displayed in the LU program, while the message "Device is ready" will appear on the transducer display. Next, by pressing " ***...*** " key you should retrieve the file with new software version in the LUMEL UPDATER program. If the file is correctly opened, the message ***File opened*** will appear in the window of the LU program. Press the ***Send*** key. During the updating process indication diodes light up in sequence and percentage updating progress is displayed in the lower line of the display. After successful updating process the transducer is switched to normal work, and the message **Done** and updating duration appear in the information window.
Current software version may also be checked by reading the transducer welcome messages after switching on the power supply.

Note: Updating the software is only possible when the transducer and a PC computer are connected directly (no other ***Master*** devices on the RS-485 interface).

Note: Switching on the power supply during the software updating process may result in an unrepairable damage to the transducer!

7. Internal archive

P30 transducers are standard equipped with internal memory intended to store the data recorded by the transducer. The standard parameter recorded by the transducer is the displayed value, it means the measured value, possibly converted on the basis of mathematical functions and the individual input characteristics. It is also possible to record additionally the second displayed value after selecting Archive → Arch.Val → +2 value from the menu or all quired values in Master RS-485 mode or Monitor RS-485 after selecting Archive → Arch.Val → Queried from menu.

Note: Changing the Archive → Arch.Val parameter value in the menu erases the archive in the internal memory!!!

The transducer memory enables to store 534336 records. The memory is a kind of a ring buffer. When the memory is full, the oldest data is overwritten. The internal archive may be read, copied and erased.

7.1. Memory structure

The transducer internal memory is divided into 8192 pages. 66 records of the archive data may be stored on each page. The records on the page always begin from the page beginning and occupy the entire space of the page. Each memory page contains 528 bytes. This memory is divided into two areas: the first 8096 memory pages are intended for primary archive memory, while the last 96 pages are intended for a reserve archive used during copying the archive to an SD/SDHC card (the total memory size is 8096*528B + 96*528B = 4275312 Bytes).
The beginning of the archive data is defined by the number of the page on which there is the first record of the archive and by the initial byte which defines from which page byte the first record begins. The end of the archive is defined similarly by the number of the page on which there is the last record of the page on which there is the last record of the page and

the byte where recording of the next archive record will begin.
Erasing the content of the archive internal memory is to assign parameters of the archive end to the archive beginning. Due to this operation, in case of scanning the archive it, is possible to restore the memory content.
The data in the archive internal memory is stored as records consisting of 8 bytes. Current status of the internal memory may be indicated on the LCD display after selecting, for the lower line, unit display function together with the indicator of the internal memory status (par. 5.4.9). The table 16 describes meanings of the internal memory status indicator.

Table 16

Symbol								
Percentage usage of internal memory	87.5...100%	75...87.5%	62.5...75%	50...62.5%	37.5...50%	25...37.5%	12.5...25%	0...12.5%

7.2. Record structure

All the data contained in the data internal memory is stored as records consisting of 8 bytes. The record structure is presented in the below table.

Table 17

Internal memory record (8 Bytes)					
Recording time (4 Bytes)			Data archived in float format (4 Bytes)		
Year - 2010	Month	Day	Hour	Minute	Second
6 bits	4 bits	5 bits	5 bits	6 bits	6 bits

Example of coding a record in the internal memory – e.g. record No. 13 on the page 559:
The record No. 13 (rec=13) on the page 559 is read out from the registers 4553 – 4556 (unsigned short registers – 2 bytes, 1 record includes 4

unsigned short registers) after entering the value 559 into the register 4500. The initial register containing the beginning of the record is found in the relationship: R_0 = 4501 + rec*4 = 4553.

Table 18

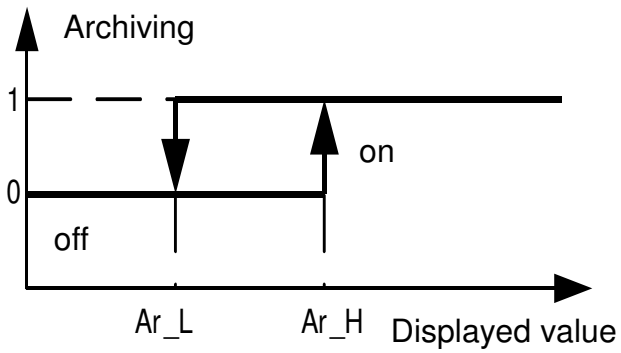
Register	HEX value
4553	0x0170
4554	0xBB95
4555	0xE87C
4556	0xB942

rec. = 0x**0170BB95**E87CB942
Datum = 0xE87CB942 → (float) → 92.743958;

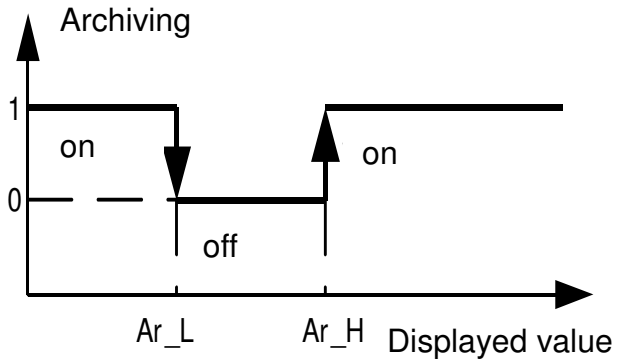
Table 19

Recording time = **0x0170BB95** → b10111000010111011100101 01					
Year + 2010	Month	Day	Hour	Minute	Second
6 bits	4 bits	5 bits	5 bits	6 bits	6 bits
0 0 0 0 0 0 0 1	0 1 1 1	0 0 0	0 1 0 1 1	1 0 1 1 1 0	0 1 0 1 0 1
0 + 2010	5	24	11	46	21
10-05-24 11:46					

a) n-on



c) off



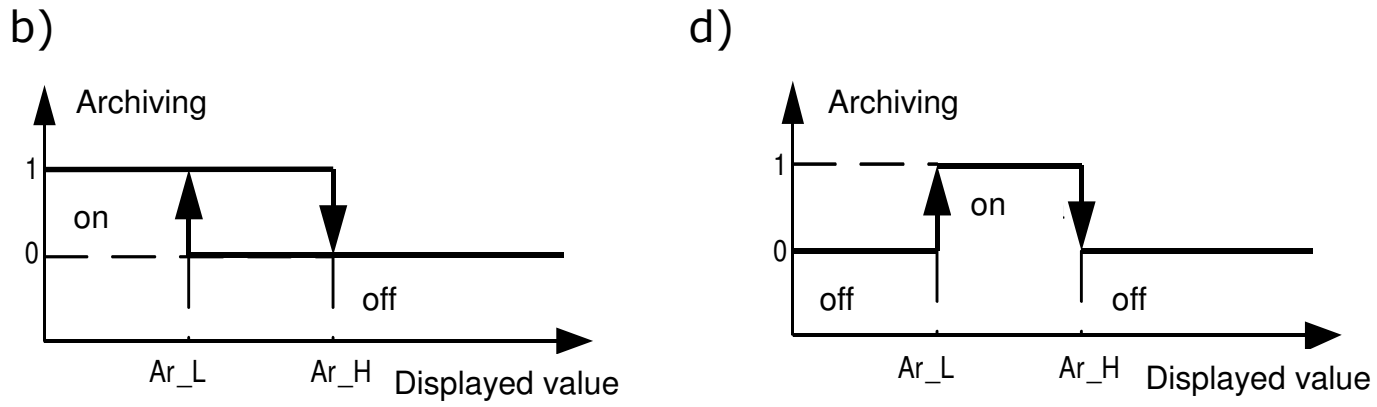


Fig. 18. Conditional archiving types

Ar_L - Lower threshold of archiving → OverLoAr → Register 7608
Ar_H – Upper threshold of archiving → OverHiAr → Register 7609

