

PANELMETER AP11

Technical documentation U-19



AP11-31-x-...
AP11-32-x-...
AP11-33-x-...

APOELMOS
measurement & control
www.apoelmos.cz



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CONTENTS

1 Introduction	5
1.1 Ordering code	6
2 Technical data	7
3 Panelmeter description	9
3.1 Front panel	9
3.2 Dimensions of panelmeter and assembly opening	10
4 Connection	11
4.1 Description of back panel	11
4.2 Instruction for making installations and connections to panel	11
4.3 Connection to feeding voltage	12
4.4 Connection of input signals	13
4.4.1 Passive current signal (input code 31).....	14
4.4.2 Active current signal (input code 31).....	14
4.4.3 Voltage signal (input code 32).....	15
4.4.4 Passive current signal (input code 33)	15
4.4.5 Active current signal (input code 33)	16
4.4.6 Voltage signal (input code 33)	16
5 Analogue output	17
5.1 Connecting of analogue output	17
5.2 Block diagram of analogue output function	18
6 Communication	19
7 Connecting of contact outputs	21
8 Panelmeter functions	21
8.1 Panelmeter switch on	21
8.2 Panelmeter reset	21
8.3 Limit switch functions	22
8.4 Panelmeter functions and limit switch setting	23
8.5 Functional characteristics of limit switches	25
8.6 Display setting	27
8.7 Bar-graph	28
9 Panelmeter menu functions	28
9.1 Functions of buttons in setting mode	28
9.2 Simplified block diagram of panelmeter menu	29
9.2.1 Configuration of desired value -SP	30
9.2.2 Configuration of limit switches - ALA-1 up to ALA 4	31
9.2.3 Configuration of sensor - SEN-1 up to SEN-2	32
9.2.4 Configuration of analogue output - DACO	34
9.2.5 Configuration of output state in breakdown condition -ERROR	35
9.2.6 Configuration of parameter -OSTAT	36
9.2.7 Configuration of bargraph - BAR-1 up to BAR 2	37
9.2.8 Configuration of display - DIS-1 up to DIS-2.....	38

CONTENTS

9.3 Limit values of parameters	39
10 Control software	42
11 ES Declaration of conformity	43
12 Quality certificate	44
13 Warranty conditions	44

Panelmeter AP 11 is 5 digit programmable apparatus for universal use. Apparatus is controlled with digital signal processor with A/D transducer. Panelmeter is operated with key-board placed on front panel or with control software that is used for setting of all parameters and archiving measured values. Panelmeter has to be provided with communication line, variants of communication lines are in ordering code. Control software is included in standard delivery. Panelmeter is equipped with three-colour display allowing for a quick check of limits within measured value oscillates. Visually interesting element is auxiliary horizontal barograph. Offer of input signals includes resistance temperature sensors (Pt100, Pt1000, Ni1000/6180ppm, Ni1000/5000ppm), thermocouple (J, K, E, T, R, S, B) and unified outputs from sensors of technological processes (4-20 mA, 0-20 mA, 0-10 V). Type of panelmeter with universal input with galvanic separation is also available. In this case necessary type of input signal is simply configured from keyboard during installation of panelmeter into technological equipment. Advantages of this type is higher accuracy, galvanic separation of input signal and universal use and thus minimizing number of spare pieces to ensure uninterrupted operation. Type AP11 is produced also in modification with more inputs, particularly in following modifications: 2x Pt100; 2x current signal 0(4)-20 mA, 1x current signal 0(4)-20 mA + 1x voltage signal 0-10 V; 4x current signal 0(4)-20 mA; 4x voltage signal; 2x current signal 0(4)-20 mA + 2x current signal 0-10 V. Power source with load capability 100 mA, that can feed current loops of passive sensors, is built in panelmeter. It can also be equipped with two or four limit switches whose outputs are relay switching contacts. Functions of switches on multi-input panelmeter types is programmable. E.g. any limit switch (or more switches) can be assigned to any input. Limit switches can be compared also with value of sum or difference of two inputs. Desired value is set individually for each limit switch or together for all limit switches when any deviation from common desired value can be set for each limit switch. Hysteresis and reaction of output relay on achieving of desired value can be set on each switch individually. Limit switches can be set also for safety function. Then the switch after its connecting has to be deactivated. There is an variant with analogue output that can be galvanic separated in panelmeter ordering code.

With multi-stage types of panelmeters analogue output can be assigned to any input by a program, eventually to sum or difference of two inputs. Any of the communication line variants can be used for communication of panelmeter with PC.

Communication lines RS232 or RS485 (can be galvanic separated) are in ordering code. Two communication lines RS485 (one can be galvanic separated) or combination of two communication lines RS232 and RS485 can be used for above standard applications. Communication enables not only setting of parameters and data archiving, but regarding the possibility of addressing of individual panelmeters it can be also used for interconnection of bigger number of apparatuses and controlling of complete technological lines. Apparatus features offers large possibilities of its usage, not only for simple rendering of measured signals but also as signal transducers, galvanic separation, data collection for their processing on PC, as limit switches, simple two-state regulator, apparatuses for failure signalling or as mathematical units.

Ordering code

This technical documentation refers to the following chart of ordering codes.

AP 11 - XX - X - X - X - X - X - XXX	
	Input
31	2 x current 0/4 – 20 mA
32	2 x voltage 0-10 V
33	1 x current 0/4 – 20 mA, 1 x voltage 0-10 V
	Contact output
0	empty
1	2 x relay (switching contacts 250 VAC, 2A)
2	4 x relay (switching contacts 250 VAC, 2A)
	Analogue output
0	empty
1	current/voltage without galvanic separ
2	current/voltage with galvanic separ. GS
	Communication
0	empty
1	RS232
2	RS485 without GS
3	RS485 with GS
4	2 x RS485 without GS
5	RS485 s GO + RS485 bez GO
6	RS485 s GO + RS232
	Power supply
1	80 - 253 VAC
2	18 - 36 V AC/DC
	Display
1	red
2	green
3	yellow
4	three colour
	Software
001	standard
XXX	special requirement

Example of order:

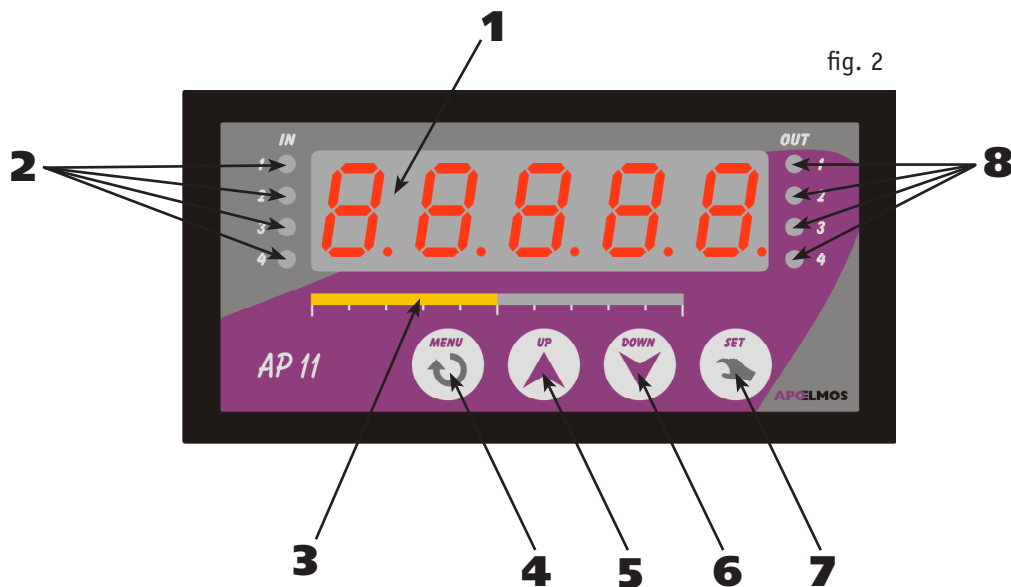
AP 11 - 32 - 2 - 1 - 5 - 1 - 4 - 001

Input signal, accuracy					
Type	Input signal	Range of measurements	Measurement accuracy (% of range)	Standard	Code
Procesní	2x current signal	2 x 0/4 - 20 mA	± 0,25%		31
	2x voltage signal	2 x 0 - 10 V	± 0,25%		32
	1 x current signal + 1 x voltage signal	1 x 0/4 - 20 mA, 1 x 0 - 10 V	± 0,25%		33
Power supply					
Power supply voltage		80 - 253 VAC, 50 Hz 18 - 36 VDC / 18 - 36 VAC, 50 Hz			
Input		max. 12 VA			
Display					
Display		-9999 ~ 0 ~ 99999			
Height of digits		14 mm			
Decimal point		Adjustable with program			
Bargraph		30 LED			
Resolution		According to position of decimal point			
Auxiliary power supply		> 18 VDC @ 25 mA for feeding of sensors Max. load of auxiliary power supply 100 mA			
Outputs					
Contact		2x relay (switching contact 250 VAC, 2A) or 4x relay (switching contact 250 VAC, 2A)			
Analogue		13.5 bit D/A transducer without galvanic separation or with galvanic separation current 0 (4) – 20 mA, loading resistance max. 400 Ω voltage 0 – 10 V, loading resistance min. 10 kΩ			
Communication					
RS485		without galvanic separation or with galvanic separation, two way communication			
RS232		without galvanic separation			

Mechanical properties	
Type	Panel apparatus
Dimensions	96 x 48 x 119 mm
Opening in panel	90,5 x 43,5 (openings in corners \varnothing 3 mm with pitch 89,5 x 42,5 mm)
Keyboard	4 keys, foil
Weight	400 g
Operating conditions	
Working conditions	0 - 60 °C
Temperature coefficient	25 ppm/°C
Stabilizing time	Within 5 min after activation
Shielding	IP 54 (front panel) IP 20 (terminal board)
Calibration	at 25 °C and 40% relative humidity
Data back-up	electrically (EEPROM)
Auxiliary input	Voltage free contact – keyboard lock
Connection	
Connector terminal board	
Max. section of conductor	2.5 mm ² for power supply and contact outputs 1 mm ² for other connectors
Safety class	I
Electromagnetic compatibility ČSN EN 61326	
Seismic resistibility ČSN IEC 980: 1993, čl. 6	
Electric safety ČSN EN 61010-1: 2003	

Front panel

3.1



1 - Display

Five-digit display for indication of measured value. With parameter programming display show clear reports.

2 - Input „IN“ indicators

No. of selected input is indicated with respective indicator. Individual inputs are selected with keys „UP“ and „DOWN“. No. of inputs depends on selected configuration.

3 - Bargraph

Bargraph relates to measured value that is determined with pre-set range of STR and END. E.g. if start of range (STR) is 0 and end (END) 200 and measured value shall be on level 100, bargraph shall indicate half of the scale. Bargraphs is formed with column of LED diodes.

4 - Key „MENU“

Key „MENU“ is used for entering configuration menu and setting mode.

5 - Key „UP“

Key „UP“ is used for browsing parameters and setting of numeric data when programming. Pushing and keeping down of the key speeds up browsing and setting procedure.

6 - Key „DOWN“

Key „DOWN“ is used for browsing parameters and setting of numeric data when programming. Pushing and keeping down of the key speeds up browsing and setting procedure.

7 - Key „SET“

Key „SET“ is used for setting data, programming termination, data uploading into EEPROM and return to operating mode.

8 - Output „OUT“ indicators

Indicators OUT 1 to OUT 4 indicates state of individual outputs in the following manner: indicator flashing – output switched, indicator is not flashing – output is off.

