User manual MB3-3V

Direct current / direct voltage signals 0-20 mA, 4-20 mA, 0-10 VDC

Technical features:

- 3-digit red display of -199…999 digits (optional green)
- 20 points bargraph tricolour (red/orange/green)
- adjustable bar or dot operation or operation with permanent display of center point
- min/max memory
- 30 additional adjustable setpoints
- display flashing at threshold value exceedance/undercut
- zero-key for triggering of Hold, Tara
- permanent min/max-value recording
- volume metering (totalisator)
- mathematical functions like reciprocal value, square root, squaring or rounding
- sliding averaging
- programming interlock via access code
- protection class IP65 at the front
- plug-in screw terminal
- optional: 1 or 2 relay outputs (changer)
- optional: sensor supply
- optional: galv. isolated digital input for triggering of Tara, Hold, display change
- optional: 1 independently scalable analog output
- optional: interface RS232 or RS485
- accessories: PC-based configuration kit PM-TOOL with CD and USB-adaptor for devices without keypad and for a simple adjustment of standard devices

Identification

STANDARD-TYPES	ORDER NUMBERS
Direct current / direct voltage Housing size: 96x24 mm	**MB3-3VT3xR.0001.S70xD** **MB3-3VT3xR.0001.W70xD**

Options – break-down ordering code:

	M	B	3-	3	V	T	3	H	R.	0	0	0	1.	S	7	2	B	D

Standard type M-Line

Bargraph — B

Installation depth
145 mm incl. plug-in terminal — 3

Housing size
B96xH24xD120 mm — 3

Type of display
V, A — V

Bargraph colour
Tricolour (red/green/orange) — T

Resolution
30 points — 3

Adjustment
horizontal — H
vertical — V

Digital display
3-digit, 8 mm, green — G
3-digit, 8 mm, red — R

Digital input
without — 0
1x digital input — I
Interface RS232 — 3
Interface RS485 — 4

Dimension
D — physical unit

Version
B — B

Setpoints
0 — no setpoint
1 — 1 switching point
2 — 2 switching points

Protection class
7 — IP65 /plug-in terminal

Supply voltage
S — 100-240 VAC
W — 10-40 VDC galv. insulated

Measuring input
1 — Standard signal 0/4-20 mA, 0-10 VDC

Analog output
0 — without
X — 0-10 VDC, 0/4-20 mA

Sensor supply
0 — without
2 — 10 VDC / 50 mA, incl. digital input
3 — 24 VDC / 50 mA, incl. digital input

Please state physical unit by order, e.g. %.

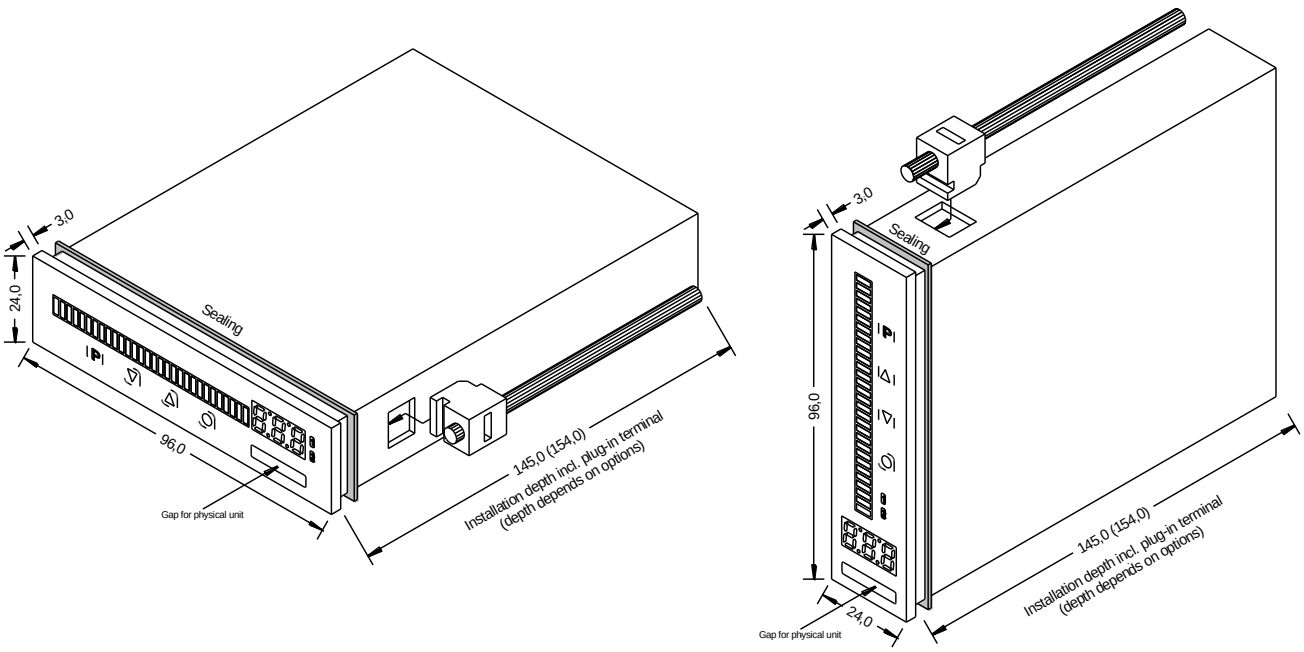
Contents

1. Brief description

The panel meter instrument **MB3-3V** is a 3-digit digital display with a 30 points bargraph display and optional two galvanic isolated setpoints; designed for direct current/direct voltage signals. The configuration happens via 4 keys at the front. The integrated programming interlock prevents unrequested changes of parameters and can be unlocked again with an individual code. Optional the following functions are available: a supply for the sensor, a digital input for triggering of Hold (Tara), two analog outputs and interfaces for further evaluating in the unit. The electrical connection is done via plug-in terminals on the back side.
Selectable functions like e.g. the recall of the min/max-value, an averaging of the measuring signals, a direct threshold value regulation during operation mode and further measuring setpoints for linearisation, complete the modern device concept.

2. Assembly

Please read the *Safety advices* on *page 33* before installation and keep this user manual for future reference.



1. After removing the fixing elements, insert the device.
2. Check the seal to make sure it fits securely.
3. Click the fixing elements back into place and tighten the clamping screws by hand. Then use a screwdriver to tighten them another half a turn.

CAUTION! The torque should not exceed 0.1 Nm!

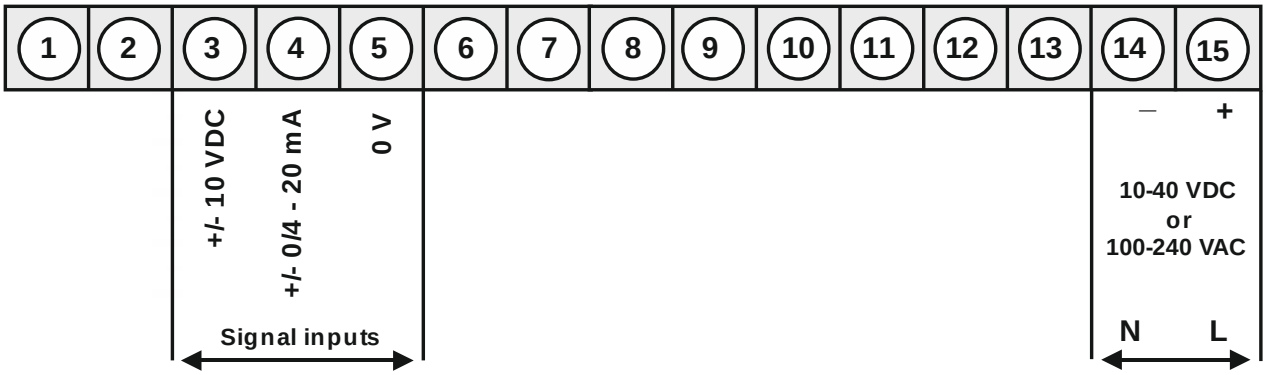
The dimension symbols can be exchanged before installation via a channel on the side!

(This is only true for the horizontal design. For the vertical design, this needs to be quoted with the order!)

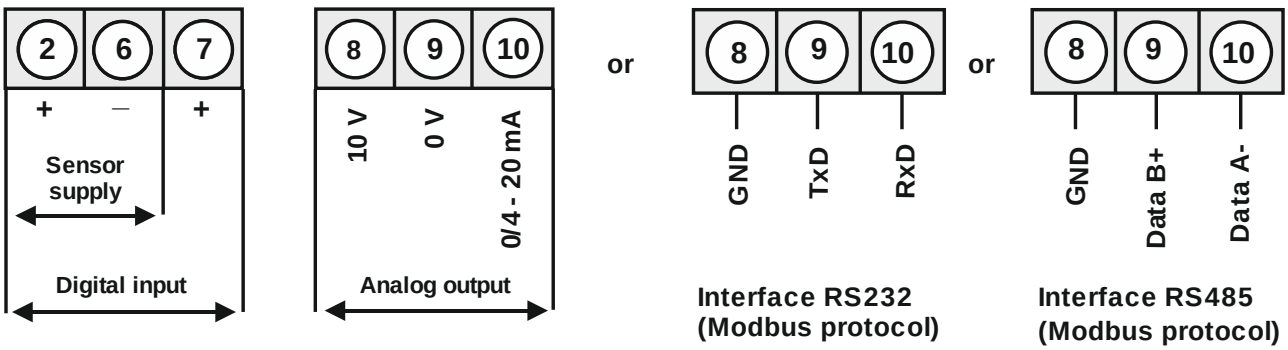
3. Electrical connection

Type MB3-3VT3HR.0001.S70xD supply of 100-240 VAC 50/60 Hz, DC ±10% *horizontally*
Type MB3-3VT3VR.0001.S70xD supply of 100-240 VAC 50/60 Hz, DC ±10% *vertically*

