Microprocessor regulator
APOSYS 20 – 01 - 01

TECHNICAL DOCUMENTATION

Producer:

APOELMOS
measurement & control

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CE

ISO 9001

1 Introduction

The controller APOSYS 20 is compact PID controller for electric drives of control and mixing armatures control.

2 Description

2.1 Front panel

1 - Display
The double display represents a measuring and a demanding value of the controlled variable. The measuring value is on the upper line and the demanding value is on the bottom line. At measure and control programming the display offers tabular report.

2 - Check light „°C“
If is by operator set the any temperature sensor (Pt 100,Ni 1000,termocouples J, K, T, E, R, S, B, N), is the check light „°C“ lighting.
Twinkle check light shows a controler breakdown (dates failure). In this case is necessity to let the controller to calibrate by the producer.

3 - Check lights of outputs state
Check lights 1 – 3 indicate the state of single outputs by this way: the check light is lighting – output is switch-on, the check light don't lights – output is switch-off. The check light „4" indicate presence in the TUNE menu (PID constants automatic tuning).

4 - Check lights of a manual control
Indicate presence in the manual control menu.

5 - Check light „MODE"
The check light „MODE" indicate presence in the programming menu.

6 - Key „UP"
Is for listing in a menu and for a numbers date setting at programming. At the key keeping the listing or setting run faster.

7 – Key „DOWN"
Is for listing in a menu and for a numbers date setting at programming. At the key keeping the listing or setting run faster.

8 – Key „SET"
Is for resetting at parameters setting. For return back in parameters programming and for switchover to the manual control.

9 – Key „MODE"
Is for input to programming of parameters and for confirmation of setting dates.

2.2 Input part

APOSYS 20 is one-loop PID controler with the feedback. In the input part is a universal sixteen bit converter with galvanic isolation. It's allowed to connect the sensor Pt 100, sensor Ni1000/5000ppm, Ni1000/6180ppm, thermocouple (J, K, E, T, R, S, B, N), unificate current (4 - 20 mA, 0 - 20 mA) or voltage (0 - 10 V, 0 - 50 mV) signal. Changing of input signal type is possible by reprogramming by keypad and by jumpers position changing (see page 10).

2.3 Output part

Output elements are three miniature relays with max. loading 250 VAC, 2 A. The relay out1 open the drive, relay out2 close the drive. Relay out3 signal the alarm. Relay contacts are protected by varistors. For switching of inductive loading is recommended ,for increase of reliability and decrease of interference, to corresponding contacts to connects anti-jamming RC networks (for example 0,1 μF + 220 Ω).

Warning: *Connected varistors are defined for max. working voltage 400 Vef. At switching some motors in a single-phase connecting with a capacitor, for phase shift, can make it on winding connected through the capacitor permanent increasing the working voltage over setting of value allowable varistors voltage. Therefore we recommend to connect electric drive per protective relays (see scheme page 15).*

Coherent analog output (10 bit PWM) is possible to set as a control or as measured value output. Control coherent analog output work duplicitly with relay outputs out1 and out2.

Adjustable ranges of analog output are 0 - 20 mA, 4 - 20 mA, 20 - 0 mA, 20 - 4 mA for current signal and 0 - 10 V, 2 - 10 V, 10 - 0 V, 10 - 2 V for voltage signal.

Dates output is realised by serial isolated communication line RS 485. The type of communication is Master-Slave. The controler is Slave.

2.4 Apparatus function

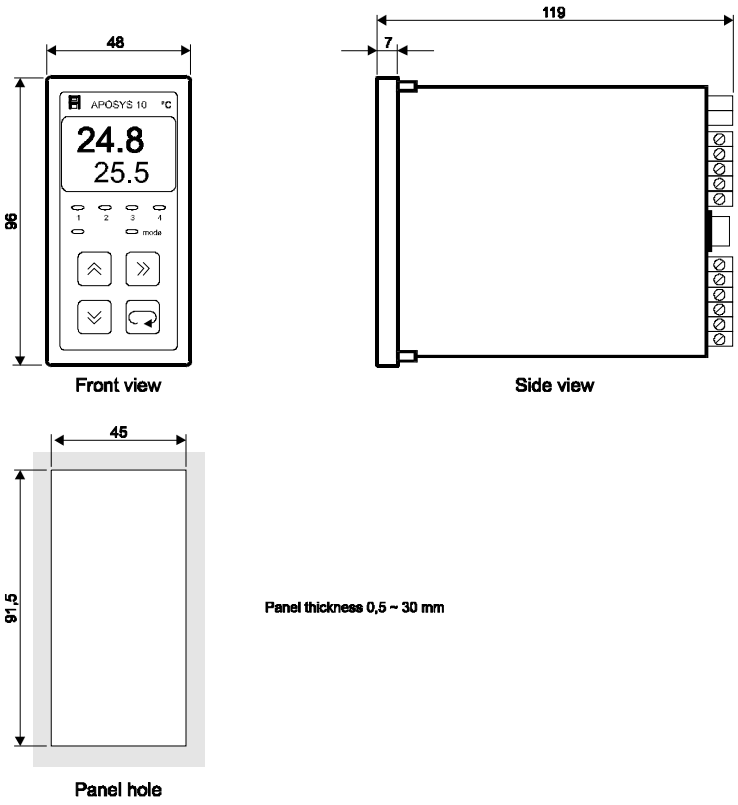
The controler APOSYS 20-10-10 allowed control to constant value with feedback. The PID control output is convert in impulse module to outputs OUT1 and OUT2. To the emulsion block is possible to load the feedback. The output from PID control is possible bring to analog output too. With the communication line RS 485 we can perform the system monitoring.

2.5 Technical dates

Power supply	1/N/PE - 230 VAC (+10 -15%)
Power input	max. 6 VA
Display	-999 ~ 9999 red double four point LED height of mark 10 mm and 7,62 mm
Decimal point	setting by program
Input signals:	
Number of inputs	1 with galvanic isolation + feedback
Possibility of inputs signals	
thermocouple „J“	-200 ~ 1200 °C
thermocouple „K“	-200 ~ 1300 °C
thermocouple „E“	-200 ~ 1000 °C
thermocouple „T“	-200 ~ 400 °C
thermocouple „R“	-50 ~ 1700 °C
thermocouple „S“	-50 ~ 1700 °C
thermocouple „B“	250 ~ 1800 °C with linearization from 400 °C
thermocouple „N“	-200 ~ 1300 °C
sensor Pt100 by DIN IEC 751/A2	-80 ~ 800 °C
sensor Ni1000/6180ppm	-50 ~ 200 °C
sensor Ni1000/5000 ppm	-50 ~ 200 °C
current	4 ~ 20 mA, 0 ~ 20 mA
voltage	0 ~ 10 V, 0 ~ 50 mV
Compensation of thermocouples comparison ends :	
inner	accuracy 0,5°C at temp. 20°C
outer	20°C, 50°C or 70°C setting by program
Feedback	resistive transmitter 0 - 100 Ω 5 - 105 Ω 0 - 140 Ω current signal 4 - 20 mA voltage signal 0 - 10 V
Outputs:	
switching-on	2 relays 250 VAC, 2 A for drive control 1 relay 250 VAC, 2 A for alarm
analogue	10 bit PWM D/A converter isolated current range 0 ~ 20 mA, 4 ~ 20 mA, 20 ~ 0 mA, 20 ~ 4 mA - loading resistance max. 500 Ω voltage range 0 ~ 10 V, 2 ~ 10 V, 10 ~ 0 V, 10 ~ 2 V - loading resistance min. 10 kΩ
dates	communication line RS 232 (nonisolated), RS 485 isolated, speed 9600 Baud, 11 transmission bits, duplex communication Master - Slave
Measuring accuracy	±0,1 % from range ±1 digit
Temperature ratio	25 ppm/°C
Resolution	by decimal point state, max. 0,01
Measurement speed	1 measurement/s for measuring input 5 measurement/s for feedback
Calibration	at 25°C and 40 % r.h.
Processor	SAB 80C535N

Data redundancy	electrically (FLASH)
Auxiliary voltage	20 VDC, max. 25 mA (electronic fuse)
Type of apparatus	panel
Dimensions	48 x 96 x 119 mm
Mounting hole in panel	43,5 x 90,5 mm (with holes ∅3mm in angles)
Keyboard	4 foil keys
Operating temperature	0 ~ 60 °C
Weight	0,3 kg
Steady time	to 5 min after switch-on
Coverage	IP 54 (front panel)
Safety rate	I
Bonding	terminal block (max. 2,5 mm^2)
Data connector for RS232	Canon 9V
Electromagnetic compatibility	ČSN EN 50081 – 2 ČSN EN 50082 – 1
Seismal imunity	ČSN IEC 980:1993, čl.6

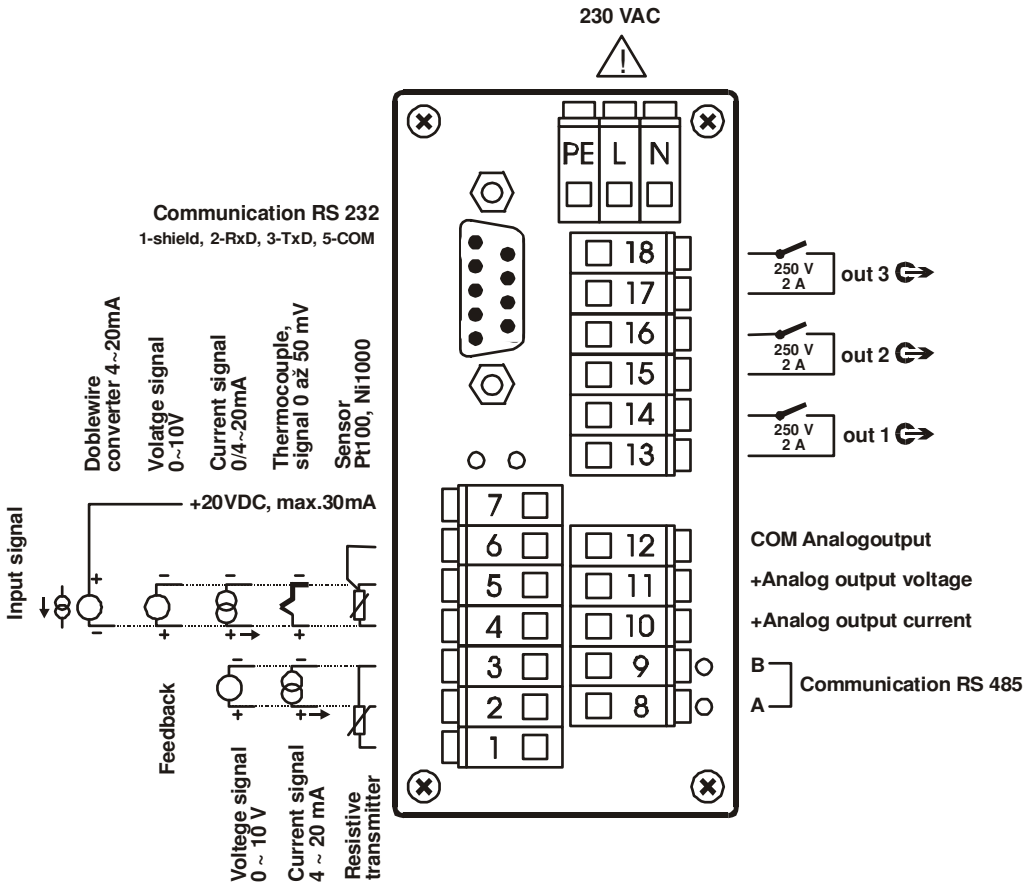
2.6 Dimensions



2.7 Mounting instruction

The controller handle in the mounting hole with help two holders. Wires are connected to screw connectors on rear panel of the controller. Connectors are as 4 single taking down construction blocks: connectors 1 - 7 - block of feedback and outputs, connectors 8 - 12 - block of communication RS 485 and analog output, connectors 13 - 18 - block of relays outputs, connectors 19 (PE), 20 (L), 21 (N) – block of power supply. Every block of connectors is possible to eject in the direction back after lock force overcoming. Wires are possible to connect to taking down blocks and then connect all blocks to the controller.
Connector Cannon is for connecting of serial communication line RS 232.

2.8 Connecting of terminal blocks

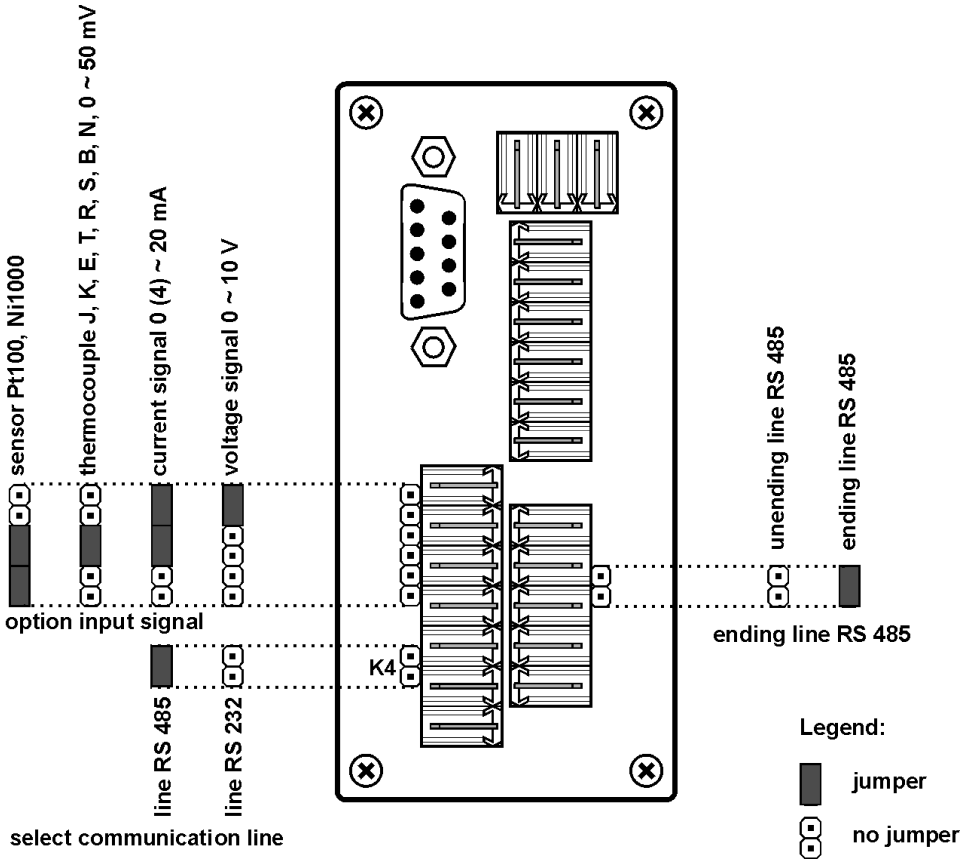


Measure ranges of inputs quantities

type	range
thermocouple J	-200 ~ 1200 °C
thermocouple K	-200 ~ 1300 °C
thermocouple E	-200 ~ 1000 °C
thermocouple T	-200 ~ 400 °C
thermocouple R	-50 ~ 1700 °C
thermocouple S	-50 ~ 1700 °C
thermocouple B	250 ~ 1800 °C with linearization from 400 °C
thermocouple N	-200 ~ 1300 °C
sensor Pt100	-80 ~ 800 °C
sensor Ni1000/6180 ppm	-50 ~ 200 °C
sensor Ni1000/5000 ppm	-50 ~ 200 °C
current signal 4 ~ 20 mA	optional
current signal 0 ~ 20 mA	optional
voltage signal 0 ~ 10 V	optional
voltage signal 0 ~ 50 mV	optional