DIMENSIONS OF PANELMETER AND ASSEMBLY OPENING

Dimensions for power supply 80 - 253 VAC, 50 Hz (fig. 3a)

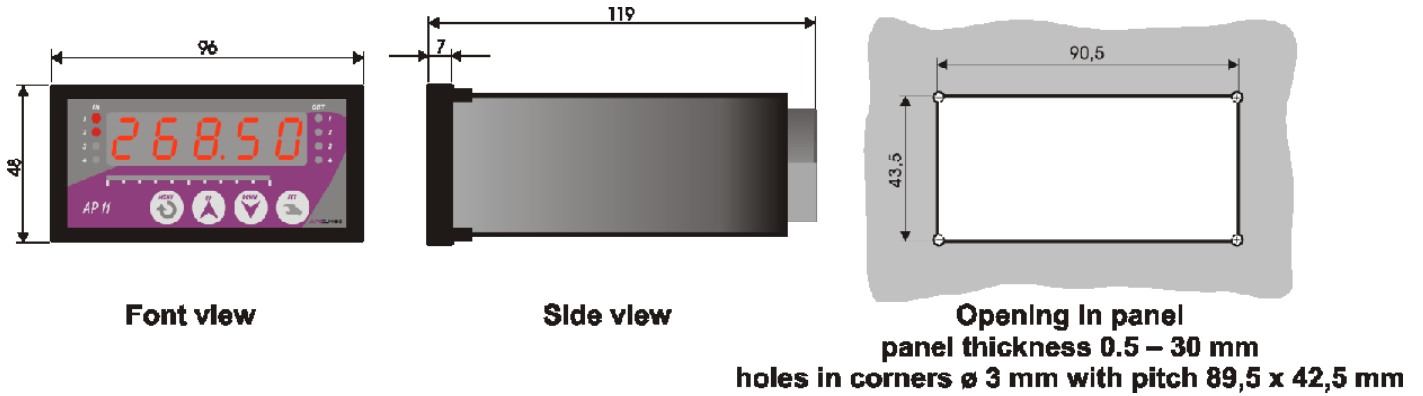


fig. 3a

Dimensions for power supply 18 - 36 VDC / 18 - 36 VAC, 50 Hz (fig. 3b)

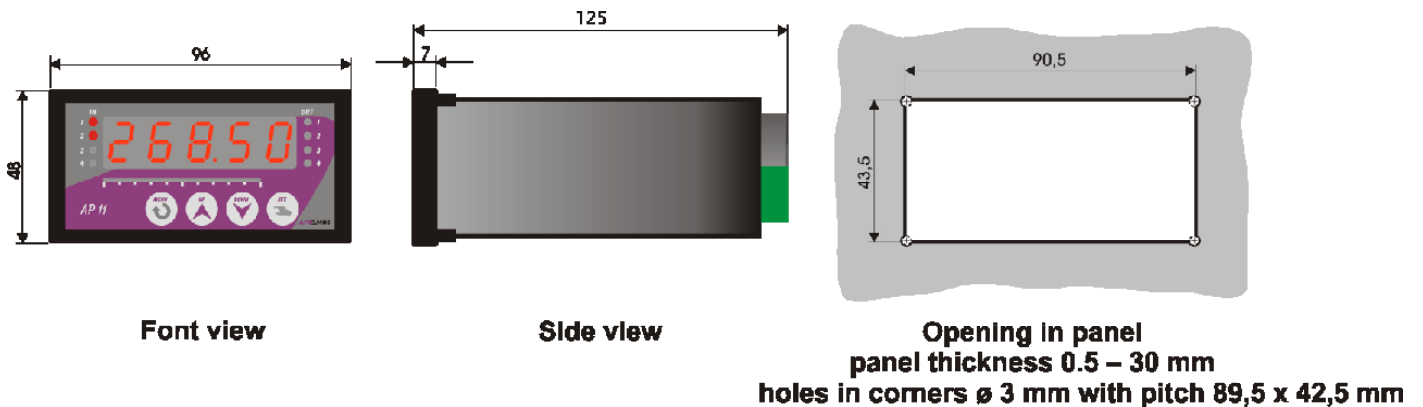
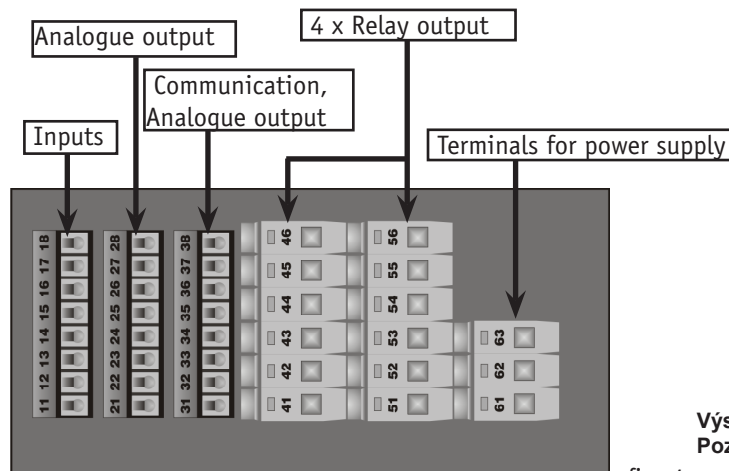


fig. 3b

Description of back panel

4.1



Výstraha rizika nebezpečí!
Pozor na napájecí napětí!

fig. 4

Instructions for installation into panel and connecting

4.2

Fix panelmeter into panel with two clamps (included in delivery).

Connect conductors into screw connectors on the back panel of regulator. Connectors are designed as separately detachable constructions blocks as follows:

- connectors 11 to 18 – process inputs
- connectors 21 to 28 – analogue output
- connectors 31 to 38 - analogue output and communication
- connectors 41 to 46 – relay output
- connectors 51 to 56 - relay output
- connectors 61 to 63 – power supply

Pull each block with connectors out from apparatus (locking force has to be surpassed) in backward direction. Then connect conductors to released blocks with connectors and then insert blocks back to apparatus. Max. cross section of conductors on relay connectors and power supply is 2,5 mm², on other connectors 1 mm².

Reducing of interference influence

Following rules should be observed with designing of the system:

- All power supply conductors and power lines has to be led separately from signal lines (e.g. thermocouple, communication). Min. gap between both types of lines should be 30 cm.
- If signal line crosses power line they should intersect in right angle.
- Lead the lines out of the potential source of interference.
- Don't install relay and contactors too close to panelmeter.
- Use twisted and screened conductor for signal line.

4.3

Connecting of power supply



Caution!

Danger: Don't connect apparatus to power supply until all inputs are connected. Wrong connection of apparatus can cause injury!

Apparatus connection

During connecting of apparatus main switch or safety circuit breaker has to be:

- part of building installation
- in the close vicinity of equipment
- easy to reach for operating personnel
- marked as equipment disconnecting element

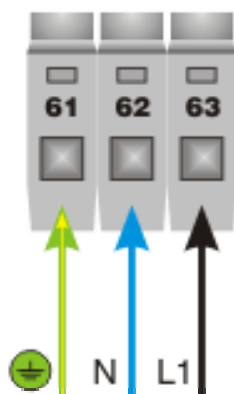
If the equipment is used in different manner than specified by producer, protection provided with equipment can be disturbed.

Recommended safety fuse for power supply 230 V je 1 A / 250 VAC

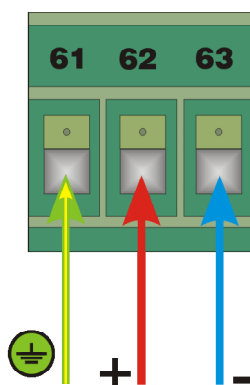
Recommended safety fuse for power supply 24 V je T 3,15 A / 250 V

Connection of power supply conductors in terminal board

Alternating feeding voltage 80 - 253 VAC, 50 Hz



Feeding voltage 18 - 36 VDC



Feeding voltage 18 - 36 VAC

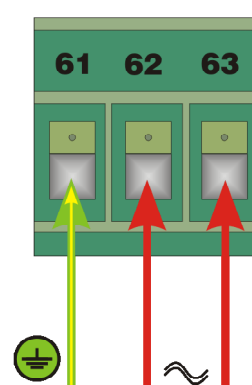


fig. 5

Connecting of input signals

Following diagrams show possibilities of process signal connections.

Select input signal in function menu *SEN - 1*, *SEN - 2* (see chapter sensor type setup - *SEN - 1* to *SEN - 2*)

Variants of input signals

Signal type	Symbol on display	Figure no.	Input code
Proudový signál			
4 až 20 mA (passive double-conductor transducer)	4 - 20	fig. 6	31
0/4 až 20 mA (active current signal)	0 - 20	fig. 7	31
Without sensor	- NO -	-no- when sensor disabled - apparatus shows zero	

Signal type	Symbol on display	Figure no.	Input code
Voltage signal			
0 až 10 V	0 - 10	fig. 8	31
Without sensor	- NO -	-no- when sensor disabled - apparatus shows zero	

Signal type	Symbol on display	Figure no.	Input code
Current / Voltage signal			
4 až 20 mA (passive double-conductor transducer)	4 - 20	fig. 9	33
0/4 až 20 mA (active current signal)	0 - 20	fig. 10	33
Voltage signal 0 - 10 V	0 - 10	fig. 11	33
Without sensor	- NO -	-no- when sensor disabled - apparatus shows zero	

Auxiliary input: Keyboard lock is activated after interconnecting of connectors 17, 18. Lock can be used in four user's setups *MEN - 1*, *MEN - 2*, *MEN - 3*, *MEN - 4* which are in configuration menu referred to as *MENU*. First set desired parameter and then interconnect connectors 17 and 18 according to diagram shown in the figures here bellow.

Properties of user's menu:

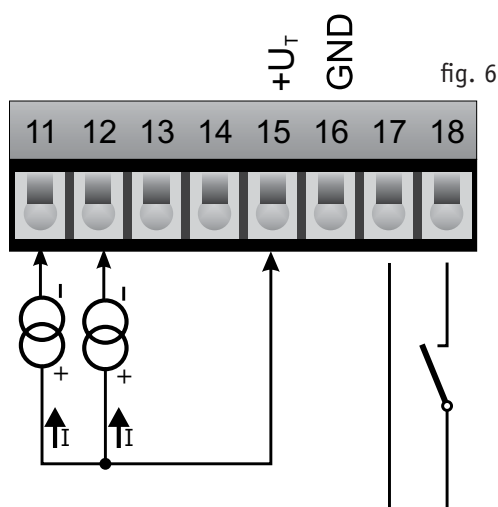
- MEN - 1* - totally disables keyboard (no parameter can be set),
- MEN - 2* - enables setup only of desired value of SP. (see chapter value SP setup).
- MEN - 3* - enables setup of limit switch values *ALA - 1* to *ALA - 4* (chapter limit switch setup - *ALA - 1* to *ALA - 4*), that can be secured with password pass (see chapter setting of password - *PASS*)
- MEN - 4* - totally disables keyboard (no parameter can be set), automatic cycling of measured values visual display on individual inputs is activated.



During apparatus configuration select type of input signal in menu *SEN - 1*, *SEN - 2* parameter *TYP* !!!

4.4.1

Current signal 4 - 20 mA (passive double-conductor transducer)



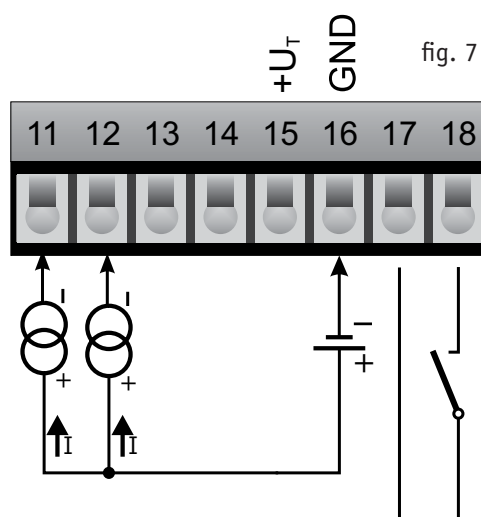
Ordering code of input 31
(AP11-31-x.....)

Auxiliary input
for setup of MENU
parameters

Connect double-conductor transducer to connectors 11, 12, 15 as shown on the diagram where connector no. 15 is power supply. Press **MENU** key and enter apparatus configuration menu, browse to the function of sensor selection *SEN - 1*, *SEN - 2*. With repeated press get to submenu for selection of sensor type *typ*. With press the menu key again and enter submenu, where with keys **UP** and **DOWN** set 4 - 20 mA select 4 - 20 for double-conductor passive transducer and press key **SET** to confirm the selection. If option -no- is selected, input is disabled. Then setup range of measurement. Start of range define in **MENU** with function **STRS**, and ending of the range with function **ENDS**.

4.4.2

Current signal 0/4 - 20 mA (active current signal)



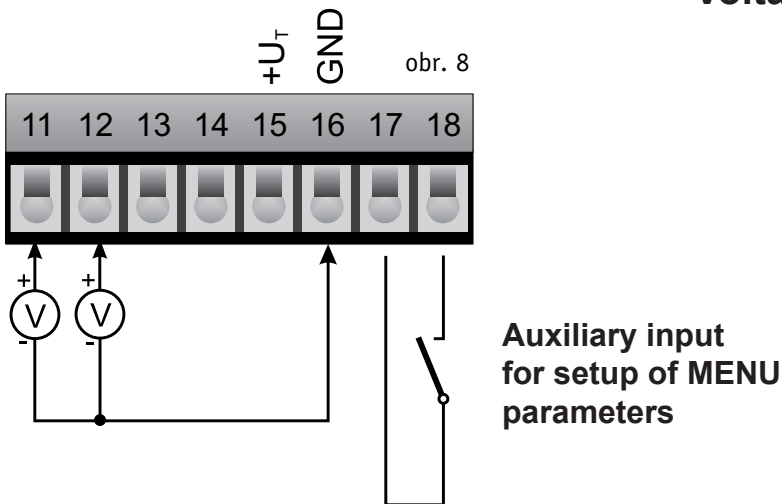
Ordering code of input 31
(AP11-31-x.....)

Auxiliary input
for setup of MENU
parameters

Connect double-conductor transducer to connectors 11, 12, 16 as shown on the diagram. Connector no. 16 is minus. Press **MENU** key and enter apparatus configuration menu, browse to the function of sensor selection *SEN - 1*, *SEN - 2*. With repeated press get to submenu for selection of sensor type *typ*. Press the menu key again and enter submenu, where with keys **UP** and **DOWN** set 4 - 20 mA select 4 - 20 for double-conductor passive transducer and press key **SET** to confirm the selection. If option -ND- is selected, input is disabled. Then setup range of measurement. Start of range define in **MENU** with function **STRS**, and ending of the range with function **ENDS**.