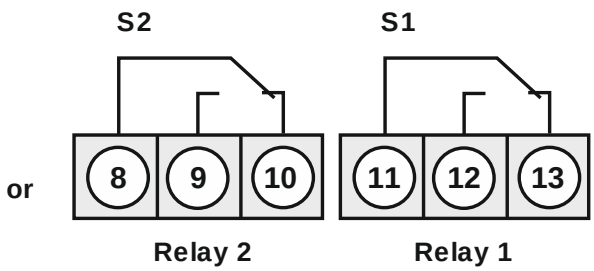
Type MB3-3VT3HR.0001.W70xD supply of 10-30 VDC, galv. isolated, 18-30 VAC 50/60 Hz *horizontally*
Type MB3-3VT3VR.0001.W70xD supply of 10-30 VDC, galv. isolated, 18-30 VAC 50/60 Hz *vertically*



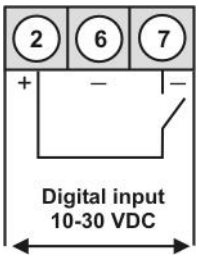
Options:



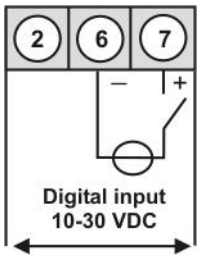
Alternative to analog output



MB3 with digital input in combination with a 24 VDC sensor supply



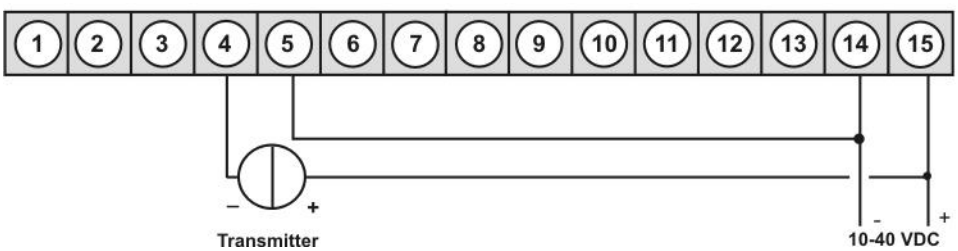
MB3 with digital input and external voltage source



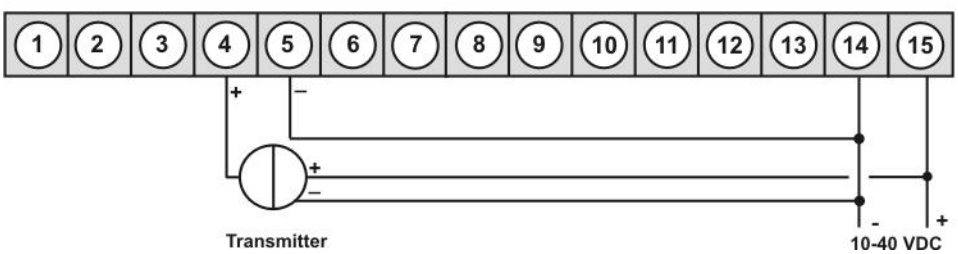
Connection examples

Below please find some connection examples that show practical applications. For devices with current inputs / voltage inputs, without sensor supply.

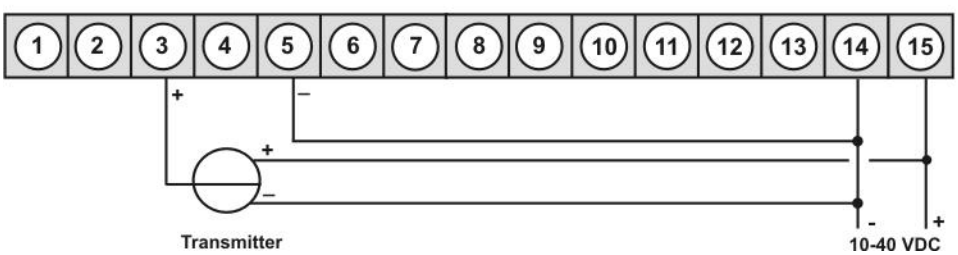
MB3 in combination with a 2-wire-sensor 4-20 mA



MB3 in combination with a 3-wire-sensor 0/4-20 mA



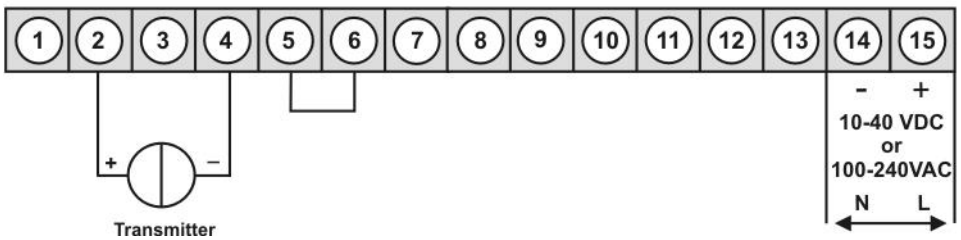
MB3 in combination with a 3-wire-sensor 0-10 V



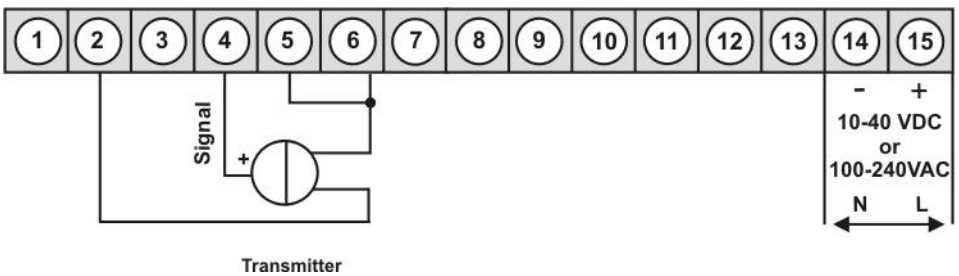
MB3 devices

With current respectively voltage input in combination with a 24 VDC sensor supply.

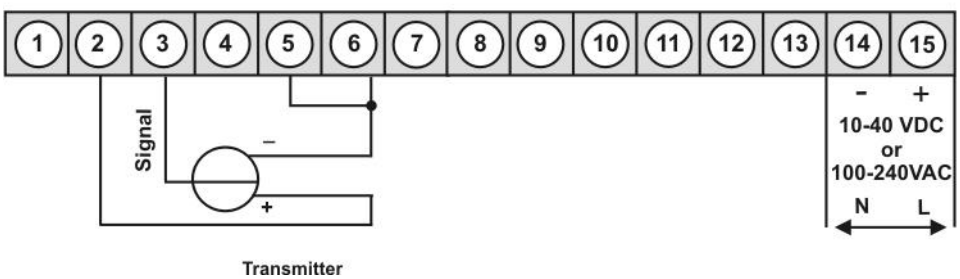
2-wire-sensor 4-20 mA



3-wire-sensor 0-20 mA



3-wire-sensor 0-10 V



4. Description of function and operation

Operation
The operation is divided into three different levels.

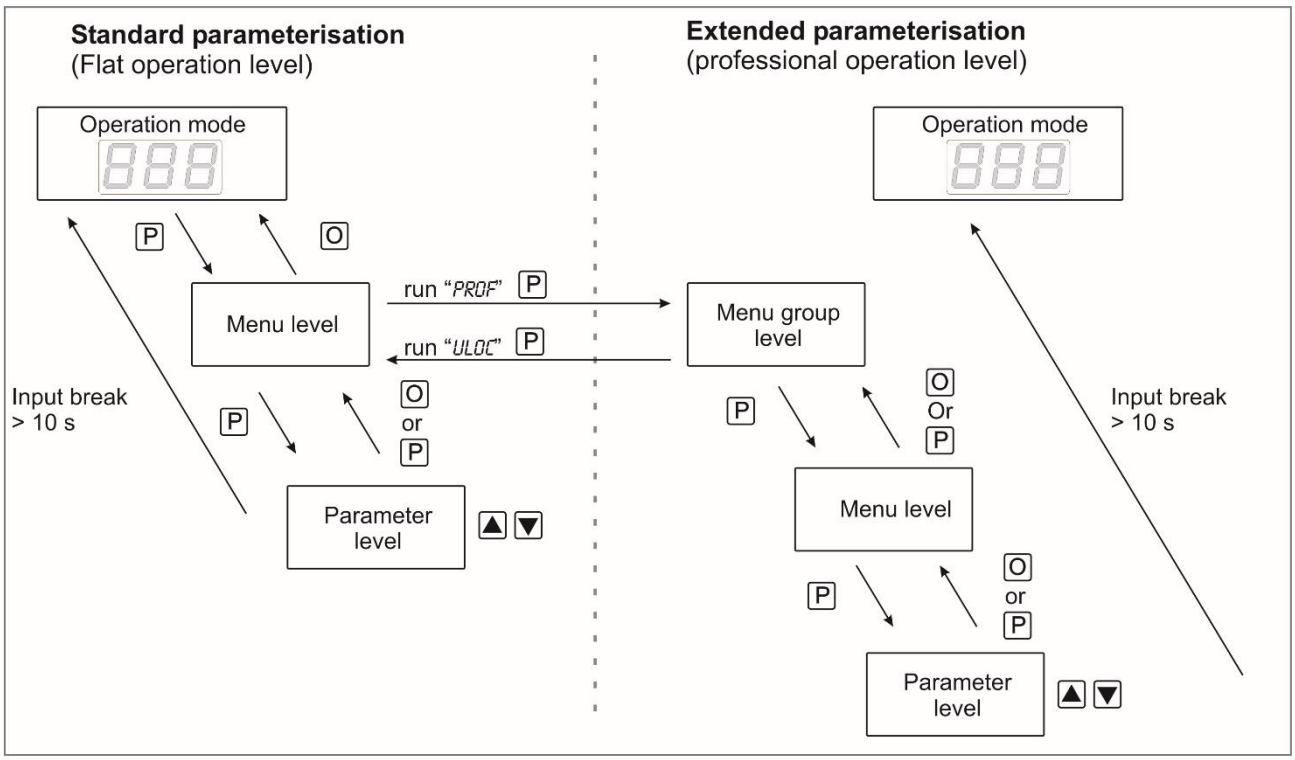
Menu level (delivery status)
This level was designed for the standard settings of the device. Only menu items which are sufficent to set the device into operation are displayed. To get into the professional level, run through the menu level and parameterise *PRF* under menu item *RUN*.