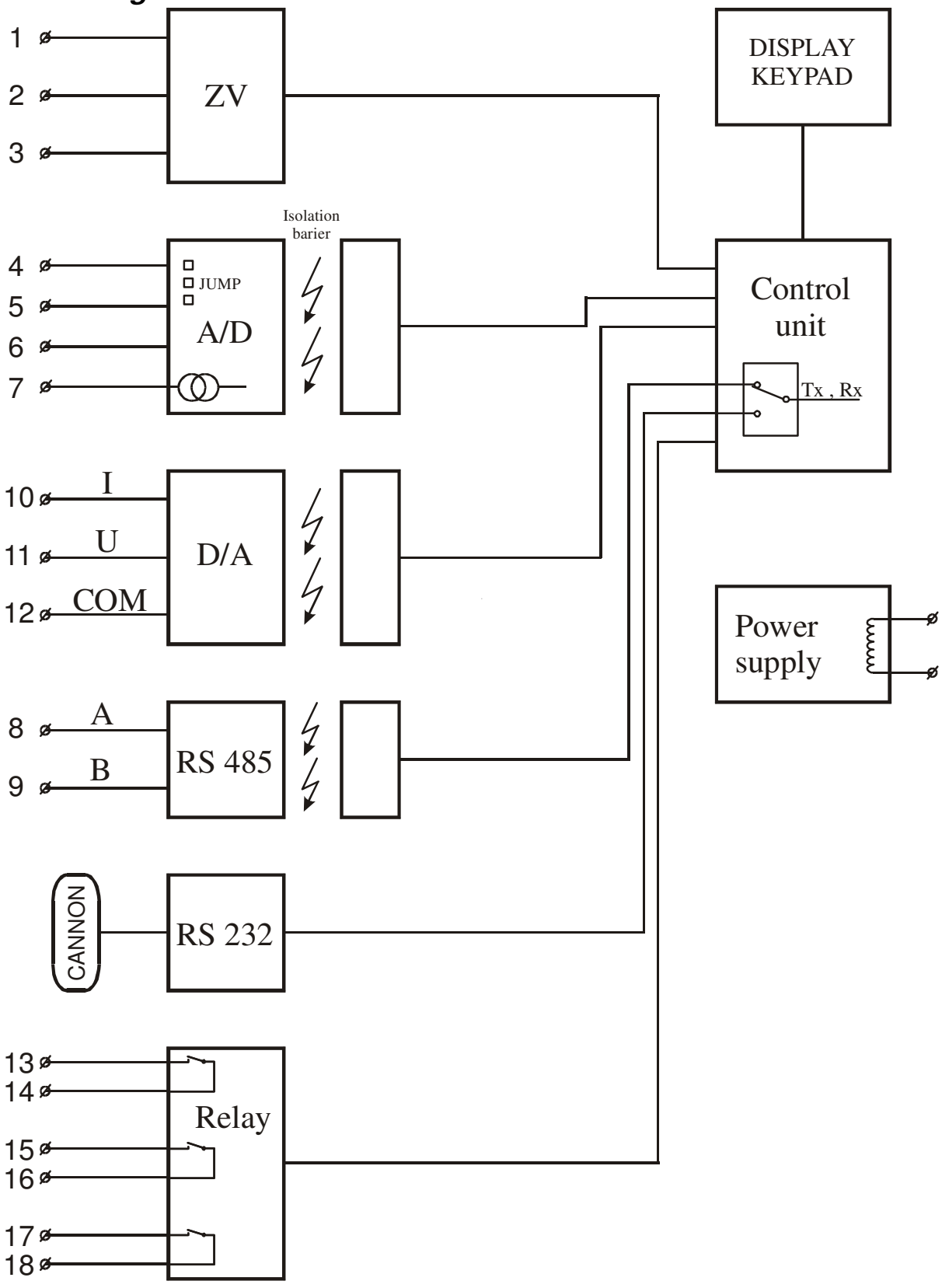
2.9 Connecting of main distribution frame

In the main distribution frame is necessary to set with delivered bonds a type of elect input signal, optionally ending of serial communication line RS 485. The main distribution frame is allowable after taking down of connectors 1 - 7 and 8 - 12. Possibilities: see the picture. On the picture is demonstrate the rear side of apparatus after taking down of connectors.



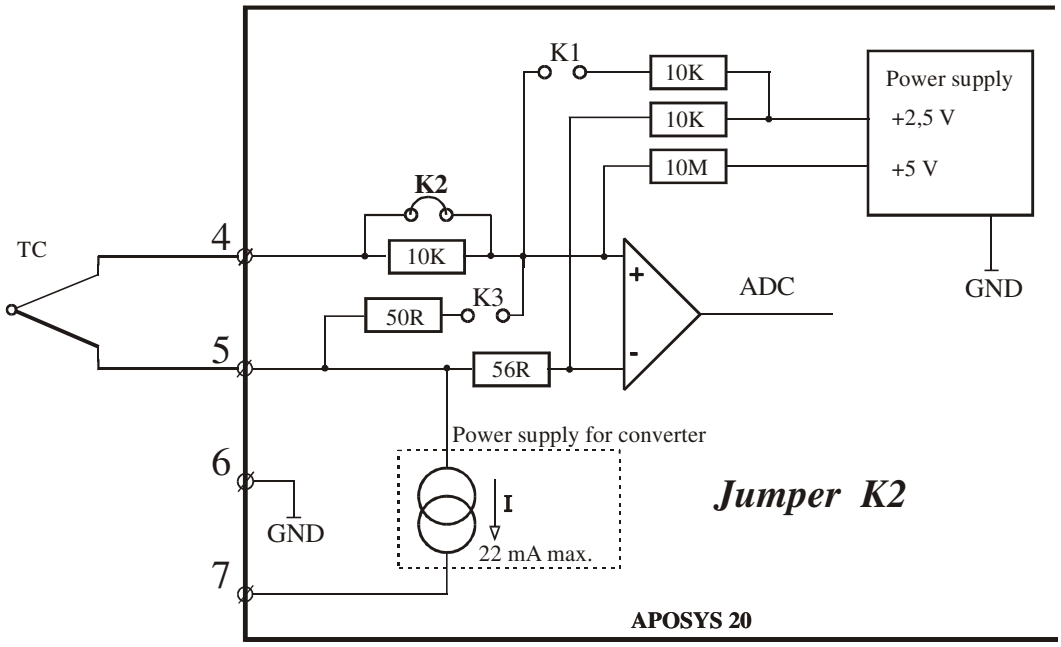
At a selection of the type of input signal is necessity to respect the main distribution frame setting for parameters setting in the programming mode.

2.10 Block diagram of inner connexion

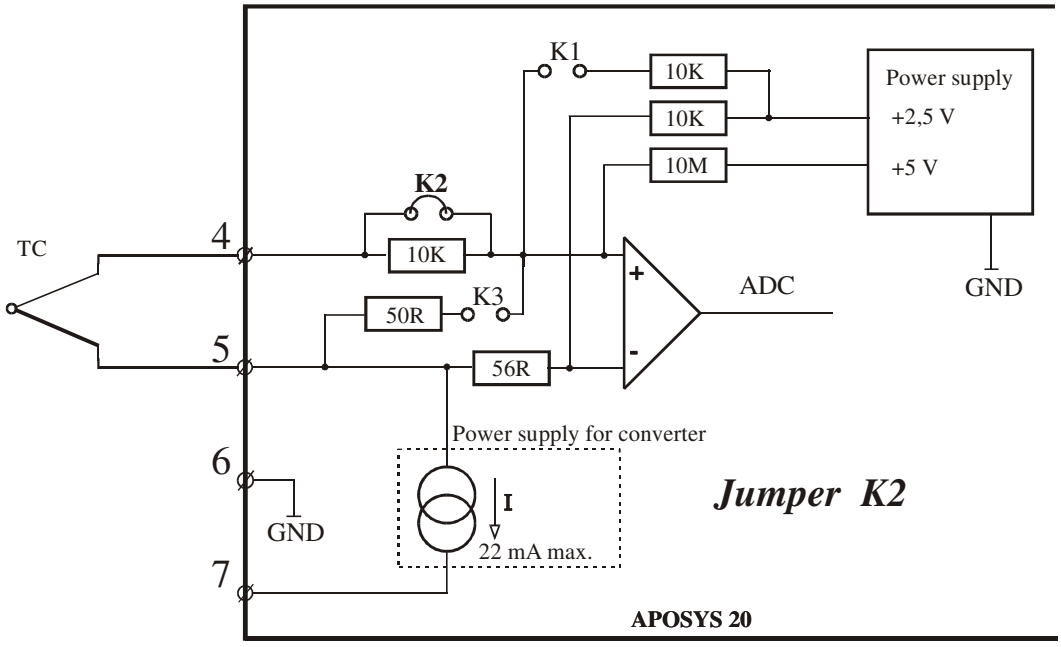


2.11 Input signals connection

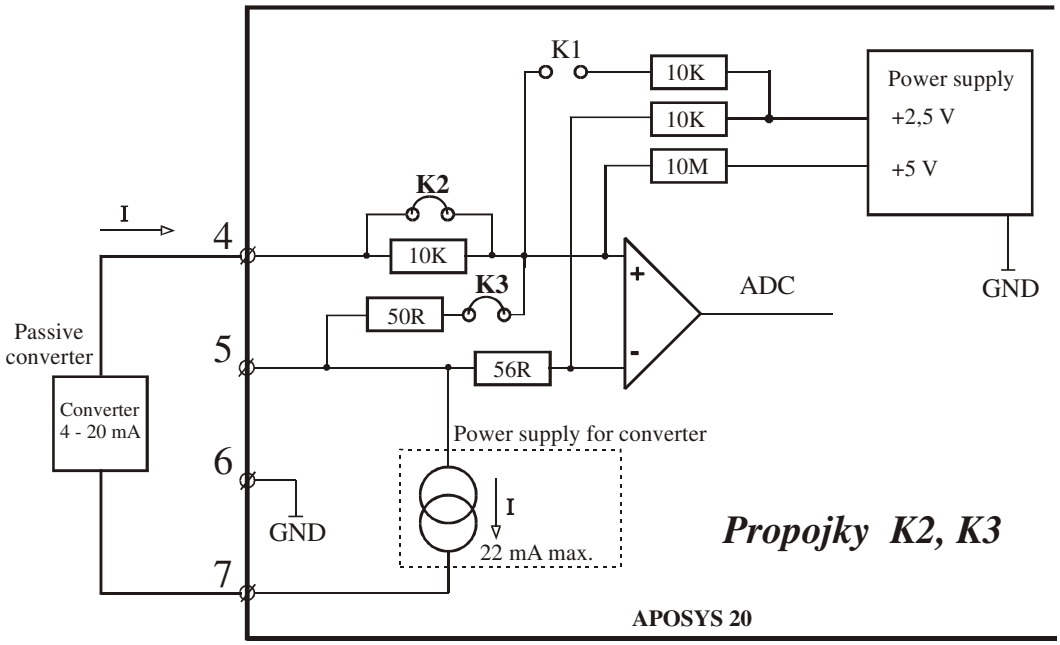
2.11.1 Thermocouple connection



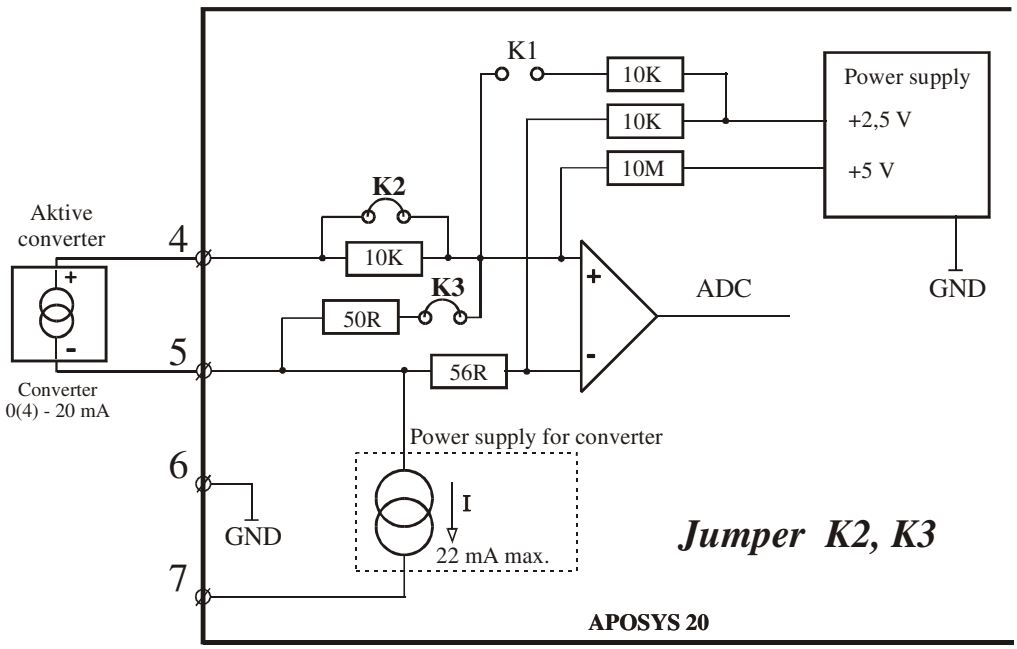
2.11.2 Resistive sensor Pt100 or Ni1000 connection