Voltage signal 0 – 10 V

4.4.3

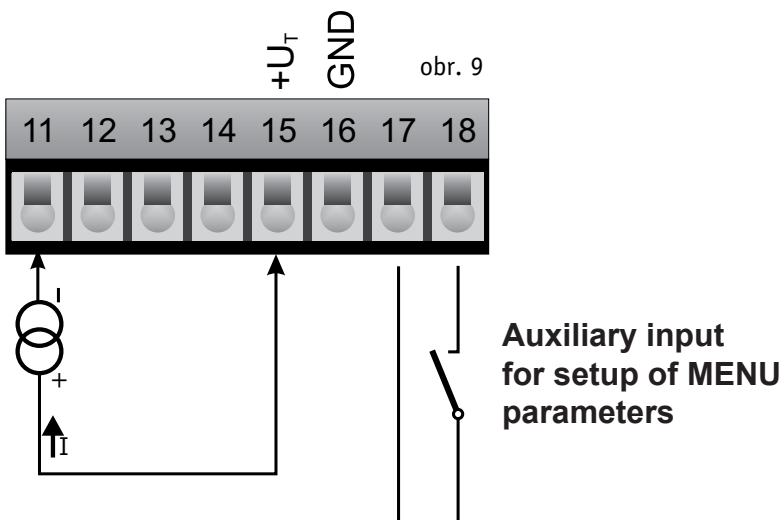


Ordering code of input 32
(AP11-32-x.....)

Connect double-conductor transducer to connectors 11, 12, 16 as shown on the diagram where connector no. 16 is common, connected to minus. Press **MENU** key and enter apparatus configuration menu, browse to the function of sensor selection *SEN - 1*, *SEN - 2*. With repeated press get to submenu for selection of sensor type *typ*. Press the menu key again and enter submenu, where with keys **UP** and **DOWN** set for voltage signal 0 – 10 V select *0 - 10* and press key **SET** to confirm the selection. If option *-NO-* is selected, input is disabled. Then set-up range of measurement. Start of range define in **MENU** with function **STRS**, and ending of the range with function **ENDS**.

Current signal 4 - 20 mA (passive double-conductor transducer)

4.4.4

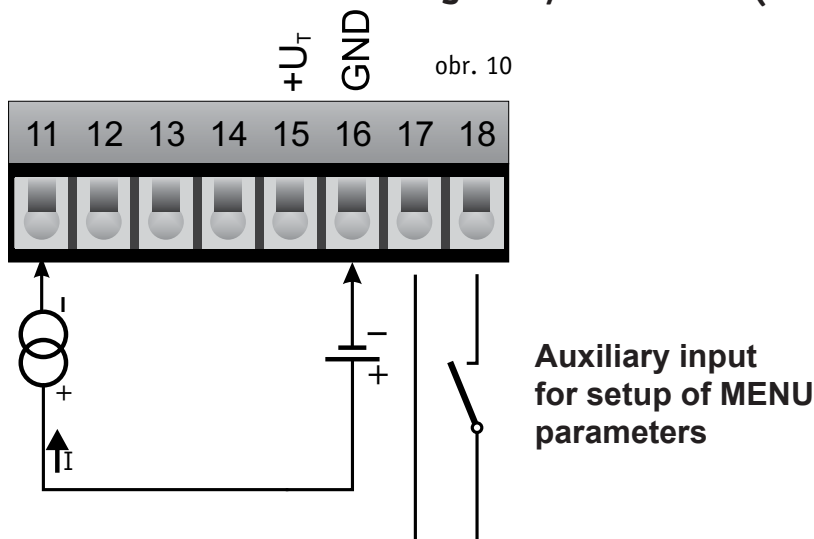


Ordering code of input 33
(AP11-33-x.....)

Connect double-conductor transducer to connectors 11, 15 as shown on the diagram where connector no. 15 is power supply. Press **MENU** key and enter apparatus configuration menu, browse to the function of sensor selection *SEN - 1*, *SEN - 2*. With repeated press get to submenu for selection of sensor type *typ*. With press the menu key again and enter submenu, where with keys **UP** and **DOWN** set 4 - 20 mA select *4 - 20* for double-conductor passive transducer and for inputs *SEN 1*, *SEN 2* and press key **SET** to confirm the selection. If option *-no-* is selected, input is disabled. Then setup range of measurement. Start of range define in **MENU** with function **STRS**, and ending of the range with function **ENDS**.

4.4.5

Current signal 0/4 - 20 mA (active current signal)

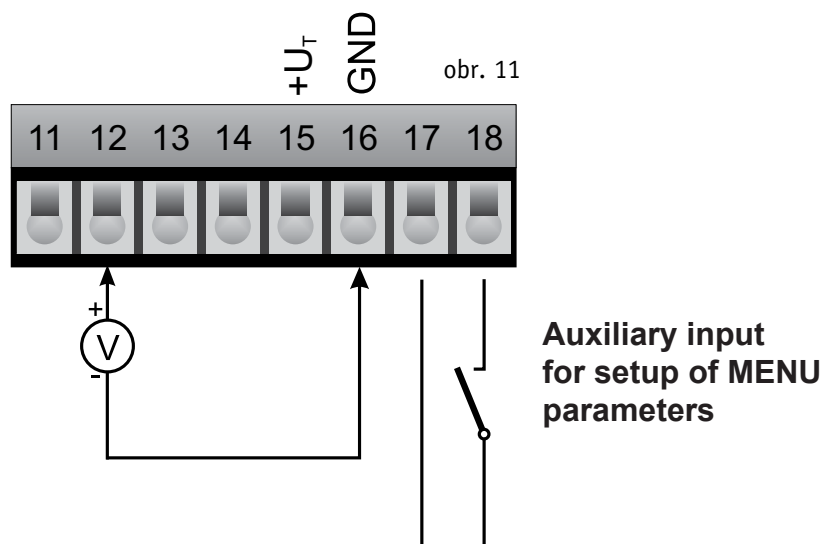


Ordering code of input 33
(AP11-33-x.....)

Connect sources of current signals to connectors 11, 16 as shown on the diagram where connector no. 16 is minus. Press **MENU** key and enter apparatus configuration menu, browse to the function of sensor selection **SEN - 1**, **SEN - 2**. With repeated press get to submenu for selection of sensor type **typ**. With press the menu key again and enter submenu, where with keys **UP** and **DOWN** set for active current signal 0/4 - 20 mA select **0 - 20** or **4 - 20** for inputs **SEN - 1** and **SEN - 2**. If option **-ND-** is selected, input is disabled and press key **SET** to confirm the selection. Then setup range of measurement. Start of range define in **MENU** with function **STRS**, and ending of the range with function **ENDS**.

4.4.6

Voltage signal 0 - 10 V



Ordering code of input 33
(AP11-33-x.....)

Connect voltage signals to connectors 12, 16 as shown on the diagram where connector no. 16 is common, connected to minus. Press **MENU** key and enter apparatus configuration menu, browse to the function of sensor selection **SEN - 1**, **SEN - 2**. With repeated press get to submenu for selection of sensor type **typ**. Press the menu key again and enter submenu, where with keys **UP** and **DOWN** set for voltage signal 0 - 10 V select **0 - 10** for input **SEN - 2**. If option **-ND-** is selected, input is disabled and press key **SET** to confirm the selection. Then setup range of measurement. Start of range define in **MENU** with function **STRS**, and ending of the range with function **ENDS**.

Options of analogue output connections with or without galvanic separation are shown on the fig. 13 and 14 (option is indicated in order). Type of output signal is selected in menu with function *OUT*. Numbers of connector positions for analogue outputs and communication are shown on fig. 12.

Connection of analogue output



Analogue output is commonly connected to position 3 (Fig. 12), but in case of communication RS232 or two communication lines analogue output is connected to position 2 on connectors 25, 26, 27, 28! (Fig. 14)

Press key **MENU**, make output setup and enter configuration menu. Press keys **UP** and **DOWN** to get to **OUT** option. Press menu key again and enter setup level. Press keys **UP** and **DOWN** to select required type of analogue output *0-20*, *4-20*, *20-0*, *20-4*.

During configuration of panelmeter select type of analogue output in menu *OUT* and setup parameters *STR* and *END*.

Features of analogue output

Type of analogue output	Symbol on display
Current	
0-20 mA	0-20
4-20 mA	4-20
20-0 mA	20-0
20-4 mA	20-4
Voltage	
0-10 V	0-20
2-10 V	4-20
10-0 V	20-0
10-2 V	20-4

fig. 12

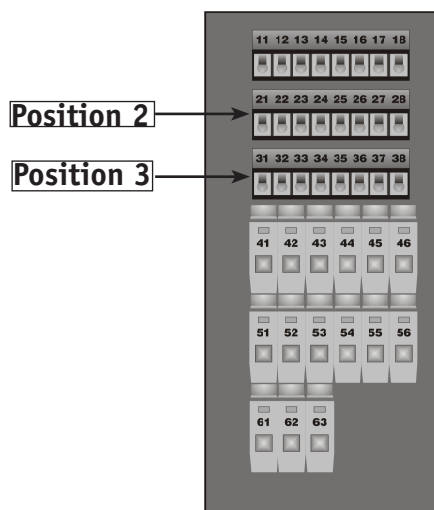
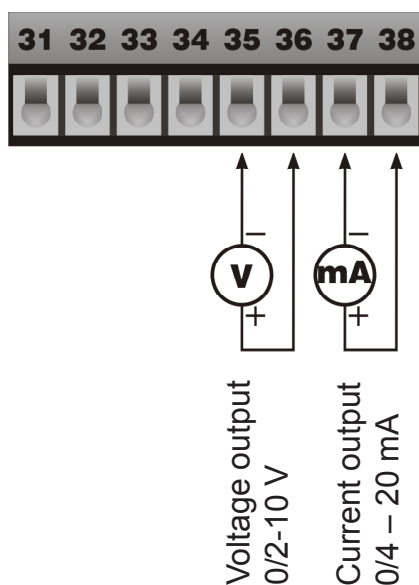
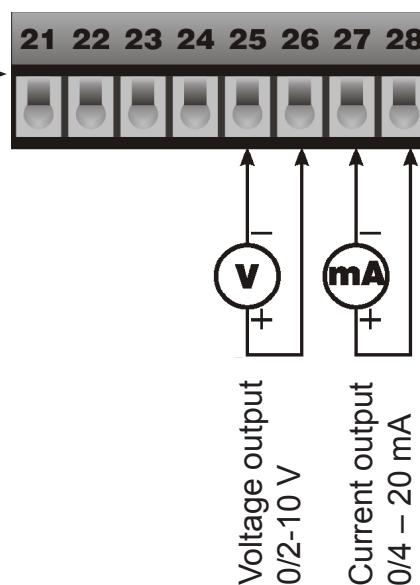


fig. 13



With 2 communication lines connected, or RS232

fig. 14

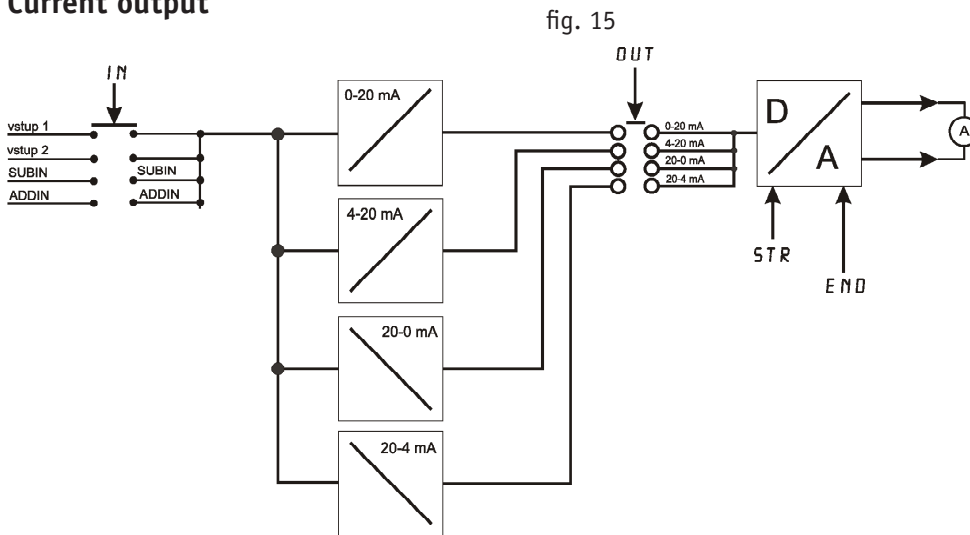


5.2

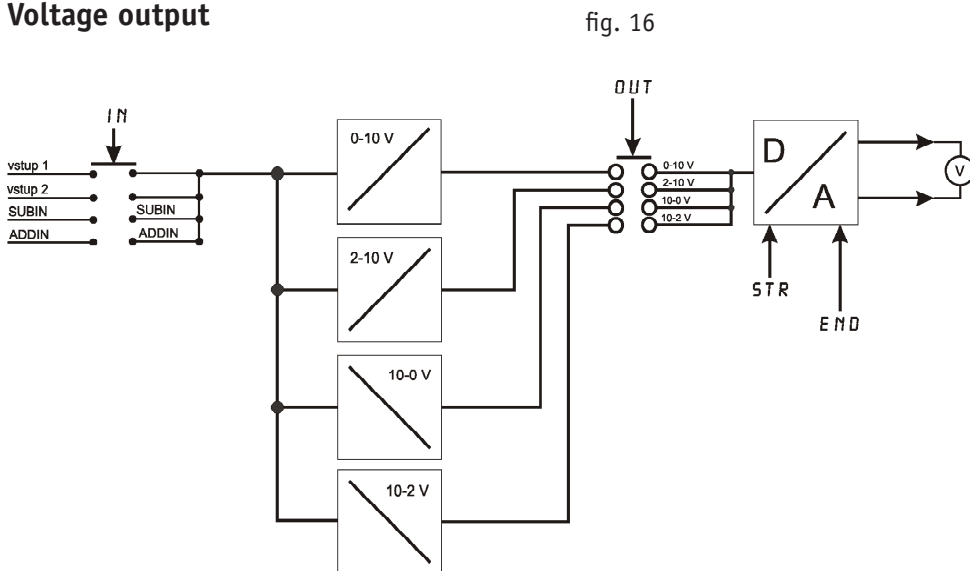
Block diagram of analogue output function

Principle of analogue output is shown on block diagrams Fig. 15 and 16. Diagrams of voltage and current output are separated for better orientation. In real connection are inputs and setup IN , OUT , STR , END common. For correct function of apparatus set range of analogue output STR (start of range), END (end of range), that relates to input signal – see configuration of start and end of analogue output.