Example 1. The transducer is configured for measurement of temperature - input Pt100 -200..850°C. Conditional archiving of both displayed values triggered by the displayed value level:

Table 20

Designation in the Fig.	Register No.	Parameter symbol in menu	Register value	Parameter value symbol in menu
	4064	Arch.Val	0	Disp.Val
	4065	Param.Ar	0	Disp.Val
	4066	Ar.Mode	2	on
Ar_L	7608	OverLoAr	50	35.0
Ar_H	7609	OverHiAr	60	45.0
	4067	Ar.Time	10	10
	4068	Ar.Erase	0	Nie
	4069	Rec.ToSD	0	Nie
	7614	Param.SD	99,9	99,9

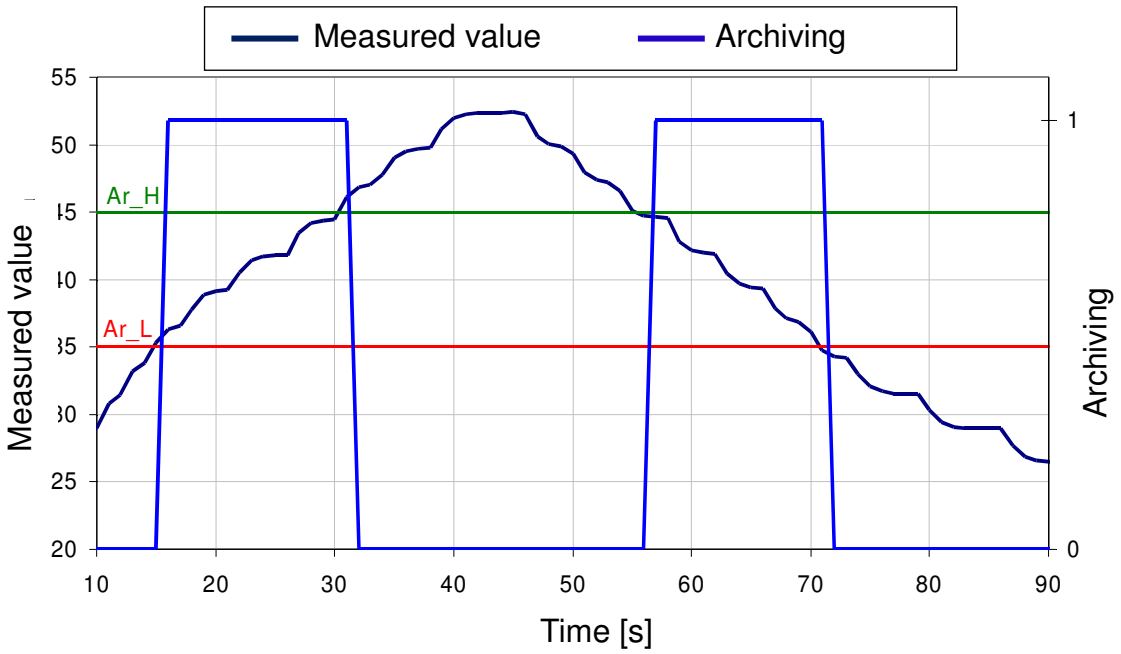


Fig.19 . Example of on type conditional archiving, configured as per the example from the table 20 (Archiving "1" means that archiving is switched on).

7.4. Getting archive data

Getting the archive data from the internal memory is performed through a memory card (option) or through the RS interface -485. Getting the archive data is to get consecutive memory pages containing records with data. Getting single pages from the internal memory is supported by the LPCon software.

If the specific transducer version supports SD/SDHC cards, then the archive data may be automatically copied to a memory card (it is the fastest method to get the archive data). To do so, you should insert an SD/SDHC card into the transducer slot (contacts facing downwards) and make sure that the card is installed correctly (card icon is displayed in the upper left corner of the display). You should also set the value of the percentage usage of the archive, for which the data will be automatically copied to the card – register 7614 or from the menu: Archive → Param.SD. For example, if the value "20.0" is entered into the register

7614, then the data will be gathered in the transducer internal memory until the internal memory is used in 20%, then the archive will be automatically copied to an SD/SDHC card. If the value of the percentage usage is higher – e.g. 99%, then the data will be saved on an SD/SDHC card with lower frequency, but the saving process will last longer. Saving the data on a card is indicated by a progress bar – a progress bar graph displayed in the lower line of the LCD display. When saving the data on a card, you should not remove the SD/SDHC card from the transducer, as it may cause damage to the data or reset the device. It is possible to stop the saving process and reject the card after uninstalling the card (par. 5.3).
It is also possible to make the device start the procedure of copying data to a SD/SDHC card at any time after pressing the combination of: ◁ ↵ keys.

8. Memory card (option)

P30 transducers support memory cards in the SD and SDHC standard. FAT and FAT32 system is supported. In case, when the memory card has not been formatted, you should format it in a card reader by means of a PC computer. When the P30U transducer works, it creates folders and files containing the archive data. Before inserting a card in the transducer you should check, if the card is not protected against writing. Never remove the memory card from the transducer until it is uninstalled (see the point 5.3.) – the card may be uninstalled by means of the keyboard by pressing △ ↵ keys. Removing an installed card may cause damage to the data saved on the card. The memory card status is described in the transducer registers (point 9.5). Just after inserting a card the card status, in the form of messages, will be displayed for about 3 seconds on the display, as presented in the below table:

Table 21

Message	Description
RemoveSD	The card is inserted, but it has not been installed (uninstalled).
Damaged SD	The card is inserted, but the installation attempt has failed.
UnlockSD	The card is inserted, it is correctly installed, but it is protected against writing. Once the writing protection is detected the card is automatically uninstalled.

SD OK or SDHC OK	The card is inserted, and has been installed successfully.
Full SD	The card is inserted and installed successfully, but it is completely full.
Instal.	The card is inserted – installation in progress

Exemplary number of records on a SD/SDHC card for the archiving time of 1s, for a single value being archived is:

- 64MB card: approx. 1,900,000 records (about 22 days)
- 2 GB card: approx. (about 700 days)

Note: It is recommended to use industrial version of SD/SDHC cards in write speed class 6. Cards intended for universal applications may also be used - in write speed class 6 (you should remember that the working temperature of the "consumer" cards is limited within the range 0...40°C).

During the recording process, the P30U transducer creates folders and files on the memory card. The exemplary structure of folders is presented in the Fig. 21.