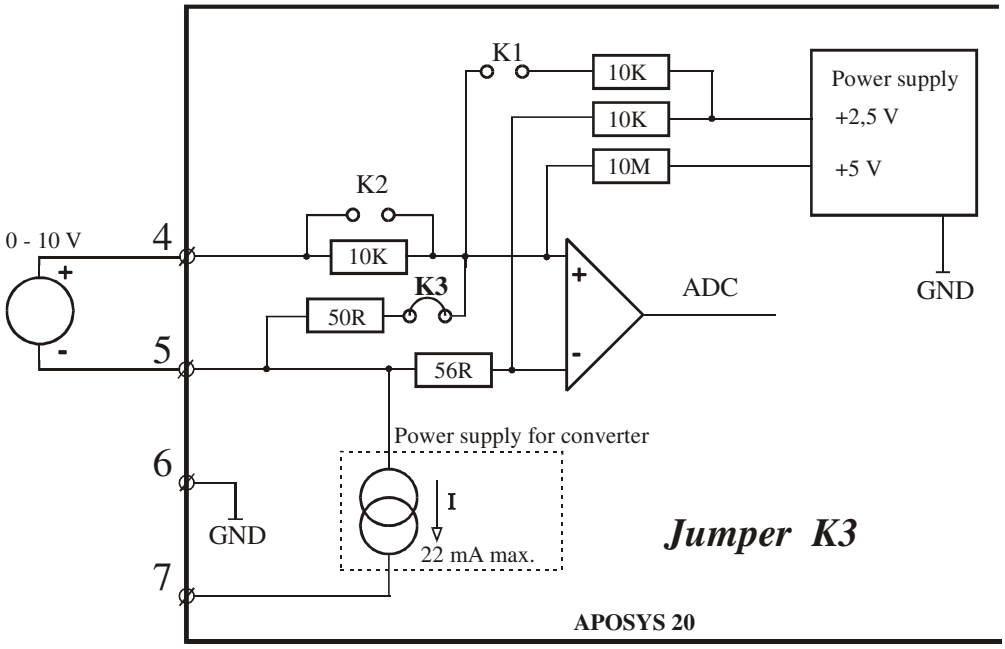
2.11.3 Passive converter 4~20 mA connection



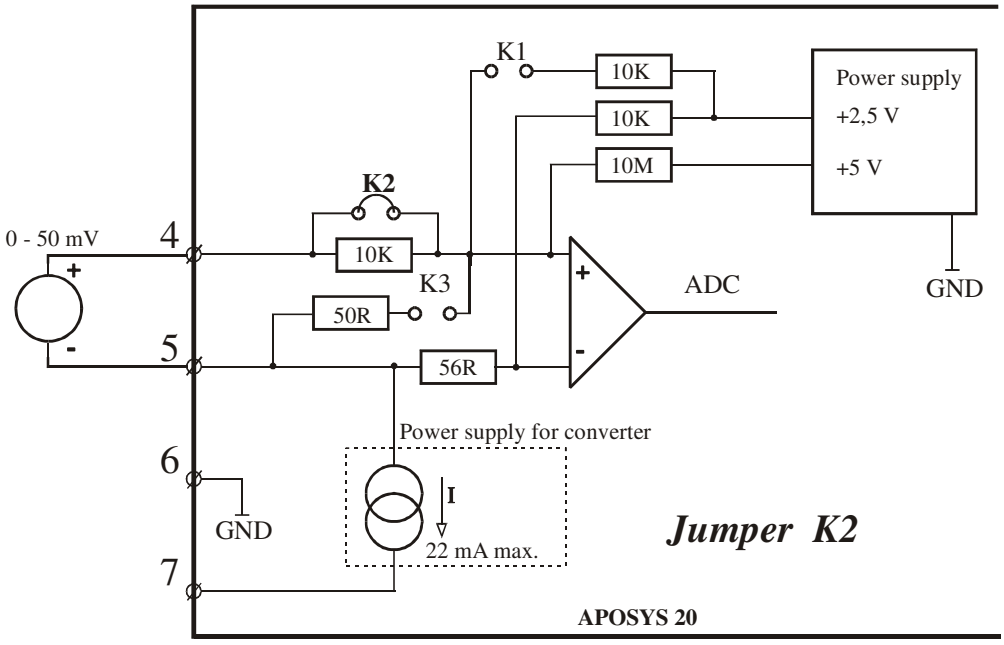
2.11.4 Active signal 0(4)~20 mA connection



2.11.5 Voltage signal 0~10 V connection

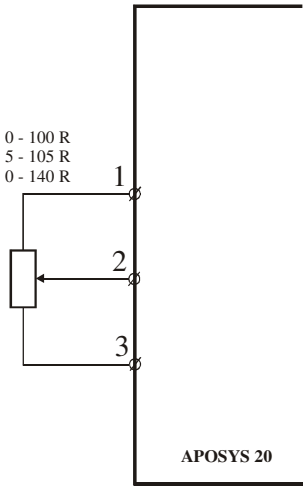


2.11.6 Voltage signal 0~50 mV connection

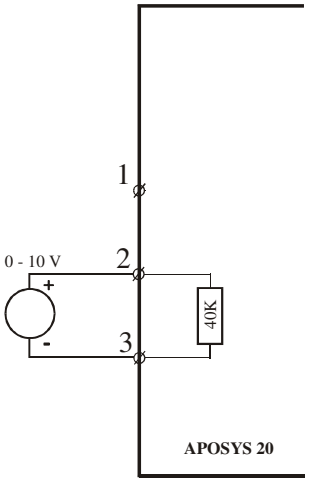


2.11.7 Feedback connection

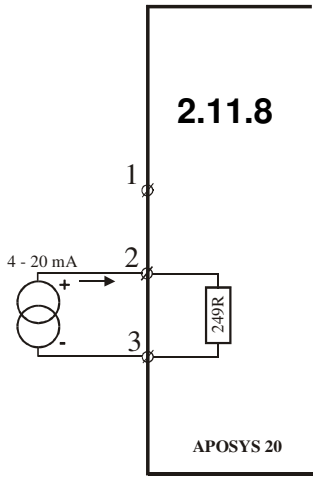
Feedback - connection resistive trasmitter 0 - 140 R



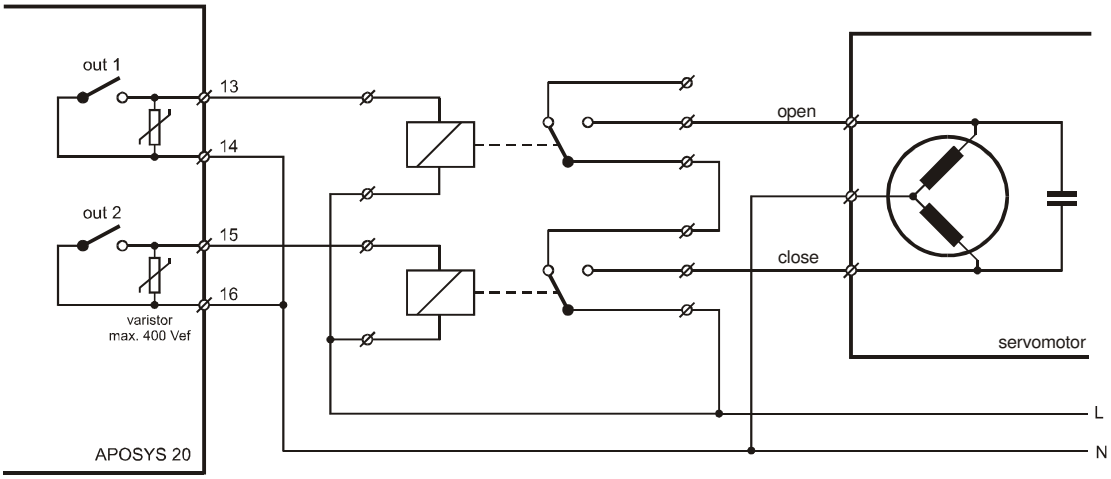
Feedback - connection voltage signal 0 - 10 V



Feedback - connection current signal 4 - 20 mA



2.11.8 Electric drive with pulse control recommended connection



3 Control

3.1 Automatic control

Drive control is controls by algorithm PID from formula:

u (k) the action intervention in the k-moment
K the amplification (_PB_)
e (k) the deviation from the required value in the k-moment
T sampling time (TPID)
Ti integration constant (INT)
Td derivative constant (DER)

The PID controller adjustment compile in suitable setting its constants. The method AUTO-TUNE (starting in the TUNE menu) lead to the basic calculation of setting constants. Is necessary to count that count settings are starting oriental values only. In the practice is always necessary the controller at the putting into operation to tune up.

At the average regulation action has controlled value even two-four times overswing after the required value reaching and then to fix.

Basic setting of constants is possible to do next way.

The controller is to set as proportional ,it is mean that derivative and proportional constant are eliminated. After that is find out a critical amplification K_r – it is mean such value K, when is the controller on a stability limit. Is to set smaller K (for exam.1) at first , and after previous initiation to stable state with changing of the required value is done a control run. After system fixation to steady state increase K and change the required value. This action repeat to the time until the system is amplitude. This value correspond to P_{kr}, length of vibration period is T_{kr}. According these values is calculated the basic system parameters setting:

$K = 0,5 * K_{kr}$ $Ti = 0,8 * T_{kr}$ $Td = 0,12 * T_{kr}$

The value of the sampling period is to set so as during transition action come to 6-10 sampling.

When you get at the basic setting of the controller parameters (AUTO-TUNE) the unit step response with the right fast growth but with the big overshoot or with next big overswings you could let the proportional constant _PB_ and to change of time constants - integration constant (INT) to increase and derivative constant (DER) to decrease. It will be the basic unit step response the other way round has character of the system with the big damping (the so-called with the long time of control and non over control) is the necessity to reduce the integration constant (INT) and to increase the derivative constant (DER).

The magnitude of the action intervention at moment is possible to subtract in the PROC menu (see page 23).

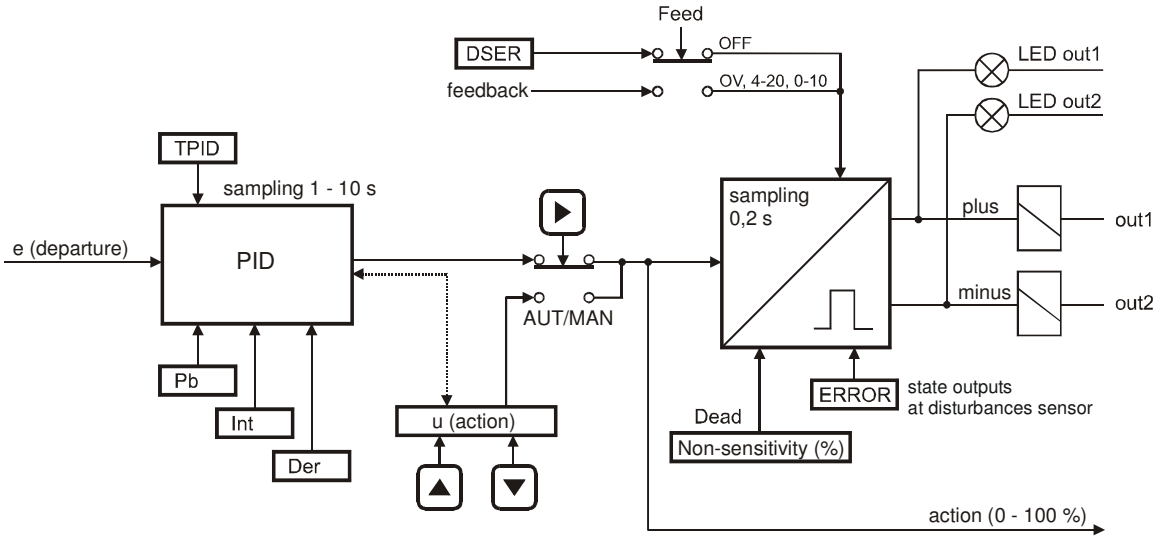
3.2 Manual control

By the key SET in the main menu the check lights of a manual control will light-on and the drive is possible manual to set to the arbitrary position. The magnitude of the action intervention at moment is on the bottom line of the display. For return to the

automatic control is necessity to depress the key MODE. Switchover from the manual control to the automatic control is non- impulse.

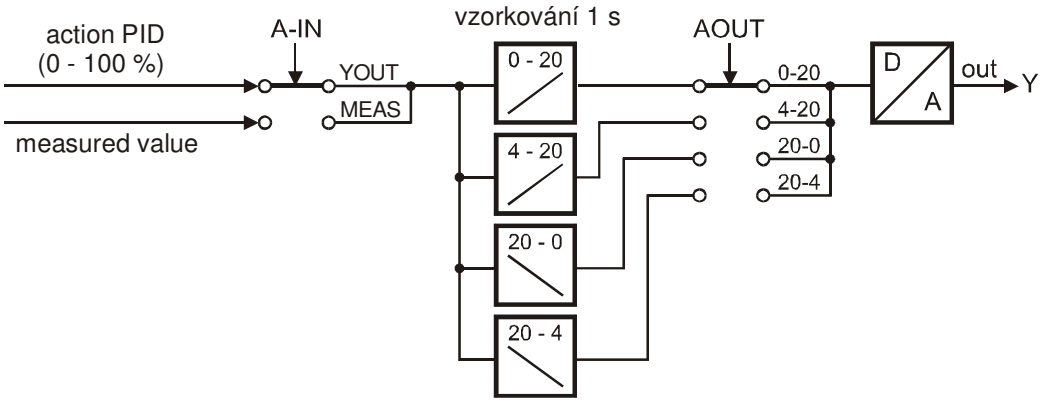
3.3 Block of control

Block of control process by the help of PID algorithm the rated diversion e, which is converted to the action intervention. Signal of the action intervention is converted in the impulse module to the output relay. To the impulse block is possible to load the feedback.