Current output



Voltage output



Definition of parameters **SUBIN** and **ADDIN**:

SUBIN: Is defined as difference of input signals on inputs 1 and 2. I.e. input 1 - input 2

ADDIN: Is defined as sum of input signals on inputs 1 and 2.

Panelmetr AP11 can be equipped with communication line of type that is selected with order of panelmeter according to ordering code. Following options of communication lines are available. RS232, RS485 without galvanic separation, RS485 with galvanic separation (further referred to as GS), 2 x RS485 without GS, RS485 with GS + RS485 without GS, RS485 with GS + RS232.

Diagram of communication lines RS232 and RS485 connections

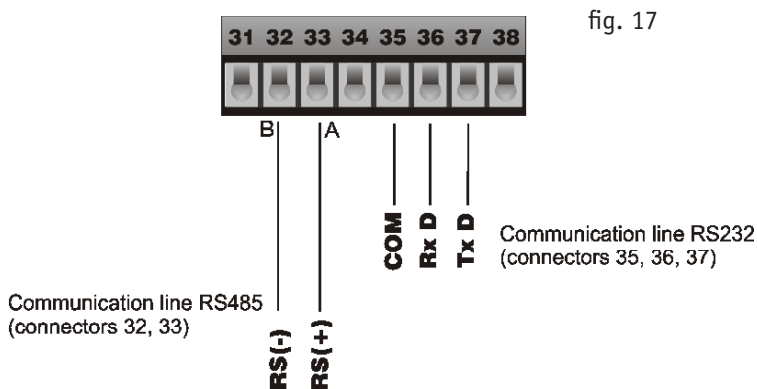
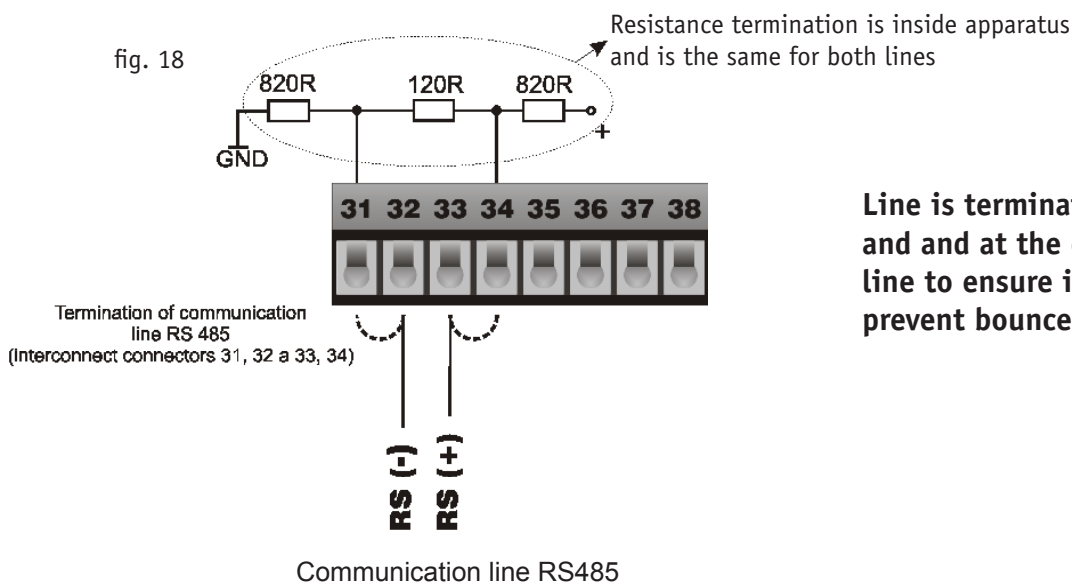


Diagram of communication line RS485 termination



Line is terminated at the beginning and at the end of communication line to ensure idle conditions and to prevent bounces in line.

Diagram of communication line RS232 connection to PC (connector Canon 9 pin)

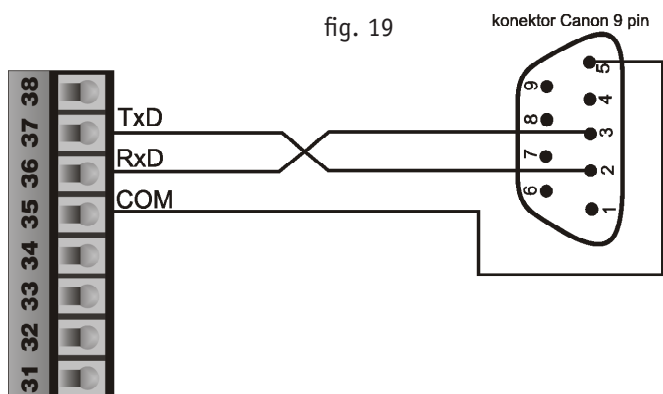
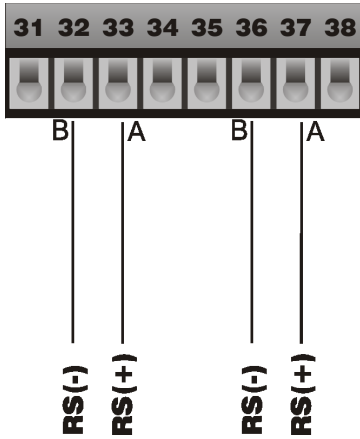


Diagram of communication lines RS485 connection

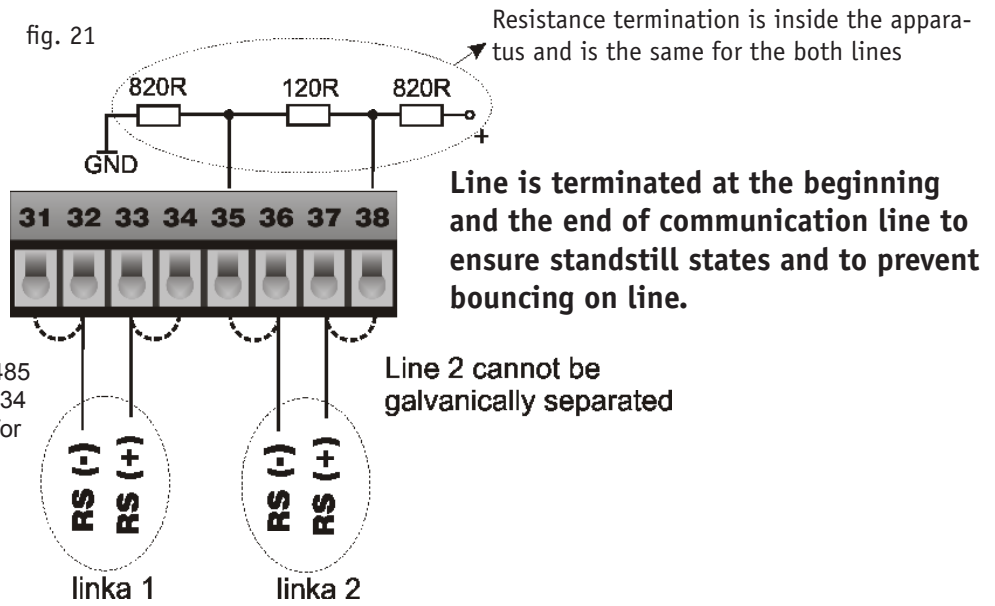
fig. 20



Communication lines
RS485 (connectors 32, 33
a 36, 37)

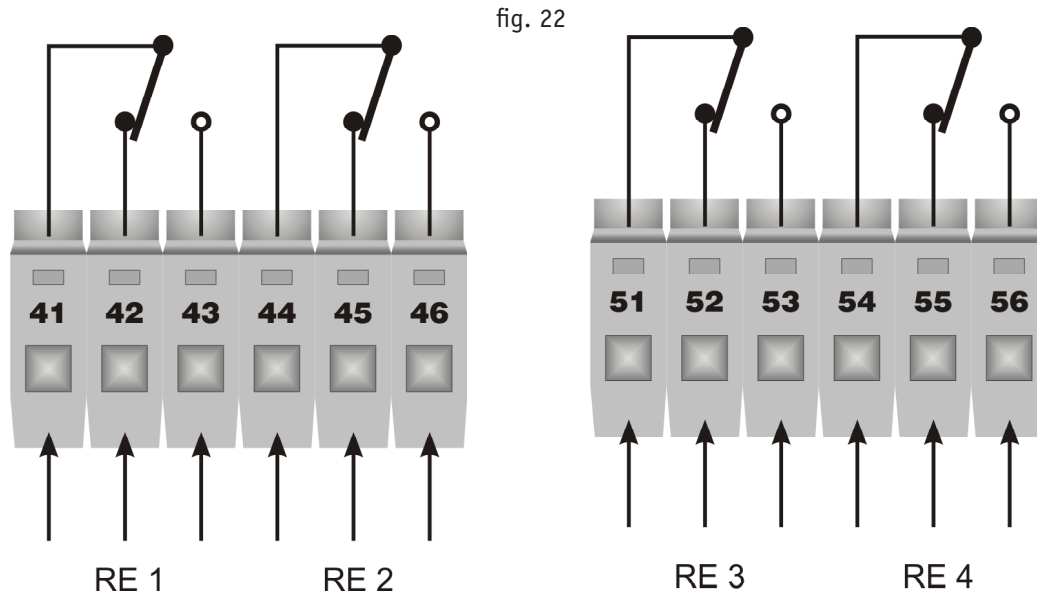
Diagram of communication lines RS485 termination

fig. 21



Termination of communication lines RS485
(interconnect connectors 31, 32 and 33, 34
for line 1, connectors 35, 36 and 37, 38 for
line 2)

Figure 22 shows options of connections of output relay contacts. Max. load of relay contacts is 250 VAC, 2 A. It is advisable to connect antijamming RC cells (e.g. 220 ohm and 0,1 μF) to respective contacts to increase reliability and to reduce jamming . Select state of output relay in menu with command RELE(x).



PANELMETER FUNCTIONS

Switching on

Main switch is not included in panelmeter therefore it activates immediately after to connection to power supply. Zero briefly appears on panelmeter display. During this time initialization and test of inner parameters is performed. After completion of test regulator switches to working mode.



Caution

If LED diode IN 1 flashes panelmeter needs to be calibrated at manufacturer's workshop.

Panelmeter reset

Unplug panelmeter from power supply. Keep key **SET** pressed and connect the apparatus to power supply. Keep the key pressed until sign **RESET** appears on display.



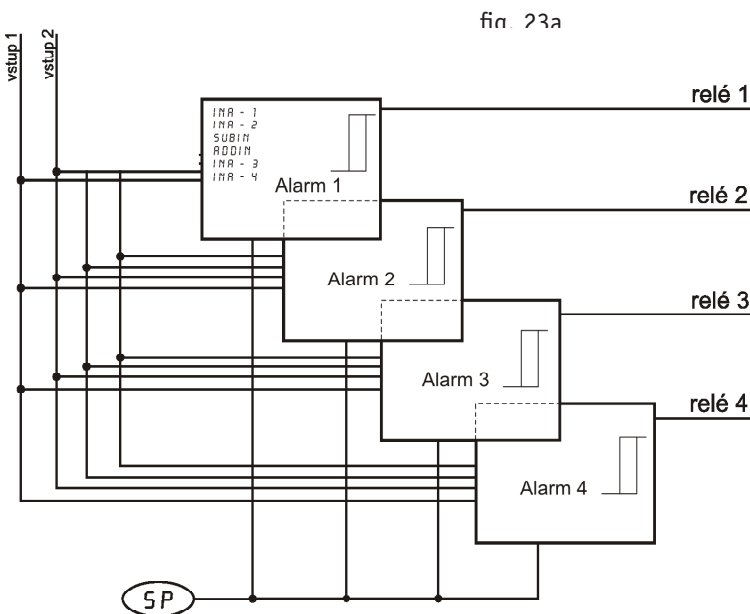
Default parameters are restored after reset!

Limit switch functions

Figure 23a shows connection of all input signals to limit switches (alarm 1 - alarm 4). Any input signal can be connected to input of limit switch. Select input signal in menu IN. On single-input type input 1 is firmly assigned and function IN is not displayed in panelmeter menu.

On multi-input types sum or difference of inputs IN-1 and IN-2 can be set with function IN. Functions are indicated as SUBIN and ADDIN. Function SUBIN is difference of inputs IN-1 - IN-2. Function ADDIN is sum of inputs IN-1 + IN-2.