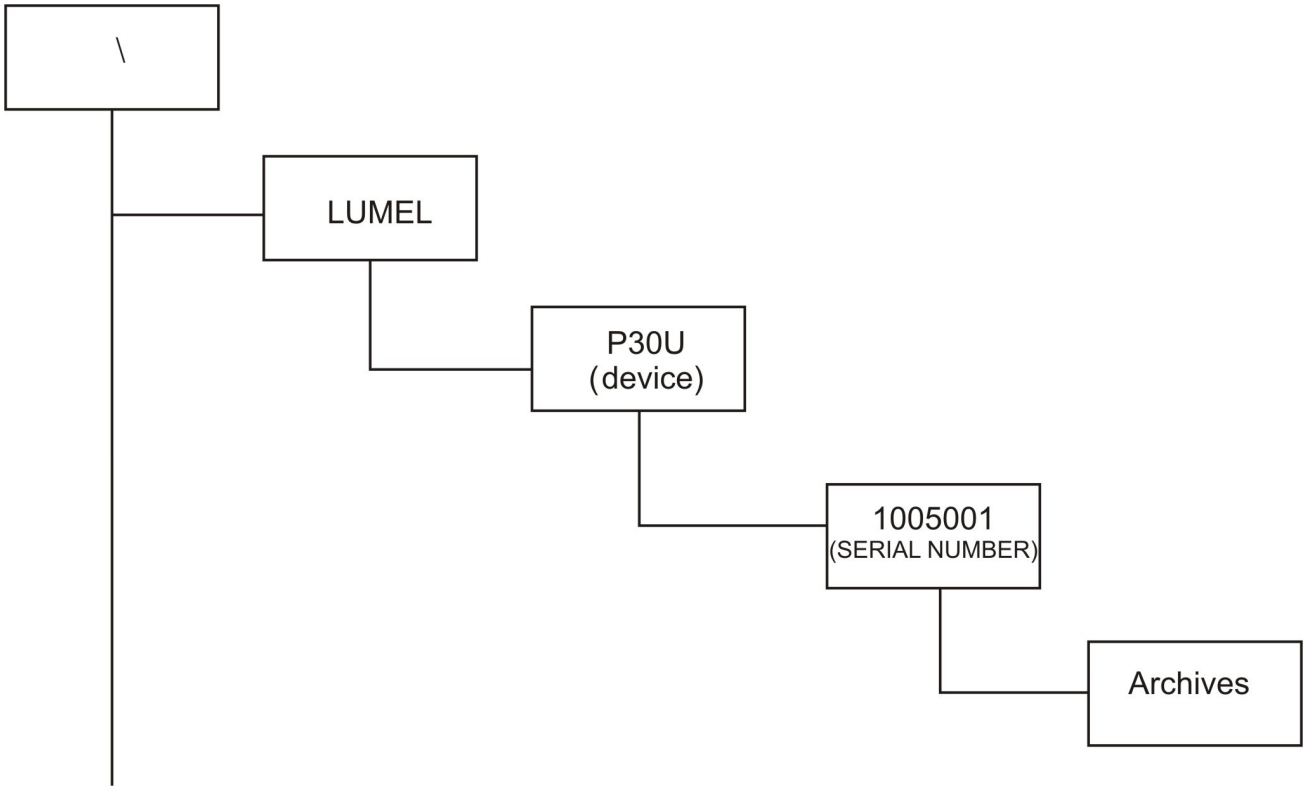


Fig. 21. Structure of folders on a memory card.

Apart from the Archives folder, also the System folder is created on the card in which the start.txt file is stored to save the date and hour of installation of the memory card (also when starting the device after the power supply has been lost).
The data on the card is stored in the files placed in the folders corresponding to the name of the device and the serial number – see Fig. 21. While the names of the files correspond to the recording date, and its format is *XXXX_YY.DAT*, where *XXXX* → year , YY → month. Thus, single files contain data archived during one month.

8.1 Archive file structure

The files containing the data are made of columns, where the consecutive data columns are separated from one another by a tab character. The first line of the file contains the column heading. The data records are arranged in sequence in lines, and the fields of the specific record are separated from one another by a tab character. View of the exemplary file is presented in the Fig. 22.

date	time	value1	value2
2011-10-14	15:16:50	-2,536392e-02	0,000000e+00
2011-10-14	15:16:51	-2,536392e-02	3,742963e-04
2011-10-14	15:16:52	-2,533341e-02	7,485927e-04
2011-10-14	15:16:53	-2,531052e-02	1,122889e-03
2011-10-14	15:16:54	-2,530289e-02	1,497185e-03
2011-10-14	15:16:55	-2,531815e-02	1,871482e-03
2011-10-14	15:16:56	-2,536392e-02	2,245778e-03
2011-10-14	15:16:57	-2,536392e-02	2,620074e-03
2011-10-14	15:16:58	-2,526856e-02	2,994371e-03
2011-10-14	15:16:59	-2,534104e-02	3,368667e-03
2011-10-14	15:17:00	-2,524185e-02	3,368667e-03
2011-10-14	15:17:01	-2,532196e-02	4,117260e-03
2011-10-14	15:17:02	-2,528763e-02	4,491556e-03
2011-10-14	15:17:03	-2,534866e-02	4,491556e-03
2011-10-14	15:17:04	-2,540970e-02	5,240149e-03
2011-10-14	15:17:05	-2,539444e-02	5,614445e-03

Fig. 22. Exemplary file with data

The consecutive fields contained in a line describing a record have the following meanings:

- *date* – *d*ate of recording the data, “-” character is the date separator,
- time – hour, minute, second of the recorded data, “ : ” character is the time separator,
- value1 – archived displayed value of the transducer, the decimal separator depends on the language version set of the transducer menu – for the Polish menu the separator is “ , ”, for the remaining language versions the separator is “ . ”, the values are written in the engineering format,
- value2 – the second archived displayed value of the transducer, the decimal separator depends on the language version set of the transducer menu – for the Polish menu the separator is “ , ”, for the remaining language versions the separator is “ . ”, the values are written in the engineering format.

9. RS-485 interface

The digital programmable P30U transducers are equipped with a serial connection in the RS485 standard to communicate in computer systems and with other Master devices. Asynchronous character communication protocol MODBUS has been implemented on the serial connection. The transmission protocol describes the methods of exchanging information between devices via a serial port.

9.1. Connecting a serial interface

RS-485 standard allows direct connection of up to 32 devices on a single serial connection with the length of up to 1200 m (with the baud rate 9600 b/s). In order to connect larger number of devices, it is necessary to use additional intermediate-and-separating systems such as PD51 made by LUMEL S.A.

Route of the interface line is presented in the Fig. 3. In order to obtain correct transmission, it is necessary to connect the lines A and B in parallel to their equivalents in other devices. Connection should be made with a shielded cable. The cable shield should be connected to the protective terminal as close to the transducer as possible (the shield is to be connected to the protective terminal at one point only).
GND line is intended for additional protection of the interface line in case of long connections. Then you should connect the GND signals of all the devices on the RS-485 bus.
In order to get connected with a computer you must have the RS-485 interface card or an appropriate converter such as PD51 or PD10. The method of connecting the devices is presented in the Fig. 23.

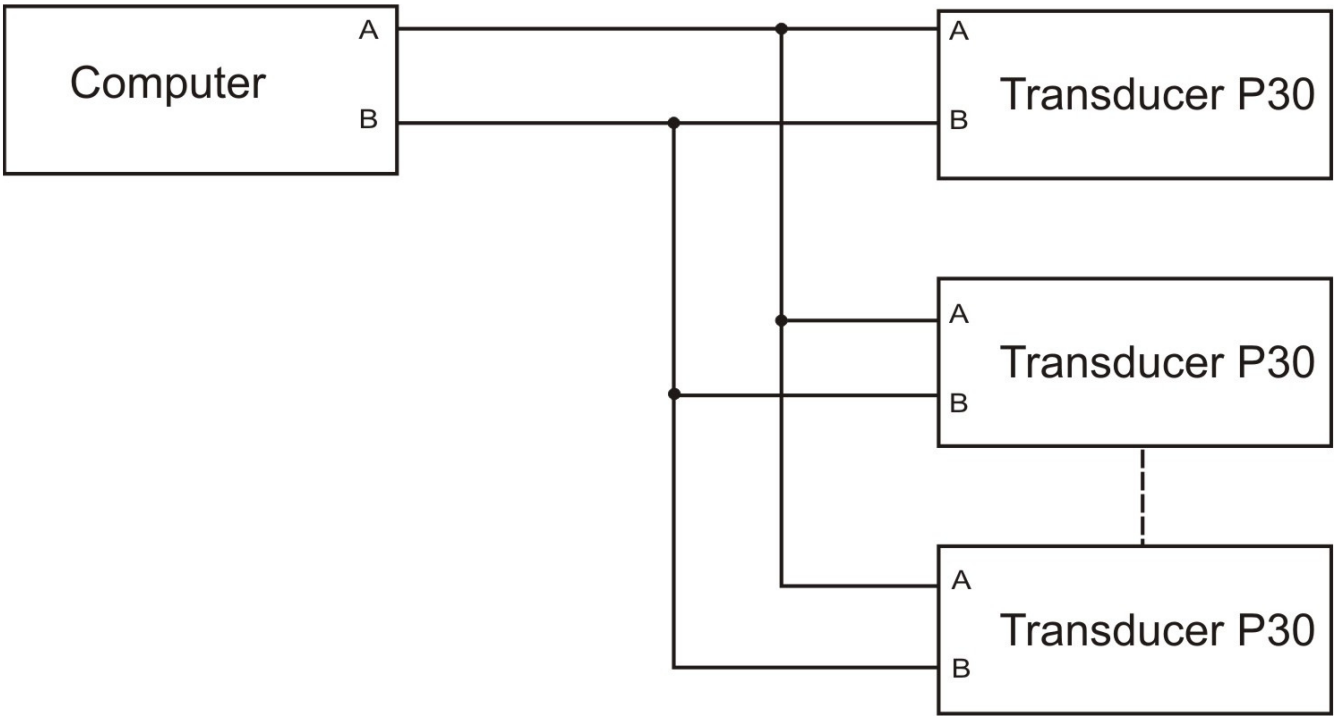


Fig.23. Method of connecting the RS-485 interface.