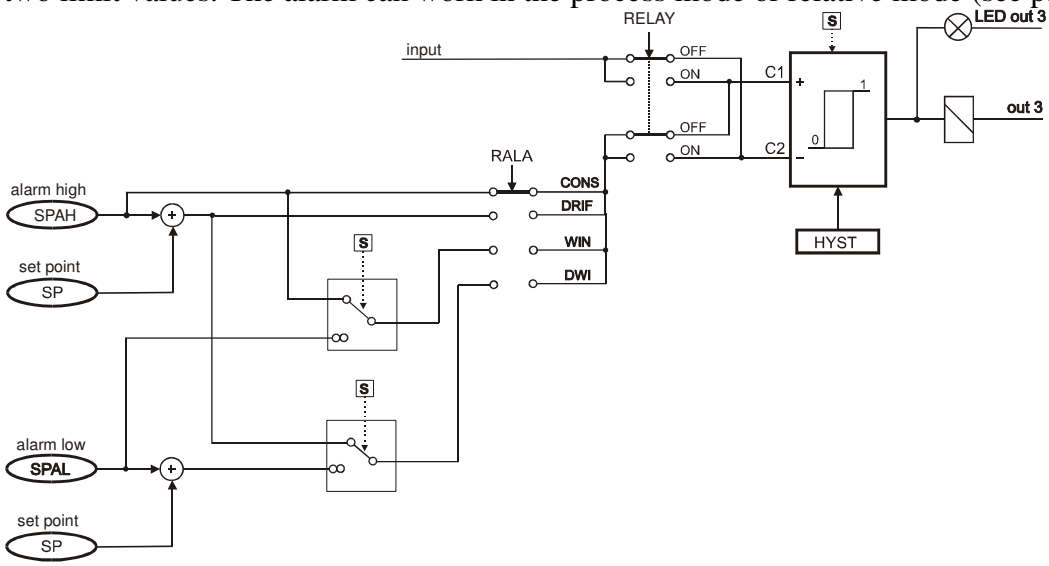
3.4 Block of analog output

Analog output is possible to set as the control (typical) output or as the measured value output. Analog output is possible to set as increasing or decreasing in the menu AOUT.



3.5 Block of alarm

The output out3 is used for signaling of wrecking states. On the output we can to set one or two limit values. The alarm can work in the process mode or relative mode (see page 26).

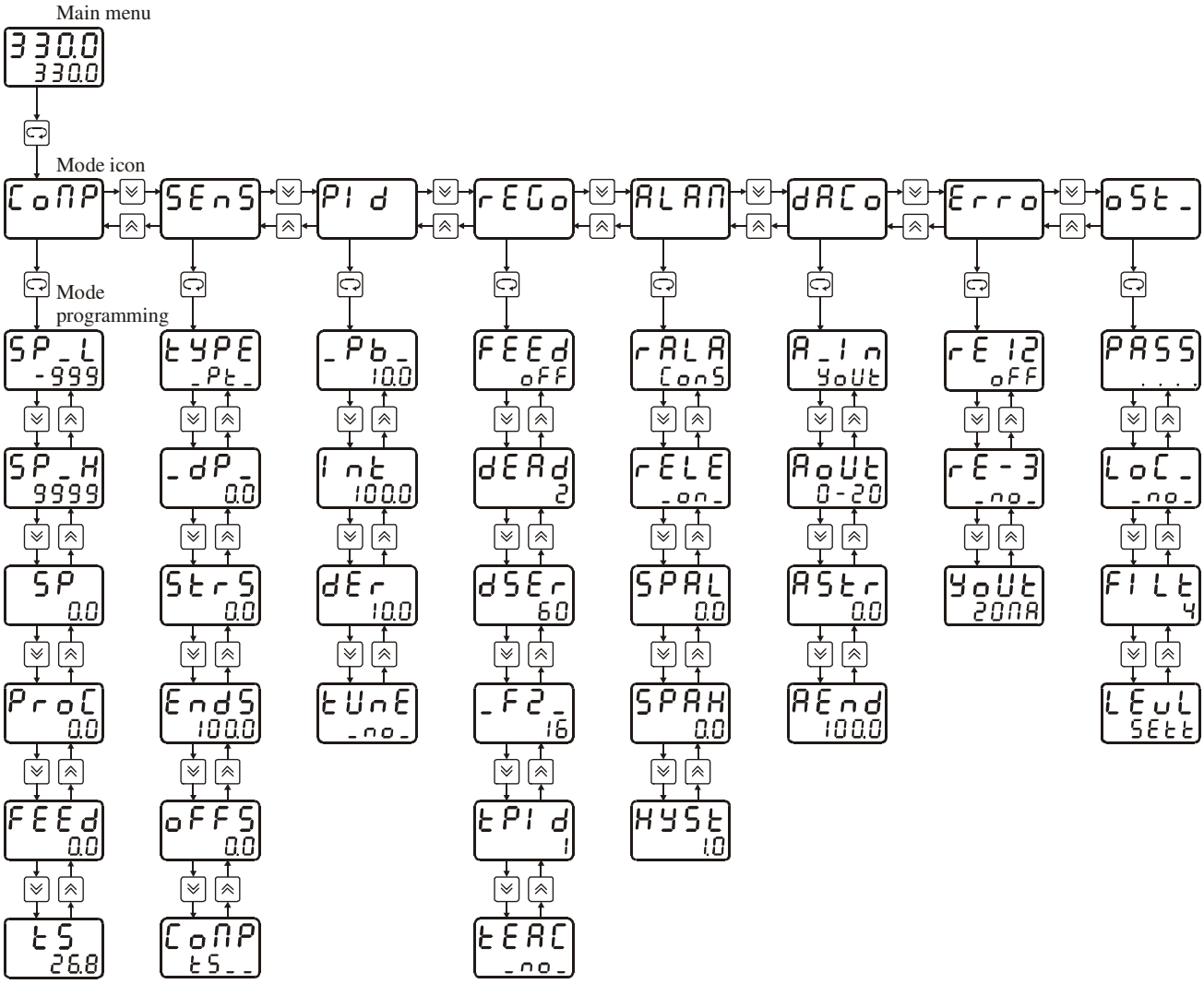


4 Programming manual

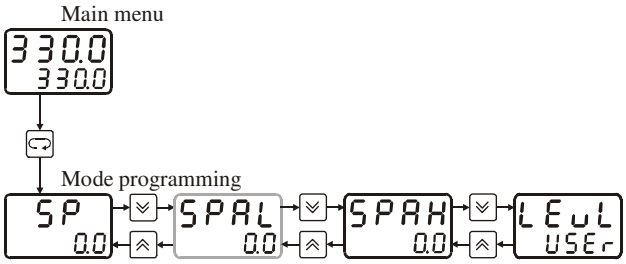
In the programming manual is a detail transcription of electing and meaning parameters setting of controller. For using of the controller is necessity to adapt the controller to concrete user application by setting of the required parameters. Standard values are in the programming mode setting by producer. And they are show in a limit values chart (page 32).

4.1 Block diagram for operating

Level SETT **- servis**



Level USER



4.2 Parameters meaning

Level USER

SP	required value for the control
SPAL	alarm limit (bottom or inactive)
SPAH	alarm limit (upper)
LEVL	setting level
	USER – user's setting
	SETT – servicing setting

The setting level is recommended to set by the operator necessity. As long as the operator change the required value only and alarm value. We recommended after parameters setting to set the level USER. If the operator need to set next parameters is necessary to set the level SETT.

Level SETT - service

Icon COMP – required value setting and action intervention view and drive position

SP_L	required value limitation – bottom limit Required value setting is possible to limit in the arbitrary range. Parameter SP_L is the bottom limit of the limitation. For example if you set 20.0, is not possible in the menu SP to set lower value then 20.0.
SP_H	required value limitation – upper limit Required value setting is possible to limit in the arbitrary range. Parameter SP_H is the upper limit of the limitation. For example if you set 100.0, is not possible in the menu SP to set higher value then 100.0.
SP	required value for the control
PROC	magnitude of action intervention view (%)
FEED	feedback view (%) – data field about momentary drive position
TS	measured temperature of binding clips for cold thermocouple end compensation

Icon SENS – input signal parameters setting

TYPE	input sensor type Possibilities:
	__J_ thermocouple „J“
	CRAL thermocouple „K“
	__E_ thermocouple „E“
	__T_ thermocouple „T“
	__R_ thermocouple „R“
	__S_ thermocouple „S“
	__B_ thermocouple „B“
	__N_ thermocouple „N“
	_PT_ sensor Pt100
	NI_6 sensor Ni1000/6180ppm
	NI_5 sensor Ni1000/5000ppm

4_20 current signal 4 - 20 mA
0_20 current signal 0 - 20 mA
0_10 voltage signal 0 - 10 V
50MV voltage signal 0 - 50 mV

If you set the temperature sensor (thermocouple, Pt100 or Ni1000), above the display light-on the red check light „°C“.
At input signal type change is necessary to check rightness of jumpers in the main distribution frame option (see page 10).

_DP_ decimal point position

Setting decimal point position is valid for most of numeric parameters set-up.

STRS input range beginning (start sensor)

You set the beginning of the measuring range the input value. The parameter have the importance at electing of current (4 - 20mA or 0 - 20 mA) or voltage (0 - 10 V or 0 - 50 mV) input signal only. If you set as the type of sensor the thermocouple Pt 100 or Ni 1000 it is not necessary to set the start of the sensor.
For example:
You want to connect the sensor with the 4 - 20 mA output and corresponding for the temperature -30 to +70°C. It is that the sensor starting STRS is necessity to set: -30. For the sensor type SENS is necessity to set 4 - 20 mA.

ENDS input range end (end sensor)

You set the end of the measuring range the input value. The parameter have the importance at electing of current (4 - 20mA or 0 - 20 mA) or voltage (0 - 10 V or 0 - 50 mV) input signal only. If you set as the type of sensor the thermocouple Pt 100 or Ni 1000 it is not necessary to set the end of the sensor.
For example:
You want to connect the sensor with the 4 - 20 mA output and corresponding for the temperature -30 to +70°C. It is that the sensor end ENDS is necessity to set: 70. For the sensor type SENS is necessity to set 4 - 20 mA.

OFFS offset (shift) of measure

Parameter is for setting for example: resistor compensation of inputs wires for Pt 100 at two-wires connection etc. Generally is possible by offset to compensate any measurement inaccuracy. As long as is not necessity to set the any shift or compensation set 0.
Example of inputs wires for Pt 100 compensation at two-wires connection:
The wire have definite resistor which make the failure of measurement. On the end of wires you connect instead the sensor Pt 100 the resistance decade and set the resistor 100,0 Ω (corresponding 0°C). You subtract the measured value on the display (for example 1,3°C). This is the failure of measurement made with resistor of inputs wires. For its compensation is necessary to set in the menu OFFS the value -1,3.

COMP thermocouple cold end compensation

Parameter have meaning at thermocouple choice only.
Compensation possibilities:

_NO_ without compensation
TS__ compensation to temperature of terminal boxes (compensation is ensure by inner resistive sensor Pt1000)
20°C compensation to temperature 20 °C
50°C compensation to temperature 50 °C
70°C compensation to temperature 70 °C

Icon PID - PID constant for control setting

_PB_	amplification
INT_	integration constant
DER_	derivative constant
TUNE	automatic adaptive tuning PID constants

Icon REGO – the others control parameters

FEED feedback type

Possibilities:

OFF	without feedback
_0V_	resistive transmitter 0 - 100 Ω, 5 - 105 Ω, 0 - 140 Ω
4_20	current signal 4 - 20 mA
0_10	voltage signal 0 - 10 V

DEAD non-sensitivity (%)

As long as is requirement for drive position change from PID controller less then set non-sensitivity, drive position is unchanged.

DSER drive overtravel time (s)

The parameter have importance in case only that control drive do not have the feedback (in the menu FEED is set OFF). In this case is necessary to set the overtravel time in seconds by the used drive.

_F2_ control magnitude digital filter (FIR)

With setting of higher value the action intervention damping is increased and by this is slowed down the drive response.

TPID sampling time period (s)

In the setting interval is running the samples drain and the PID constant re-counting for regulation.

TEAC drive limit position learning

At the drive with feedback using is recommended so-called learn the controller drive limit positions for right feedback function. To the controller is necessary to connect the drive including the feedback. The drive we recommended to connect no load without the controled system, in order to not come in the function continuance to crash estates due to short lived absolute opening and after it shut of drive. After function TEAC startup take drive open (output out1 switch-on). The controller at the same time measure the signal from the feedback. As long as is the signal from the feedback constant after time 20 s, the drive is considered as open and measured value of the feedback is recorded by controller as the drive limit position „open“. After it begin the drive to close (output out2 switch-on) and by the same way is after complete shut by the controller registered limit position „closed“. After both limit positions registerd come over the controller back to the automatic control. In the function course is on the upper line of the display the legend TEAC and on the bottom line of the display the value from the A/D converter which is after learning finished re-count to 0-100 %. Function TEAC is active at feedback setting in the FEED only.

Icon ALAM – alarm setting

RALA alarm mode

Possibilities:

- CONS processed, belong to measured value only
- DRIF relative, deduce from the required value as the allowed deviation WIN processed with allowed deviation zone, belong to measured value only
- DWI relative with allowed deviation zone, deduce from the required value, as allowed deviation

RELE output relay state at alarm limit overstepping

Possibilities:

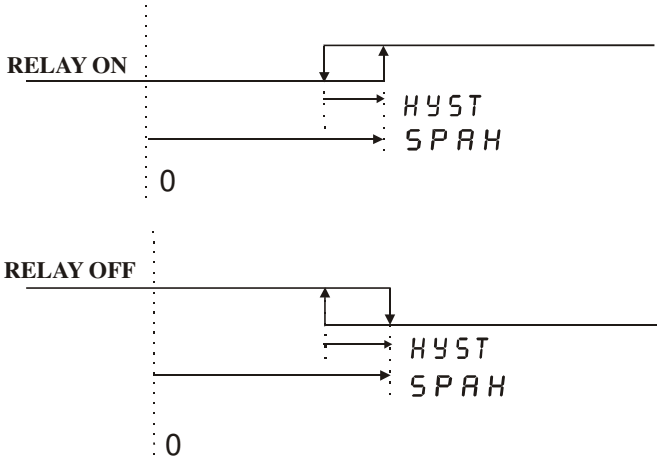
- OFF at alarm limit overstepping the relay switch-off
- _ON_ at alarm limit overstepping the relay switch-on

SPAL bottom alarm limit at set mode WIN, DWI or unactive at CONS, DRIF

SPAH upper alarm limit

HYST alarm hysteresis

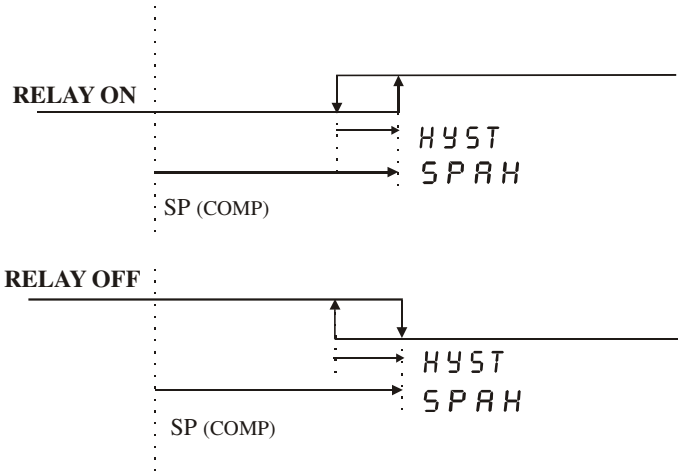
4.2.1 Alarm mode, processed, belong to measured value (CONS)



Example:

1) At relay setting ON and SPAH=130 °C, HYST=2 °C. If will be the measured value greater than 130 °C, output relay switch-on. If the measured value fall below 128 °C, output relay switch-off.
2) At relay setting OFF and SPAH=130 °C, HYST=2 °C. If will be the measured value greater than 130 °C, output relay switch-off. If the measured value fall below 128 °C, output relay switch-on.