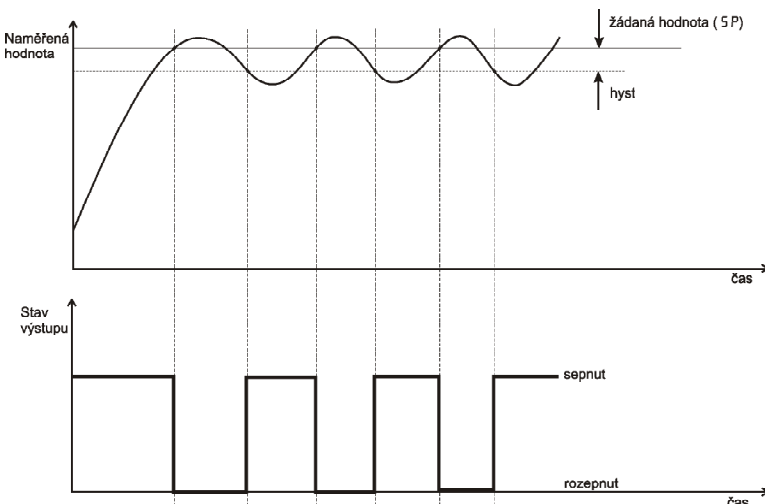
Multy-input type of panelmeter



Characteristics of double-position regulation

- Double position regulation is set in alarm block
- Is used for less requiring applications
- Zero regulation deviation cannot be achieved
- Measured value oscillates in characteristic manner around required value

fig. 23b



Functions used for limit switch setup

8.4

Any input value that can be compared with value for limit switch can be selected for signalling of emergency condition. Value for limit switch can be selected with shift from required value SP or from value of limit switch ALSP (x). Select value in menu MODE (x). Set state of output relay (whether it should switch on or off after exceeding of required value) in menu with command RELE (x).

Limit switch alarm is delayed by hysteresis set with command HYST (x).

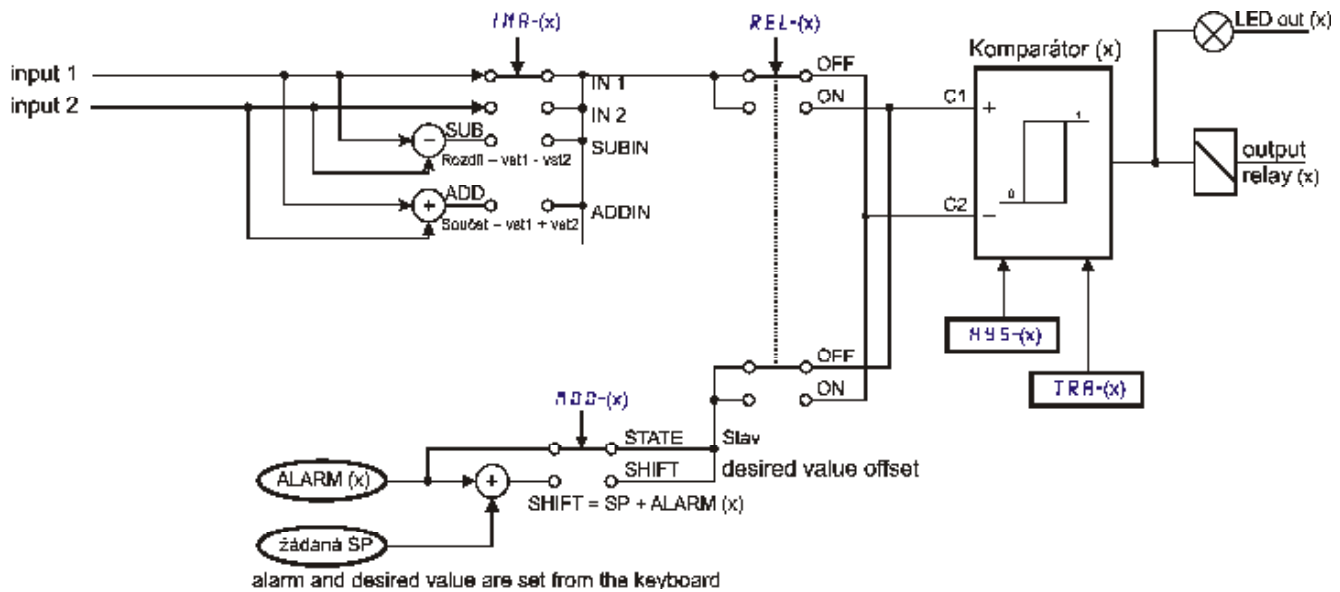
Function name	Configuration menu	Meaning
Input value	<i>IN</i> (x)	Selection of inlet for which limit switch shall be setup (<i>IN-1, IN-2, SUBIN, ADDIN, IN-3, IN-4</i>)
State of relay	<i>RELE</i> (x)	Setup of output relay positing at exceeding of limit switch values. OFF switches off with exceeding the value. ON switches on.
Value of limit switch	<i>ALSP</i> (x)	Setup of limit switch alarm value.
Required value	<i>SP</i>	Setup of required value. Required value is common for all limit switches and is important only with setting MODE to SHIFT .
Mode	<i>MODE</i> (x)	Assigning of limit switch value for evaluation. STATE value of alarm ALSP (X) is directly connected to limit switch SHIFT value SP shifted by the value of alarm ALSP (X) is connected to limit switch.
Hysteresis	<i>HYST</i> (x)	Setup of switching hysteresis of output relays.
Output signalling	<i>TRAL</i> (x)	Alarm for limit switch can be temporary TRAL (x) = NO or permanent TRAL (x) = YES. a) Temporary limit switch alarm goes off after elapsing of alarm conditions. b) Permanent limit switch alarm is on even after elapsing of alarm conditions. Alarm can e switched off after elapsing of alarm conditions with pressing key SET. Permanent alarm is also switched after power supply failure.



Caution:

- 1) Limits of limit switches in mode STATE are set in absolute values.
- 2) Limits of limit switches in mode SHIFT are set as deviations from required value SP.

Limit switch diagram for modification with 4 inputs



On 4-input modification first press key **MENU** and enter panelmeter configuration menu scroll to alarm functions *RLR-1* to *RLR-4* with repeated pressing of **MENU**, enter submenu and scroll to parameter in. Press key **MENU** and get to the other submenu, where define inputs according to diagram (*IN-1*, *IN-2*, *SUB-IN*, *ADDIN*). Function *in-1* to *IN-2* is configuration of limit switch for given inputs. *SUBIN* is here defined as difference of values on inputs 1 and 2 ($vst1 - vst2$) and *ADDIN* enables to set as input sum of inputs 1 and 2 ($vst1 + vst2$).

Next step is setting of state of output relay contacts when alarm values are exceeded. Scroll to *RELE* function, press **MENU** key and enter setting mode. With keys **UP** and **DOWN** select either **ON** (switches when the value is exceeded), or **OFF** (switches off when the value is exceeded), confirm the setting with pressing **SET**. Then in configuration menu scroll to *RLSP* function, where value of limit switch is assigned to inputs. Select the value with **UP** and **DOWN** keys and confirm with pressing **SET** key. Further step is setting of required value of *SP*, that is designated as *SP* in configuration menu, and is common for all limit switches. Then define mode of limit switches. Scroll to function mode in configuration menu and select either process mode, relating to measured value (function *STATE*), or relative mode, derived from required value of *SP* as its allowable deviation (function *SHIFT*), see characteristics Fig. 25, 26, 27, 28. After these parameters are set select hysteresis *HYST* in configuration menu. Last item necessary for complete setting of limit switches is *TRAL* function. This function determines whether limit switch should automatically switch off (function *TRAL* of respective input is in state no) after vanishing of alarm conditions, or if limit switch remains permanently switched/switched off after exceeding alarm conditions and it can be switched off only after alarm conditions subside by pressing **SET** key (function *TRAL* of respective input is in state yes). Permanent alarm is also switched after failure of power supply voltage. In configuration menu scroll to *TRAL* function, press **MENU** key and enter setting mode and assign state **ON** or **OF** to respective input. Confirm the setting by pressing **SET**. Function of limit switch is shown with characteristics on Fig. 25, 26, 27, 28.

Functional characteristics of limit switches

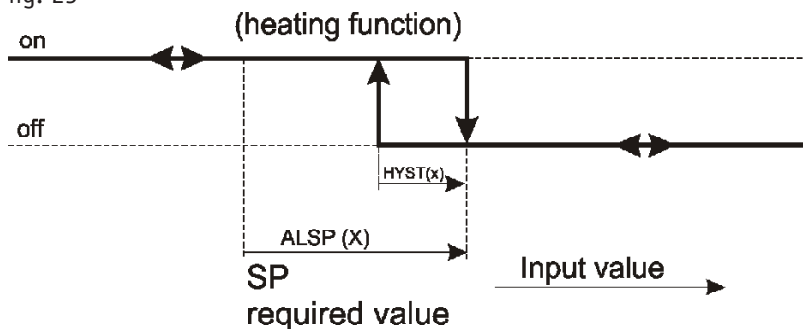
8.5

Limit switch mode with MODE set to SHIFT state

(limit shift mode derived from required value of SP)

After limit switch value is achieved relay state set to OFF

fig. 25



Example:

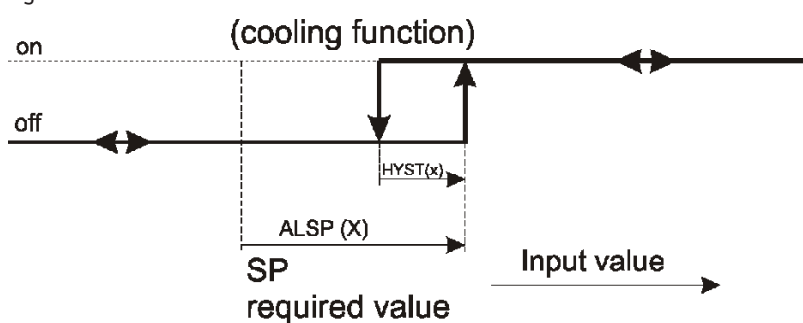
Switching off of the limit switch with temperature increase by 10 °C from required value. Required value shall be set to 50 °C. Activating of limit switch alarm clock is required at 55 °C.

Panelmeter setting:

Set *SP* value to 50. Set input where sensor connected in configuration menu (function in) e.g. *IN-1*. Then set value of limit switch *ALSP* to 10 (50 + 10 = switch off limit) and function *MODE* to value *SHIFT*. Set the state of output relay in menu *RELE* to *OFF*. Set deactivating of limit switch alarm in menu *HYST* to the value 5. Confirm the setting by pressing the key *SET*.

After limit switch value is achieved relay state set to ON

fig. 26



Example:

Switching of limit switch when temperature increases by 10 °C from required value. Required value shall be set to 50 °C. Deactivating of limit switch is required at 58 °C.

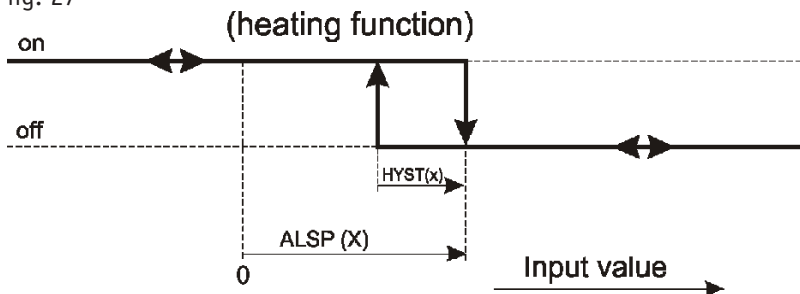
Panelmeter setting:

Set value *SP* to 50. In configuration menu set input with sensor connection (function in) e.g. *in-1*. Then set value of limit switch *ALSP* to 10 (50 + 10 = switching limit) and function *MODE* to value *SHIFT*. State of output relay set in *RELE* menu to *ON*. Set deactivating of limit switch in menu *HYST* to value 2. Confirm and leave the setting by pressing key *SET*.

Limit switch mode with MODE set to STATE (limit shift mode related to measured value)

After limit switch value is achieved relay state set to OFF

fig. 27



Example:

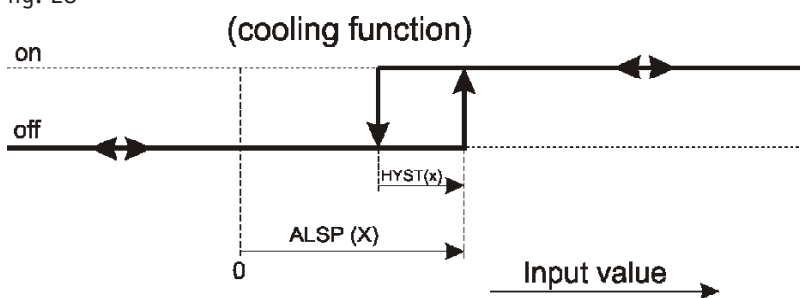
Switching off of the limit switch with temperature increase over 60 °C. Required value will not be used. Alarm shall be set to the value of limit switch. Deactivating of limit switch alarm is required at 55 °C.

Panelmeter setting:

In configuration menu set input with sensor connection (function in) e.g. in-1. Then set value of limit switch ALSP to 60 and function MODE to value STATE. State of output relay set in RELE menu to OFF. Set deactivating of limit switch in menu HYST to value 5. Confirm and leave the setting by pressing key SET.

After limit switch value is achieved relay state set to ON

fig. 28



Example:

Switching of the limit switch with temperature increase over 60 °C. Required value will not be used. Deactivating of limit switch alarm is required at 58 °C.

Panelmeter setting:

In configuration menu set input with sensor connection (function in) e.g. in-1. Then set value of limit switch ALSP to 60 and function MODE to value STATE. Set state of output relay in RELE menu to ON. Set deactivating of limit switch in menu HYST to value 2. Confirm and leave the setting by pressing key SET.