Designation of the transmission lines for the card in a PC computer depends on the card manufacturer.

9.2. Description of MODBUS protocol implementation

The implemented protocol is in conformity with the specification PI-MBUS-300 Rev G of Modicon.
Specification of the parameters of the serial connection of the P30 transducers in the MODBUS protocol:

- Transducer address 1..247.
- Baud rate: 4800, 9600, 19200, 38400, 57600, 115200, 230400, 256000 [b/s].
- Work mode: RTU with a frame in the format: 8n2, 8e1, 8o1, 8n1.
- Maximum response time: 100 ms (the response time may get longer up to 500ms when saving the data on a SD/SDHC card).

Configuration of the parameters of the serial connection is to determine the baud rate, device address and information unit format - protocol.
Note: Each transducer connected to a transmission network must:

- Have a unique address, different from the addresses of other devices connected in the network.
- Have exactly the same baud rate and information unit format.

9.3 Description of the functions applied

The following MODBUS functions are implemented in P30 transducers:

- 03 (03h) – readout a register group.
- 04 (04h) - readout a input register group
- 06 (06h) – recording a single register
- 16 (10h) – recording a register group.
- 17 (11h) – identification of the slave device.

Reading-out n-registers (code 03h)

Example 1. Reading-out 2 registers starting with the register with the float(32 bits) 1DB0h (7600) address, (register values 10, 100.)
Request:

Table 22

Device address	Function	Register address		Number of registers		Control sum CRC
		Hi	Lo	Hi	Lo	
01	03	1D	B0	00	02	C3 80

Response:

Table 23

Device address	Function	Number bytes	Value from the register 1DB0 (7600)				Value from the register 1DB1 (7601)				Control sum CRC
			MSB			LSB	MSB			LSB	
01	03	08	41	20	00	00	42	C8	00	00	E4 6F

Recording a single register (code 06h)

Example 2. Recording the value 543 (0x021F) in the register 4001 (0x0FA1)
Request:

Table 24

Device address	Function	Register address		Register value		Control sum CRC
		Hi	Lo	Hi	Lo	
01	6	0F	A1	2	1F	9B 94

Response:

Table 25

Device address	Function	Register address		Register value		Control sum CRC
		Hi	Lo	Hi	Lo	
01	6	0F	A1	2	1F	9B 94

Recording to n-registers (code 10h)

Example 3. Recording 2 registers starting with the register with the 1DB0h (7600) address
Recorded values 20, 200.
Request:

Table 26

Device address	Function	Address of reg.Hi	Address of reg.Lo	Number of reg. Hi	Number of reg. Lo	Number of bytes	Value for the reg. 1DB0 (7600)				Value for the reg. 1DB1 (7601)				Control sum CRC
							MSB			LSB	MSB			LSB	
01	10	1D	B0	00	02	08	41	A0	00	00	43	48	00	00	C9 E2

Response:

Table 27

Device address	Function	Register address		Number of registers		Control sum CRC
		Hi	Lo	Hi	Lo	
01	10	1D	B0	00	02	46 43

Report identifying the device (code 11h)

Example 4. Device identification

Request:

Table 28

Address device	Function	Control sum
01	11	C0 2C

Response:

Table 29

Address	Function	Number of bytes	Identifier	Device status	Field depending on the device software version (eg. 0.70)	Control sum (CRC)
01	11	08	C1	FF	50 33 30 55 20 30 2E 37 30	C0EC

9.4 Register map

In the P30U transducer the data is stored in 16- and 32-bit registers. The process variables and parameters of the instrument are stored in the address space of the registers in such way that they depend on the variable type. The bits in the 16-bit registers are numbered from the least significant to the most significant (b0 … b15). The 32-bit registers (4 Bytes) contain floating-point numbers in IEEE-754 standard. Sequence of bytes: B3 B2 B1 B0 – the most significant byte is sent as the first one. 16-bits register representing 32-bits values on the next two registers are duplicated in another address area of the arrangement of bytes address: B0 B1 B2 B3 (Table 30).
Register map of the P30U transducer is presented below.

Note: All the addresses given are physical addresses. In some computer programs logical addressing is applied, then the addresses should be increased by 1.

Table 30

Address range	Value type	Description
4000 - 4127	integer (16 bits)	Value stored in a 16-bit register.
4300 - 4320	integer (16 bits)	Value stored in a 16-bit register.
4400 - 4440	integer (16 bits)	Value stored in a 16-bit register.
4500 - 4765	integer (16 bits)	Value stored in a 16-bit register.
6000 -6038	float (32 bits)	Value stored in two consecutive 16-bit registers. Those registers contain the same data as the 32-bit registers from the 7500 area. Those are read only registers. Sequence of byte (1-0-3-2)
6200-6326	float (32 bits)	Value stored in two consecutive 16-bit registers. Those registers contain the same data as the 32-bit registers from the 7600 area. Those registers may be read and written. Sequence of byte (1-0-3-2)
7000 -7038	float (32 bits)	Value stored in two consecutive 16-bit registers. Those registers contain the same data as the 32-bit registers from the 7500 area. Those are read only registers. Sequence of byte (3-2-1-0)
7200-7326	float (32 bits)	Value stored in two consecutive 16-bit registers. Those registers contain the same data as the 32-bit registers from the 7600 area. Those registers may be read and written. Sequence of byte (3-2-1-0)
7500-7519	float (32 bits)	Value stored in a 32-bit register. Those are read only registers. Sequence of byte (3-2-1-0)
7600-7668	float (32 bits)	Value stored in a 32-bit register. Those registers may be read and written. Sequence of byte (3-2-1-0)
8000-8049	float (32 bits)	Value stored in a 32-bit register. Those registers may be read and written. Sequence of byte (3-2-1-0)
8100-8199	float (32 bits)	Value stored in two consecutive 16-bit registers. Those registers contain the same data as the 32-bit registers from the 8000 area. Those are read only registers. Sequence of byte (3-2-1-0)
8200-8199	float (32 bits)	Value stored in two consecutive 16-bit registers. Those registers contain the same data as the 32-bit registers from the 8000 area. Those are read only registers. Sequence of byte (1-0-3-2)

9.5 Read and write registers

Table 31

The value is placed in 16-bit registers	Symbol	Write (w) / read-out (r)	Range	Description	
4000	Input type	w/r	0...35	Input type	
				Value	
				0	reserved
				1	Voltage -10…10V
				2	Voltage -24…24V
				3	Current -20...20mA
				4	Resistance 0...400Ω
				5	Resistance 0...2000Ω
				6	Resistance 0...5500Ω
				7	Pt100 -200...850 ºC
				8	Pt250 -200...600 ºC
				9	Pt250 -200...850 ºC
				10	Pt500 -200...180 ºC
				11	Pt500 -200...850 ºC
				12	Pt1000 -200...250 ºC
				13	Pt1000 -200...850 ºC
				14	Ni100 -60...180 ºC
				15	Ni1000 -60...180 ºC
				16	Ni100-LG -60...180 ºC
				17	Ni1000-LG -60...180 ºC
				18	Cu100 -50...180 ºC
				19	Voltage -5...20mV
				20	Voltage -75...75mV
				21	Voltage -200...200mV
				22	Thermocouple J 0...420ºC
				23	Thermocouple J -200...1200ºC