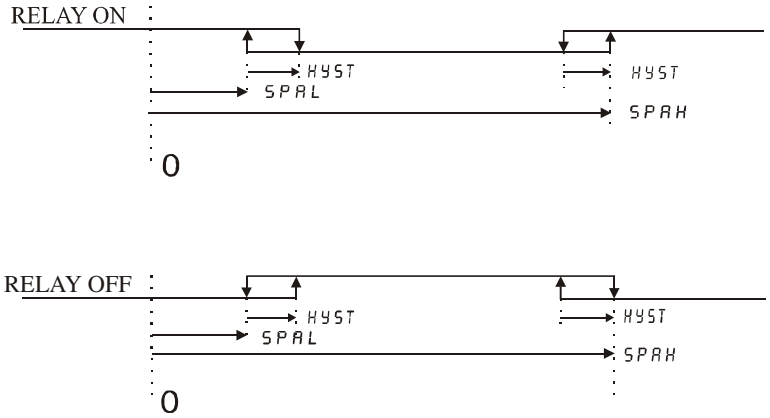
4.2.2 Relative alarm mode, deduce from the required value as the allowed deviation (DRIF)



Example:

1) At relay setting ON and SP=120 °C, SPAH=10 °C, HYST=2 °C. If will be the measured value greater than 130 °C, output relay switch-on. If the measured value fall below 128 °C, output relay switch-off.
2) At relay setting OFF and SP=120 °C, SPAH=10 °C, HYST=2 °C. If will be the measured value greater than 130 °C, output relay switch-off. If the measured value fall below 128 °C, output relay switch-on.

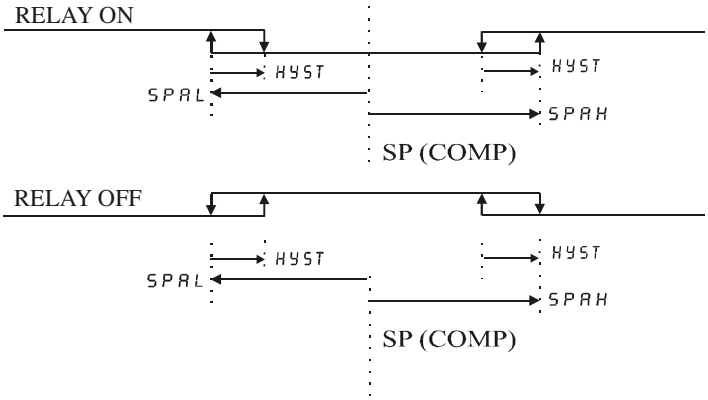
4.2.3 Processed alarmu mode with allowed deviation zone, belong to measured value (WIN)



Example:

1) At relay setting ON and SPAL=120 °C, SPAH=150 °C, HYST=2 °C. If will be the measured temperature to move among 120 °C - 150 °C output relay will be switch-off. If the measured temperature fall below 120 °C or if overstep the value 150 °C, output relay will switch-on. To the relay reentry switching-off come at temperature increase above 122 °C or in the second case at decrease below 148 °C.
2) At relay setting OFF and SPAL=120 °C, SPAH=150 °C, HYST=2 °C. If will be the measured temperature to move among 120 °C - 150 °C output relay will be switch-on. If the measured temperature fall below 120 °C or if overstep the value 150 °C, output relay will switch-off. To the relay reentry switching-on come at temperature increase above 122 °C or in the second case at decrease below 148 °C.

4.2.4 Alarmu relative mode with allowed deviation zone, deduce from the required value, as allowed deviation (DWI)



Example:

1) At relay setting ON and SP=130 °C, SPAL= -20 °C, SPAH= 20 °C, HYST=2 °C. If will be the measured temperature to move among 110 °C - 150 °C output relay will be switch-off. If the measured temperature fall below 110 °C or if overstep the value 150 °C, output relay will switch-on. To the relay reentry switching-off come at temperature increase above 112 °C or in the second case at decrease below 148°C.
2) At relay setting OFF and SP=130 °C, SPAL= -20 °C, SPAH=20 °C, HYST=2 °C. If will be the measured temperature to move among 110 °C - 150 °C output relay will be switch-on. If the measured temperature fall below 110 °C or if overstep the value 150 °C, output relay will switch-off. To the relay reentry switching-on come at temperature increase above 112 °C or in the second case at decrease below 148 °C.

Icon DACO – Analog output parameters setting

A_IN INPUT magnitude for the analog output
Possibilities:
YOUT control magnitude – analog output behave as control
MEAS measured value – analog output change in dependence on the measured value

AOUT analog output election
Possibilities:
0-20 0 - 20 mA, 0 - 10 V
4-20 4 - 20 mA, 2 - 10 V
20-0 20 - 0 mA, 10 - 0 V
20-4 20 - 4 mA, 10 - 2 V

ASTR measured value analog output start
The parameter have importance in case only at the measured value MEAS election in the menu A_IN. The measured value is set and correspond to analog output start. Setting example:
If you need that analog output 0 - 10 V correspond to the measured value on the display in among 0 - 100 °C. This means that analog output ASTR start is necessary to set 0. Condition is the measured value MEAS setting in the menu A_IN and the analog output election 0 - 10 V in the menu AOUT.

AEND measured value analog output end

The parameter have importance in case only at the measured value MEAS election in the menu A_IN. The measured value is set and correspond to analog output end. Setting example:

If you need that analog output 0 - 10 V correspond to the measured value on the display in among 0 - 100 °C. This means that analog output AEND end is necessary to set 100. Condition is the measured value MEAS setting in the menu A_IN and the analog output election 0 - 10 V in the menu AOUT.

Ikona ERRO – Outputs state at sensor trouble

The controller evaluate the input sensor trouble by sign ERRO on the bottom line of the display. At the input sensor trouble is possible to set arbitrary output relays state and analog output. The controller signal the input sensor trouble as long as the measured value is out of following limits:

Pt100	-80 - 802 °C
Ni1000/5000 ppm	-50 - 202 °C
Ni1000/6180 ppm	-50 - 202 °C
thermocouple J	-210 - 1200 °C
thermocouple K	-200 - 1372 °C
thermocouple E	-200 - 1000 °C
thermocouple T	-200 - 400 °C
thermocouple S	-50 - 1768 °C
thermocouple B	250 - 1820 °C
thermocouple R	-50 - 1768 °C
thermocouple N	-200 - 1300 °C
0 - 20 mA	> 21 mA
4 - 20 mA	3,6 - 21 mA
0 - 10 V	> 10,5 V
0 - 50 mV	> 75 mV

RE12 outputs out 1 and out 2 state at the sensor trouble

_NO_	out 1 and out 2 without response to the sensor trouble (response by parameters in the icon PID)
OPEN	out 1 switch-on and out 2 switch-off at the sensor trouble
SHUT	out 1 switch-off and out 2 switch-on at the sensor trouble
OFF	out 1 and out 2 switch-off at the sensor trouble

RE-3 output out 3 state at the sensor trouble

_NO_	out 3 without response to the sensor trouble (response by parameters in the icon ALAM)
ON	out 3 switch-on at the sensor trouble
OFF	out 3 switch-off at the sensor trouble

YOUT analog output state at the sensor trouble

_NO_	analog output without response to the sensor trouble (response by parameters in the icon DACO)
0-MA	analog output set to 0 mA (0 V) at the sensor trouble
20MA	analog output set to 20 mA (10 V) at the sensor trouble

Icon OST_ – the others parameters setting

PASS access password

With the access password setting is possible to prohibit for the unqualified intervention to control parameters. The PASS password serve for access to all parameters settings. From the production is set the 0 password. In this case is the controller behaviour as world be setting as the no password and the access to the setting is not limited. If you set the arbitrary number password is possible to enter to parameters setting after the password adjust only. If you want change the password you have to secure the access to the password adjusting with the knowledge a the old access password. As long as you will forget this password you set code 555 with its help you will get to the password adjusting.

The controller demand the password always one time in the each icon only. For example when you in the SENS icon set the _DP_ parameter (decimal point position) at the enter to the parameter setting the controller demand the access password. As long as you set the password right, you will have the free access to all the others parameters below the SENS icon (TYPE, STRS, ENDS, OFFS).

LOC_ keyboard lock for the required value direct setting

Possibilities:

_NO_ keyboard unlocked

YES_ keyboard locked

If is the keyboard unlocked is possible in the main menu by keys UP and DOWN the required value SETP direct to set. After keyboard lock is possible the required value set as much as after program mode entry.

FILT input signal filter

By the filter value increasing come to the controller response deceleration to the input magnitude change and respectively by the filter value decreasing come to the controller response acceleration to the input magnitude change. Filter have the effect for the measured value representation on the display and on the control.

LEVL level setting

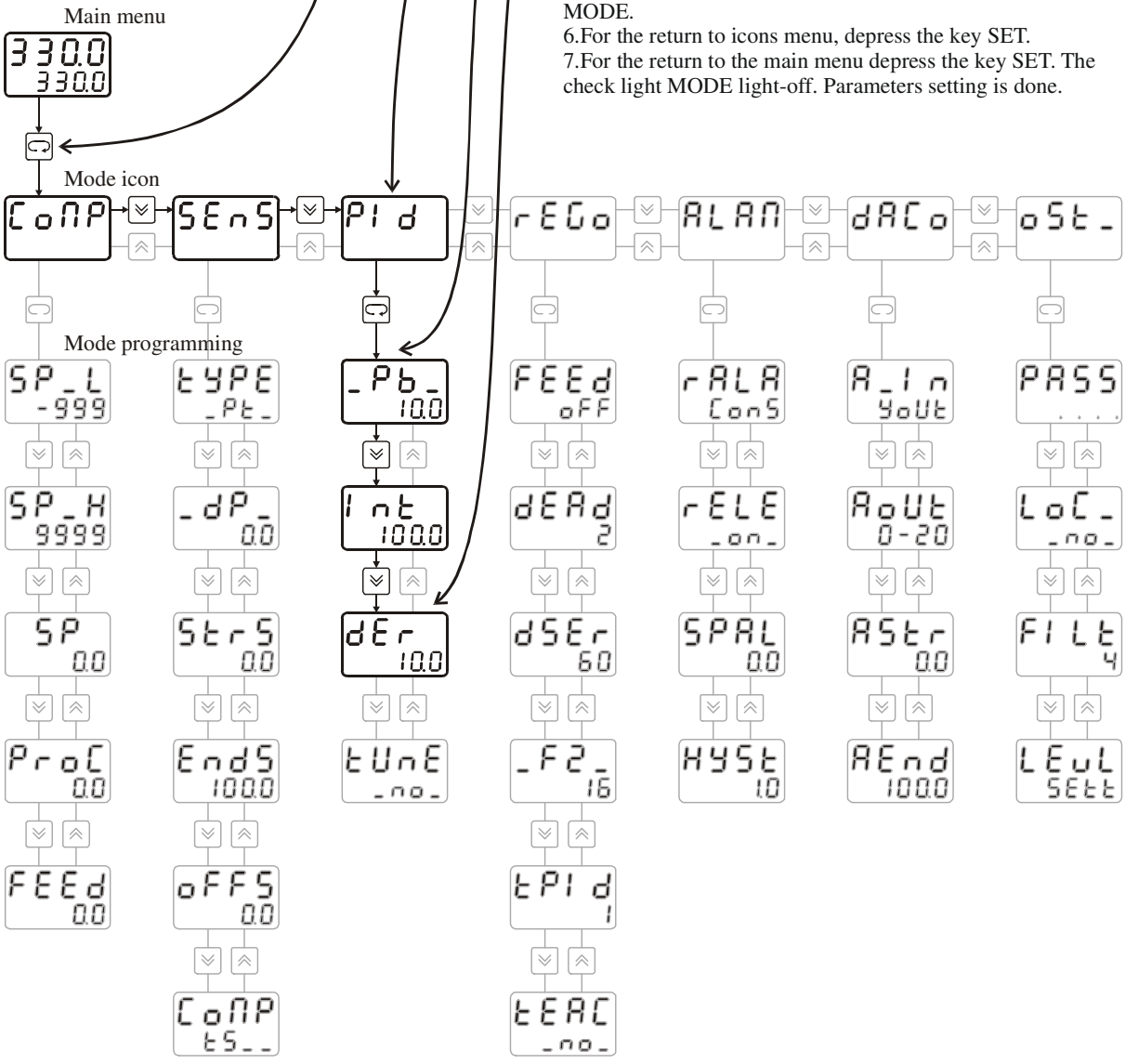
USER user – user setting

SETT service – service setting

4.3 Setting example

The derivative constant setting for PID control

1.In the main menu you depress the key MODE and you are in the icon mode. The check light MODE will light-on and on the display twinkle icon COMP.
2.In the icon mode you with keys DOWN (optionally UP) you listing the icon PID.
3.Depress the key MODE and you are in the programming mode and on the display the twinkle parameter _PB_.
4.With keys DOWN (optionally UP) you listing the twinkle parameter DER.
5.By the key MODE depress you come over to the parameter value setting DER. Necessary value you set by keys Up and DOWN. By key holding is the setting faster. The value resetting is performed by the key SET depress. After necessary value setting you acknowledge with the key MODE.
6.For the return to icons menu, depress the key SET.
7.For the return to the main menu depress the key SET. The check light MODE light-off. Parameters setting is done.



With the same way is possible to set the next parameters by the block diagram of the operation. As long as in the programming course do not take after 40 seconds to depress any key the controller automatically come over to the main menu (so-called Time out function).