Menu group level (complete function volume)
Suited for complex applications as e.g. linkage of alarms, supporting point treatment, totaliser function etc. In this level function groups which allow an extended parameterisation of the standard settings are availabe. To leave the menu group level, run through this level and parameterise *ULC* under menu item *RUN*.

Parameterisation level:
Parameter deposited in the menu item can here be parameterised. Functions, that can be changed or adjusted, are always signalised by a flashing of the display. Settings that are made in the parameterisation level are confirmed with **[P]** and thus saved. Pressing the **[O]-key** leads to a break-off of the value input and to a change into the menu level. All adjustments are saved automatically by the device and changes into operating mode, if no further key operation is done within the next 10 seconds.

Level	Key	Description
Menu-level	P	Change to parameterisation level and deposited values.
	▲ ▼	Keys for up and down navigation in the menu level.
	O	Change into operation mode.
Parameterisation-level	P	To confirm the changes made at the parameterisation level.
	▲ ▼	Adjustment of the value / the setting.
	O	Change into menu level or break-off in value input.
Menu group level	P	Change to menu level.
	▲ ▼	Keys for up and down navigation in the menu group level.
	O	Change into operation mode or back into menu level.

Function chart:



Underline:

P **Takeover**

O **Stop**

▲ **Value selection (+)**

▼ **Value selection (-)**

4.1 Parameterisation software PM-TOOL:

Part of the PM-TOOL are the software on CD and the USB-cable with device adapter. The connection happens via a 4-pole micromatch-plug on the back side of the device, to the PC-side the connection happens via an USB plug.

System requirements: PC incl. USB interface
Software: Windows XP, Windows VISTA

With this tool the device configuration can be generated, omitted and saved on the PC. The parameters can be changed via the easy to handle program surface, whereat the operating mode and the possible selection options can be preset by the program.

CAUTION!
During parameterisation with connected measuring signal, make sure that the measuring signal has no mass supply to the programming plug. The programming adapter is galvanic not isolated and directly connected with the PC. Via polarity of the input signal, a current can discharge via the adapter and destroy the device as well as other connected components!

5. Setting up the device

5.1. Switching on

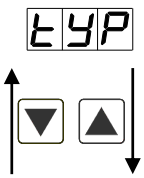
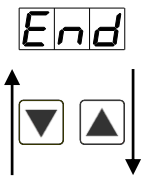
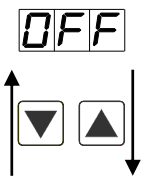
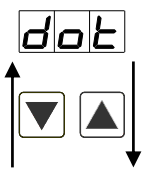
Once the installation is complete, start the device by applying the voltage supply. Before, check once again that all electrical connections are correct.

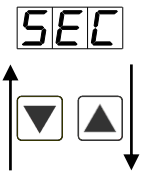
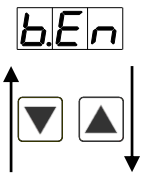
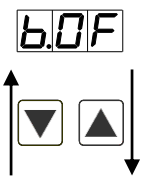
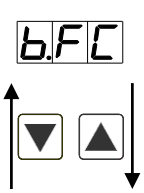
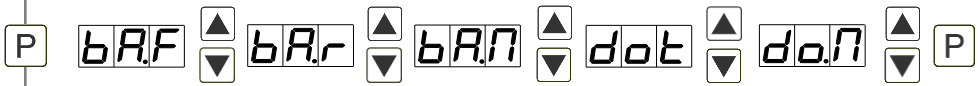
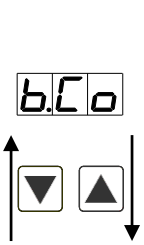
Starting sequence

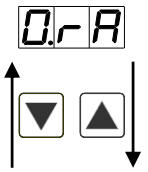
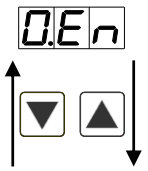
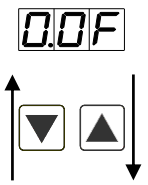
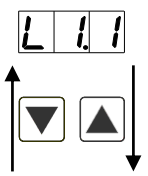
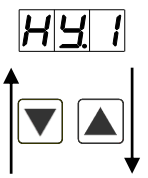
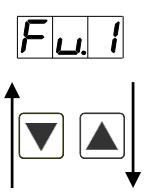
For 1 second during the switching-on process, the segment test (*8 8 8*) is displayed followed by an indication of the software type and, after that, also for 1 second the software version. After the starting sequence, the device switches to operation/display mode.

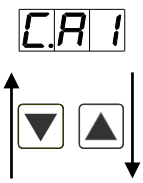
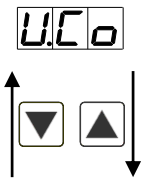
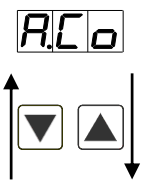
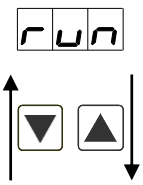
5.2. Standard parameterisation: (Flat operation level)

To parameterise the display, press the **[P]**-key in operating mode for 1 second. The display then changes to the menu level with the first menu item *TYPE*.

Menu level	Parameterisation level
	**Selection of the input signal, *TYP*:** Default: *SE.U*  Available as measuring input options are 0-20 mA, 4-20 mA or 0-10 VDC signals as works calibration (without application of the sensor signal) and *SE.U* (voltage) **or** *SE.A* (current) as sensor calibration (with the sensor applied). Confirm the selection with **[P]** and the display switches back to menu level.
	**Setting the end value of the measuring range, *END*:** Default: *100*  Set the end value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterized on the highest value digit. After the last digit, the display switches back to the menu level. If *SE.U* or *SE.A* were selected as input option, you can only select between *NOC* and *CAL*. With *NOC*, only the previously set display value is taken over, and with *CAL*, the device takes over both the display value and the analogue input value.
	**Setting the start/offset value of the measuring range, *OFF*:** Default: *0*  Enter the start/offset value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. After the last digit the display switches back to the menu level. If *SEN* was selected as input option, you can only select between *NOC* and *CAL*. With *NOC*, only the previously set display value is taken over, and with *CAL*, the device takes over both the display value and the analogue input value.
	**Setting the decimal point, *DOT*:** Default: *0*  The decimal point on the display can be moved with **[▲] [▼]** and confirmed with **[P]**. The display then switches back to the menu level again.

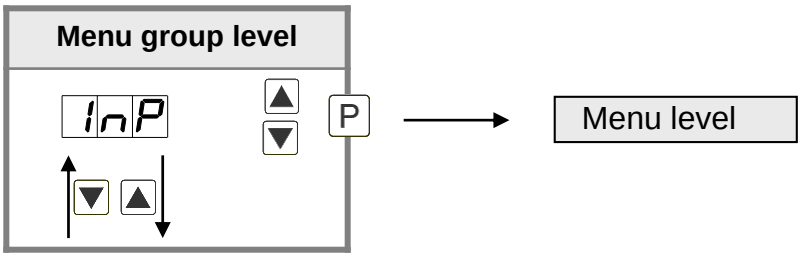
Menu level	Parameterisation level
	**Setting up the display time, SEC:** Default: 1.0  The display time is set with **[▲] [▼]**. The display moves up in increments of 0.1 up to 1 second and in increments of 1.0 up to 10.0 seconds. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.
	**Setting up the final value of the bargraph, B.EN:** Default: 100  Set the final value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterised on the highest value digit. After the last digit, the display switches back to the menu level.
	**Setting up the initial value of the bargraph, B.OF:** Default: 0  Set the initial value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterised on the highest value digit. After the last digit, the display switches back to the menu level.
	**Selection of the bargraph functions, B.FC:** Default: BAR  The bargraph can be displayed with the following possibilites: bars from left to right (top to bottom) or bars from right to left (bottom to top), bars from the middle, a dot display of the bargraph or a dot display with a permanently displayed midpoint. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.
	**Set the standard colour of the bargraph, B.CO:** Default: GRE  Under this menu item the standard colour of the display can be parameterised. The colours green, orange and red are available. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.

Menu level	Parameterisation level
	**Select analog output, *0.RA:*** Default: *4.20*  Three output signals are available: 0-10 VDC, 0-20 mA and 4-20 mA, with function the desired signal can be selected.
	**Setting up the final value of the analog output, *0.EN:*** Default: *100*  Set the final value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterised on the highest value digit. After the last digit, the display switches back to the menu level.
	**Setting up the initial value of the analog output, *0.0F:*** Default: *0*  Set the initial value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterised on the highest value digit. After the last digit, the display switches back to the menu level.
	**Threshold value / limit value, *LI.1:*** Default: *20*  The threshold value shows the limit, that leads to an activation of the alarm, respectively shows until which value the alarm stays inactive.
	**Hysteresis for threshold values, *HY.1:*** Default: *0*  The delayed reaction of the alarm is the difference to the threshold value, which is defined by the hysteresis.
	**Function for threshold value undercut / exceedance, *FU.1:*** Default: *HIG*  A limit value undercut is selected with ***LOU*** (for LOW = lower limit value), a limit value exceedance with ***HIG*** (for HIGH = higher limit value). If e.g. limit value 1 is on a threshold level of 100 and allocated with function ***HIG***, an alarm is activated by reaching of the threshold level. If the threshold value was allocated to ***LOW,*** an alarm will be activated by undercutting the threshold value, as long as the hysteresis is zero.

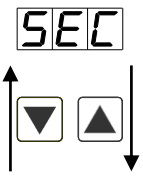
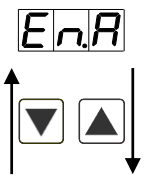
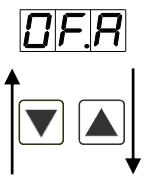
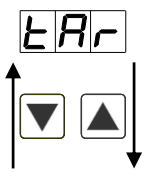
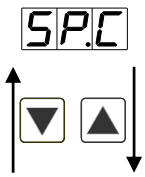
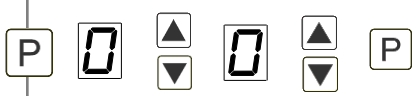
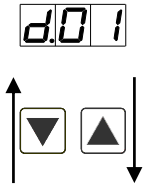
Menu level	Parameterisation level
	**Threshold values / limits, *C.A1*:** Default: *NO*  Here, the colour of the bargraph that displays a breaking of *ALARM1*. Available are green, orange and red. If *NO* was parameterised, the standard colouor remains. Confirm the selection with **[P]** and the display switches back to menu level.
	The same applies to *LI-1* to *LI-2* !
	**User code (3-digit number combination, free available), *U.CODE*:** Default: *000*  If this code was set (>0000), all parameters are locked for the user, if *LOC* has been selected before under menu item *RUN*. By pressing **[P]** for 3 seconds in operation mode, the display shows *COD*. The *U.CO* needs to be entered to get to the reduced number of parameter sets. The code has to be entered befor each parameterisation, until the *A.CO* (Master code) unlocks all parameters again.
	**Master code (3-digit number-combination, free available), *A.CODE*:** Default: *123*  All parameters can be unlocked with this code, after *LOC* has been activated under menu item *RUN*. By pressing **[P]** for 3 seconds in operation mode, the display shows *COD* and enables the user to reach all parameters by entering the *A.CO*. Under *RUN* the parameterisation can be activated permanently by selecting *ULC* or *PRF*, thus at an anew pushing of **[P]** in operation mode, the code needs not to be entered again.
5.3. Programming interlock „*RUN*“	
	**Activation / deactivation of the programming lock or completion of the standard parameterization with change into menu group level (complete function range), *RUN*:** Default: *ULC*  With the navigation keys **[▲] [▼]** choose between the deactivated key lock *ULC* (works setting) and the activated key lock *LOC*, or the change into the menu group level *PRF*. Confirm the selection with **[P]**. After this, the display confirms the settings with **"- - -"**, and automatically switches to operating mode. If *LOC* was selected, the keyboard is locked. To get back into the menu level, press **[P]** for 3 seconds in operating mode. Now enter the *COD* (works setting *1 2 3*) that appears using **[▲] [▼]** plus **[P]** to unlock the keyboard. *FAI* appears if the input was wrong. To parameterize further functions *PRF* needs to be set. The device confirms this setting with **„- - -„** and changes automatically in operation mode. By pressing **[P]** for approx. 3 seconds in operation mode, the first menu group *INP* is shown in the display and thus confirms the change into the extended parameterisation. It stays activated as long as *ULC* is entered in menu group *RUN*, which sets the display into standard parameterisation again.

5.4. Extended parameterisation (professional operation level)

5.4.1. Signal input parameters

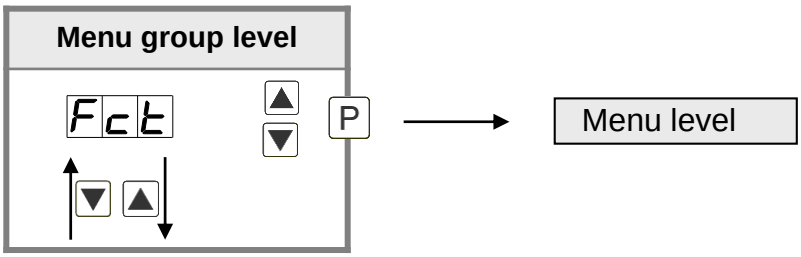


Menu level	Parameterisation level
tYP	**Selection of the input signal, *TYP:*** Default: ***SE.U*** tYP P 0..10 0.20 4.20 SE.U SE.A P There are several measuring input options: 0-20 mA, 4-20 mA or 0-10 VDC signals are available as works calibration (without application of the sensor signal) and ***SE.U*** (voltage) **or** ***SE.A*** (current) as sensor calibration (with the sensor applied). Confirm the selection with **[P]** and the display switches back to menu level.
End	**Setting up the final value of the measuring range, *END*:** Default: ***100*** End P 8 P 8 P 8 nOC CAL P Set the final value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterised on the highest value digit. After the last digit, the display switches back to the menu level. If ***SE.U*** or ***SE.A*** were selected as input option, you can only select between ***NOC*** and ***CAL***. With ***NOC***, only the previously set display value is taken over, and with ***CAL***, the matching via the measuring section is done and the device takes over the analogue input value.
OFF	**Setting up the initial value of the measuring range, *OFF*:** Default: ***0*** OFF P 8 P 8 P 8 nOC CAL P Set the initial value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterised on the highest value digit. After the last digit, the display switches back to the menu level. If ***SE.U*** or ***SE.A*** were selected as input option, you can only select between ***NOC*** and ***CAL***. With ***NOC***, only the previously set display value is taken over, and with ***CAL***, the matching via the measuring section is done and the device takes over the analogue input value.
dot	**Setting the decimal point, *DOT*:** Default: ***0*** dot P 0 0.0 0.00 P The decimal point on the display can be moved with **[▲] [▼]** and confirmed with **[P]**. The display then switches back to the menu level again.

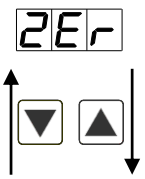
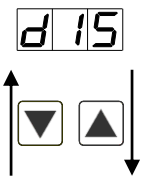
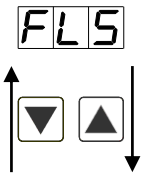
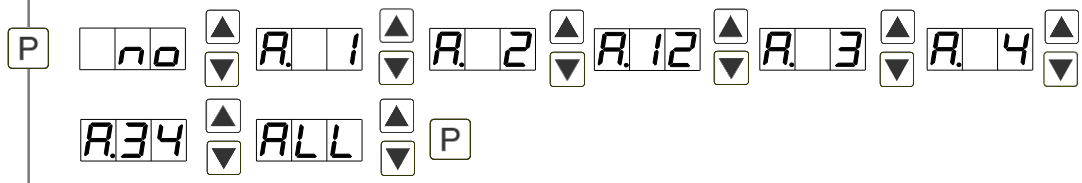
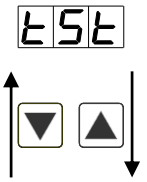
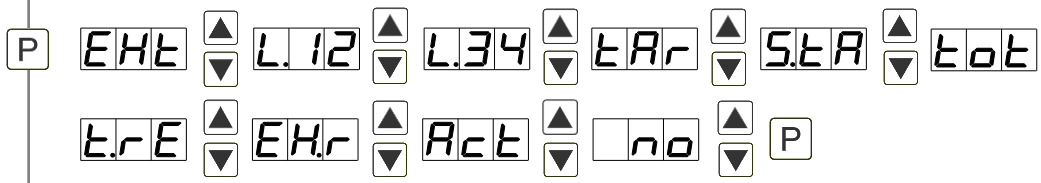
Menu level	Parameterisation level
	**Setting up the measuring time, *SEC*:** Default: *1.0*  The measuring time is set with **[▲] [▼]**. The display moves up in increments of 0.1 up to 1 second and in increments of 1.0 up to 10.0 seconds. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.
	**Rescaling the measuring input values, *EN.A*:** Default: *100*  With this function, you can rescale the final value to **e.g. 19.5 mA** input signal, without applying a measuring signal.
	**Rescaling the measuring input values, *OF.A*:** Default: *0*  With this function, you can rescale the initial value to **e.g. 3.5 mA** input signal, without applying a measuring signal.
	**Setting up the tare/offset value, *TAR*:** Default: *0*  The given value is added to the linerarized value. In this way, the characteristic line can be shifted by the selected amount
	**Number of additional supporting points, *SP.C*:** Default: *00*  30 additional supporting points can be defined to the initial- and final value, so linear sensor values are not linearised. Only activated setpoint parameters are displayed.
	**Display values for supporting points, *0.01 ... 0.30*:**  Under this parameter supporting points are defined according to their value. At the sensor calibration, like at „Final value/offset“, one is asked at the end if a calibration shall be activated.

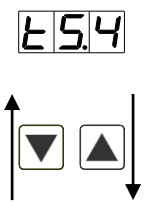
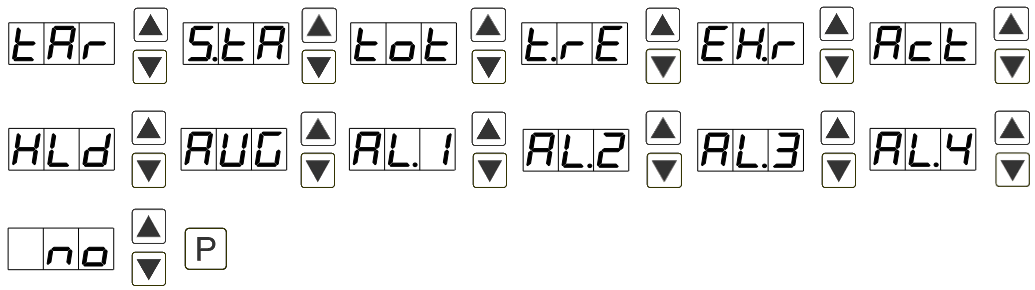
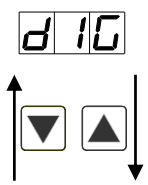
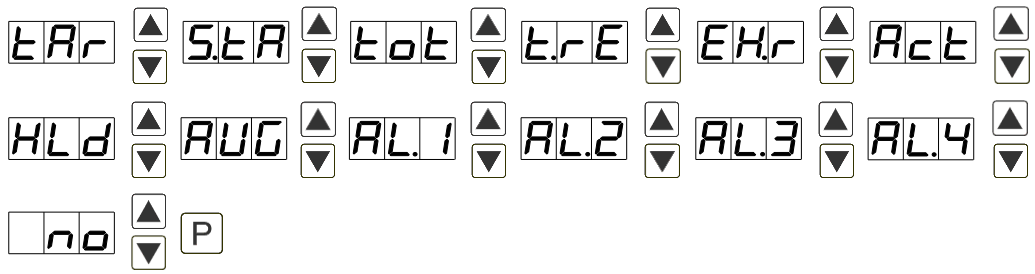
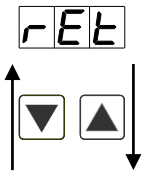
Menu level	Parameterisation level
A.01	**Analog values for setpoints, A.01 ... A.30:**  The setpoints are always set according to the selected input signal mA/V. The desired analog values can be freely parametrised in ascending order.
Und	**Display underflow, UND:** Default: **-199**  With this function the display underflow (_ _ _) can be defined to a determinate value.
OUE	**Display overflow, OUE:** Default: **999**  With this function the display overflow (¯¯¯) can be defined to a determinate value.
rEt	**Back to menu group level, RET:** With **[P]** the selection is confirmed and the device changes into menu group level **„INP"**.

5.4.2. General device parameters

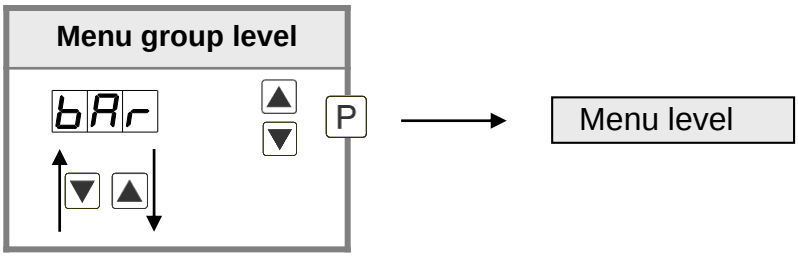


Menu level	Parameterisation level
d 1.5 P 00.1 00.9 then 0 1.0 10.0 P	**Display time, DI.S:** Default: 1.0 The display is set up with **[▲] [▼]**. Thereby it switches until 1 second in increments of 0.1 seconds and until 10.0 seconds in increments of 1.0. With **[P]** the selection is confirmed and the device changes into menu level.
rnd P 001 005 010 P	**Rounding of display values, RND:** Default: 001 This function is for instable display values, where the display value is changed in increments of 1, 5 or 10. This does not affect the resolution of the optional outputs. With **[P]** the selection is confirmed and the device changes into menu level.
Ar 1 P no rE2 rAd SQU P Reciprocal value Square root Squaring	**Arithmetic, ARI:** Default: NO With this function the calculated value, not the measuring value, is shown in the display. With NO, no calulation is deposited. With **[P]** the selection is confirmed and the device changes into menu level.
AUG P 01 P 50 P	**Sliding average determination, AVG:** Default: 10 Here, the number of the meterings that need to be averaged is preset. The time of averaging results of the product of measuring time SEC and the averaged metering AVG. With the selection of AVG in the menu level DIS, the result will be shown in the display and evaluated by entering AL1-AL4 in the alarm or via the analog output OUT.

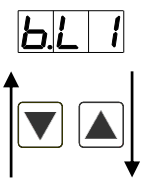
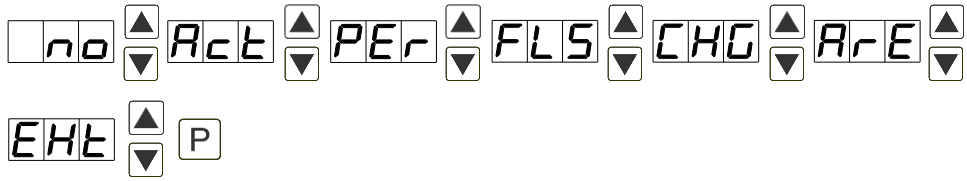
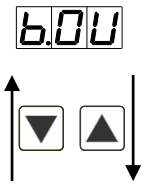
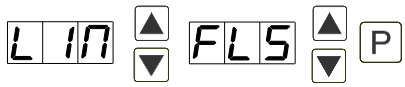
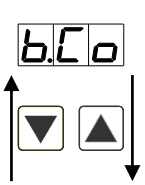
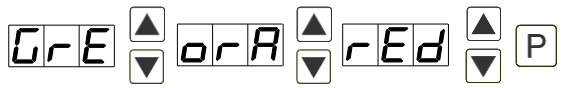
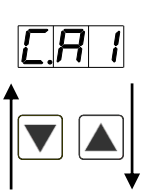
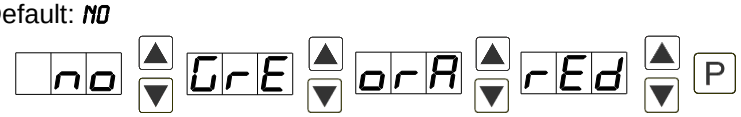
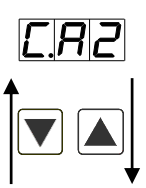
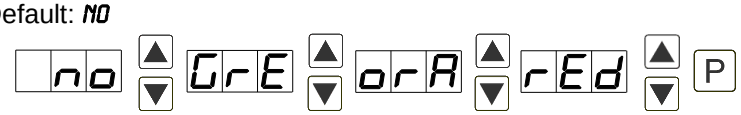
Menu level	Parameterisation level
	**Zero point slowdown, *ZER:*** Default: ***00***  At the zero point slowdown, a value range around the zero point can be preset, so the display shows a zero. If e.g. a 10 is set, the display would show a zero in the value range from -10 to +10; below continue with -11 and beyond with +11. The maximum adjustable range of value is 99.
	**Display, *DIS:*** Default: ***ACT***  With this function the current measuring value, min/max value, totaliser value or the process-controlled Hold value can be allocated to the display. With **[P]** the selection is confirmed and the device changes into menu level.
	**Display flashing, *FLS:*** Default: ***NO***  A display flashing can be added as additional alarm function either to single or to a combination of off-limit condition. With ***NO***, no flashing is allocated.
	**Assignment (deposit) of key functions, *TST*:** Default: ***NO***  For the operation mode, special functions can be deposited on the navigation keys **[▲] [▼]**, in particular this function is made for devices in housing size 48x24mm which do not have a 4th key (**[O]**-key). If the min/max-memory was activated by ***EHT***, all measured min/max-values are saved during operation and can be recalled via the navigation keys. The values get lost by restart of the device. If the threshold value correction ***L.12*** or ***L.34*** is choosen, the values of the threshold can be changed during operation without disturbing the operating procedure. With ***TAR*** the device is tared to zero and saved permanently as offset. The device confirms the correct taring by showing ***000*** in the display. ***S.TA*** switches into the offset value and can be changed via the navigation keys **[▲] [▼]**. With ***TOT*** the current totaliser value can be displayed, after this, the display switches back onto the parameterised display value. If ***T.RE*** was selected, the totaliser can be set back by using the navigation keys **[▲] [▼]**, the display confirms this by showing ***000*** in the display. The configuration of ***EH.R*** deletes the min/max-memory. With ***ACT*** the measurand is displayed, after this the display switches back to the parameterised display value. If ***NO*** is selected, the navigation keys are without any function in the operation mode.

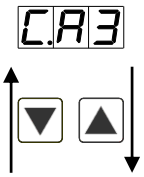
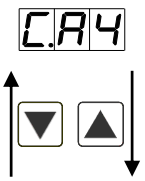
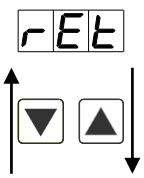
Menu level	Parameterisation level
	**Special function [O]-key, *TS.4*:** Default: *NO*  For the operation mode, special functions can be laid on the **[O]-**key. This function is triggered by pushing the key. With *TAR* the display is tared to zero and is saved permanently as offset. The display confirms the correct taring by showing *000* in the display. *S.TA* switches into the offset value and can be changed via the navigation keys **[▲] [▼]**. With *TOT* the current totaliser value can be displayed. After this, the display switches back onto the parameterised display value. If *TOT* was deposited the totaliser can be set back by using the navigation keys **[▲] [▼]**, the display confirms this by showing *000* in the display. *EH.R* deletes the min/max-memory. At selected *HLD* the instant value is held by pushing the **[O]-**key and updated by releasing the key. **Advice:** *HOLD* can only be activated if *HOLD* was selected under parameter *DIS*. *ACT* shows the measurand. Then the display switches to the parameterised display value. The same applies for *AVG*, here the sliding average value is displayed. At *AL-1...AL-4* an output can be set and therewith e.g. a switch of the metering point can be done. If *NO* is selected, the **[O]-**key has no function in the operation mode.
	**Special function digital input, *DIG*:** Default: *NO*  The above given parameters can be set for the operation mode onto the optional digital input aswell. See function description *TS.4*.
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level *„FCT“*.

5.4.3. Bargraph functions



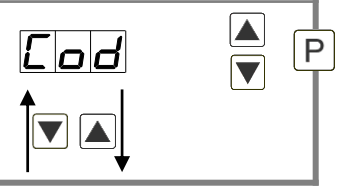
Menu level	Parameterisation level
b.Sr	**Bargraph, *B.SR:*** Default: ***ACT*** P Act Min MAX tot HLd AUG P With this function the following values can be allocated to the display: the current measurand, the min/max value, the totaliser value, the process-controlled Hold value or the sliding average value. With **[P]** the selection is confirmed and the device changes into menu level.
b.En	**Adjusting the final value of the bargraph, *B.EN:*** Default: ***100*** P 8 P 8 P 8 P Set the final value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterized on the highest value digit. After the last digit, the display switches back to the menu level.
b.0F	**Adjusting the initial value of the bargraph, *B.0F:*** Default: ***0*** P 8 P 8 P 8 P Set the initial value from the smallest to the highest digit with **[▲] [▼]** and confirm each digit with **[P]**. A minus sign can only be parameterized on the highest value digit. After the last digit, the display switches back to the menu level.
b.FC	**Selection of the bargraph functions, *B.FC:*** Default: ***BA.F*** for horizontal ***AND BA.R*** for vertical P bA.F bA.r bA.n dot do.n P The bargraph can be displayed with the following possibilites: bars from left to right (top to bottom) or bars from right to left (bottom to top), bars from the middle, a dot display of the bargraph or a dot display with a permanently displayed midpoint. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.

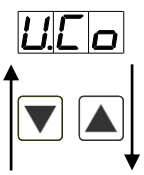
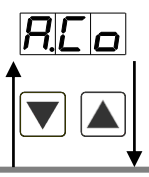
Menu level	Parameterisation level
	**Change of colour at alarm, *B.L1*:** Default: *CHG*  A change of colour of the bargraph to green, red or orange, can be allocated to each of the 4 alarms. The allocation of the colours is done under parameters *C.A1-C.A4*. Under adjustment *NO*, there is no change of colour, with *ACT* one bar segment will be switched by reaching of the alarm. *PER* corresponds to a permant display of the allocated alarm, even if it has not been reached yet. *FLS* actuates a flashing of the bargraph segment at upcoming alarm. *CHG* changes the complete bargraph into the colour of the alarm with highest priority, whereat the priority is set to be always ascending from alarm 1-4. In *ARE*-mode alarm ranges can be deposited in different colours, always in consideration of the priorities. With **[P]** the selection is confirmed and the device changes into menu level.
	**Overflow behaviour, *B.OU*:** Default: *LIM*  To recognis and evaluated faulty signals, e.g. via a control, the overflow behaviour of the bargraph can be defined. *LIM* can be seen as overflow, the bargraph remains on the adjusted min/max-value, or *FLS*. If *FLS* was selected, the complete bargraph flashes in case of an overflow. With **[P]** the selection is confirmed and the device changes into menu level.
	**Setting the standard colour of the bargraph, *B.CO*:** Default: *GRE*  Under this menu item the standard colour of the display can be parameterised. The colours green, orange and red are available. Confirm the selection by pressing the **[P]** button. The display then switches back to the menu level again.
	**Colour allocation alarm 1, *C.A1*:** Default: *NO*  Here the change of colour at break of *ALARM.1* is selected. Available are the colours green, orange or red. If *NO* is parameterised, the display remains in its standard colour, even at an upcoming *ALARM.1*. With **[P]** the selection is confirmed and the device changes into menu level.
	**Colour allocation alarm 2, *C.A1*:** Default: *NO*  Here the change of colour at break of *ALARM.2* is selected. Available are the colours green, orange or red. If *NO* is parameterised, the display remains in its standard colour, even at an upcoming *ALARM.2*. With **[P]** the selection is confirmed and the device changes into menu level.

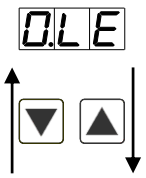
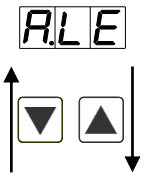
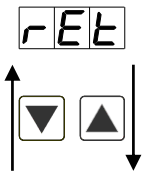
Menu level	Parameterisation level
	**Colour allocation alarm 3, *C.A1*:** Default: *NO*  Here the change of colour at break of *ALARM.3* is selected. Available are the colours green, orange or red. If *NO* is parameterised, the display remains in its standard colour, even at an upcoming *ALARM.3*. With **[P]** the selection is confirmed and the device changes into menu level.
	**Colour allocation alarm 4, *C.A1*:** Default: *NO*  Here the change of colour at break of *ALARM.4* is selected. Available are the colours green, orange or red. If *NO* is parametrised, the display remains in its standard colour, even at an upcoming *ALARM.4*. With **[P]** the selection is confirmed and the device changes into menu level.
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level *„BAR“*.

5.4.4. Safety parameters

Menu group level

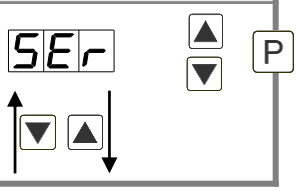


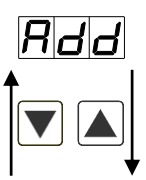
Menu level	Parameterisation level
	**User code *U.CO*:** Default: *000*  Via this code locked reduced sets of parameters *A.LE* and *O.LE* can be set free during locked programming. Further parameters cannot be reached via this code. A change of the *U.CO* can be done via the correct input of the *A.CO* (master code).
	**Master code, *A.CODE*:** Default: *000*  By entering *A.CO* the device will be unlocked and all parameters are released.

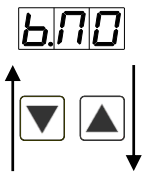
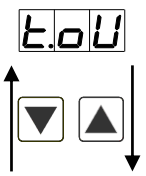
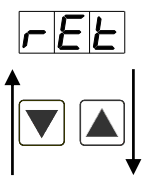
Menu level	Parameterisation level
	**Release/lock analog output parameters, *O.LE:*** Default: ***ALL***  Analog output parameters can be locked or released for the user: - ***SRC:*** the initial or final value can be changed in operation mode - ***O.OE:*** the output signal can be changed from e.g. 0-20mA to 4-20 mA or 0-10 VDC - ***ALL:*** analog output parameters are released - ***NO:*** all analog outpout parameters are locked
	**Release/lock alarm parameters, *A.LE:*** Default: ***ALL***  This parameter describes the user release/user lock of the alarm: - ***LIM***: here only the range of value of the threshold values 1-4 can be changed - ***ALR***: here the range of value and the alarm trigger can be changed - ***ALL:*** all alarm parameters are released - ***NO:*** all alarm parameters are locked
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level ***„COD“***.

5.4.5. Serial parameters

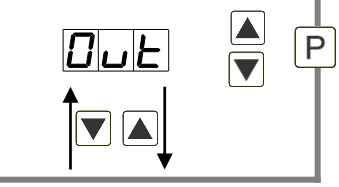
Menu group level

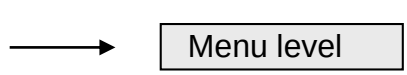


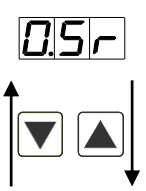
Menu level	Parameterisation level
	**Device address, *ADD*:** Default: ***001***  The device address can be adjusted from the smallest to the highest digit with the navigation keys **[▲] [▼]** and confirmed digit per digit with **[P]**. A device address up to max. 250 is available.

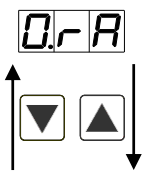
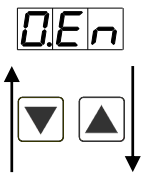
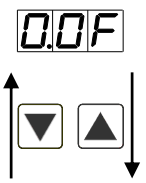
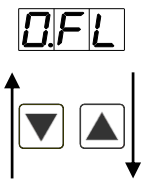
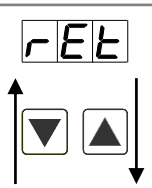
Menu level	Parameterisation level
	**ModBus operating modes, *B.MO*:** Default: *ASC*  There are two different types of operating modes: *ASC* and *RTU*. Modbus transfers no binary cycle, but the **ASCII**-Code. Thus it is directly readable, however the data throughput is smaller in comparison to the **RTU**. Modbus **RTU** (**RTU** = **R**emote **T**erminal **U**nit) transfers the data in binary-coded. This leads to a good data troughput, even though the data cannot be evaluated directly, as they first need to be transfered into a readable format.
	**Timeout, *T.OU*:** Default: *000*  The monitoring of the data transfer is parameterised in seconds up to max. 100 seconds; there is no monitoring with an entry of *000*. The timeout is adjusted from the smallest to the highest digit with **[▲] [▼]** and confirmed digit per digit with **[P]**. After the last digit, the display changes into menu level.
	**Return to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level *„SER"*.

5.4.6. Analog output parameters

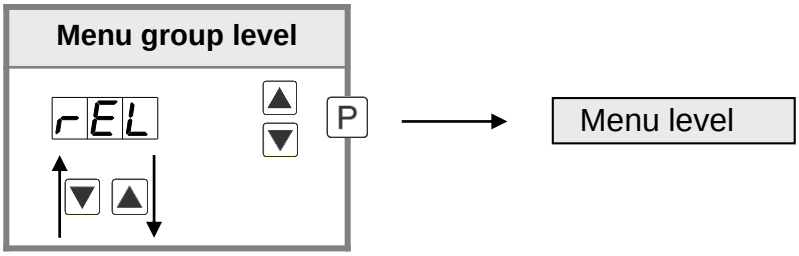
Menu group level




Menu level	Parameterisation level
	**Selection reference of analog output, *O.SR*:** **Default:** *ACT*  The analog output signal can refer to different functions, in detail these are the current measurand, the min-value, the max-value or the totaliser function/sum function. If *HLD* was selected, the the signal of the analog output will be kept. It can be continued processing after a deactivation of *HLD*. With **[P]** the selection is confirmed and the device changes into menu level.

Menu level	Parameterisation level
	**Selection analog output, *O.RA*:** **Default:** *4.20*  3 output signals are available 0-10 VDC, 0-20 mA and 4-20 mA. Select the desired signal with this function.
	**Setting the final value of the analog output, *O.EN*:** **Default:** *100*  The final value is adjusted from the smallest to the highest digit with **[▲] [▼]** and confirmed digit per digit with **[P]**. A minus sign can only be parameterized on the highest digit. After the last digit the device changes back into menu level.
	**Setting the initial value of the analog output, *O.OF*:** **Default:** *0*  The initial value is adjusted from the smallest to the highest digit with **[▲] [▼]** and confirmed digit per digit with **[P]**. A minus sign can only be parameterized on the highest digit. After the last digit the device changes back into menu level.
	**Overflow behaviour, *O.FL*:** **Default:** *EDG*  To recognise and evaluate faulty signals, e.g. by a controller, the overflow behaviour of the analog output can be defined. As overflow can be seen either ***EDG***, that means the analog output runs on the set limits e.g. 4 and 20 mA, or ***T.OF*** (input value smaller than initial value, analog output switches on e.g. 4 mA), ***T.EN*** (higher than final value, analog output switches on e.g. 20 mA). If ***T.MI*** or ***T.MA*** is set, the analog output switches on the smallest or highest possible binary value. This means that values of e.g. 0 mA, 0 VDC or values higher than 20 mA or 10 VDC can be reached. With **[P]** the selection is confirmed and the device changes into menu level.
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level ***„OUT"***.

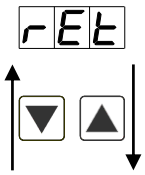
5.4.7. Relay functions



Menu level	Parameterisation level
r-1	**Alarm relay 1,** *R.1:* **The same applies for relay 2!** **Default:** *A.1* r-1 P A. 1 .... A. 4 An 1 .... An4 LoG OFF On P Each setpoint (optional) can be linked up via 4 alarms (by default). This can either be inserted at activated alarms *A.1/4* or deactivated alarms *A.N1/4*. If *LOG* was selected, logical links are available in the menu level *LO-1* and *CO-1*. Access to these two menu levels is via *LOG*, at all other selected functions, these two parameters are overleaped. Via *ON/OFF* the setpoints can be activated/deactivated, in this case the output and the setpoint display are set/not set on the front of the device. With **[P]** the selection is confirmed and the device changes into menu level.
Lo.1	**Logic relay 1,** *LOG-1* **Default:** *OR* Lo.1 P or nor And nAd P Here, the switching behaviour of the relay is defined via a logic link, the following schema describes these functions with inclusion of *AL-1* and *AL-2*:

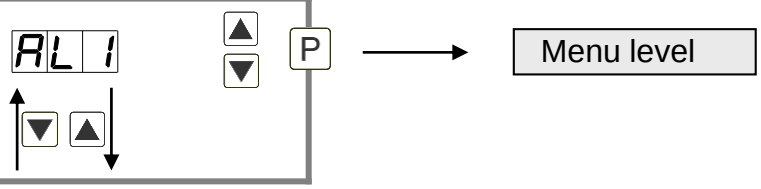
or	$A1 \vee A2$	As soon as a selected alarm is activated, the relay operates. Equates to operating current principle.
nor	$\overline{A1 \vee A2} = \overline{A1} \wedge \overline{A2}$	The relay operates only, if no selected alarm is active. Equates to quiescent current principle.
And	$A1 \wedge a2$	The relay operates only, if all selected alarms are active.
nAd	$\overline{A1 \wedge A2} = \overline{A1} \vee \overline{A2}$	As soon as a selected alarm is not activated, the relay operates.

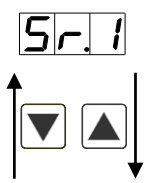
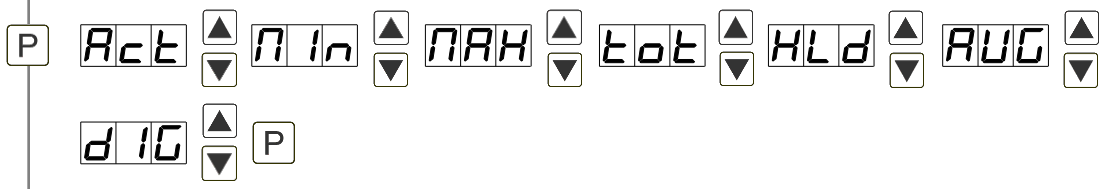
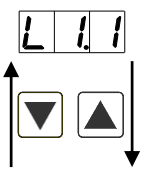
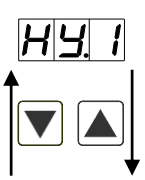
	With **[P]** the selection is confirmed and the device changes into menu level.
Co.1	**Alarms for relay 1,** *CO.1:* **Default:** *A. 1* Co.1 P no A. 1 A. 2 A. 12 A. 3 A. 4 A.34 ALL P The allocation of the alarms to relay 1 happens via this parameter, one alarm or a group of alarms can be chosen. With **[P]** the selection is confirmed and the device changes into menu level.

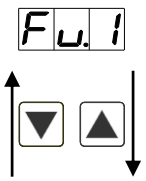
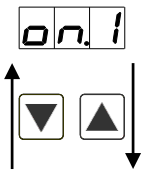
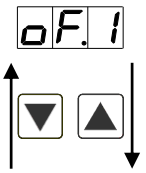
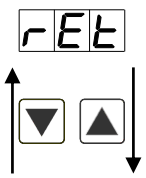
Menu level	Parameterisation level
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level *„REL"*.

5.4.8. Alarm parameters

Menu group level

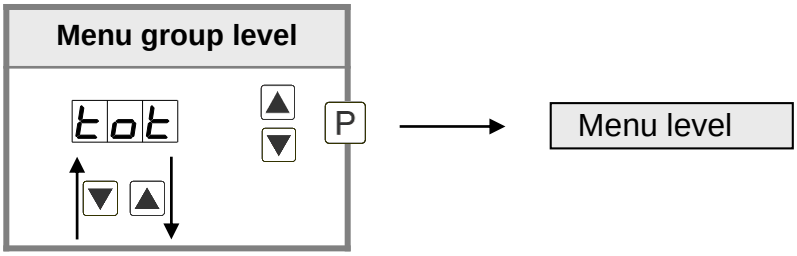


Menu level	Parameterisation level
	**Dependency alarm 1, *SR.1*:** **Default: *ACT***  The dependency of alarm 1 can be related to special functions, in detail these are the current measuring value, the min-value, the max-value or the totaliser value/sum-value. If ***HLD*** was selected, then the alarm is hold and processed just after deactivation of ***HLD***. ***DIG*** causes the dependency either by pressing the **[O]**-key on the front of the housing or by an external signal via the digital input. With **[P]** the selection is confirmed and the device changes into menu level.
	**Threshold values / limit values, *LI.1*:** **Default: *20***  The limit value defines the threshold, that activates/deactivates an alarm.
	**Hysteresis for threshold values, *HY.1*:** **Default: *0***  The delayed reaction of the alarm is the difference to the threshold value, which is defined by the hysteresis.

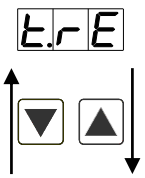
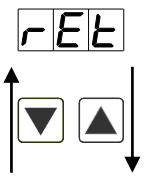
Menu level	Parameterisation level
	**Function for threshold value undercut / exceedance, *FU.1*:** **Default: *HIG***  A limit value undercut is selected with ***LOU*** (for LOW = lower limit value), a limit value exceedance with ***HIG*** (for HIGH = higher limit value). If e.g. limit value 1 is on a threshold level of 100 and allocated with function ***HIG***, an alarm is activated by reaching of the threshold level. If the threshold value was allocated to ***LOU***, an alarm will be activated by undercutting the threshold value, as long as the hysteresis is zero.
	**Switching-on delay, *ON.1*:** **Default: *0***  For limit value 1 one can preset a delayed switching-on of 0-100 seconds.
	**Switching-off delay, *OF.1*:** **Default: *0***  For limit value 1 one can preset a delayed switching-off of 0-100 seconds.
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level „*AL1*“.

The same applies for *AL2* to *AL4*.

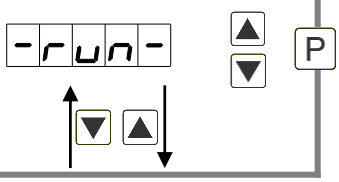
5.4.9. Totaliser (Volume metering)



Menu level	Parameterisation level
t.FC	**Totaliser state,** *T.FC:* **Default:** *OFF*  The totaliser makes measurements on a time base of e.g. l/h possible, at this the scaled input signal is integrated by a time and steadily (select *STD*) or temporarily (select *TEM*) saved. If *OFF* is selected, the function is deactivated. With **[P]** the selection is confirmed and the device changes into menu level.
t.bA	**Time base,** *T.BA:* **Default:** *SEC*  Under this parameter the time base of the measurement can be preset in seconds, minutes or hours.
FAC	**Totaliser factor,** *FAC*: **Default:** *IE0*  At this the factor (10^0…10^6) respectively the divisor for the internal calculation of the measuring value is assigned.
t.dt	**Setting up the decimal point for the totaliser,** *TOT.DT:* **Default:** *0*  The decimal point of the device can be adjusted with the navigation keys **[▲] [▼]**. With **[P]** the selection is confirmed and the device changes into menu level.

Menu level	Parameterisation level
	**Totaliser reset, *T.RE:*** **Default: *OFF***  The reset value is adjusted from the smallest to the highest digit with the navigation keys **[▲] [▼]** and digit per digit confirmed with **[P]**. After the last digit, the display switches back to the menu level. The activator for the reset is parameter driven via the 4th key or via the optional digital input.
	**Back to menu group level, *RET*:** With **[P]** the selection is confirmed and the device changes into menu group level **„*TOT*"**.

Programming interlock, *RUN*:

Menu group level
 Description see page 11, menu level ***RUN***

6. Reset to default values

To return the unit to a **defined basic state**, a reset can be carried out to the default values.

The following procedure should be used:

- Switch off the power supply
- Press button **[P]**
- Switch on voltage supply and press **[P]-**button until **„- - - - -"** is shown in the display.

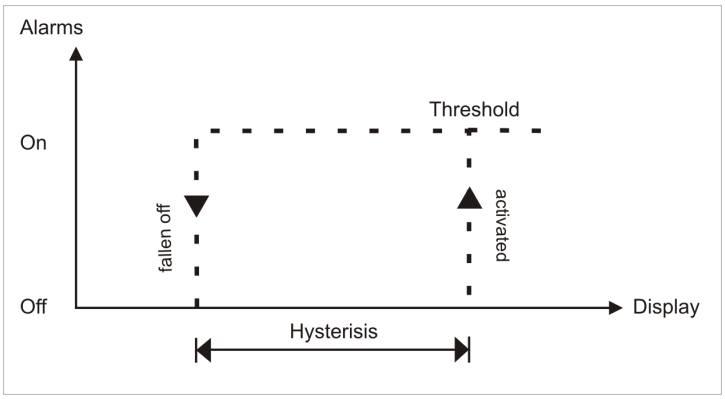
With reset, the default values of the program table are loaded and used for subsequent operation. This puts the unit back to the state in which it was supplied.

Caution! All application-related data are lost.

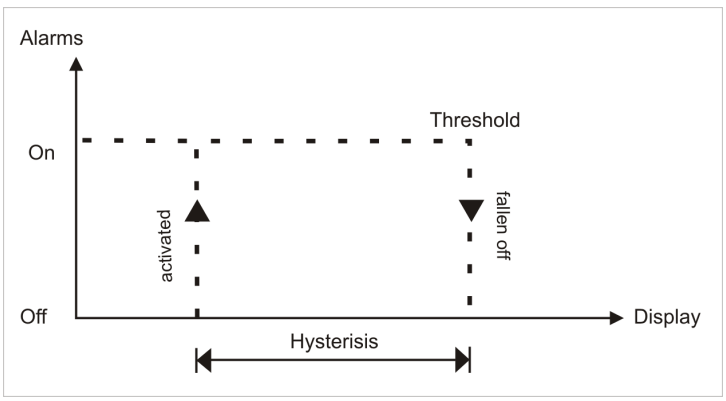
7. Alarms / Relays

This device has 4 virtual alarms that can monitor one limit value in regard of an undercut or exceedance. Each alarm can be allocated to an optional relay output S1-S2; furthermore alarms can be controlled by events like e.g. hold value or min/max-value.

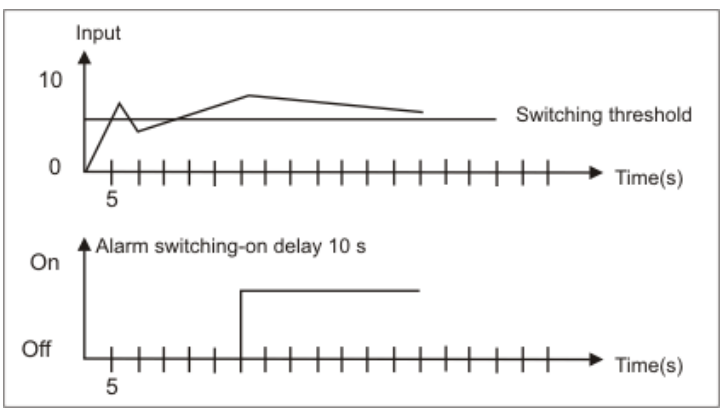
Function principle of alarms / relays	
Alarm / Relay x	Deactivated, instantaneous value, min/max-value, hold-value, totaliser value, sliding average value or an activation via the digital input
Switching threshold	Threshold / limit value of the change-over
Hysteresis	Broadness of the window between the switching thresholds
Working principle	Operating current / Quiescent current



Operating current
By operating current the alarm S1-S2 is **off** below the threshold and **on** on reaching the threshold.



Quiescent current
By quiescent current the alarm S1-S2 is **on** below the threshold and switched **off** on reaching the threshold.

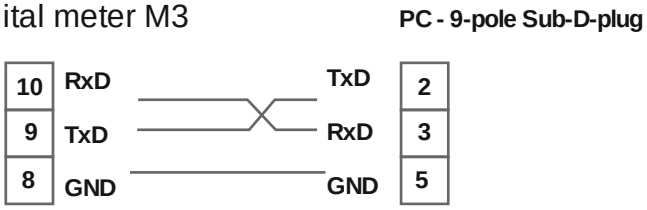


Switching-on delay
The switching-on delay is activated via an alarm and e.g. switched 10 seconds after reaching the switching threshold, a short-term exceedance of the switching value does not cause an alarm, respectively does not cause a switching operation of the relay. The switching-off delay operates in the same way, keeps the alarm / the relay switched longer for the parameterised time.

8. Interfaces

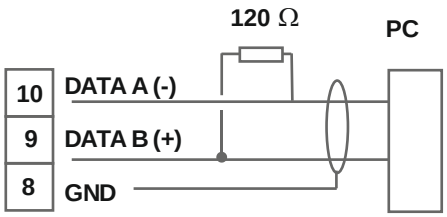
Connection RS232

Digital meter M3



Connection RS485

Digital meter M3



The interface **RS485** is connected via a screened data line with twisted wires (Twisted-Pair). On each end of the bus segment a termination of the bus lines needs to be connected. This is neccessary to ensure a secure data transfer to the bus. For this a resistance (120 Ohm) is interposed between the lines Data B (+) and Data A (–).

9. Technical data

Housing				
Dimensions	96x24x120 mm (BxHxD)			
	96x24x145 mm (BxHxD) incl. plug-in terminal			
Panel cut-out	$92.0^{+0.8}$ x $22.0^{+0.3}$ mm			
Wall thickness	to 15 mm			
Fixing	screw elements			
Material	PC Polycarbonate, black, UL94V-0			
Sealing material	EPDM, 65 Shore, black			
Protection class	standard IP65 (front), IP00 (back)			
Weight	approx. 200 g			
Connection	plug-in terminal; wire cross section up to 2.5 mm^2			
Display				
Digit height	8 mm			
Segment colour - display	red (optional green)			
Range of display	-199 to 999			
Bargraph display	30 digit, tricolour			
Setpoints	one LED per setpoint			
Overflow	horizontal bars at the top			
Underflow	horizontal bars at the bottom			
Display time	0.1 to 10.0 seconds			
Input	**Measuring range**	**Ri**	**Measuring error**	**Digit**
min -22…max 24 mA	0/4-20 mA	~100 Ω	0.1 % of measuring range	±1
min -12…max 12 VDC	0…10 VDC	~ 200 kΩ	0.1 % of measuring range	±1
Digital input	< 2.4 V OFF, >10 V ON, max. 30 VDC R_I ~ 5 kΩ			
Accuracy				
Temperature drift	100 ppm / K			
Measuring time	0.1…10.0 seconds			
Measuring principle	U/F-conversion			
Resolution	approx. 18 bit at 1 seconds measuring time			

Output	
Sensor supply	24 VDC / 50 mA; 10 VDC / 50 mA
Analog output	0/4-20 mA / burden ≤500 Ω or 0-10 VDC / ≥10 kΩ 16 bit
Switching outputs	
Relay with change-over contact Switching cycles	250 VAC / 2 AAC; 30 VDC / 2 ADC 30 x 10^3 with 2 AAC, 2 ADC ohm resistive burden 10 x 10^6 mechanically Division according to DIN EN50178 / Characteristics according to DIN EN60255
Interface	
Protocol	Modbus with ASCII or RTU-protocol
RS232	9.600 Baud, no parity, 8 databit, 1 stopbit, wire length max. 3 m
RS485	9.600 Baud, no parity, 8 databit, 1 stopbit, wire length max 1000 m
Power supply	100-240 VAC, 50/60 Hz, DC ± 10% (max. 10 VA) 10-40 VDC galvanically isolated, 18-30 VAC 50/60 Hz (max. 10 VA)
Memory	EEPROM
Data life	≥ 100 years at 25°C
Ambient conditions	
Working temperature	0°C…50°C for panel meters, -20°C…60°C for build-up devices
Storing temperature	-20°C…80°C
Climativ density	relative humidity 0-80% on years average without dew
Height	up to 2000 m over sea level
EMV	EN 61326
CE-sign	Conformity to directive 2004/108/EG
Safety standard	According to low voltage directive 2006/95/EG EN 61010; EN 60664-1

10. Safety advices

Please read the following safety advices and the assembly *chapter 2* before installation and keep it for future reference.

Proper use

The **MB3-31-device** is designed for the evaluation and display of sensor signals.

Danger! Careless use or improper operation can result in personal injury and/or cause damage to the equipment.

Control of the device

The panel meters are checked before dispatch and sent out in perfect condition. Should there be any visible damage, we recommend close examination of the packaging. Please inform the supplier immediately of any damage.

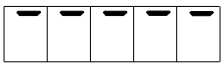
Installation

The **MB3-31-device** must be installed by a suitably **qualified specialist** (e.g. with a qualification in industrial electronics).

Notes on installation

- There must be no magnetic or electric fields in the vicinity of the device, e.g. due to transformers, mobile phones or electrostatic discharge.
- **The fuse rating of the supply voltage should not exceed a value of 0.5A N.B. fuse!**
- Do not install **inductive consumers** (relays, solenoid valves etc.) near the device and **suppress** any interference with the aid of RC spark extinguishing combinations or free-wheeling diodes.
- Keep input, output and supply lines separate from one another and do not lay them parallel with each other. Position “go” and “return lines” next to one another. Where possible use twisted pair. So, you receive best measuring results.
- Screen off and twist sensor lines. Do not lay current-carrying lines in the vicinity. Connect the **screening on one side** on a suitable potential equaliser (normally signal ground).
- The device is not suitable for installation in areas where there is a risk of explosion.
- Any electrical connection deviating from the connection diagram can endanger human life and/or can destroy the equipment.
- The terminal area of the devices is part of the service. Here electrostatic discharge needs to be avoided. Attention! High voltages can cause dangerous body currents.
- Galvanic isolated potentials within one complex need to be placed on an appropriate point (normally earth or machines ground). So, a lower disturbance sensibility against impacted energy can be reached and dangerous potentials, that can occur on long lines or due to faulty wiring, can be avoided.

11. Error elimination

	Error description	Measures
1.	The unit permanently indicates overflow. 	• The input has a very high measurement, check the measuring circuit. • With a selected input with a low voltage signal, it is only connected on one side or the input is open. • Not all of the activated supporting points are parameterised. Check if the relevant parameters are adjusted correctly.
2.	The unit permanently shows underflow. 	• The input has a very low measurement, check the measuring circuit. • With a selected input with a low voltage signal, it is only connected on one side or the input is open. • Not all of the activated supporting points are parameterised. Check if the relevant parameters are adjusted correctly.
3.	The word *HELP* lights up in the 7-segment display.	• The unit has found an error in the configuration memory. Perform a reset on the default values and reconfigure the unit according to your application.
4.	Program numbers for parameterising of the input are not accessible.	• Programming lock is activated. • Enter correct code.
5.	*ERR1* lights up in the 7-segment display	• Please contact the manufacturer if errors of this kind occur.
6.	The device does not react as expected.	• If you are not sure if the device has been parameterised before, then follow the steps as written in *chapter 6.* and set it back to its delivery state.