Display setting

8.6

Panelmeter AP 11 is equipped with three-colour display with possibility to set permanent colour changes or changes with relation to the amount of measured value. You will appreciate this function namely with instant visual check of limits, within which measured value oscillates. E.g. if measured value oscillates within the correct range it flashes in green (G). If the value is lower it flashes in yellow (Y). If maximum allowed limit is exceeded it flashes in red (R). Display colours in dependence on measured value can be modified as needed. Colour and display parameters can be set in regulator menu (key MENU) and scrolling to parameter dis-1 to dis-2.

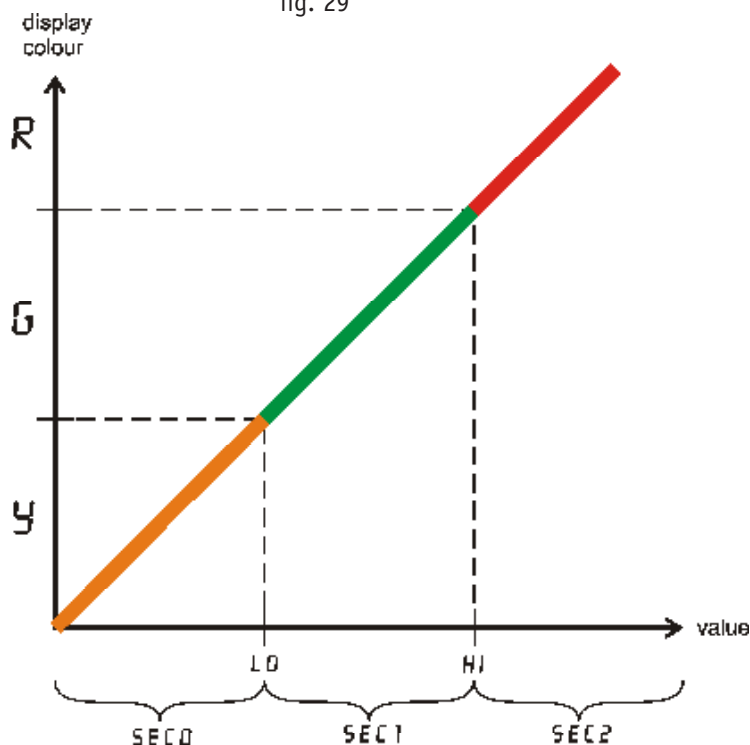
Fig. 29 schematically shows principle of colour change in dependence on measured value.

In regulator Menu it is necessary to set to which sector (SEC-0, SEC-1 and SEC-2) the particular colour is assigned (R, G, Y). Then it is necessary to set limits within which the measured value should oscillate. Bottom limit is defined with parameter LO and top limit with HI. With this setting we suppose that required value is located in sector 1 (SEC-1) and if it oscillates within set limits, display flashes in green. If the value falls below LO (sector 0) it starts flashing in yellow and on contrary if measured value rises on the top limit HI display starts flashing in red. Colours assigned to individual sectors SEC-0, SEC-1, SEC-2 can be changed in regulator menu as needed. If you want to change display colour permanently without any relation to measured value set the same colour to all parameters SEC0, SEC1, SEC2 .

With requirement for two colour display set only one of two limit parameters LO or HI separating two neighbouring sectors and set for one sector e.g. red colour (R) and for remaining two sectors green (G).

example:

fig. 29



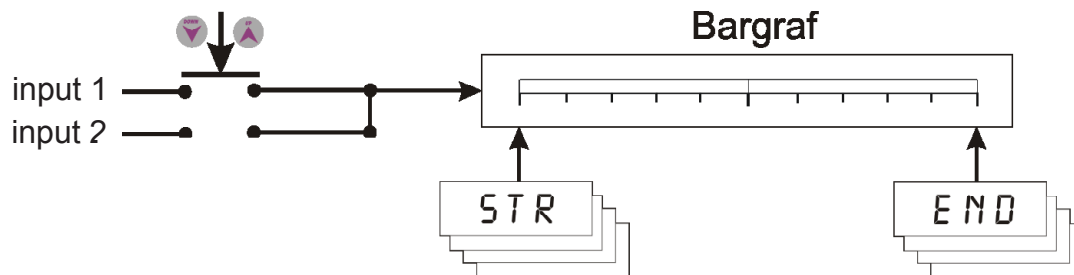
In menu for display properties setting DIS-1 to DIS-2, intensity of display light can be set. Scroll to parameter LIGHT in menu. In setting mode display light intensity can be set to 25%, 50%, 75% and 100% with keys UP and DOWN. Change of display light intensity is common for all inputs.



Change of display colour according to measured value is always related to selected input! When coloured display is required, this option has to be indicated with panelmeter order. On single-coloured display menu DIS- (x) is not displayed.

8.7

Bargraph



Bargraph relates to measured value, that is given by set range STR and END.

It roughly indicates amount of measured value within limits set by a user. Thanks to these properties of bargraph it is possible to find out immediately the limits of measured value oscillation.

Press MENU key to enter configuration menu, scroll to function BAR-1 to BAR-2, press MENU key repeatedly to enter submenu where the start of bargraph range STR can be selected. Press MENU key again to get to setting mode. Set required value with UP and DOWN keys. Press SET to confirm the setting.

To set the end of bargraph range scroll in configuration menu to function END. Setting procedure is identical with STR.

E.g. the start of range (STR) is 0 and the end (END) 200 and measured value shall be on level 100, bargraph shall indicate to the half of the scale. Bargraph is formed with column of LED diodes.

9.1

Functions of buttons in setting mode



Key „MENU“ is used to enter configuration menu and setting mode.



Key „UP“ is used to scroll and set the value in configuration mode.
Keep the key pressed for approx. 3 s to speed up scrolling and setting.



Key „DOWN“ is used to scroll and set the value in configuration mode.
Keep the key pressed for approx. 3 s to speed up scrolling and setting.



Press „SET“ key to confirm the setting, finish configuration, enter data to EEPROM and to return to working mode.

Caution:

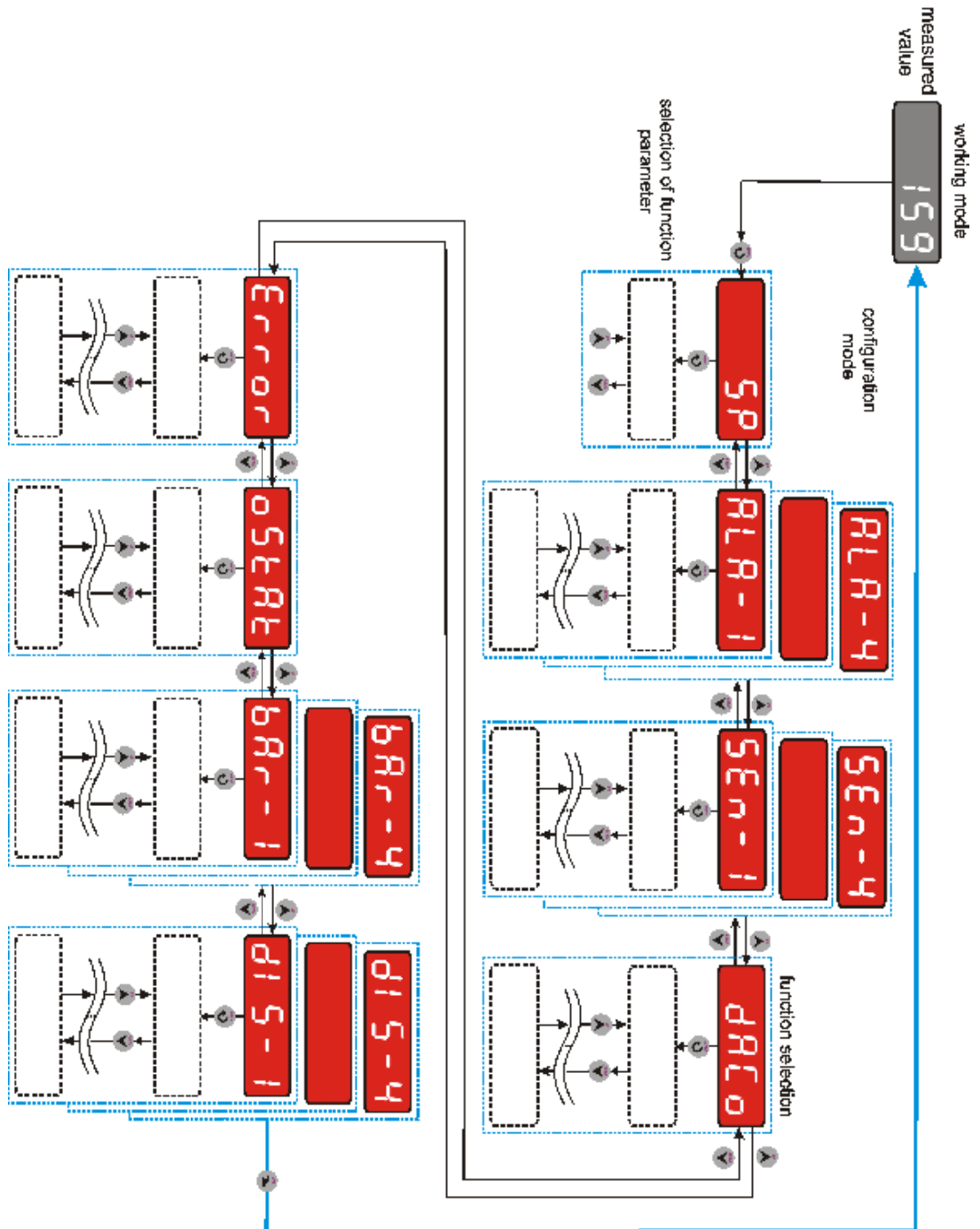
Beware of TIME OUT function.

If any key is not pressed in configuration mode during the period of 1 minute regulator switches by means of TIME OUT function to working mode without saving of selected parameters!



Simplified block diagram of panelmeter menu

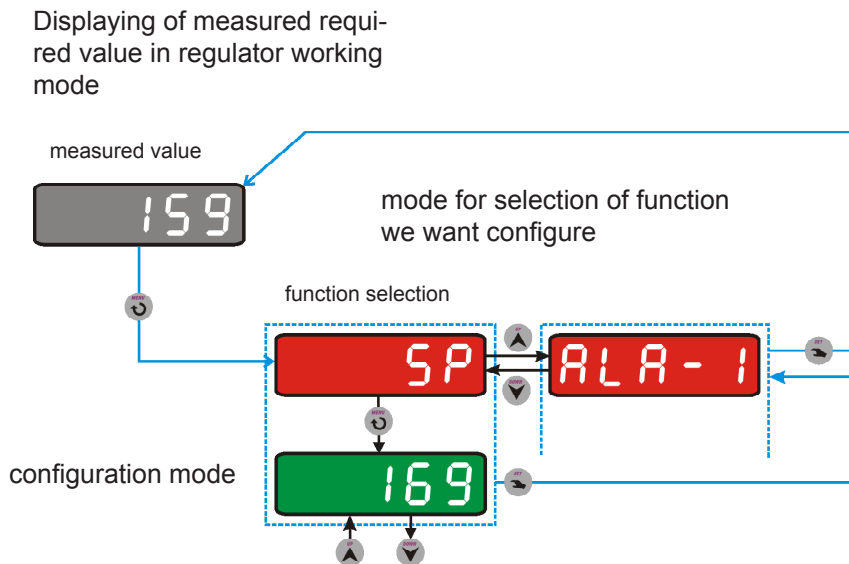
Configuration of inputs that are not connected is not shown in the menu.



Here below diagrams of individual parameters in configuration menu of panelmeter are shown. With the first two examples configuration of parameters in menu is described. Configuration of other parameters is identical. Only function name is modified. Button functions remain the same. Buttons are shown on the diagrams.

9.2.1

Configuration of required value – SP



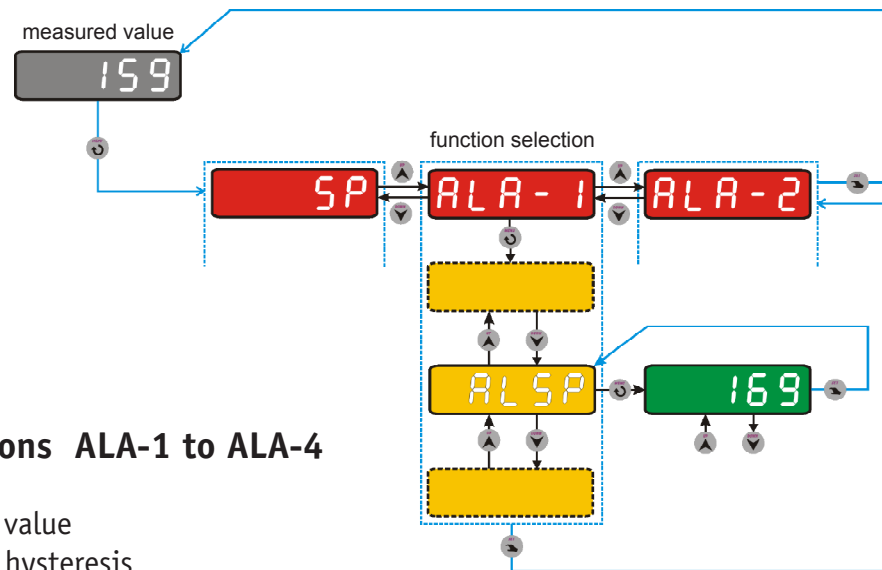
SP function parameters

SP – setting of required value for regulation

Press MENU key to enter configuration menu. Scroll to required function (SP) with keys UP and DOWN . Press MENU key to enter configuration mode. Set required value using keys UP and DOWN . Press SET key to return to configuration menu. Press SET key again to return to working menu and to save selected parameters.