				24	Thermocouple K 0...400ºC
				25	Thermocouple K -200...1370ºC
				26	Thermocouple S 0...1760ºC
				27	Thermocouple N -20...420ºC
				28	Thermocouple N -200...1300ºC
				29	Thermocouple E -40...260ºC
				30	Thermocouple E -200...1000ºC
				31	Thermocouple R 0...1760ºC
				32	Thermocouple T -100...400ºC
				33	Thermocouple B 400...1800ºC
				34	RS-485 Master
				35	RS-485 Monitor
4001	Measurement time	w/r	200...20000	Averaging time of the measured values [ms]	
4002	Point No	w/r	1...21	Number of points of the individual characteristic. For the value of 1 individual characteristic is switched off. Sections of individual characteristic are defined by individual parameters Xn and Yn, where n - number of point.	
4003	Compensation	w/r	0...1	Select the type of compensation: - Terminals temperature for thermocouple inputs - Resistance of wires for resistance inputs	
				Value	Description
				1	The automatic compensation
				0	The manual compensation (compensation value should be entered in the register of 7668)
4004		w/r	0...1	Deleting minimum and maximum value	
4005		w/r	0...10	Permissible number of wrong answers in the mode of RS-485 Master	
4006	Math.Fun	w/r	0...5	Value	Description
				0	Mathematical functions switched off
				1	Square of the measured value
				2	Square root of the measured value
				3	Inversion of the measured value
				4	Square of inverse of the measured value
				5	Square root of inverse of the measured value
4007...		w/r		RESERVED	

...4016				
4017		w/r	0...1	Deleting of status registers
4018	Dec.P 2	w/r	0...4	The minimal position of the decimal point when is displayed the second displayed values (displayed value on the LCD lower line).

Value	Description
0	0.0000
1	00.000
2	000.00
3	0000.0
4	00000

4019	Intensity	w/r	1...10	Value: Description
				1: Intensity of LCD Display backlight intensity - 10% of maximum illumination
				4019 ...:
				10: Intensity of LCD Display backlight intensity - 100% of maximum illumination
4020	unit	w/r	0...57	Displayed unit

Value	Unit	Value	Unit	Value	Unit
0		20	kVAh	40	pcs
1	V	21	MVAh	41	imp
2	A	22	Hz	42	rps
3	mV	23	kHz	43	m/s
4	kV	24	Ω	44	l/s
5	mA	25	k Ω	45	rev / min
6	kA	26	°C	46	rpm
7	W	27	°F	47	mm/min
8	kW	28	K	48	m/min
9	MW	29	%	49	l/min
10	var	30	%RH	50	m^3/min
11	kvar	31	ph	51	pcs/h
12	Mvar	32	kg	52	m/h
13	VA	33	bar	53	km/h

				14	kVA	34	m	54	m^3/h		
				15	MVA	35	l	55	kg/h		
				16	kWh	35	s	56	l/h		
				17	MWh	37	h	57	Self, user-defined		
				18	kVarh	38	m^3				
				19	MVarh	39	Rev.				
4021	DecimalP	w/r	0...4	The minimal position of the decimal point when is displayed the displaying values							
				Value	Description						
				0	0.0000						
				1	00.000						
				2	000.00						
				3	0000.0						
				4	00000						
4022	Backlight	w/r	0....61	LCD backlight							
				Value	Description						
				0	Switched off						
				1...60	Switched on for time 1...60 s						
				61	Switched on for good						
4023		w/r		RESERVED							
4024	Disp.Reg.	w/r	0....65535	Number of register displayed on the lower line (wanting to see the registry value of float type, which is placed in 16-bit register, enter the number of corresponding 32 – bit register)							
4025		w/r	0...1	Deleting backup alarms on LED diodes (A1, A2)							
4026	Param.A1	w/r	0...1	The input size controlling an alarm 1							
				Value	Description						
				0	Measuring input						
				1	Clock						
				2	The second displayed value						
4027	Type A1			Alarm type 1 (Description – fig.12)							
				Value	Description						
				0	n-on						
				1	n-off						
				2	on						
				3	off						
				4	h_on						
				5	h_off						

4028	DlyOnA1	w/r	0...900	Delay time of switching on the alarm 1 (s)	
4029	DlyoffA1	w/r	0...900	Delay time of switching off the alarm 1 (s)	
4030	OnLockA1	w/r	0...900	Delay time of re-switching on the alarm 1 (s)	
4031	SgKeepA1	w/r	0...1	Support of the alarm 1 signaling (flashing LED)	
				Value	Description
				0	Support is switched off
				1	Support is switched on
4032		w/r		RESERVED	
4033	Param.A2	w/r	0...1	The input size of the control alarm 2	
				Value	Description
				0	Measuring input
				1	Clock
				2	The second displayed value
4034	Type A2			The alarm type 2 (Description – Fig. 12)	
				Value	Description
				0	n-on
				1	n-off
				2	on
				3	off
				4	h_on
				5	h_off
4035	DlyOnA2	w/r	0...900	Delay time of switching on the alarm 2 (s)	
4036	DlyOffA2	w/r	0...900	Delay time of switching off the alarm 2 (s)	
4037	OpoPonA2	w/r	0...900	Delay time of re-switching on the alarm 2 (s)	
4038	OnLockA1	w/r	0...1	Support of the alarm 2 signaling (flashing LED)	
				Value	Description
				0	Support is switched off
				1	Support is switched on
4039		w/r		RESERVED	
4040	Param.An	w/r	0..1	The input size control analog output	
				Value	Description
				0	Measuring input
				1	Clock
				2	The second displayed value
4041	OvrServ	w/r	0...1	Overflow options of analog output	
				Value	Description

				0	Switched off
				1	Switched on
4042		w/r		RESERVED	
4043	Address	w/r	0...247	Converter address for interface RS-485. Entering a value of 0 switches off the interface.	
4044	Protokol	w/r	0...3	Transfer Mode RS-485 interface	
				0	RTU 8N2
				1	RTU 8E1
				2	RTU 8O1
				3	RTU 8N1
4045	BaudRate	w/r	0...7	Baude rate of the RS-485 interface	
				Value	Description
				0	4800 bit/s
				1	9600 bit/s
				2	19200 bit/s
				3	38400 bit/s
				4	57600 bit/s
				5	115200 bit/s
				6	230400 bit/s
				7	256000 bit/s
4046... ...4047		w/r		RESERVED	
4048	AnswTime	w/r	10...5000	The maximal response time of the device in mode Master RS-485, RS-485 Monitor [ms]	
4049	TypeReg	w/r	0...8	Type of polled / monitored registers in either Master RS-485, RS-485 Monitor	
				char 8	Registers *char* type (8 bit with sign)
				uchar 8	Registers *unsigned char* type (8 bit without sign)
				short 16	Registers *short* type (16 bit with sign)
				ushort 16	Registers *unsigned short* type (16 bit without sign)
				long 32	Registers *slong* type (32 bit without sign)
				ulong 32	Registers *unsigned long* type (32 bit without sign)
				flt 32	Registers *float* type (32 bity, variable point with sign)

				sflt2x16	Registers *swapped float* type, value placed in two registers 16-bit (3,2,1,0 byte order)
				flt 2x16	Registers *float* type, value placed in two registers 16-bit (1,0,3,2 byte order)
				lng 2x16	Register *long* type, value placed in two 16-bit registers (1,0,3,2 byte order)
				slng2x16	Register *swapped long* type, value placed in two 16-bit registers (3,2,1,0 byte order)
				ulng2x16	Register *usigned long* type, value placed in two 16-bit registers without sign) (1,0,3,2 byte order)
				uSln2x16	Register *swapped unsigned long* type, value placed in two 16-bit registers without sign (3,2,1,0 byte order)
4050	Polled reg.	w/r	0...65535	Polled / monitored register number in modes of Master RS-485, RS-485 Monitor	
4051	Number of polled	w/r	0...50	Number of polled registers in the mode Master RS-485	
4052	Interv.	w/r	1...36000	Polling interval Device in the mode of Master RS-485	
4053		w/r	0...1	Update the transmission parameters. Applies the settings entered in RS-485 interface.	
4054	Language	w/r	0...3	Menu language of converter:	
				Value	Description
				0	Polish
				1	English
				2	German
				3	French
4055	ParFact	w/r	0...1	Recording of standard parameters	
				Value	Description
				0	No change
				1	Setting of standard parameters
4056	Security	w/r	0...9999	Password for editing parameters	
				Value	Description
				0	No change
				...	Entrance to edit of parameters

					preceded by inquiry for a password
4057	Time	w/r	0...2359	The current time - hour, minute	
				This parameter appears in the format ggmm, where: gg - means hours, mm - means minutes. Introduction of the wrong hours will set 23, while introduction a false value will set the 59. After the entered register is reseted 4055 (seconds)	
4058		w/r	0...60	The current time - seconds	
4059		o	0...100	The current time - hundredths of a second	
4060	Date	w/r	101...1231	Current date in the format of month * 100 + day	
4061		w/r	2001...2099	Current year in YYYY format .	
4062		w/r	0...1	Automatic change of summer / winter time and vice versa	
				Value	Description
				0	Switched off
				1	Switched on
4063...		w/r		RESERVED	
4064	Arch.Val	w/r	0...1	Selection of the values archived **Note:** changing of registry value erases the archive in the internal memory!!!	
				Value	Description
				0	Displayed value
				1	Displayed value +the second displayed value
				2	All quired registers in Master RS-485 or Monitor RS-485 mode
4065	Param.Ar	w/r	0...1	The control size of triggering conditional archiving	
				Value	Description
				0	Displayed value
				1	Clock (period of time)
4066	Ar.Mode	w/r	0...5	Archiving type (Description – Fig.18)	
				Value	Description
				0	n-on
				1	n-off
				2	on
				3	off
				4	h_on
				5	h_off

4067	Ar.Time	w/r	1...3600	Period of archiving in seconds	
4068	Ar. Erase	w/r	0...1	Erasing of the internal archive	
4069	Rec.ToSD	w/r	0...1	Record internal archive to the SD / SDHC card:	
				Value	Description
				0	No action
				1	Start rewriting the internal archive to the SD / SDHC
4070... ...4127		w/r		RESERVED	

Table 32

Value is stored in 16-bit registers ($1 \le n \le 5$)	Writing (w) /reading (r)	Range	Description
4400+8*(n-1)	w/r	0...31	Filling the character n of the line 1 of your own unit (see Fig.15)
4401+8*(n-1)	w/r	0...31	Filling the character n of the line 2 of your own unit (see Fig.15)
4402+8*(n-1)	w/r	0...31	Filling the character n of the line 3 of your own unit (see Fig.15)
4403+8*(n-1)	w/r	0...31	Filling the character n of the line 4 of your own unit (see Fig.15)
4404+8*(n-1)	w/r	0...31	Filling the character n of the line 5 of your own unit (see Fig.15)
4405+8*(n-1)	w/r	0...31	Filling the character n of the line 6 of your own unit (see Fig.15)
4406+8*(n-1)	w/r	0...31	Filling the character n of the line 7 of your own unit (see Fig.15)
4407+8*(n-1)	w/r	0...31	Filling the character n of the line 8 of your own unit (see Fig.15)

Table 33

Value is stored in 16-bit registers	Writing (w) /reading (r)	Range	Description
4500	w/r	0...8096	Number of the memory page to which we want to get access. Writing the page number
4501	r	0...65535	Two first data bytes from the page indicated by the 4500 register.
4502	r	0...65535	Two consecutive bytes
---	---	---	---
4764	r	0...65535	Two last bytes of the memory page (526 and 527 byte)

Table 34

Value is stored in two consecutive 16-bit registers. Those registers contain the same data as 32-bit registers from the 7500 area	Value is stored in 32-bit registers	Symbol	Writing (w) /reading (r)	Range	Description
7200...7203 /6200...6203	7600...7601				RESERVED
7204/6204	7602	OverLo	w/r	-99999...99999	Lower threshold of display narrowing
7206/6206	7603	OverHi	w/r	-99999...99999	Upper threshold of display narrowing
7208/6208	7604	OverLoA1	w/r	-99999...99999	Lower threshold of alarm 1
7210/6210	7605	OverHiA1	w/r	-99999...99999	Upper threshold of alarm 1
7212/6212	7606	OverLoA2	w/r	-99999...99999	Lower threshold of alarm 2
7214/6214	7607	OverHiA2	w/r	-99999...99999	Upper threshold of alarm 2
7216/6216	7608	OverLoAr	w/r	-99999...99999	Lower threshold of archiving

7218/6218	7609	OverHi Ar	w/r	-99999...99999	Upper threshold of archiving
7220/6220	7610	AnIn Lo	w/r	-99999...99999	Individual characteristics of analog output- Lower threshold of displayed value
7222/6222	7611	AnIn Hi	w/r	-99999...99999	Individual characteristics of analog output- upper threshold of displayed value
7224/6224	7612	AnOut Lo	w/r	-24...24	Individual characteristics of analog output- Lower threshold of output value
7226/6226	7613	AnOut Hi	w/r	-24...24	Individual characteristics of analog output- upper threshold output value
7228/6228	7614	Param. SD	w/r	5 … 100	Fulfillment percentage of internal archive, which will turn on automatic record on the SD/SDHC card
7230...7242 /6230...6242	7615...7621				RESERVED
7244/6244	7622	X1	w/r	-99999...99999	Individual characteristics point (measured value). Point No. 1.
7246/6246	7623	Y1	w/r	-99999...99999	Value expected for point No. 1.
7248/6248	7624	X2	w/r	-99999...99999	Point No. 2 of individual characteristics.
7250/6250	7625	Y2	w/r	-99999...99999	Value expected for point No. 2.
7252/6252	7626	X3	w/r	-99999...99999	Point No. 3 of individual characteristics.
7254/6254	7627	Y3	w/r	-99999...99999	Value expected for point No. 3.
7256/6256	7628	X4	w/r	-99999...99999	Point No. 4 of individual characteristics.
7258/6258	7629	Y4	w/r	-99999...99999	Value expected for point No. 4.
7260/6260	7630	X5	w/r	-99999...99999	Point No. 5 of individual characteristics.
7262/6262	7631	Y5	w/r	-99999...99999	Value expected for point No. 5.
7264/6264	7632	X6	w/r	-99999...99999	Point No. 6 of individual characteristics.
7266/6266	7633	Y6	w/r	-99999...99999	Value expected for point No. 6.
7268/6268	7634	X7	w/r	-99999...99999	Point No. 7 of individual characteristics.
7270/6270	7635	Y7	w/r	-99999...99999	Value expected for point No. 7.
7272/6272	7636	X8	w/r	-99999...99999	Point No. 8 of individual characteristics.
7274/6274	7637	Y8	w/r	-99999...99999	Value expected for point No. 8.
7276/6276	7638	X9	w/r	-99999...99999	Point No. 9 of individual characteristics.
7278/6278	7639	Y9	w/r	-99999...99999	Value expected for point No. 9.
7280/6280	7640	X10	w/r	-99999...99999	Point No. 10 of individual characteristics.
7282/6282	7641	Y10	w/r	-99999...99999	Value expected for point No. 10.
7284/6284	7642	X11	w/r	-99999...99999	Point No. 11 of individual characteristics.
7286/6286	7643	Y11	w/r	-99999...99999	Value expected for point No. 11.
7288/6288	7644	X12	w/r	-99999...99999	Point No. 12 of individual

					characteristics.
7290/6290	7645	Y12	w/r	-99999...99999	Value expected for point No. 12.
7292/6292	7646	X13	w/r	-99999...99999	Point No. 13 of individual characteristics.
7294/6294	7647	Y13	w/r	-99999...99999	Value expected for point No. 13.
7296/6296	7648	X14	w/r	-99999...99999	Point No. 14 of individual characteristics.
7298/6298	7649	Y14	w/r	-99999...99999	Value expected for point No. 14.
7300/6300	7650	X15	w/r	-99999...99999	Point No. 15 of individual characteristics.
7302/6302	7651	Y15	w/r	-99999...99999	Value expected for point No. 15.
7304/6304	7652	X16	w/r	-99999...99999	Point No. 16 of individual characteristics.
7306/6306	7653	Y16	w/r	-99999...99999	Value expected for point No. 16.
7308/6308	7654	X17	w/r	-99999...99999	Point No. 17 of individual characteristics.
7310/6310	7655	Y17	w/r	-99999...99999	Value expected for point No. 17.
7312/6312	7656	X18	w/r	-99999...99999	Point No. 18 of individual characteristics.
7314/6314	7657	Y18	w/r	-99999...99999	Value expected for point No. 18.
7316/6316	7658	X19	w/r	-99999...99999	Point No. 19 of individual characteristics.
7318/6318	7659	Y19	w/r	-99999...99999	Value expected for point No. 19.
7320/6320	7660	X20	w/r	-99999...99999	Point No. 20 of individual characteristics.
7322/6322	7661	Y20	w/r	-99999...99999	Value expected for point No. 20.
7324/6324	7662	X21	w/r	-99999...99999	Point No. 21 of individual characteristics.
7326/6326	7663	Y21	w/r	-99999...99999	Value expected for point No. 21.
7328/6328	7664	OvrIn Lo	w/r	-99999...99999	Lower overflow of input
7330/6330	7665	OvrIn Hi	w/r	-99999...99999	Upper overflow of input
7332/6332	7666	OvrOut Lo	w/r	-24...24	Value expected on the output during lower overflow of input
7334/6334	7667	OvrOut Hi	w/r	-24...24	Value expected on the output during upper overflow of input
7336/6336	7668	Comp.Val	w/r	-99999...99999	Value of compensation of temperature of terminals or of resistance of cables (depending on the selected type of input) in case of selecting the transducer work with manual compensation

9.6 Read registers

Table 35

Value is stored in 16-bit registers	Writing (w) /reading (r)	Range	Description	
4300	r	0...9999	Software version * 100	
4301	r	0...65535	Status No. 1 of the transducer. It describes current status of the transducer. The next bits represent the specific event. A bit set to 1 means that an event has occurred. Events may be erased only.	
			Bit15 31	Loss of calibration parameters
			Bit14 30	RTC clock – loss of setpoints – battery failure
			Bit13 29	Clock – changing time summer/winter
			Bit12 28	No communication with the data memory
			Bit11 27	Incorrect setpoints
			Bit10 26	Standard setpoints have been restored
			Bit9 25	Exceeding measurement range
			Bit8 24	Internal archive memory communication error
			Bit7 23	Archive parameter error
			Bit6 22	Measurement transducer error
			Bit5 21	Usage of the internal archive 100%
			Bit4 20	The need to restore the default settings after software update
			Bit3 19	Incorrect configuration of the individual characteristics
			Bit2 18	not used
			Bit1 17	not used
			Bit0 16	not used
4302	r	0...65535	Status No. 2 of the transducer. It describes current status of the transducer. The next bits represent the specific event. A bit set to 1 means that an event has occurred. Events may be erased only.	
			Bit15	not used
			Bit14	not used
			Bit13	not used
			Bit12	not used
			Bit11	not used

			Bit10	not used
			Bit9	not used
			Bit8	not used
			Bit7	not used
			Bit6	Overflow options of analog output are switched on
			Bit5	LED2 – Indication alarm No. 2.
			Bit4	LED1 – Indication alarm No. 1.
			Bit3	not used
			Bit2	not used
			Bit1	Status of the transducer of the alarm number 2.
			Bit0	Status of the transducer of the alarm number 1.
4303	r	0...5	Memory card status	
			Value	Description
			0	No card
			1	The card is inserted, but it has not been installed (uninstalled)..
			2	The card is inserted, but the installation attempt has failed.
			3	The card is inserted, it is correctly installed, but it is protected against writing. Once the writing protection is detected the card is automatically uninstalled.
			4	The card is inserted, and has been installed successfully.
			5	The card is inserted and installed successfully, but it is completely full.
			6	Card installation in progress
4304	r		Production status 1	
			Bit15 ... Bit8	not used
			Bit7 … Bit4	Calibrating number (0... 15)
			Bit3 … Bit0	4 more significant bits of the serial number (bits 19…16 of the serial number)
4305	o		Production status 2	
			Bit15 … Bit0	16 less significant bits of the serial number (serial number consists of 19 bits and is built as follows: bits 19...14 – year (0...63) bits 13...10 – month (0...12) bits 9...0 – consecutive number (1...9999)

4306	r		RESERVED
4307	r	0...8192	Memory page describing the archive beginning
4308	r	0...8192	Memory page describing the archive end
4309	r	0...527	Byte describing the archive beginning. The value in the register describes from which byte of the archive beginning page the archive begins.
4310	r	0...527	Byte describing the archive end. The value in the register indicates the next byte under which the archive record will be written.
4311... ...4322			RESERVED

Table 36

Value is stored in two consecutive 16-bit registers. Those registers contain the same data as 32-bit registers from the 7500 area	Value is stored in 32-bit registers	Name	Writing (w) /reading (r)	Unit	Name value
7000/6000	7500	Identifier	r	-	Constant value identifying the device The value 193 stands for the P30U transducer .
7002/6002	7501	Status	r	-	Register describing the actual status of the transducer.
7004/6004	7502	Control	r	%	Register describing the control of the analog output.
7006/6006	7503	Minimum	r	-	Minimum value of the value being displayed.
7008/6008	7504	Maximum	r	-	Maximum value of the value being displayed.
7010/6010	7505	Displayed value	r	-	Value being displayed
7012/6012	7506	Actual time	r	-	Actual time
7014/6014	7507	Date - year	r	YYYY	Actual date - year
7016/6016	7508	Month, day	r	MMDD	Actual date – month, day

7018/6018	7509	Usage of the archive	r	%	Actual status of usage of the archive internal memory
7020/6020	7510	Measured value	r	-	Value being measured not converted by individual characteristics
7022/6022	7511	Temperature of terminals	r	ºC	Temperature of the transducer terminals for measurements of temperature by means of thermocouples
7024/6024	7512	Second displayed value	r		Value displayed in the lower line of the LCD display - value of any transducer register (see description of the reg. 4024, Table 30)
7026/6026	7513		r		Free memory on a SD/SDHC card (kB), value ”-1” means that there is no correctly installed card
7028/6028	7514		r		Total capacity of an SD/SDHC card (kB), value ”-1” means that there is no correctly installed card
7024...7049 /6024...6049	7515... ...7524		r	-	RESERVED

Table 37

Value is stored in two consecutive 16-bit registers. Those registers contain the same data as 32-bit registers from the 8000 area	Value is stored in 32-bit registers	Name	Writing (w) /reading (r)	Unit	Name value
8100/8200	8000		r		Value of the first register read out by the transducer working in RS-485 Master or RS-485 Monitor mode
8102/8202	8001		r		Value of the 2nd register read out by the transducer working in RS-485 Master or RS-485 Monitor mode
8104/8204	8002		r		Value of the 3rd read out by the transducer working in RS-485 Master or RS-485 Monitor mode

8106...8196 /8206...8296	8003... ...8049				Value of the n-th read out by the transducer working in RS-485 Master or RS-485 Monitor mode
8198/8298	8049		r		Value of the 50th read out by the transducer working in RS-485 Master or RS-485 Monitor mode

10. Accessories

For the transducers in P30U-X1XXXXXX versions that support SD/SDHC cards you may order an additional industrial SD card with the capacity adapted to the user's needs according to the below table. **It is disadvised to use the "consumer" cards** due to significant deviations of their parameters and their short durability.

Table 38

Item	Order code	Capacity
1	0923-611-193	1 GB
2	0923-611-194	2 GB

11. Technical data

Inputs:

Table 39

Input type	Nominal measuring range	Maximum measurement range	Multiplicity of narrowing the scope (from the west. class)	Measurement class
Voltage 10 V	−10 ... 10V	-12...12 V	5	0,1
Voltage 24 V	−24 ... 24V	-28...28 V	10	
Current	−20 ... 20 mA	-24 ... 24 mA	10	
Resistance 400 Ω	0 ... 400 Ω	0 ... 420 Ω	4	
Resistance 2000 Ω	0 ... 2000 Ω	0 ... 2050 Ω	2	
Resistance 5500 Ω	0 ... 5500 Ω	0 ... 5550 Ω	2	
Pt100	−200 ... 850 ºC	-205 ... 855 ºC	5	
Pt250	−200 ... 600 ºC	-205 ... 605 ºC	4	
	−200 ...850 ºC	-205 ... 855 ºC	3	
Pt500	−200 ... 180 ºC	-205 ... 185 ºC	3	
	−200 ... 850 ºC	-205 ... 855 ºC	3	
Pt1000	−200 ... 250 ºC	-205 ... 255 ºC	4	
	−200 ... 850 ºC	-205 ... 855 ºC	2	
Ni100	−60 ... 180 ºC	-65 ... 185 ºC	1	
Ni1000	−60 ... 150 ºC	-65 ... 155 ºC	2	
Ni100-LG	−60 ... 180 ºC	-65 ... 185 ºC	1	
Ni1000-LG	−60 ... 180 ºC	-65 ... 185 ºC	2	
Cu100	−50 ... 180 ºC	-55 ... 185 ºC	1	
Voltage mV	−5 ... 20 mV	-6 ... 21 mV	1	
	−75 ... 75 mV	-80 ... 80 mV	4	
	−200 ... 200 mV	-210 ... 210 mV	4	
Thermocouple J type	0 ... 400 ºC	-20 ... 420 ºC	1	
	−200 ... 1200 ºC	-220 ... 1210 ºC	2	
Thermocouple K type	0 ... 400 ºC	-20 ... 420 ºC	1	
	−200 ... 1370 ºC	-280 ... 1382 ºC	2	
Thermocouple S type	0 ... 1760 ºC	-55 ... 1775 ºC	2	0,5

Thermocouple N type	−20 … 420 ºC	-50 … 450 ºC	1	0,1
	−200 … 1300 ºC	-240 … 1350 ºC	1	
Thermocouple E type	−40… 260 ºC	-50 … 280 ºC	1	
	−200 … 1000 ºC	-210 … 1010 ºC	2	
Thermocouple R type	0 … 1760 ºC	-55 … 1765 ºC	2	0,5
Thermocouple T type	−200 … 400 ºC	-210 ... 410 ºC	1	0,1
Thermocouple B type	400 … 1800 ºC	390 ...1820 ºC	1	0,5
Master RS-485	In the RS-485 Master mode, converter can poll a device with Modbus protocol implemented by the RS-485 interface. In this mode, you cannot poll the transducer by the master device.			
Monitor RS-485	In of the RS-485 Monitor mode, converter can monitor the traffic on the RS-485 line and reacts (takes a measured value) on the value of response frame specified slave device. The transmitter can respond to a single registers. In this mode, you cannot poll transducer by the master device			

Outputs:

- analog, programmable, galvanically isolated (0/4...20 mA, load resistance ≤ 500 Ω) or voltage (0...10 V, load resistance ≥ 500 Ω),
- analog output class 0,1;
- conversion time < 200 ms
- transducer type – 1 or 2 transducers; voltage free contacts – closing – maximum rated load 5 A 30 V DC, 250 V AC
- digital – interface RS-485:
  - transmission protocol: modbus RTU
  - address: 1...247
  - mode: 8N2, 8E1, 8O1, 8N1
  - response time: 100 ms [1]
- auxiliary power supply (option) 24 ±2 V DC / 30 mA.
- clock accuracy 1s/24h

Power consumption <5 VA

Weight <0.25 kg

Dimensions 120 x 45 x 100 mm

Fixing rail 35 mm as per PN-EN 60715

Degree of protection provided by the housing

from the housing side (version not supporting SD/SDHC cards)
IP40
from the housing side (version supporting SD/SDHC cards)
IP30
from the housing terminal side
IP20

Display text LCD display, 2x8 characters with LED backlight

Transducer preliminary warm-up time 15 min

Recording

Recording in the 4MB internal memory (max. 534336 records) - recording with a time stamp, for versions supporting SD/SDHC cards it is possible to save automatically the internal archive on SD/SDHC memory cards,

[1] the response time may get longer up to 500ms when saving the data on a SD/SDHC card

Reference conditions and nominal operational conditions

- power supply voltage 85..253 V DC/AC(40..400 Hz) or 20..40 V AC(40..400 Hz), 20...60 V DC
- ambient temperature -25..23..+55 °C
- storing temperature -30..+70 °C
- humidity 25..95 % (condensations are not acceptable)
- working position arbitrary

Additional errors:

- due to temperature variations: for the analog outputs 50% of the class / 10 K for measurement inputs 75% of the class / 10 K
- due to automatic compensation of the reference junction temperature ≤ 1℃
- due to automatic compensation of the cable resistance for thermoresistors ≤ 0.2℃
- due to automatic compensation of the cables for resistance measurement ≤ 0,05Ω
-

Input parameters

- resistance of the voltage input [V]: > 1 MΩ
- resistance of the current input [mA]: 12 ±1 Ω%
- intensity of the current flowing through a thermometric resistor < 0.2 mA
- resistance of cables connecting a thermometric resistor with the transducer: <10 Ω

Long-term overload capability

- thermocouples, thermoresistors 1.1 Xn
- voltage, current and resistance 1.3 Xn

Short-term overload capability

- voltage input 3 Un
- current input = 10 In
-

Standards met by the transducer
Electromagnetic compatibility:

- Resistance to interference as per EN 61000-6-2
- Emission of interference as per EN 61000-6-4
-

Safety requirements:
according to the standard EN 61010-1

- isolation between circuits: basic,
- installation category III,

- pollution grade 2,
- maximum working voltage work in relation to the earth:
  300 V for the power supply circuit and
  50 V for the remaining circuits
- asl <2000 m

12. Execution code

Table 40

The transducer P30U	X	X	X	X	XX	X	X
Analog output:							
current (0/4...20 mA)	1						
voltage (0...10 V)	2						
SD/SDHC card:							
no service		0					
witht service		1					
Addition output:							
NO relay, 5 A 30 V d.c., 250 V a.c.			1				
supply 24 V d.c. / 30 mA.			2				
Supply							
85...253 V a.c./d.c.				1			
20...40 V a.c. , 20...60 V d.c.				2			
Version:							
standard					0		
custom-made *					XX		
Language version:							
Polish						P	
English						E	
other						X	
Acceptance tests:							
without extra requirements							0
with an extra quality inspection certificate							1
according to customer's request							X

* after consultation with the manufacturer

Coding example:

P30U-112100P1 *stands for a transducer in a standard version with a an analog current output, supporting SD/SDHC cards, with a 24 V/30 mA power supply output, power supply 85...235 V AC/DC, in Polish language version with a Quality Control certificate.*

ACCESORIES:

SD CARD	
Capacity	Ordering Code
1 GB	0923-611-193
2 GB	0923-611-194

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