5 Parameters limit values

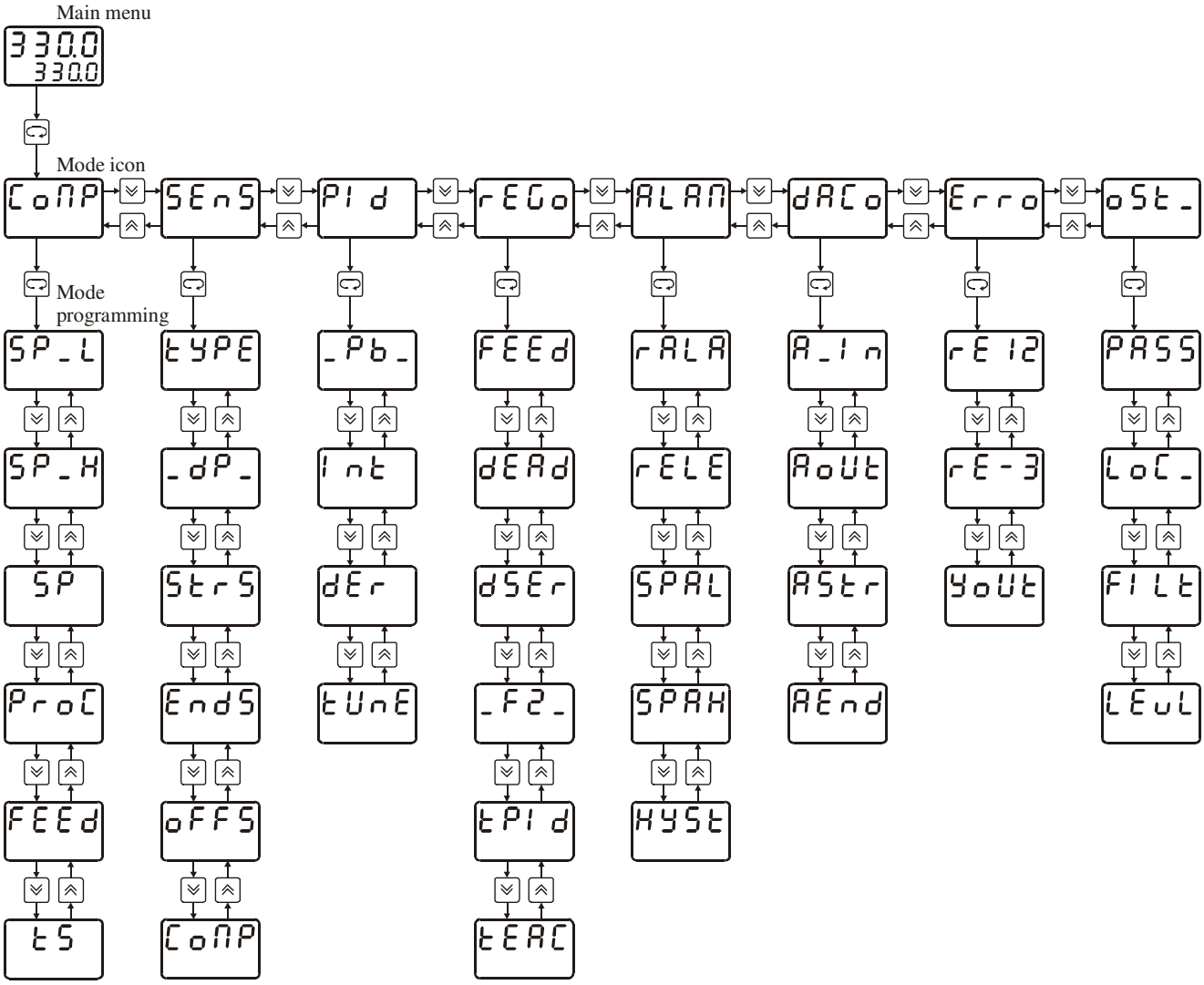
Code	Importance	Limit values	From production
SP-L	required value limitation – bottom limit	-999 - 9999	-999
SP-H	required value limitation – upper limit	-999 - 9999	9999
SP	required value	-999 - 9999	0.0
PROC	magnitude of action intervention	0 - 100%	
FEED	feedback view – drive position	0 - 100 %	
TS	binding clips temperature view	0 - 100 %	
TYPE	sensor type	thermocouple J, K, E, T, R, S, B, N Pt100 Ni1000/6180ppm Ni1000/5000ppm 4 - 20 mA 0 - 20 mA 0 - 10 V 0 - 50 mV	Pt100
-DP-	decimal point	0., 0.0, 0.00	0.0
STRS	Sensor start	-999 - 9999	0.0
ENDS	sensor end	-999 - 9999	100.0
OFFS	Offset	-999 - 9999	0.0
CoMP	thermocouple compensation type	-NO-, binding clips temperature, 20°C, 50°C, 70°C	binding clips temperature
-PB-	Amplification	-500 - 500	
INT-	integration constant	1 - 9999	100.0
DER-	derivative constant	0.01 - 9999	10.0
TUNE	automatic constants tuning	-NO-, YES-	-NO-
FEED	feedback type	OFF, resistive transmitter, 4 - 20 mA, 0 - 10 V	OFF
DEAD	non-sensitivity	0 - 100 %	2 %
DSER	drive overtravel time	5 - 1000 s	60
-F2-	control magnitude filter	0 - 16	16
TPID	sampling time period	1 - 10	1
TEAC	drive limit position learning	-NO-, YES-	-NO-
RALA	alarm mode	constant limit, shift from required	constant limit
RELE	output alarm relay state	OFF, -ON-	-ON-
SPAL	alarm value (bottom limit)	-999 - 9999	0.0
SPAH	alarm value (upper limit)	-999 - 9999	0.0
HYST	alarm hysteresis	0 - 100	1.0
A-IN	input magnitude for the analog output	control magnitude, measured value	control magnitude

AOUT	analog output election	0 - 20 mA (0 - 10 V), 4 - 20 mA (2 - 10 V), 20 - 0 mA (10 - 0 V), 20 - 4 mA (10 - 2 V)	0 - 20 mA (0 - 10 V)
ASTR	measured value analog output start range	-999 - 9999	0.0
AEND	measured value analog output end range	-999 - 9999	100.0
RE12	output relay 1 and 2 state at the sensor trouble	-NO-, OPEN, SHUT, OFF	-NO-
RE_3	output relay 3 state at the sensor trouble	-NO-, ON, OFF	-NO-
YOUT	analog output state at the sensor trouble	-NO-, 0 mA, 20 mA	-NO-
PASS	access password	0 - 9999	0
LOC-	keyboard lock	-NO-, YES-	-NO-
FILT	input signal filter	0 - 8	4
LEVL	level setting	user, service	service

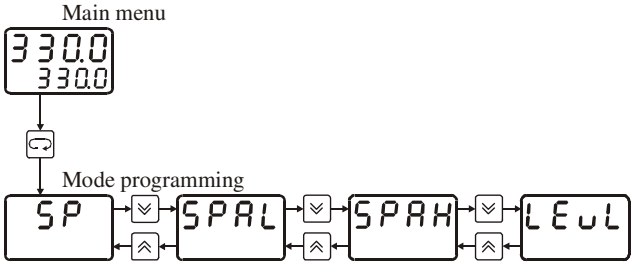
6 Operating parameters

We recommend to register to the scheme the entered operating parameters which accord to the existing control system. In the case of control trouble, data failure or setting of wrong values by operator, preseted back dates entered in the scheme.

Level SETT - servis



Level USER



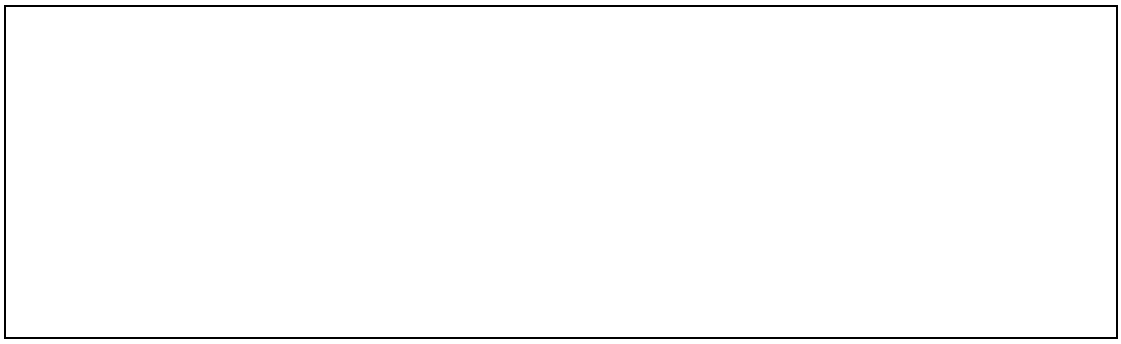
7 Communication protocol

7.1 Protocol description

Communication protocol is from protocol **PROFIBUS** layer 2. Data part (layer 7) implemented the protocol.
Communication is of the type **master - slave** and enable the two-ways communication between systems. The communication use the interface RS 485.

Telegram mark (UART - Character)

Protocol:



Every UART – have a character 11 bits, and so 1st start-bit (ST) with signal logic "0", 8th inform bits (I), 1st parity bit for even parity (P) with signal logic "1" and 1th stop-bit (SP) with signal logic "1". Transmit speed 9600 Bd.

Communication conditions:
Communications are invoked by superior communications participant on a principle request - answer. This principle allowed a addition of greater users number to superior system on the interface RS-485. Controlers and sensors behave as a slave user (slave).
From a time aspect is necessary to observe next conditions:

a) between single bytes transmited from superior system have to be a **shorter** delay than treble of a time necessary for one byte transmitting.
b) between received answer and transmited next report have to be a rest on the line **longer** than treble of a time necessary for one byte transmitting.
c) if come by receiving side to line protocol error detecting (frame error, parity, unpassing line, breaking above mentioned conditions), or at error in transmission protocol (start parity error, ended mark, telegram length), the receiving side the report do not work and do not answer for that. In case do not grant requirement for transmission or for dates writting (the apparatus do not contain dates), send the error report with SD1 and FC = 2 (negative confirmation).
d) between last byte of transmited report and first byte of receiving answer is delay at minimum identical as the time necessary for one byte transmitting.

7.2 LAYER 2

Format of telegrams with firm length without data pole:

a) question

SD1	DA	SA	FC	FCS	ED

b) answer

SD1	DA	SA	FC	FCS	ED

Format of telegram with constant length

Telegram start with SD1 and FC=0x69 and end ended mark ED.
Positive answer is telegram with constant lenght with FC=0. Negative answer FC=2.

Example of setting format of telegram with firm length without dates pole:

```
REQUEST                    Number of transmitting marks: 6
10 02 04 69 6F 16

ANSWER                     Number of receiving marks:    6
10 04 02 00 06 16
```

Format of telegrams with variable length of information pole:

a) question

SD2	LE	LEr	SD2	DA	SA	FC	DATA	FCS	ED

b) answer

SD2	LE	LEr	SD2	SA	DA	FC	DATA	FCS	ED

Importance of used symbols

SD1	frame start (Start Delimiter), code 10H
SD2	frame start (Start Delimiter), code 68H
LE	length of information pole (Length) start by bit DA and finished by bit before FCS. Length of pole 4 - 249.
LEr	repeating of bits length of the information pole
DA	address of target station
SA	address of supply station
FC	drive bit (Frame Control)
DATA	pole of dates max 246 bits
FCS	control sum (Frame Check Sequence)
ED	frame end (End Delimiter), code 16H

LE, LEr – Length of information pole

Both bits in the head of telegram with variable length of information pole contents numbers of bits of information pole. In this is count DA, SA, FC and DATA. Upset value LE is 4, highest 249. By this possible to transmit 1 - 246 bits of dates.

DA, SA – Address of the station (DA - target, SA - supply)

Addresses can be in the range 0 - 126, and the address 127 is use as global address for transmitting of messages for all stations. At setting of global address the apparatus receive only (do not transmitting). In the corresponding telegram is target address (DA) actually source address (SA) from appeal telegram.
Limitation: Maximal setting address is 126. Controllers and sensors can not increase the address by bits EXT, how is definite in PROFIBUS.

FC – <u>Driving bit</u>

Driving bit in the head of frame contents the transmit function and information to prevent for loss or doubling of message.

b8	b7	b6	b5	b4	b3	b2	b1
RES	**1**	**FCB**	**FCV**	**FUNCTION**			
	0	**Stn - Type**					

RES - reservation

b 7 = 1 – frame of call (Send / Request)

FCB (Frame Count Bit): 0/1 – alternated bit of sequence of calls
FCV (Frame Count Bit Valid): 0 - function FCB invalid
1 - function FCB valid

Controllers and sensors unused alternating bite FCB at FCV = 1, these bites have to have a value FCB=1 and FCV=0.

FUNCTION: frame of call b7 = 1

code	function
0x03	Send Dat with Acknowledge Data sending with acknowledgement
0x09	Request FDL - Status With Reply Request for Status
0x0C	Send and Request Data Sending and request for dates

b7 = 0 - **frame of acknowledge or answer** (Acknowledgement/Response)

Stn - Type (Station type a FDL - STATUS) - characterised the type of customer.
Only passive customer $\Rightarrow$ b 6 and b5 = 0.

FUNCTION: frame of answers b7 = 0

code	function
0x00	Acknowledgement positive Positive acknowledgement
0x02	Acknowledgement negative Negative acknowledgement
0x08	Response FDL / FMA - Date data transmitting

FCS - control sum

Control sum is done with arithmetic data sum of information frame DA, SA, FC and DATA modulo 256 (100h) with ignore of higher frames arised by transfer 256 (100h).
25h = (24h + 30h + 37h + 52h + 48h) MOD 100h

For SD1 $\sum_{DA}^{FC}$ mod 256 for SD2 $\sum_{DA}^{FCS-1}$ mod 256

Format of telegram with variable length of information pole:

Telegram start with SD2 and FC=0x6C and end ended mark ED.
Request is reading from chart nr. 3 two bytes with offset = 0.
Positive answer is telegram with constant lenght with FC=0. Negative answer FC=2.

```
REQUEST                Number of transmitting marks:  13
68 07 07 68 02 04 6C 01 04 02 00 79 16

ANSWER                 Number of receiving marks:    11
68 05 05 68 04 02 08 06 01 15 16
```

7.3 Layer 7

Layer 7 (PROFIBUS **data** part) implement the protocol. There are these services:

1) Reading of apparatus identification
2) Reading of firmware version
3) Reading of value
4) Record of value
5) Reading of apparatus state
6) Reading and record of synchronizing dates
7) Record of dates to FLASH

1) <u>Reading of apparatus identification - Identify</u>
telegram SD2 data part

a) request

SD2	LE	LEr	SD2	DA	SA	FC	RI	FCS	ED

FC 0x6C
RI REQ_IDENTIFY 0x00

b) answer

SD2	LE	LEr	SD2	DA	SA	FC	DATA	FCS	ED

FC 0x08
DATA Apparatus type name

2) <u>Reading of firmware version - Version</u>
telegram SD2 data part

a) request

SD2	LE	LEr	SD2	DA	SA	FC	RV	FCS	ED

FC 0x6C
RV REQ_VERSION 0x04

b) answer

SD2	LE	LEr	SD2	DA	SA	FC	DATA	FCS	ED

FC 0x08
DATA Apparatus version name

3) <u>Reading of dates - Read</u>
Reading value is determinate by chart, bytes number and offset.

a) request

SD2	LE	LEr	SD2	DA	SA	FC	RR TC PB OF	FCS	ED

FC		0x6C
RR	REQ_READ	0x01
TC	TABULKA_ČÍSLO	used chart number
PB	POČET_BYTE	bytes number in chart
OF	OFFSET	shift in chart

b) answer

SD2	LE	LEr	SD2	DA	SA	FC	1 - n byte by chart	FCS	ED

Positive acknowledgement (SD2, FC = 08), in error case (SD1, FC = 2).

FC	0x08
Dates	1 - n byte by chart

4) <u>Record of one value - Write</u>

Record value is determinate by chart, bytes number and offset.

a) request

SD2	LE	LEr	SD2	DA	SA	FC	RW TC PB OF DT	FCS	ED

FC		0x63
RW	REQ_WRITE	0x02
TC	TABULKA_ČÍSLO	used chart number
PB	POČET_BYTE	bytes number in chart
OF	OFFSET	shift in chart
DT	DATA	sended dates n byte (PB byte)

b) answer

Positive acknowledgement (SD1, FC = 0), in error case FC = 2.

SD1	DA	SA	FC	FCS	ED

5) <u>Reading of apparatus state</u>

telegram SD2 data part

a) request

SD2	LE	Ler	SD2	DA	SA	FC	RU	FCS	ED

FC		0x6C
RU	REQ_Unit_Status	0x03

b) answer

SD2	LE	Ler	SD2	DA	SA	FC	DATA	FCS	ED

FC 0x08
DATA controller state 5 byte

4 byte	1 byte
measured value (float)	**OUT** (char)

OUT bit =0 output relay is switch-off, bit =1 output relay is switch-on

OUT bit D0 represent output 1
bit D1 represent output 2
bit D2 represent output 3

6) <u>Reading and record of synchronizing dates</u>
Telegram SD2 data part.

a) request

SD2	LE	Ler	SD2	DA	SA	FC	RSS	FCS	ED

FC 0x63
RSS REQ_SYNCHRO_SAMPLING 0x05

b) answer after instruction REQ_SYNCHRO_SAMPLING with FC=0x63 achieve the measured value draft to memory. Positive acknowledgement (SD1, FC = 0), in error case (FC = 2). At using a global address DA=127 there is not any answer, the apparatus achieve the measured value draft only.

c) answer after instruction REQ_SYNCHRO_SAMPLING with FC=0x6C

SD2	LE	Ler	SD2	DA	SA	FC	RES Measured value	FCS	ED

1 byte	4 - byte
RES	**measured value** (float)

define FC 0x08
#define RES 0x01 indicate first draft
#define RES 0x00 indicate, that one at least are dates read

7) <u>Record of dates to FLASH</u>
The apparatus activity at record to FLASH: the apparatus erase Flash. Relocate setting dates from RAM to buffer. Compound and send answer. And then create the request for record to Flash.
The record is performed from buffer after 1 byte in free time of processor.
The time needful for record is 2 sec. At next reading or recording next dates on communication line may the time needful for record to FLASH rather elongate.
Record immunity to FLASH is 100.000 cycles.

a) request

SD2	LE	Ler	SD2	DA	SA	FC	RWF	FCS	ED

FC 0x63
RWF REQ_WRITE_FLASH 0x06

b) answer
Positive acknowledgement (SD1, FC = 0), in error case FC = 2.

SD1	DA	SA	FC	FCS	ED

Importance of use symbols

The first data layer 7 part byte at request.

# define REQ_IDENTIFY	0x00	request on the identification
# define REQ_READ	0x01	request for data sending
# define REQ_WRITE	0x02	request for data record
# define REQ_Unit Status	0x03	request on the apparatus state
# define REQ_VERSION	0x04	request on firmware version
# define REQ_SYNCRO_SAMPLING	0x05	request on synchronous draft
# define REQ_WRITE_FLASH	0x06	request on record of dates to Flash

Importance of charts and dates structures

Chart 0

Tabulka_číslo TC = 0				
Importance	**code**	**range**	**type**	**bytes number**
Required value	**SP**	**SP_L- SP_H**	**float**	**4**
Required value LOW	**SP_L**	**-999 - 9999**	**float**	**4**
Required value HIGH	**SP_H**	**-999 - 9999**	**float**	**4**

Chart 1

Tabulka_číslo TC = 1				
importance	**code**	**range**	**type**	**bytes number**
Alarm value	**SPAL**	**-999 - 9999**	**float**	**4**
Alarm value	**SPAH**	**-999 - 9999**	**float**	**4**
Hysteresis	**HYST**	**0 - 9999**	**float**	**4**
Mode	**RALA**	**0 / 1**	**char**	**1**
Output state at overrun	**RELE**	**0 / 1**	**char**	**1**

Mode 0 = alarm value is alarm limit
1 = alarm value + required is alarm limit

Output state 0 = OFF at alarm limit overrun relay switch-off
1 = ON at alarm limit overrun relay switch-on

Chart 2

Tabulka_číslo TC = 2				
importance	**code**	**range**	**type**	**bytes number**
Sensor type	**TYPE**	**0 - 14**	**char**	**1**
Decimal point	**_DP_**	**0 - 2**	**char**	**1**
Range beginning	**STRS**	**-999 - 9999**	**float**	**4**
Range end	**ENDS**	**-999 - 9999**	**float**	**4**
Offset	**OFFS**	**-999 - 9999**	**float**	**4**
Compensation	**COMP**	**0 - 4**	**char**	**1**

Sensor type

0 = thermocouple "J"
1 = thermocouple "K"
2 = thermocouple "E"
3 = thermocouple "T"
4 = thermocouple „R“
5 = thermocouple "S"
6 = thermocouple „B“
7 = thermocouple "N"
8 = Pt100
9 = Ni1000/6180ppm
10= Ni1000/5000ppm
11 = 4 - 20 mA
12 = 0 - 20 mA
13 = 0 - 10 V
14 = 0-50mV

Decimal point 0 = number
1 = one decimal point
2 = two decimal points

Compensation 0 = without compensation
1 = clamps temperature
2 = temperature 20°C
3 = temperature 50°C
4 = temperature 70°C

Chart 3

Tabulka_číslo TC = 3				
Importance	**code**	**range**	**type**	**bytes number**
Amplification	**PB**	**-500 - 500**	**float**	**4**
Integrate constant	**INT**	**1 - 9999**	**float**	**4**
Derivative constant	**DER**	**0,01 - 9999**	**float**	**4**
Automatical PID tuning	**TUNE**	**0/1**	**char**	**1**

Automatical tuning 0 = NO (NO)
1 = YES (YES)

Chart 4

Tabulka_číslo TC = 4				
Importance	**code**	**range**	**type**	**bytes number**
Drive overtravel time	**DSER**	**5 - 1000**	**int**	**2**
On change non-sensitivity Yout	**DEAD**	**0 - 10**	**int**	**2**
Filter F2	**F2**	**0 - 16**	**int**	**2**
Sampling	**TPID**	**1 - 10**	**int**	**2**
Feedback	**FEED**	**0 - 3**	**char**	**1**
ps (idle)		**0**	**int**	**2**
Drive limit position learning	**TEAC**	**0/1**	**char**	**1**

Feedback 0 = resistive transmitter 2 = 0 - 10V
1 = 4 - 20mA 3 = OFF
TEAC 1 = drive limit position learning

Chart 5

Tabulka_číslo TC = 5				
Importance	**code**	**range**	**type**	**bytes number**
Input value to analog output	**A_IN**	**0/1**	**char**	**1**
Analog output	**AOUT**	**0 - 3**	**char**	**1**
Range beginning for measured value	**ASTR**	**-999 - 9999**	**float**	**4**
Range end for measured value	**AEND**	**-999 - 9999**	**float**	**4**

A_IN 0 = connected control value
1 = connected measured value
AOUT 0 = 0 - 20mA 2 = 20 - 0mA
1 = 4 - 20mA 3 = 20 - 4mA

Chart 6

Tabulka_číslo TC = 6				
importance	**code**	**range**	**type**	**bytes number**
Output relay 1 and 2 state at the sensor trouble (erro)	**RE12**	**0-3**	**char**	**1**
Output relay 3 state at the sensor trouble (erro)	**RE_3**	**0-2**	**char**	**1**
Analog output state at the sensor trouble (erro)	**YOUT**	**0-2**	**char**	**1**

RE12 0 = _NO_ without response
1 = OPEN relay 1 switch-on relay 2 switch-off
2 = SHUT relay 1 switch-off relay 2 switch-on
3 = OFF relay 1 switch-off relay 2 switch-off

RE_3 0 = _NO_ without response
1 = ON relay 3 switch-on
2 = OFF relay 3 switch-off

YOUT 0 = _NO_ without response
1 = 0mA
2 = 20mA

Chart 7

Tabulka_číslo TC = 7				
importance	**code**	**range**	**type**	**bytes number**
Password	**PASS**	**0 - 9999**	**int**	**2**
Filter	**FILT**	**0 - 8**	**int**	**2**
Keyboard lock	**LOC_**	**0/1**	**char**	**1**
Level	**LEVL**	**0/1**	**char**	**1**
Controller address	**-**	**0 - 126**	**char**	**1**

Keyboard lock 0 = keyboard unlocked
1 = keyboard locked

Level 0 = user level (short cut menu)
1 = service setting

Chart 8

Tabulka_číslo TC = 8				
importance	**code**	**range**	**type**	**bytes number**
Apparatus address	**-**	**0 - 126**	**char**	**1**

After apparatus address setting is answer with new address SA.

Parameters intended for diagnostic of controller

Chart 9 (FOR READING ONLY)

Tabulka_číslo TC = 9				
Importance	**code**	**range**	**type**	**bytes number**
Initial drive position	**-**	**0 - 1023**	**int**	**2**
Final drive position	**-**	**0 - 1023**	**int**	**2**

Chart 10 (FOR READING ONLY)

Tabulka_číslo TC = 10				
importance	**code**	**range**	**type**	**bytes number**
Measured value state	**-**		**float**	**4**
Relay state	**-**		**char**	**1**
Required value state	**-**		**float**	**4**
Required value state	**-**		**float**	**4**
Clamps temperature	**-**		**int**	**2**
Input sensor trouble state	**-**		**char**	**1**
Feedback state	**-**		**int**	**2**
Analog output state	**-**		**int**	**2**
Relay 1 and 2 actual position (position for servomotor)	**-**		**char**	**1**

Some controllers states are not in physical units.

7.3 Stored dates format

Signed and Unsigned Characters
Range of char type is 1 byte (8 bites). For example value 0x12

Address	+0
Contents	0x12

Signed and Unsigned Integers
Range of int type is 2 byte (16 bites). For example value 0x1234

Address	+0	+1
Contents	0x12	0x34

Signed and Unsigned Long Integers
Range of long type is 4 byte (32 bites). For example value 0x12345678

Address	+0	+1	+2	+3
Contents	0x12	0x34	0x56	0x78

Floating-point Numbers
Range of float type is 4 byte (32 bites) by standard IEEE-754

Address	+0	+1	+2	+3
Contents	SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM

S represent sign (1 negative value and 0 is positive value)
E "Two's complement exponent" with offset 127
M 23-bit nominal mantise

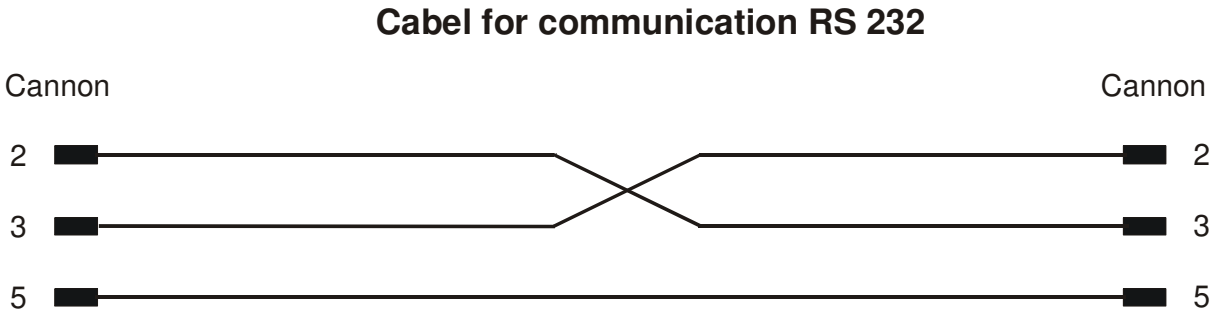
Example: value -12,5 is given hexadecimally 0xC1480000

Address	+0	+1	+2	+3
Contents	0xC1	0x48	0x00	0x00

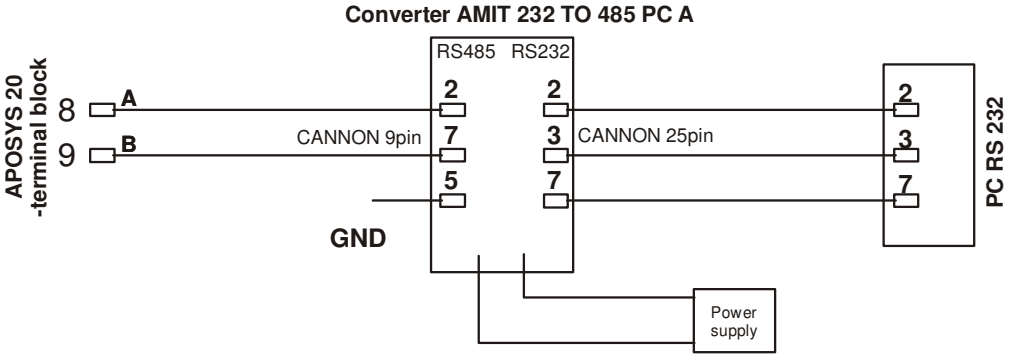
Note:
At first is sended the mark with the address (address+0) and last is sended the mark with the address (address+n).

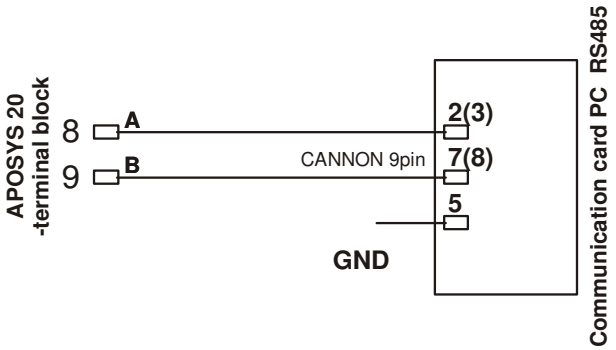
8 Controller connecting with PC

8.1 Cable connexion for communication RS 232



8.2 Cable connexion for communication RS485





9 Software

9.1 Application of software APOELMOS

Request on hardware:

PC: Pentium 100
graphic card: VGA
CD ROM drive

Request on software:

operation system MS Windows 95/98/ME and higher versions

Installation of software suppose the basic knowledge for working with PC and selected instructions MS Windows.

9.2 Installation

1) Enter CD ROM to CD ROM drive. As long as the CD ROM after enter to CD ROM drive will run Internet Explorer (autorun), you set from concrete menu „Service software“ and use a program for the controller APOSYS 20.
2) Copy software to HDD.
3) Create shortcut and move shortcut to Start Programs.
4) Now you can run the software (PA-20.exe).

9.3 Program PA-20 description

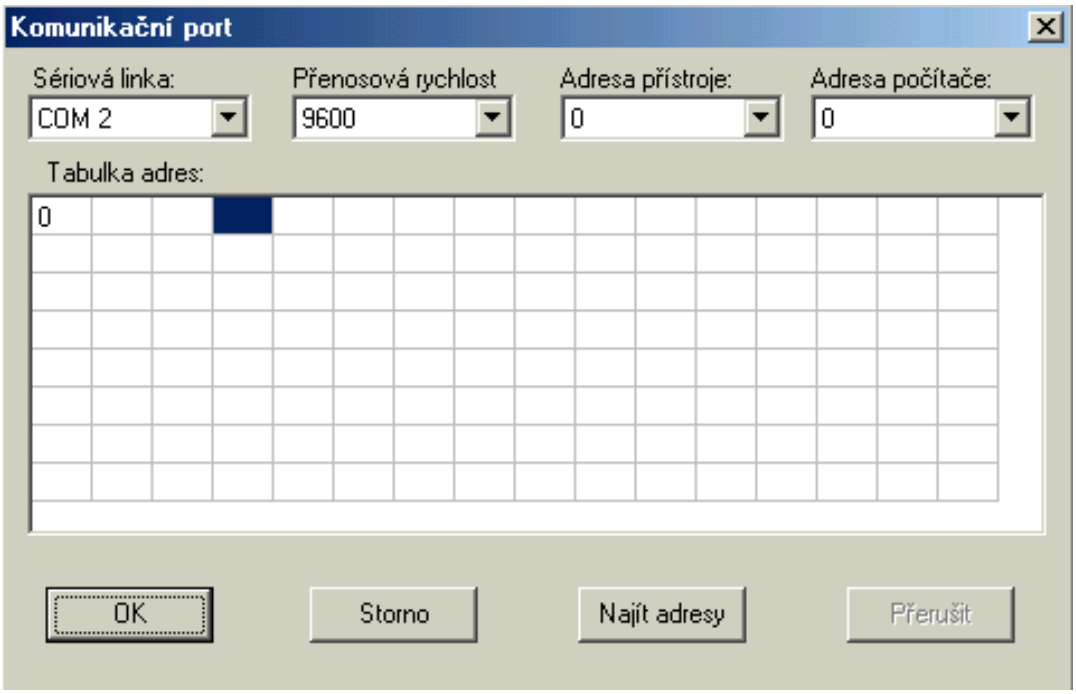
1) Introduction
2) Communication line setting
3) Graph setting
4) Data record speed setting
5) Controllers parameters setting
6) Controller set parameters save
7) Automatical record start
8) Record from controller reading
9) Parameters set from production reading

9.3.1 Introduction

The software is for the controller parameters setting and for measured values monitoring.

9.3.2 First start

After the software start at first you have to set the communication line and the controller address.
In the menu setting you click on a button communication port. There is open a window the communication port. At first you set a serial line and a communication speed 9600Bd. After that you click on a button find addresses. In the address chart is detected the controller address which you set to apparatus address. The PC address have to be arbitrary in the range 0 - 126. After setting you acknowledge by button OK.

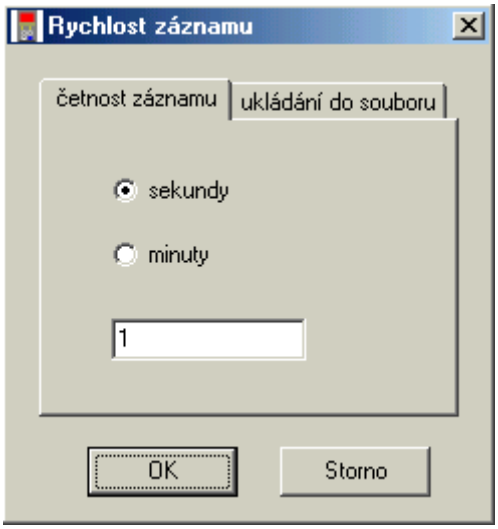


9.3.3 Graph setting

In the menu setting you click on the button graph setting. There is open the window graph 3D. Here you set required graph view.

9.3.4 Data record speed setting

In the menu setting you click on the button record speed. There is open the window record speed. Here you set required speed of save to form and automatical form save to file time.

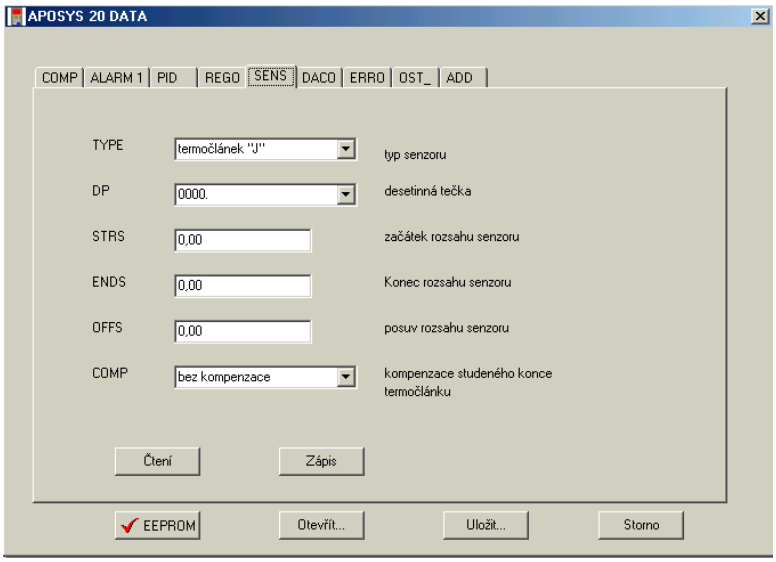


9.3.5 Controllers parameters setting

In the menu setting you click on the button controller setting. There is open the window APOSYS 20 dates. By button reading you can read parameters from the controller namely always those parameters only which active card contain. By button record you can record parameters from active card to the controller. After the controllers parametars setting you click on the button FLASH for parameters storage in the controller in case of the controller power supply failure.

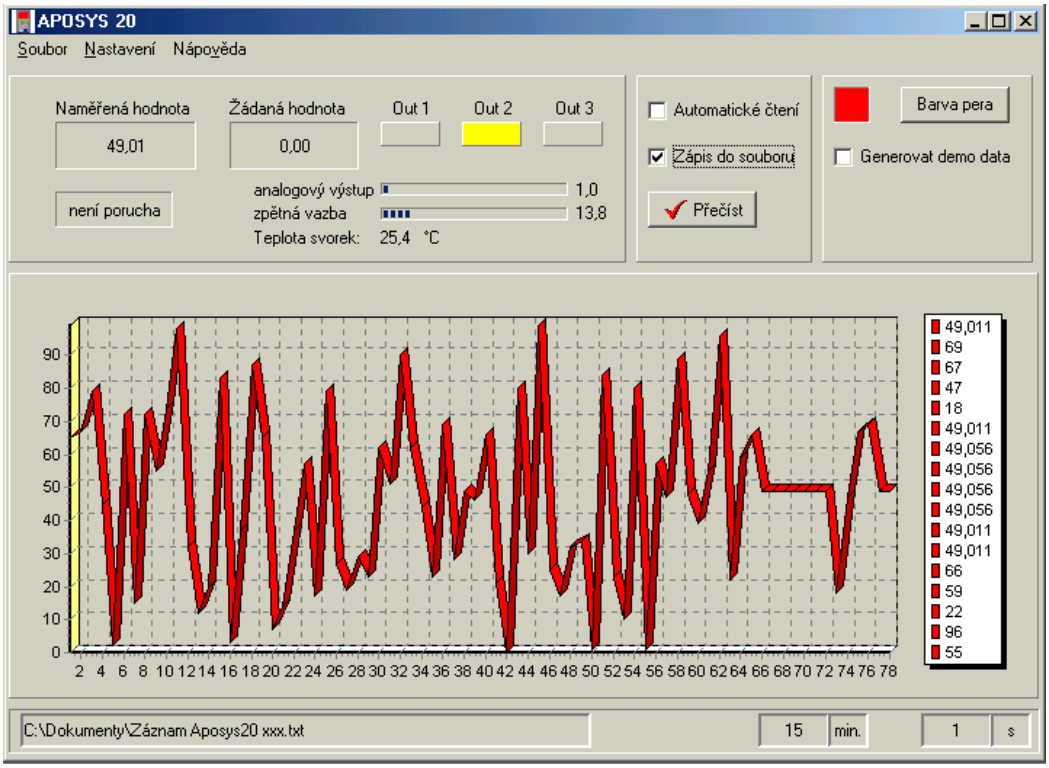
9.3.6 Controller set parameters save

In the window APOSYS 20 dates (see previous setting). By the button save (open) you can set parameters save to file (refresh from file). File have a suffix ini.
At dates refresh from file are parameters projection on the controller parameters cards only. Parameters record to the controller you have to do from every card extra.



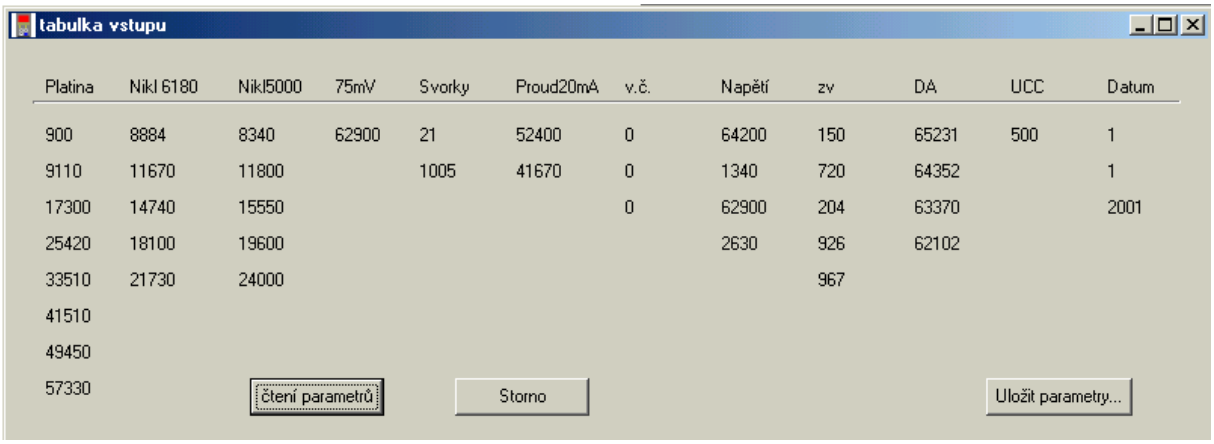
9.3.7 Automatical record start

In the main window you check off automatical reading and record to file.



9.3.8 Parameters set from production reading

In the menu setting you click on a button parameters from production. There is open the window input chart. By button reading you can read parameters from the controller. By button save you record parameters to txt file.



10 ES declaration of comformity

ES EC DECLARATION OF COMFORMITY

We,
A.P.O. - ELMOS v.o.s., Pražská 90, 509 01 Nová Paka, Czech Republic
IČO: 60111615
declare on our exclusive responsibility that below mentioned product meet a technical rule requirements that the product is at ours designate application condition secure and that we have taken steps by which we guarantee a comformity of all products below mentioned type be given on market with technical documentation and with requirements of corresponding decree of the government and European guidelines.

Product: **Regulátor APOSYS 20**
Type: **APOSYS 20**
Producer: A.P.O. - ELMOS v.o.s.
Pražská 90
509 01 Nová Paka
Czech Republic
The product is determined for measuring and control of temperature or the other values.

Appreciation deuces product is effected in terms of appreciation system quality production on the premises chartered person (No. AO 201, Electrotechnic trial institution, Pod lisem 129, Praha 8 – Troja) and transaction supervision above his upright function.
Above mentioned product is with comformity with norms
electric security:
ČSN EN 61010-1 ed.2:2011 including amendment EN 61010-1:2010 including amendment
ČSN EN 61326-1:2013 including amendment EN 61326-1:2013 including amendment

and decree of the government (European guidelines)
NV 17/2003 Sb. including amendment 2006/95/EC including amendment
NV 616/2006 Sb. including amendment 2004/108/EC including amendment
NV 481/2012 Sb. including amendment 2011/65/EU including amendment

A sample revision achieve a authorized person nr. AO 201, Electrotechnical experimental institute, Pod lisem 129, Praha 8 - Troja, which issue for this product a Certificate nr. 1040416 from day 5.4.2004 and Protocol obout test EMC nr. 4.800385-00 from day 20.4.1999.

Last double issue year, whereof was product powered mark CE: 02

Place of issue: Nová Paka Name: Ing. Libor Lukeš
Date of issue: 22.7.2014 Function: comp. director

Stamp: APOELMOS
A.P.O. - ELMOS v.o.s.
Pražská 90, 509 01 Nová Paka
DIČ: CZ60111615

Signature: .....

11 Certificate about the product assembly and quality

Microprocessor controller APOSYS 20

product nr. 88-18-08888

We acknowledge that the above mentioned product is complete. And the product answers to technical conditions and it is well inspected and tested.

12 Guarantee conditions

The producer is responsible that his product has and will have characters appointed by technical norms for appointed time, that it is complete and without defect. The producer is also responsible for defects, which a customer will find out in the guarantee time and which he will claim in time. The basic condition of guarantee is using the controller this way as the above mentioned in the using handbook.

The guarantee time is 36 months from the day of sale.

The guarantee is possible to apply at material defects or at bad function of product. Guarantee repairs are achieved with exchange way.

The guarantee is dissolved as long as on the product there were made arrangements or guarantee labels were broken down and as long as the product was violently mechanically damaged or it was used the wrong way.

Guarantee and afterguarantee service perform entirely A.P.O. – ELMOS.

stamp

Date of sale: .....

Signature: .....

Substance