Beware of TIME OUT function!

Configuration of limit switches - ALA-1 to ALA-4



Parameters of functions ALA-1 to ALA-4

ALSP - setting of alarm value

HYST - setting of alarm hysteresis

MODE - assignment of limit switch mode (absolute or as a deviation from required menu)

Options:

STATE limit switch value ALSP is directly connected to comparator

SHIFT value SP (required) is directly connected to comparator, shifted by limit switch value ALSP (see limit switch functional characteristics)

RELE - state of output relay when limit switch value is achieved (relay 3)

Options:

OFF relay switches off when set value for limit switch is exceeded

ON relay switches on when set value for limit switch is exceeded

IN - selection of input for which limit switch shall be configured, see limit switch diagram

Options:

IN-1 input 1

IN-2 input 2

ADDIN sum of inputs IN-1 + IN-2

SUBIN difference of inputs IN-1 - IN-2

TRAL - state of relay contacts after alarm conditions subside

Options:

NO temporary switching of limit switch – after limit switch alarm conditions subside, limit switch returns to original state

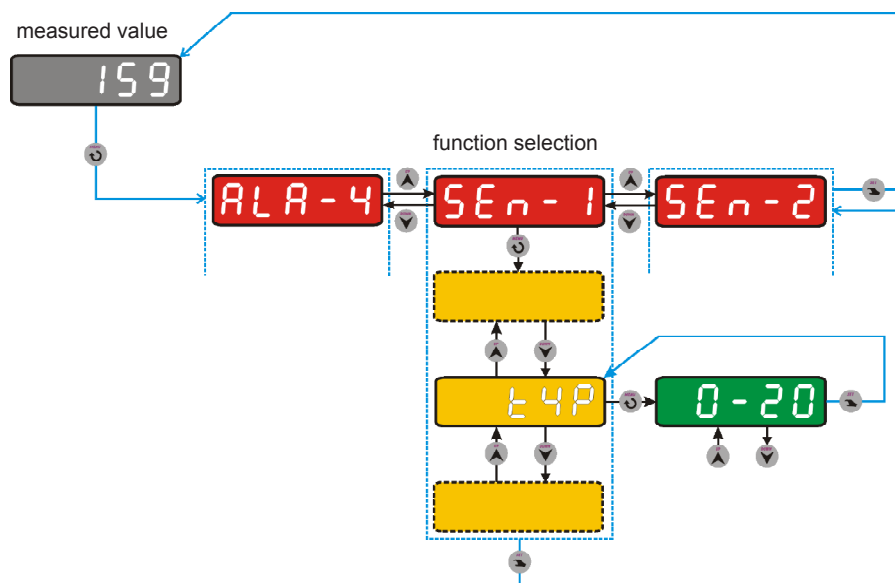
YES permanent switching of limit switch – after limit switch alarm conditions subside, limit switch remains permanently switched. It can be switched off only after subsiding of alarm conditions and disconnecting of regulator from supply voltage

If alarm relays are not connected, alarm MENU is not displayed.

Press MENU key to enter configuration menu. Scroll to required function (ALA-1) with keys UP and DOWN. Press MENU to enter submenu of required function. Set required parameter using keys UP and DOWN. Press MENU key again to get to parameter setting mode. Set required value or parameters with UP and DOWN keys. Press SET to return to submenu of required function. Press key SET again to return to configuration menu. Press SET key again to return to working menu and to save selected parameters.

9.2.3

Configuration of sensors - SEN-1 to SEN-2



Functions SEN-1 to SEN-2 parameters

TYPE - Setting of input sensor type

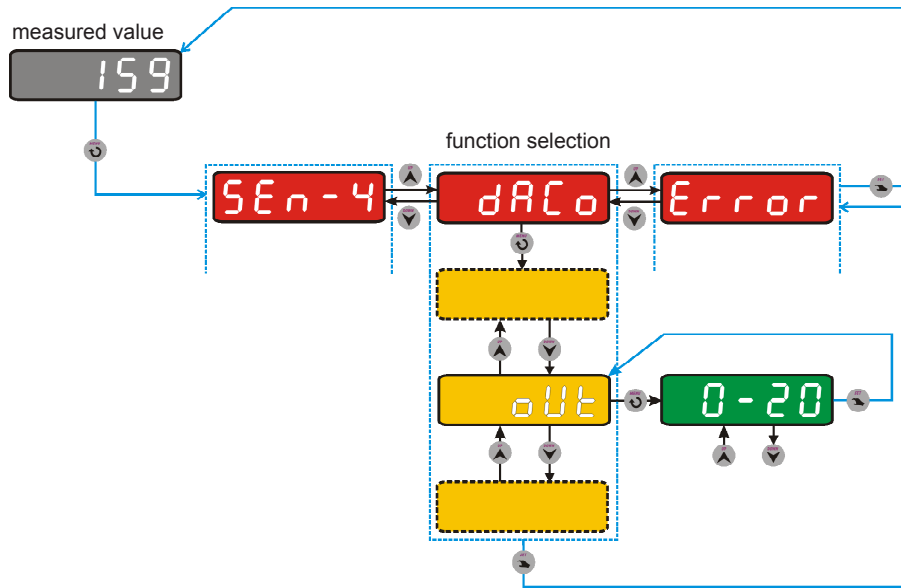
Options:

Signal type	Symbol on display	Reference Figure no.	Input code
Current signal			
4 až 20 mA (passive double-conductor transducer)	4 - 20	fig. 6	31
0/4 až 20 mA (active current signal)	0 - 20	fig. 7	31
Without sensor	- NO -	-no- deactivates sensor and zero is displayed	
Voltage signal			
0 až 10 V	0 - 10	fig. 8	32
Without sensor	- NO -	-no- deactivates sensor and zero is displayed	
Signal type	Symbol on display	Reference Figure no.	Input code
Current/Voltage signal			
4 až 20 mA (passive double-conductor transducer)	4 - 20	fig. 9	33
0/4 až 20 mA (active current signal)	0 - 20	fig. 10	33
Voltage signal 0 - 10V	0 - 10	fig. 11	33
Without sensor	- NO -	-no- deactivates sensor and zero is displayed	

- DP** setting of decimal point position – refers to most numerically input parameters.
Options:
00000. units are displayed
0000.0 tenths are displayed
000.00 hundredths are displayed
00.000 thousandths are displayed
- STRS** - Setting of start of input value measurement range The function sets start of range of input value measurement. Parameter is important only with selection of current (4 to 20 mA or 0 to 20 mA) or voltage (0 to 10 V) input signal.
- ENDS** - Setting of ending of input value measurement range
The function sets the ending of range of input value measurement. Parameter is important only with selection of current (4 to 20 mA or 0 to 20 mA) or voltage (0 to 10 V) input signal.
- OFFS** - Setting of measured input value offset
Generally it is possible to compensate any inaccuracy of measurement with offset. If it is not necessary to set any offset or compensation, set the value to 0.

9.2.4

Configuration of analogue output - DACO



Function DACO parameters

IN selection of input for which analogue output shall be configured

Options:

IN-1 input 1

IN-2 input 2

SUBIN sum of inputs $IN-1 + IN-2$

ADDIN difference of inputs $IN-1 - IN-2$

Type of analogue output

Options:

OUT *0-20* 0 to 20 mA

4-20 4 to 20 mA

20-0 20 to 0 mA

20-4 20 to 4 mA

STR Start of analogue output range

END End of analogue output range

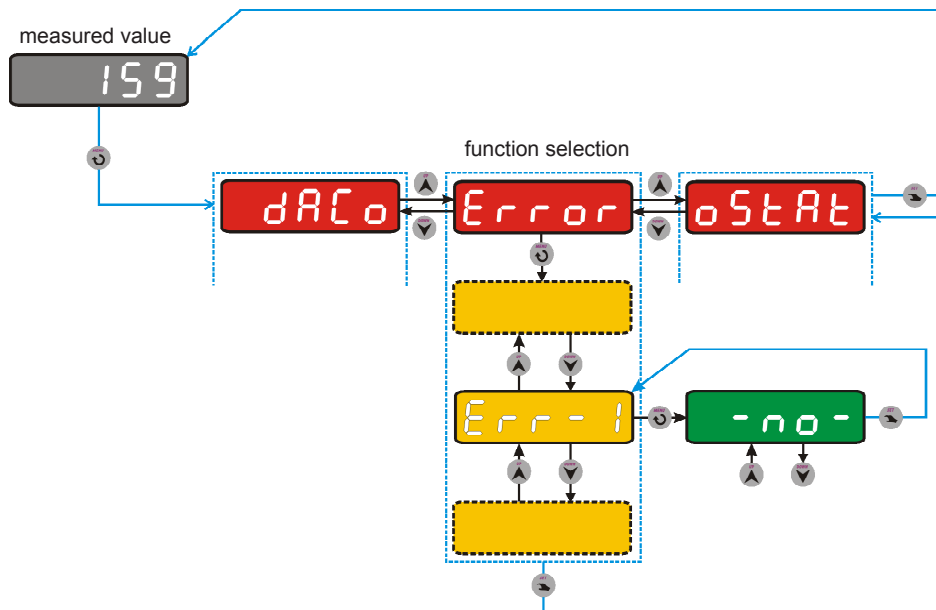
Example of configuration:

Press MENU key to enter configuration menu. Scroll to required function (DACO) with keys UP and DOWN. Press Menu key again to enter function submenu. Select type of analogue output (OUT). Then set start and ending of analogue output range (STR, END).

E.g.: Range of analogue output should be 100°C to 200°C, that corresponds to 0 to 20 mA of output current. That means that start STR has to be set to 100, END has to be set to 200 and OUT 0-20.

Configuration of output state in case of breakdown – ERROR

9.2.5



Function ERROR parameters

ERR-1 až ERR-4 - Setting of output relay at breakdown of any sensor

Options:

- NO- Without response to sensor breakdown
- OFF At breakdown switch off the output
- ON At breakdown switch on the output

ERR-A - Setting of analogue output at sensor breakdown

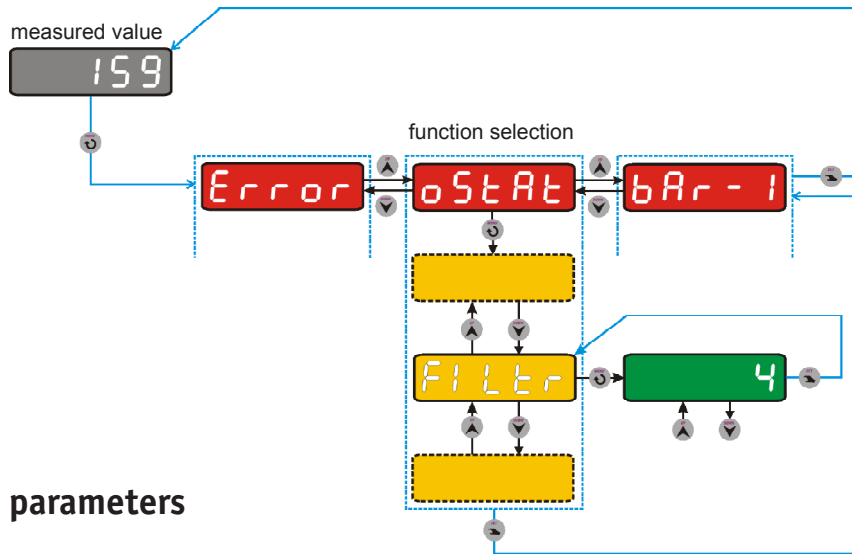
Options:

- NO- Without response to sensor breakdown
- 0 At breakdown output current 0 mA
- 20 At breakdown output current 20 mA

ERROR icon is not displayed unless analogue output board or a single relay module are connected. Icon displays only options that are connected (E.g.: If only one relay module and analogue output is connected, items ERR-1,ERR-2,ERR-A are displayed).

9.2.6

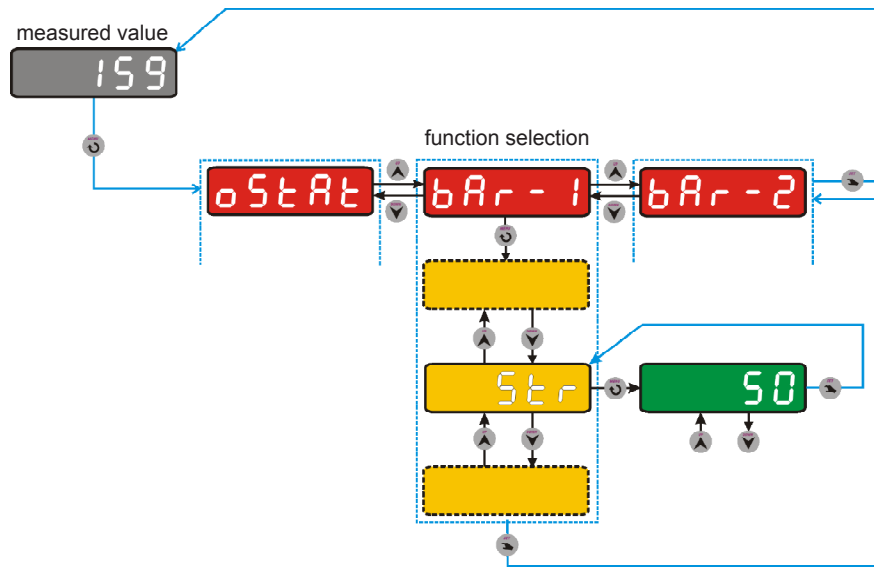
Configuration of OSTAT parameter



Function OSTAT parameters

- FILTR** Configuration of input signal filter
Increase of filter value slows down regulator response to change of input value, on contrary reduction of filter value accelerates regulator response to change of input value. Filter affects displaying of measured value and also regulation.
- PASS** Setting of access password
Setting of access password can prevent unauthorized interference in regulation parameters. Password PASS enables access to set all panelmeter parameters. Default password is 0. In this case regulator operates as if no password was set and access into setting mode is not restricted. If any numerical password is set, parameters can be configured only after this password is entered. For changing the password you have to enter old access password first. In case you forget the old password enter code 555 instead, to get to new password setting mode. Regulator requires password only once in configuration menu. If you enter correct password you have free access to all parameters in configuration mode.
- LEVEL** Configuration of user menu and access to parameters
Options:
- MEN-1** function of keyboard disconnection.
Set MEN-1 and interconnect terminals 17 and 18 on rear panel of panelmeter to disconnect keyboard function, no parameter can be set from keyboard.
 - MEN-2** function of direct setting of required value SP.
Set MEN-2 and interconnect terminals 17 and 18 on rear panel of panelmeter and press MENU key for direct setting of SP parameter using up and down arrows, setting is confirmed with pressing SET key.
 - MEN-3** reduced setting function.
Set MEN-3 and interconnect terminals 17 and 18 on rear panel of panelmeter to get to reduced menu. In this menu parameters ALA-1 to ALA-4 s can be set with the option to be secured by password.
 - MEN-4** completely deactivates keyboard (no parameter can be set), automatic cycling (for 3s) of displaying of measured values on individual inputs is activated.
- ADDR** Setting of panelmeter address (active only when communication connected)

Configuration of bargraph - BAR-1 to BAR-2



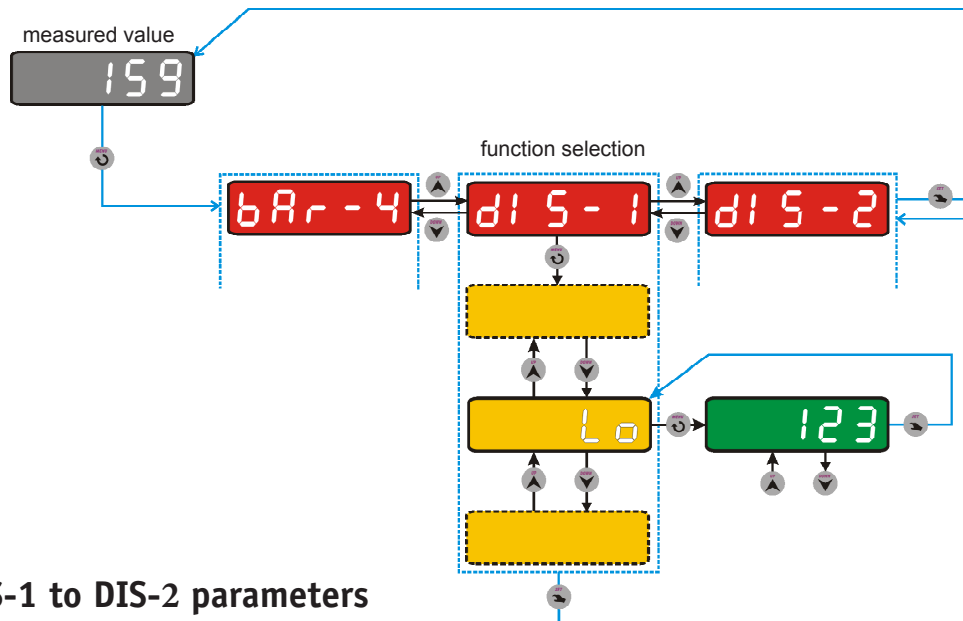
Function BAR-1 to BAR-2 parameters

- STR** Setting of bargraph range start
 This parameter is used for setting the bottom limit of bargraph range. When measured value drops to bottom limit of set range, all bargraph LEDs stop flashing.
- END** Setting of bargraph range end.
 This parameter is used for setting the top limit of bargraph range. When measured value reaches top limit of set range, all bargraph LEDs start flashing.

For detail description of setting refer to page 28, chapter „Bargraph“.

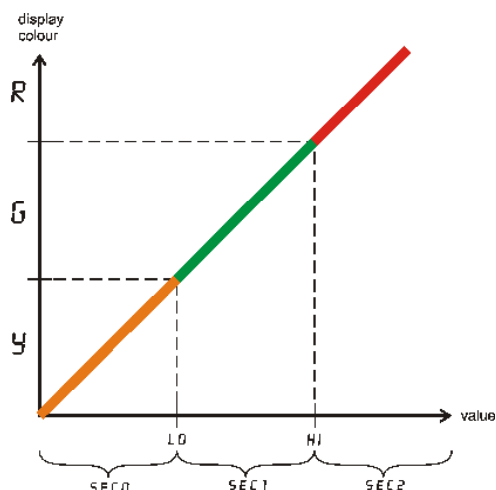
9.2.8

Configuration of display - DIS-1 to DIS-2



Function DIS-1 to DIS-2 parameters

LO	Setting of value bottom limit when display changes its colour
HI	Setting of value top limit when display changes its colour
SEC-0	Setting of colour for sector 0
SEC-1	Setting of colour for sector 1
SEC-2	Setting of colour for sector 2
Options:	
-G-	green
-R-	red
-Y-	yellow
MODE	setting of display range
Options:	
STATE	absolute value of limits LO and HI
SHIFT	value of limits LO and HI derived from required value SP
LIGHT	Setting of display brightness (25%, 50%, 75%, 100%)



For detail description of setting refer to page 27, chapter „Display setting“.

Parameter limit values

9.3

Alarm parameters - ALA- (x)

Parameters	Function	Limit values	Default value	Operation
<i>SP</i>	Required value	-9999 to 99999	0	
<i>RLSP-1</i>	Limit value of switch 1	-9999 to 99999	0	
<i>RLSP-2</i>	Limit value of switch 2	-9999 to 99999	0	
<i>HYST-1</i>	Hysteresis 1	-9999 to 99999	1	
<i>HYST-2</i>	Hysteresis 2	-9999 to 99999	1	
<i>IN-1</i>	Selection of input signal to limit switch	IN-1, IN-2, SUBIN, ADDIN, IN-3, IN-4	IN-1	
<i>IN-2</i>	Selection of input signal to limit switch	IN-1, IN-2, SUBIN, ADDIN, IN-3, IN-4	IN-1	
<i>RELE-1</i>	State of output relay 1	ON, OFF	OFF	
<i>RELE-2</i>	State of output relay 2	ON, OFF	OFF	
<i>RELE-3</i>	State of output relay 3	ON, OFF	OFF	
<i>RELE-4</i>	State of output relay 4	ON, OFF	OFF	
<i>MODE-1</i>	Limit switch mode	STATE,SHIFT	STATE	
<i>MODE-2</i>	Limit switch mode	STATE,SHIFT	STATE	
<i>MODE-3</i>	Limit switch mode	STATE,SHIFT	STATE	
<i>MODE-4</i>	Limit switch mode	STATE,SHIFT	STATE	
<i>TRAL-1</i>	Signalling of limit switch output	ON, OFF	OFF	
<i>TRAL-2</i>	Signalling of limit switch output	ON, OFF	OFF	
<i>TRAL-3</i>	Signalling of limit switch output	ON, OFF	OFF	
<i>TRAL-4</i>	Signalling of limit switch output	ON, OFF	OFF	

Input signal Parametr - SEN- (x)

Parameters	Function	Limit values	Default value	Operation
SEN-1	Sensor type	4-20, 0-20, 0-10	4 - 20	
SEN-2	Sensor type	4-20, 0-20, 0-10	4 - 20	
DP-1	Decimal point	0., 0.0, 0.00, 0.000	0.0	
DP-2	Decimal point	0., 0.0, 0.00, 0.000	0.0	
STR-1	Start of the range	-9999 to 99999	0.0	
STR-2	Start of the range	-9999 to 99999	0.0	
END-1	End of the range	-9999 to 99999	100.0	
END-2	End of the range	-9999 to 99999	100.0	
OFFS-1	Offset of the range	-9999 to 99999	0	
OFFS-2	Offset of the range	-9999 to 99999	0	

Bargraph parameters - BAR- (x)

Parameters	Function	Limit values	Default value	Operation
STR	Start of bargraph range	-9999 to 99999	0	
END	End of bargraph range	-9999 to 99999	100	

Display parameters - DIS- (x)

Parameters	Function	Limit values	Default value	Operation
LO	Setting of bottom limit	-999 to 9999	0	
HI	Setting of top limit	-999 to 9999	100	
SECO	Setting of colour for sector 0	-G-, -R-, -Y-	-Y-	
SEC1	Setting of colour for sector 1	-G-, -R-, -Y-	-G-	
SEC2	Setting of colour for sector 2	-G-, -R-, -Y-	-R-	
LIGHT	Setting of display brightness	25, 50, 75, 100	75	
MODE	Setting of display range	STATE, SHIFT	STATE	
RESET	Setting of display value after start	STATE, SHIFT	STATE	

Parameters of input sensor breakdown - ERROR

Parameters	Function	Limit values	Default value	Operation
<i>ERR-1</i>	State of outputs at breakdown	-no-, off, on	-no-	
<i>ERR-2</i>	State of outputs at breakdown	-no-, off, on	-no-	
<i>ERR-3</i>	State of outputs at breakdown	-no-, off, on	-no-	
<i>ERR-4</i>	State of outputs at breakdown	-no-, off, on	-no-	
<i>ERR-R</i>	State of analogue outputs at breakdown	-no-, 0 mA, 20 mA	-no-	

Parameters of analogue output – DAC0

Parameters	Function	Limit values	Default value	Operation
<i>R-IN</i>	Setting of analogue input	IN-1, IN-2, SUBIN, ADDIN	IN-1	
<i>R-OUT</i>	Type of analogue output	0-20, 4-20, 20-0, 20-4	0-20	
<i>R-STR</i>	Start of bargraph range	-9999 to 99999	0.0	
<i>R-END</i>	End of bargraph range	-9999 to 99999	100.0	

Parameters of other functions – OSTAT

Parameters	Function	Limit values	Default value	Operation
<i>FILTR</i>	Input signal filter	0 to 32	0	
<i>PASS</i>	Access password	-9999 to 99999	0	
<i>MENU</i>	Keyboard lock (interconnect terminals 17, 18)	MEN-1, MEN-2, MEN-3, MEN-4	MEN-1	
<i>RDR</i>	Setting of regulator address	1 to 126	1	

Application software

Software PAP is intended for setting of AP21 controller parameters and monitoring of measured values.
Software available on www.apoelmos.cz.

Software / Hardware requirements and installation:

-> TD-U-19-19 (PAP Software)

Communication protocol

-> TD-U-19-20 (Communication protocol)

We,

A.P.O. - ELMOS v.o.s., Pražská 90, 509 01 Nová Paka, Česká republika
IČO: 60111615

declare under our sole responsibility that the below specified product meets requirements of technical directives and regulations, under specified conditions is safe to use and we adopted all measures to guarantee the compliance of all products of below specified type introduced on market with technical documentation and requirements of relating government and European directives.

Product: Panelmeter AP 11
Type: AP 11
Manufacturer: A.P.O. - ELMOS v.o.s.
Pražská 90
509 01 Nová Paka
The Czech Republic

The product is intended for measurement and displaying of temperature or analogue signals.

Assessment of product compliance was performed within the frame of assessment of production quality system by authorised person (no. AO 201, Electro-technical Testing Institute, Pod lisem 129, Prague 8 – Troja) and monitoring of proper maintaining of the system.

Above mention product is in compliance with the following standards

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 government directives (European directives)

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

Sample was examined by accredited testing laboratory no. 1103, VOP-026 Šternberk, s.p., division VTÚPV Vyškov, that issued for the product Protocol of safety type test no. 6450-20/2006 dated 28/3/2006, Protocol of EMC test no. 6440-68/2006 dated 2/3/2006 and no. 6440-129/2006 dated 20/3/2006.

The last two digits of the year when the product was certified with mark CE: 06

Place of issue: Nová Paka
Date of issue: 22.7.2014

Name: Ing. Libor Lukeš
Position: Company director

APÆLMOS

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



Stamp:

Signature:

Product: **Panelmetr AP 11**

Specification acc. to code: **AP 11** -

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Serial number: **20-1911-08888**

Hereby we confirm that above mentioned product is complete, complies with technical conditions and is duly inspected and tested.

Manufacturer is responsible for the product to have properties specified by technical standards for stipulated period of time, to be complete and without any defects. Manufacturer is also liable for the defects found by customer within guarantee period and that are timely claimed. The basic condition to be entitled to claim any defect is that the panelmeter is used in the manner specified by technical documentation.

Guarantee period is 36 months since the date of purchase.

Complaint can be claimed on material defects or product malfunction. Guarantee repairs are performed in accordance with internal regulations of A.P.O.-ELMOS in company's workshop. Faulty product has to be properly protected not to be damaged during transport.

Guarantee expires if any modifications are performed on product or guarantee tags are broken and if the product was damaged mechanically or by improper use.

Guarantee and after guarantee service is provided exclusively by A.P.O. – ELMOS.

Date of purchase:

Signature:

