Operating Instructions

1 General Information

This document contains necessary information for the proper installation and use of this device. In addition to this instruction, be sure to observe all statutory requirements, applicable standards, the additional technical specifications on the accompanying data sheet (see www.labom.com) as well as the specifications indicated on the type plate.

1.1 General Safety Notes

The installation, set up, service or disassembly of this device must only be done by trained, qualified personnel using suitable equipment and authorized to do so.

Warning

Media can escape if unsuitable devices are used or if the installation is not correct.

Danger of severe injury or damage

- Ensure that the device is suitable for the process and undamaged.

1.2 Intended Use

The device is intended to measure pressure of gases, vapors and liquids as specified in the data sheet.

1.3 Conformity with EU Regulations

The CE-marking on the device certifies its compliance with the applicable EU Directives for placing products on the market within the European Union.

The following guidelines apply to these devices:

ATEX Directive	2014/34/EU
EMC Directive	2014/30/EU
PED Directive	2014/68/EU

You find the complete EC Declaration of Conformity (document no. KE_042) at www.labom.com.

1.4 ATEX Approval

If you purchased a device with ATEX approval, please refer to the accompanying document XA_010 or XA_011 for ATEX-relevant information.

2 Transportation and Storage

Store and transport the device only under clean and dry conditions preferably in the original packaging. Avoid exposure to shocks and excessive vibrations.

Permissible storage temperature:	-40…80 °C

3 Installation and Commissioning

Ensure that the device is suitable for the intended application with respect to pressure range, overpressure limit, media compatibility, temperature range and process connection.

After the mechanical installation and electrical connection is completed, the device is ready for operation as soon as the power supply is switched on.

3.1 Mechanical Installation

Use gaskets, if required, that are suitable for the process connection and resistant to the media.

Before starting operation, check the process connection carefully for leaks under pressure.

You can use the device in any mounting position. Normally the transmitter is adjusted for a vertical mounting position. A different mounting position in combination with a small nominal range might cause a zero point offset. In this case a zero point adjustment might be necessary.

3.2 Electrical Connection

Complete the mechanical installation before you connect the device electrically.
Set up all electrical connections while the voltage supply is switched off.

Output (2-wire)	4...20 mA (20...4 mA)
Permissible supply voltage	U_V = 12…30 VDC
Permissible load	$R_B \leq (U_V - 12\ V) / 22\ mA$

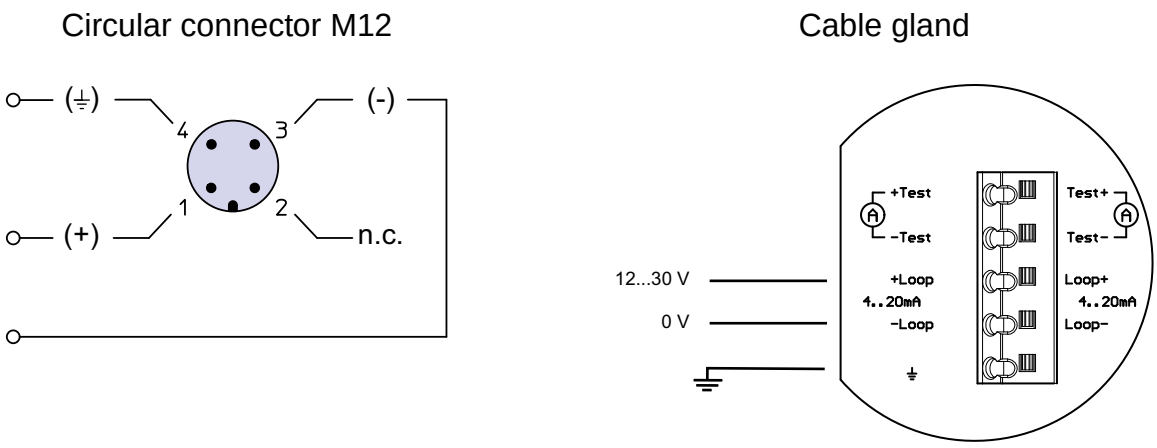


Figure 1: Options for the electrical connection

Observe the following points for electrical connections via cable gland and terminal block:

- Do not forget to tighten the cable gland after the electrical connection is finalised.
- Press down the spring of spring-operated terminals as far as possible, e.g. with a screwdriver, before you insert the cable. Otherwise a safe electrical connection cannot be ensured.

3.3 Devices with Diaphragm Seal

Remove the protective cap or protective wrapping from the diaphragm only just before installation to prevent contamination or damage.

The diaphragm must not be touched. Do not place the device on its diaphragm. Even small scratches or deformations may negatively influence the zero point or other characteristics of the device.

Pressure transmitter and diaphragm seal are a closed system that must not be separated.

You can find further information about diaphragm seals in the document TA_031 on www.labom.com.

3.4 Mounting the Remote Display

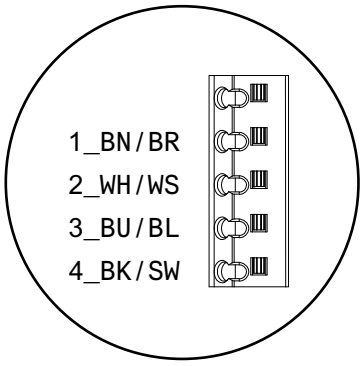
Optionally you can mount the display and control unit up to 10 m away from the measuring point in an additional housing. The back plate of the housing is universally suitable for wall mounting or pipe mounting for pipe diameters from 30 – 64 mm. For pipe mounting, you can order the corresponding U-bolts from LABOM.

For best EMC protection, only use the included cable.

If you ordered the remote display together with the device, the assembly has been completed in the factory. You only need to route the cable and mount the housing with the remote display.

If you have received the remote display as a retrofit kit, proceed as follows:

1. Unmount the front cover and the display unit from the PASCAL Ci4 (see 4.2).
2. Replace them with the adapter piece (round part with M12 socket) and front cover, which were screwed onto the remote display housing for shipment. Do not forget to connect the cable on the back with the display connector on the CPU module.
3. The cable may be shortened to on-site requirements. Colour codes on the terminals indicate which wire should be connected to which terminal (see Figure 2).
4. Mount the remote display housing using the mounting holes to a wall, a pipe or another suitable location.
5. Plug the M12 connector of the cable into the socket of the adapter piece.
6. Now connect the cable on the display module with the corresponding connector on the terminal board in the remote housing and insert the display module in the same manner as for the device itself (see 4.2).
7. The last step is to close the remote housing with the display cover that was previously on the device.



Colour codes
BN/BR: Brown
WH/WS: White
BU/BL: Blue
BK/SW: Black

Figure 2: Connection of the remote display housing

This modification can be performed during operation. We do recommend, however, to switch off the device during the modification.

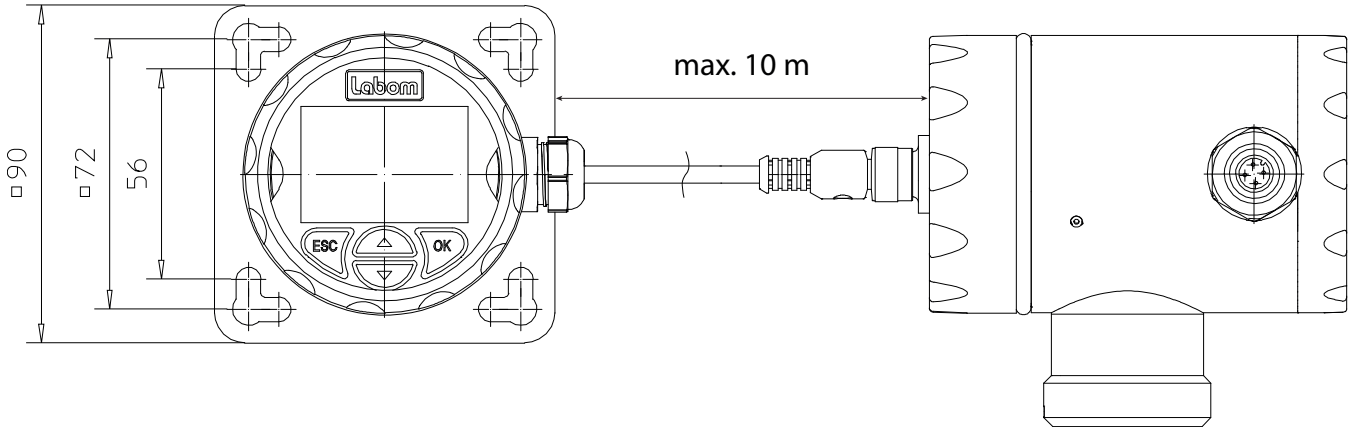


Figure 3: Remote display and control unit after installation

4 Operation

During operation, take care that the device remains within its intended pressure and temperature ranges. No other monitoring is necessary.

Permissible ambient temperature: -40…80 °C

4.1 Test Terminals

You can check the output current without interrupting the current loop, using the test terminals on the terminal board. When you connect a current meter to the "+Test" and "-Test" terminals, the current is automatically routed through it.

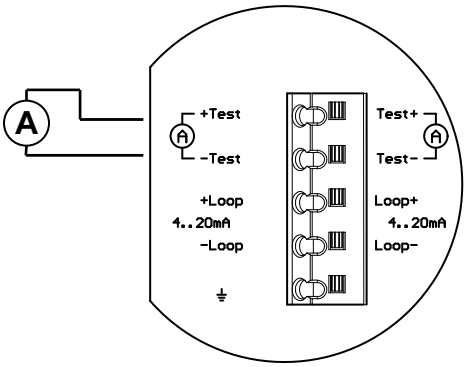


Figure 4: Current measurement during operation using test terminals

4.2 Remove Display / Activate Write Protection

Using the DIP switch in the device, you can disable changes to the configuration via the display or via HART (not for the type series CI4xx3 with a process connection on the back).

To activate the write protection, you must first remove the display module. Proceed as follows:

- Unscrew the front cover
- Turn the display module 20° counterclockwise
- Lift off the display module carefully

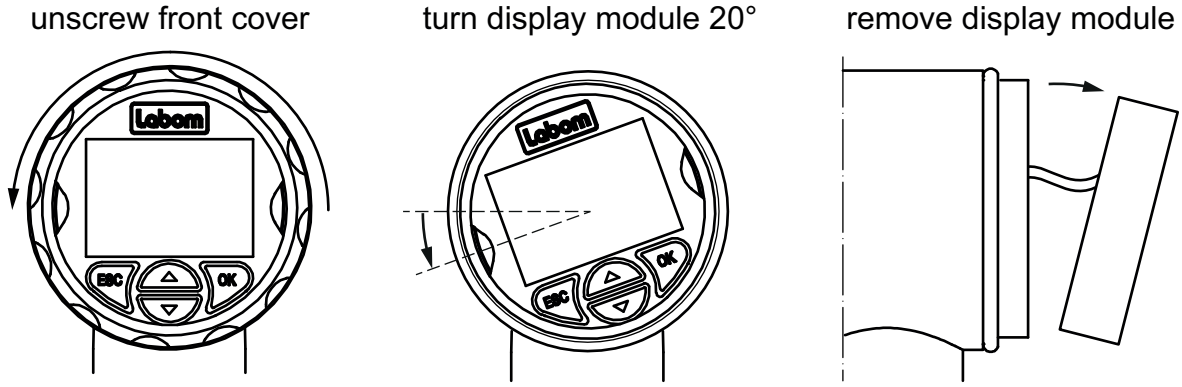


Figure 5: Removing the display

After removing the display module you can reach the DIP switch on the CPU module. The write protection is active when the DIP switch is in the "ON" position.

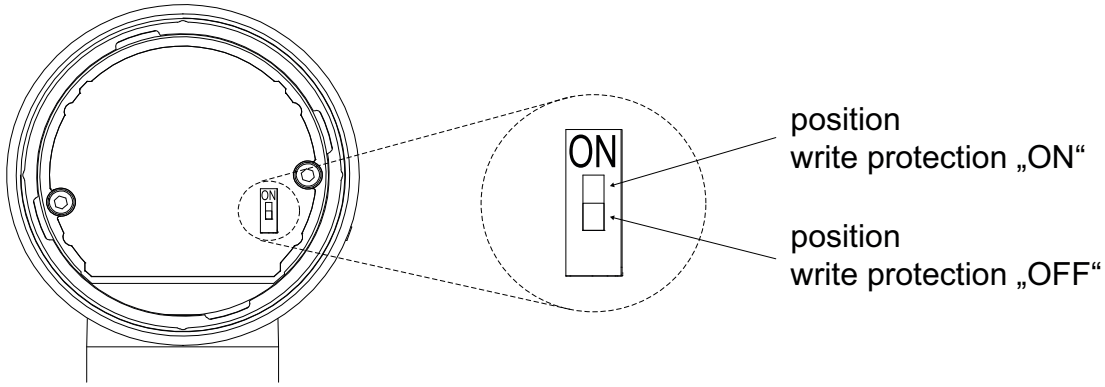


Figure 6: Write protection via slide switch in the device

Re-mount the display module in the reverse order.

4.3 Maintenance / Service

When properly installed in accordance with applicable specifications, this device is maintenance-free. However, we recommend an annual recalibration of the device.

In case of damage or defects, the customer can replace the following elements:

- Display module
- Cable glands (if applicable)

For defects to other components, repairs must be performed in the factory.

5 Disassembly

When measuring hot media, make sure that the device has cooled down prior to any dismounting or wear appropriate protective clothing to avoid burns.

Switch off the power supply to the device before disconnecting the electrical connections. Once this is done, the device may be mechanically removed.

Warning

Opening pressurized lines might cause severe injuries.

Danger of severe injuries or damage

- Relieve the process pressure before attempting to remove the device. Shut off the pressure supply for all feed lines to the device and relieve the pressure in them.

Warning

Hazardous deposits and residues might remain on opened process connections and removed devices.

Danger of injury

- After the device has been removed, seal off the measuring point and mark the open process connection accordingly. Consider a possible danger due to residues when handling the removed device.

6 User Manual

The device can be configured via the display module as well as the HART protocol. The following pages describe operation and configuration of the device using the display module. (valid from display module software version 2.0.0).

An overview of the menue structure can be found on the last page of this document.

6.1 Basics of the Operating Concept

The display module consists of a dot-matrix display with 80x120 pixels as well as a 4-button control panel.

The four buttons below the display allow an intuitive operation of the device. The general functionality of the buttons is identical in all operating modes.

Figure 7: Control elements

If you press and hold the up or down button, it will automatically be triggered multiple times. This allows to easily navigate through longer selection lists. If you press and hold the ESC button, you always return to the measured value display.

Button	Function
△ / ▽	Select function, increase/decrease value
OK	Confirm selected function or selected value
ESC	Cancel action
ESC long	Return to measured value display

Table 1: General button functions

The structure of the display is the same in every operating mode. The display area is divided into four zones:

- Header
- Icon indicating device status
- Data area
- Bar graph related to the currently measured value

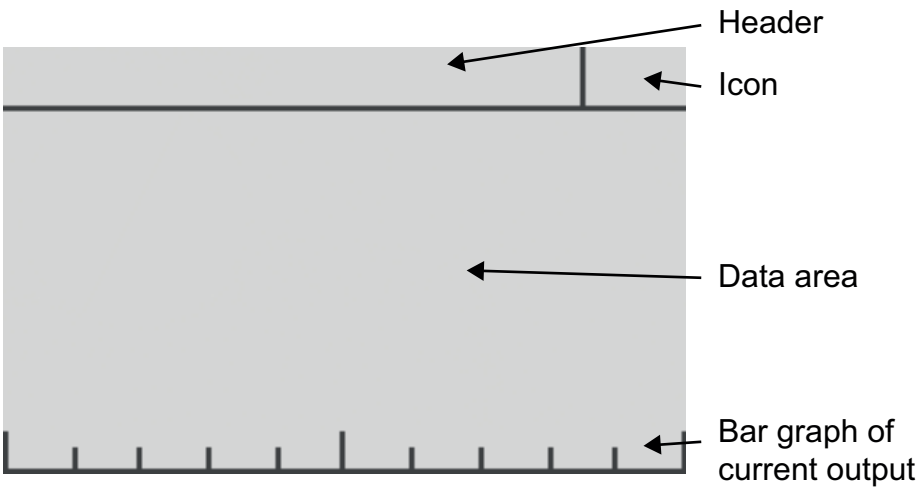


Figure 8: Display structure

The icon for the device status (see 6.2.3) as well as the bar graph is displayed in each operating mode. The bar graph always shows the state of the current output (4 mA = 0%, 20 mA = 100%). The contents of the header and the data area depend on the operating mode:

Display of measured value

- Header: Icon description, if applicable. Otherwise "Value"
- Data area: Measured values and parameters according to the selected display mode (see 6.2.4)

Display of device data (see 6.2.1)

- Header: Title for the displayed device data
- Data area: Device data

Operating menue

- Header: Selected menue item
- Data area: Submenue or dialogue during setting procedure

6.2 Display Mode / Measured Value Display

After applying the supply voltage and completion of the initialisation, the device switches to the display mode. In the display, the currently measured value is shown.

If the measured value is larger than the displayable number due to setting a fixed decimal point, the largest displayable number is shown flashing. In this case please select a different setting of the decimal point.

In display mode you can review the device data, enter the menue or lock/unlock the menue.

Button	Function
△ / ▽	Scroll through the pages with device data
OK	Go to the operating menue
ESC	Return to measured value display
ESC+OK	Activate / deactivate menue lock (see 6.3.2)

Table 2: Button functions in display mode

6.2.1 Quick Access to Device Data

You can access a number of device parameters directly from the measured value display using the △ / ▽-buttons. This allows a quick overview of the device configuration.

With the △-button you can display variable data (trailing pointers and counters), with the ▽-button static information such as configuration data.

From any screen of the device data, you can enter the operating menue with OK and go back to the measured value display by pressing ESC.

The sequence of the screens with device data is as follows:

- △ Counter (operating hour counter, maintenance timer)
- △ Trailing pointer (pressure and sensor temperature)
- ----- *Measured value display (starting point)* ---
- ▽ Pressure measurement (rel/abs, nominal range, measuring range, damping)
- ▽ Current output (characteristic curve, alarm current, limits)
- ▽ HART data (address, tag, descriptor, date)
- ▽ Device identification (device ID, order number, serial number)
- ▽ Module information (hardware and software versions, serial numbers)

6.2.2 Locking the Menue

You can lock the menue with a key combination at the device. Press and hold the ESC-key and press then OK to activate the menue lock. You can still access the device data but the menue is now locked.

An active menue lock is indicated by the header text „Menue locked“ in combination with the lock icon.

Use the same key combination to unlock the menu again. The menu cannot be unlocked with the key combination if the hardware DIP-switch is aktivated.

6.2.3 Icons indicating device status

In the top right corner of the display, depending on the device status an NE107-conform icon is displayed. The following icons are defined:

	Error/failure	Critical error, alarm current is activated The error description is indicated in the display. The operating menue can still be opened.
	Warning	Temperature or pressure limits are exceeded, faulty ATC sensor (for devices with the ATC option).
	Saturation	The output current has reached the pre-set upper or lower current limit.
	Function control	The output current corresponds to the measured value or current simulation, but not to the applied pressure value.
	Maintenance	The device indicates necessary maintenance due to maintenance timer settings (see 6.4.6.2).
	Write protection	The write protection of the device was activated via the DIP switch or with the key combination in the display.

Table 3: Icons for device state

The list of icons is sorted in descending priority. Only the icon with the highest priority is shown. The two most important icons for fault and/or warning are flashing when displayed.

6.2.4 Display layouts

You can configure the layout of the measured value display as well as the displayed information individually. There are five different layouts available:

Designation	Layout	Description	Example
Five values	1st value 2nd value | 3rd value 4th value | 5th value	Under the main value, four additional values are shown.	Value 1.23 bar P= 44.69% T= 22.7°C ID: ### I= 11.150mA
Four values	1st value 2nd value | 3rd value 4th value	Under the main value, three additional values are shown. One of these can use the entire display width.	Value 1.23 bar P= 44.69% T= 22.7°C ID: PASCAL CI4
Three values	1st value 2nd value 3rd value	Under the main value, two additional values are shown. Both of them can use the entire display width.	Value 1.23 bar Pressure = 44.69% Temperature = 22.7°C
Two values	1st value 2nd value	Two values are shown in the same size, one under the other.	Value 1.23 bar 44.69 %
Large display	1st value 2nd value | unit	The main value is shown at the maximum size (best readability from a distance). One additional value can also be shown.	Value 1.23 P= 44.69% bar

Table 4: Display layouts

You can define what information shall be shown in the layout's placeholders.

You can select the 1st value (main value) from the following data:

1. Pressure with the selected unit
2. Pressure in per cent of the measuring range
3. Pressure in milliampere

For all further values, you can additionally choose from the following data:

- Sensor temperature
- ATC temperature (for devices with the ATC option)
- Device ID (see 6.4.9.1)
- HART tag
- HART descriptor

When information (such as the device ID) cannot be displayed in a short layout placeholder, "###" appears on the screen. Then select another layout or assign the value to a longer layout placeholder.

You can configure the display mode in the operating menue (see 6.4.4.2).

6.3 Menue Mode / Operating Menue

Press OK in the measured value display to go to the operating menue. Then the main menue appears in the display.

In the operating menue you can navigate in the menus by using the arrow buttons. The selected menue item is indicated by triangles on the left and right. The OK button selects the menue item or switches to the corresponding submenue. You can return to the higher-level menue by pressing ESC. From the main menue, pressing ESC returns to the measured value display.

From every position in the operating menue, you can return to the measured value display by pressing and holding the ESC button (for at least one second).

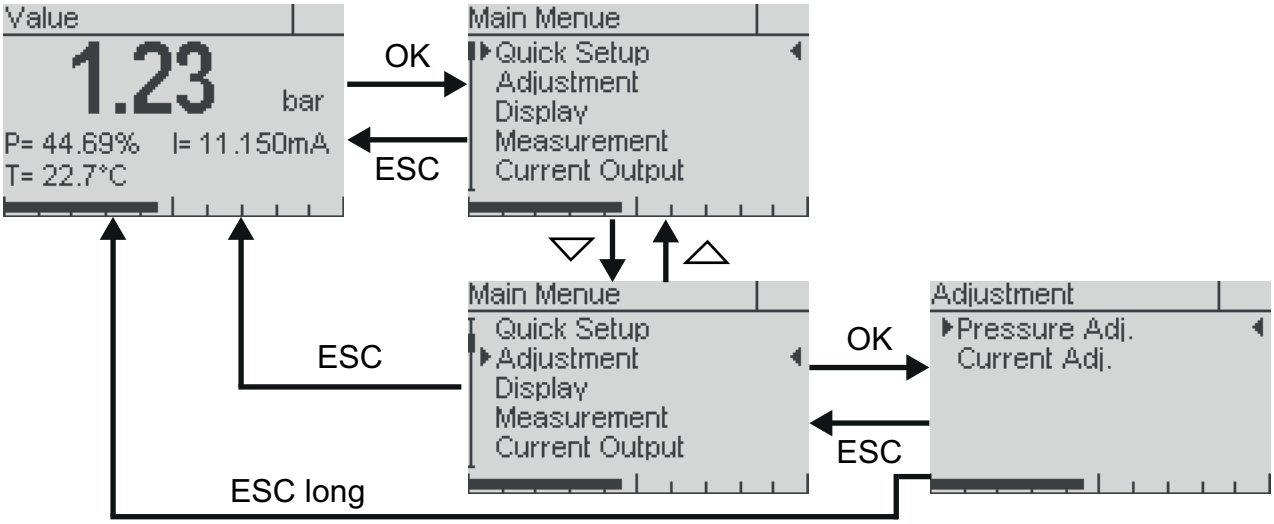


Figure 9: The Operating menue

In long menus and selection lists, a scroll bar on the left side shows the position of the currently selected item.

Menue items that open a setting dialogue differ from submenus by three trailing points, e.g. "Lower range …" (setting dialogue) and "System" (submenue).

If no button is pressed in menue mode for five minutes, the device automatically returns to the display mode without saving any values.

Button	**Function**
△	Scroll up in the menue, increase value/position in list
▽	Scroll down in the menue, decrease value/position in list
OK	Select menue, confirm value/list entry
ESC	Cancel the data entry or menue selection, return to the next higher menue
ESC long	Cancel menue mode, return to display mode

Table 5: Button functions in the operating menue

6.3.1 Displaying and entering parameters

When entering parameters, either numerical inputs or a selection lists with fixed options is available.

In general, the current setting will be displayed first (view mode). Press OK to switch to edit mode to change the parameter. After this is done, the display will then switch back to view mode so that you can check the new setting.

6.3.1.1 Selection of a value from a selection list

Up to three options are shown at the same time in one selection list. When the selection list is longer, a scroll bar on the left side of the display indicates the position of the selected item in the selection list.

When you press the ESC button, you cancel the entry and go back to view mode. The selected value is not saved.

With the OK button, the selected value is saved. Saving the value is confirmed with an information window and the new value is shown in view mode.

With ESC, you leave the view mode and return to the menue.

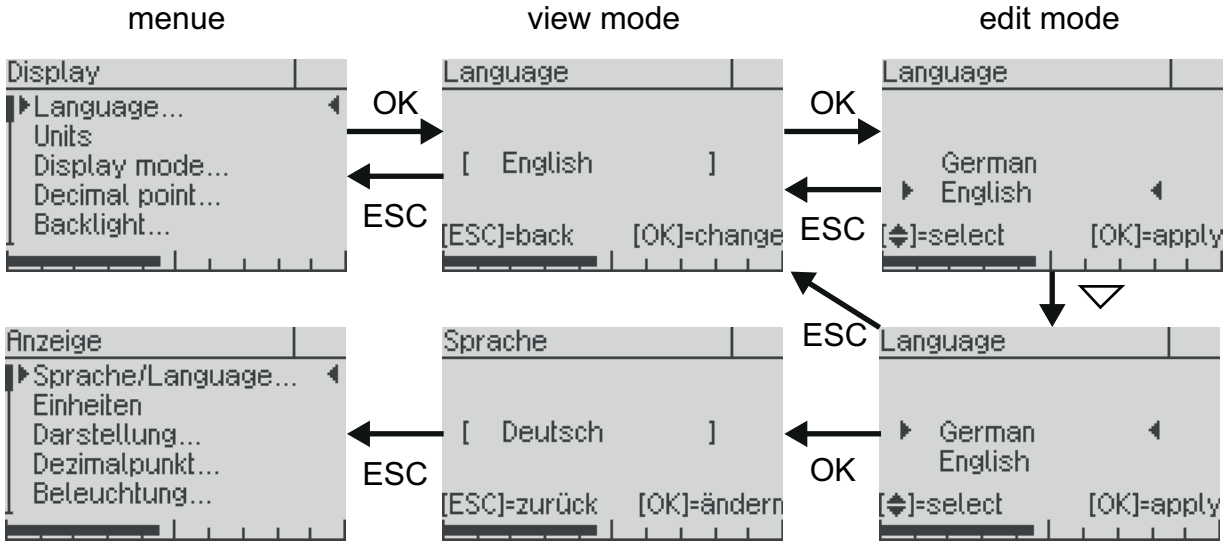


Figure 10: Procedure for value selection (e.g. changing language from english to german)

6.3.2 Setting a numeric value

When setting numeric values, the screen shows the following elements (from top to bottom):

- Designation of the parameter that can be set
- Help text (if applicable)
- Numeric value and unit
- Function of buttons
- Bar graph

After selecting a menue item for numerical entry (e.g. damping), at first the value is only displayed. The numeric value itself is shown in square brackets and its the unit below. Unused leading digits are marked with bottom lines. You need to press OK again to enter the edit mode.

Numeric values are entered digit by digit. First, always the leftmost digit is selected (visible with two triangles above and below the number). By pressing OK, you go to the next digit.

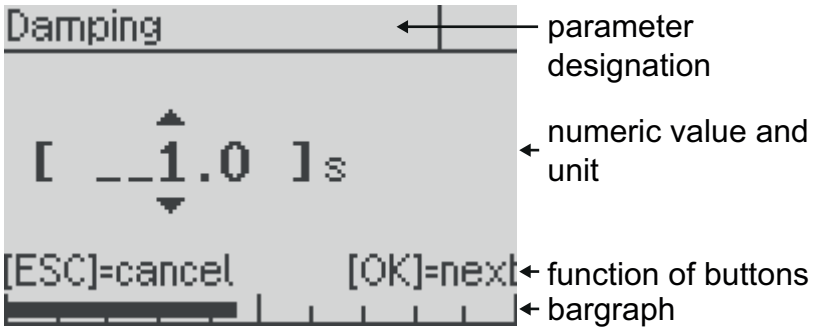


Figure 11: Elements when setting a numeric value

You change the selected digit by pressing the △ or ▽ button. The higher value digit is also increased or decreased when passing zero. For instance, you can easily go from 19 to 20 without having to edit two digits.

Lower value digits are not influenced, unless the parameter limit is reached. The value is then set to the parameter limit.

You can set negative numbers by decreasing the value below zero.

When you press the ESC button, you can cancel the entry at any time and return to the display of the set value. Any change of the value is not saved.

With the OK button you confirm the set digit value and jump to the next digit.

When you confirm the rightmost digit, the entire value is saved. You can save the new value from any digit by pressing and holding the OK button.

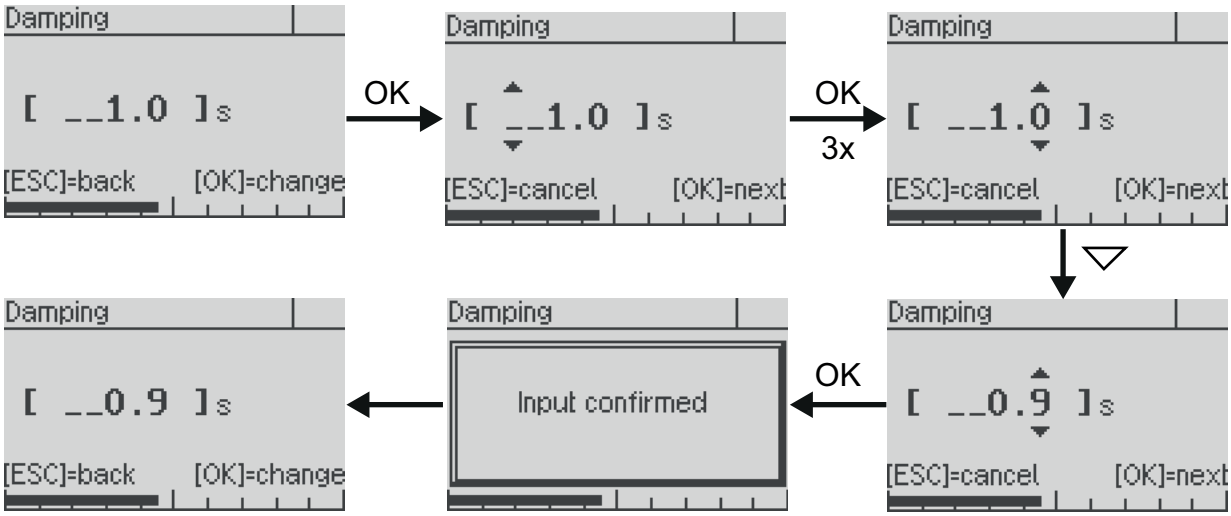


Figure 12: Procedure for setting a numeric value (e.g. from 1.0 to 0.9)

6.4 The Menue Tree

In the following, the display and adjustment options are described by their position in the menue tree. An overview of the menue tree can be found on the last page of this document.

6.4.1 Main menue

The main menue has the following entries:

Menue entry	Description
Quick setup	Selection of the most important settings
Adjustment	Adjustment functions for pressure measurement and current output
Display	Functions for configuring the display
Measurement/output	Configuration of the pressure measurement and current output
Diagnosis	Diagnostic information such as min/max values
Simulation	Simulation of pressure and current for function check of the measurement chain
Communication	Information and settings regarding HART communication
System	Device data and function such as factory reset

Tabelle 6: The main menue

6.4.2 "Quick Setup" menue

In Quick Setup, basic configuration options are combined to make it possible to quickly configure key functions. All functions of the quick setup can also be found at another position in the menue tree.

The following functions are available in the Quick Setup menue:

Menue entry	Description
Sprache/Language	Select menue language
Unit Pressure	Select unit for measured pressure (see 6.4.4.1)
Unit Temperature	Select unit for sensor temperature and for ATC-temperature (if applicable) (see 6.4.4.1)
Lower Range Value	Setting of the pressure value that should correspond to 4 mA (start of range) (see 6.4.5.3)
Upper Range Value	Setting of the pressure value that should correspond to 20 mA (end of range) (see 6.4.5.3)
Damping	Setting the damping of the output signal (see 6.4.5.1)
Device ID	Setting the device ID (see 6.4.9.1)
Config.-memory	Configuration memory: reading, writing and status (see 6.4.9.3)

Table 7: "Quick Setup" menue

6.4.3 "Adjustment" menue

The following functions are available for the adjustment:

Menue entry	Description
Zero point	Set device at ambient pressure to zero (0 bar rel) *(not with absolute pressure devices)*
Position correction	Correct zero point error due to installation position *(not with absolute pressure devices)*
Lower adjustment	Offset correction with applied reference pressure
Upper adjustment	Span correction with applied reference pressure

Table 8: "Pressure Adjustment" menue

6.4.3.1 Zero-point correction

The zero-point correction requires a non-pressurized pressure port e.g. during calibration in the lab. When executing this function the applied pressure will be interpreted as zero bar relative pressure.

The zero point correction results in an offset of the whole characteristic curve. Therefore it is a special case of the lower adjustment (see below).

6.4.3.2 Position correction

Using the function "Position correction", you can correct the offset error due to the installation position independent of the zero-point offset.

In the corresponding submenue, you will find the following entries:

Menue entry	Description
Pos.corr. on/off	Activate/deactivate position correction
Set pos. corr.	Correct position error at ambient pressure

Table 9: "Position Correction" submenue

When you set the position correction, it will be activated automatically. You can deactivate the position correction, for instance for a subsequent calibration to check the zero point independently from the installation position.

6.4.3.3 Upper and lower adjustment

The lower adjustment results in an offset of the characteristic curve. It thus affects zero and span of the measuring range.

The upper adjustment changes the slope of the characteristic curve by correcting the span of the measuring range.

Execute the lower adjustment prior to the upper adjustment for a correct full adjustment.

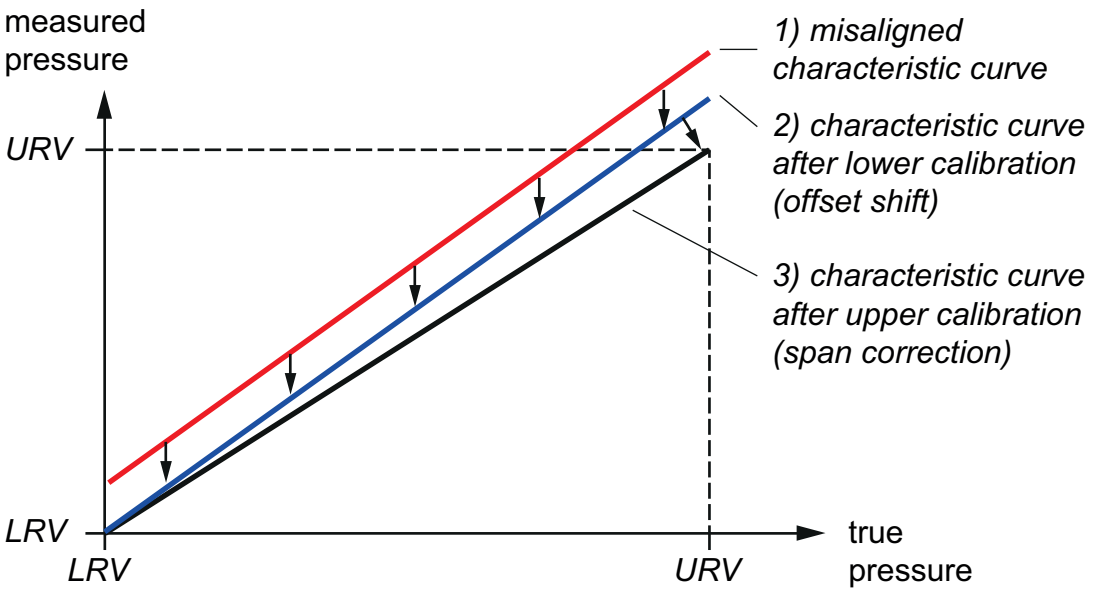


Figure 13: Effect of the upper and lower adjustment on the characteristic curve

You can perform the upper and lower adjustment at any reference pressure level. For instance, you can perform the lower adjustment of a -1…4 bar device at -900 mbar rel. The reference pressure level for the upper offset can also be freely chosen. For an exact adjustment, however, it should be as close to the upper range value as possible.

6.4.3.4 Current adjustment

You can use the current adjustment, if the reading at the end of the measurement chain (re-converted current value) does not correspond to the measured pressure. With this function you can compensate deviations in the output stage as well as the downstream measurement chain.

Proceed as follows (example for 4 mA):

- Select function "Current adjustment" –> "4mA"
- Use "OK" to activate constant current mode (4 mA). CAUTION! The output current value now no longer corresponds with the measured pressure! This is indicated by the icon "Function check" (see 6.2.3).
- Read the displayed current value at the end of the measurement chain.
- Enter this current value (e.g. 3.996) at the device. The device now corrects the current output so that 4 mA are shown at the end of the measurement chain.

When leaving the function, the constant current mode is disabled and the current value corresponds again to the measured pressure.

6.4.4 "Display" menue

In the "Display" menue, you find all the settings that affect the display on the screen.

Menue entry	Description
Language	Select menue language
Units	Setting units for the different measured variables and display sizes
Display mode	Configuration of the display layout and content (see 6.2.4)
Decimal point	Select setting of decimal point to determine number of decimal places
Backlight	Switch backlight on/off

Table 10: "Display" menue

6.4.4.1 "Units" submenue

You can select the unit of every value for the display. These settings do not affect the internal calculations of the device.

The shown conversions are only meant for your orientation. The device uses conversion values with ten decimal places.

The unit selection in this submenue only affects the display on the screen. Communication via HART is performed using the unit set in the HART driver.

Unit Pressure

The unit in which the measured pressure is to be shown can be selected from the following list:

Unit	Description
mbar	Millibar (1 mbar = 0,001 bar)
bar	Bar (1 bar = 1000 mbar = 10^5 Pa)
Pa	Pascal (1 Pa = 1 kg/(m*s^2) = 10^{-5} bar = 0,01 mbar)
hPa	Hectopascal (1 hPa = 100 Pa = 1 mbar)
kPa	Kilopascal (1 kPa = 1.000 Pa = 10 mbar)
MPa	Megapascal (1 MPa = 1.000.000 Pa = 10 bar)
g/cm^2	Gram per square centimetre (1 g/cm^2 = 0,981 mbar)
kg/cm^2	Kilogram per square centimetre (1 kg/cm^2 = 0,981 bar)
psi	Pound force per square inch (1 psi = 68,9 mbar)
atm	Atmospheric pressure (1 atm = 1013 mbar)
mmH_2O	Millimetre water column (1 mmH_2O = 0,0981 mbar)
mH_2O	Metre water column (1 mH_2O = 98,1 mbar)
inH_2O	Inch water column (1 inH_2O = 2,49 mbar)
ftH_2O	Foot water column (1 ftH_2O = 29,84 mbar)

Unit	Description
torr	Torr (1 Torr = 1 mmHg = 1,33 mbar)
mmHg	Millimetre mercury column (1 mmHg = 1,33 mbar)
inHg	Inch mercury column (1 inHg = 33,86 mbar)

Table 11: Possible units for pressure

Unit Temperature

The unit in which the temperature is to be shown can be selected from the following list:

Unit	Description
°C	Degree Celsius
°F	Degree Fahrenheit ($T_{Fahrenheit} = T_{Celsius}*1,8 + 32$)
°R	Degree Rankine ($T_{Rankine} = T_{Kelvin}*1,8$)
K	Kelvin ($T_{Kelvin} = T_{Celsius} + 273,15$)

Table 12: Possible units for temperature

6.4.4.2 “Display mode” submenue

In the "Display mode" submenue, you configure the representation of the measured values and additional information on the display.

With the menue item “Screen layout” you configure the information that is displayed and its layout. Up to five values can be displayed at the same time. In the additional menue entries "1st value" to "5th value" you define the contents of the placeholders in the layout.

The various layouts as well as the possible content of the values are described in Chapter 6.2.4.

6.4.5 "Measurement/Output" menue

Configure the measured value as well as the current output in the "Measurement/output" menue.

Menue entry	Description
Damping	Setting the damping of the output signal
Measuring rate	Setting the measuring rate (20 or 100 Hz)
Output function	Setting the output function (linear, inverse, square root, table)
Lower Range Value	Setting the pressure value that shall correspond to 4 mA (start of range)
Upper Range Value	Setting the pressure value that shall correspond to 20 mA (end of range)
Table	Specifying the points for the table function
Alarm current	Select the alarm current: High (>21 mA) or low (<3.6 mA)
Lower current limit	Limit of the lower output current (3.8…4.0 mA)
Upper current limit	Limit of the upper output current (20…21 mA)

Table13: "Measurement/Output" menue

Independent from the setting of the upper and lower current limit, the set measuring range always corresponds to a current range of 4…20 mA.

6.4.5.1 Setting the damping

Using an adjustable damping you can eliminate fast pressure changes or peaks from having direct influence to the output signal. The set value in seconds corresponds to the time constant of an exponential rise. After a sudden pressure change, it takes the damping time to reach 63.2% of the actual pressure at the output. After the damping time has elapsed three times, 95% of the pressure is reached.

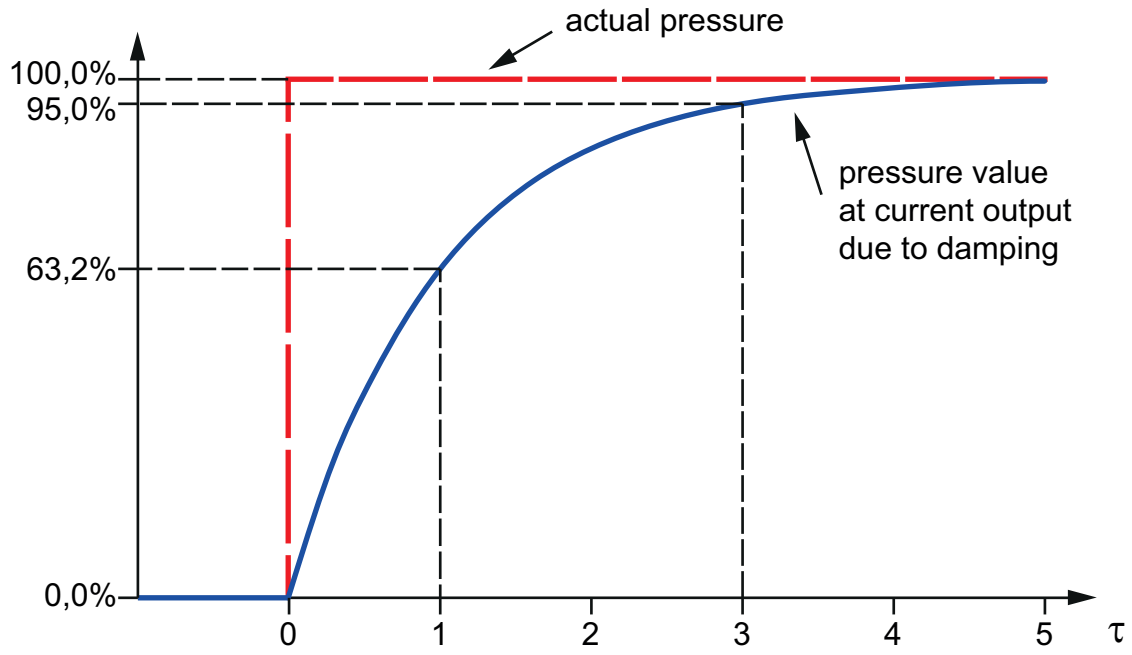


Figure 14: Damping effect

The damping affects the current output as well as the displayed pressure value.

6.4.5.2 Setting of the measuring rate

When shipped, the transmitter is set to a measuring rate of 20 Hz, i.e. 20 times per second the pressure is measured and the current is calculated and imprinted in the current loop. When a particularly fast measuring rate is required, for instance to detect pressure peaks, you can increase the measuring rate to 100 Hz. This can lead to the following restrictions:

- Communication via HART can be disturbed by fast pressure changes.
- The measuring signal can be noisier.

For this reason, you should only increase the measuring rate to 100 Hz if necessary for the application.

6.4.5.3 Setting the measurement range

You can freely set the lower and upper range value within the nominal range of the device, as long as the set range is not smaller than 1% of the nominal range (turndown 100:1). Please note that when the turndown is increased, the measurement error also increases. If you use a very small range you must therefore accept a significant measurement error. We recommended a maximum turndown of 10:1.

The lower range value must be below the upper range value. For an inverse characteristic curve, select the output function setting “inverse”.

6.4.5.4 Configuration of the table function

With the table function you can realise any output function. E.g. you can convert the fill height to the fill quantity depending on the tank shape. You can use up to 64 interpolation points for this purpose.

We recommend the use of a PASCAL Ci4 LEVEL device for fill level applications. Its operating software has been specially optimised for fill level applications.

Menue entry	Description
Number of points	Number of interpolation points
Table values	Combination of pressure in per cent and corresponding current value that are used as interpolation points of the table function

Table 14: "Output Table" submenue

You can only edit the table points when the table function is not active. You may need to set the output function to "linear", for instance (see above) before editing table points.

The table points must be sorted according to ascending pressure. For instance, the 20% point may not be before the 10% point. Otherwise you cannot activate the table function.

If the first table point is not set at 0%, the start of the table is calculated by means of the first two interpolation points. The same applies when the last table point is not at 100%.

With the △- and ▽- buttons, you can scroll through the table points and look at the combinations of pressure in per cent and current in mA. With OK, you switch to the edit mode for the displayed table point. Now enter the first per cent value and then the current value. When you confirm the current value, you return to the display of the table point you just edited.

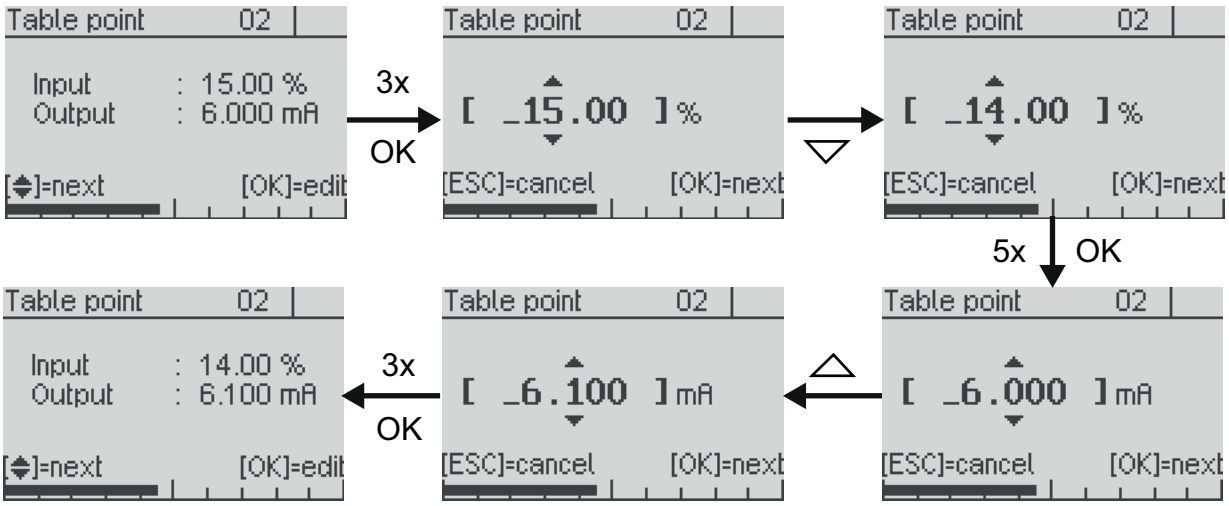


Figure 15: Changing the table point

Confirming inputs with a long OK is not available when editing table points.

6.4.5.5 Upper and lower current limit

In the standard setting, the current output is limited at 3.8 and 20.5 mA, meaning a further drop or rise in the measured variable does not change the current. You can freely select these current limits for the lower limit between 3.8 and 4 mA and for the upper limit between 20 and 21 mA.

6.4.6 "Diagnosis" menue

In this menue you can view and configure various diagnostic information. The following diagnostic functions are available:

Menue entry	Description
Counter	Display of operating hour counter and maintenance timer
Min/max values	Displaying and resetting the min/max values for the different measured variables
Last error	Display and reset of the last critical error
Self test	Self test of the device like after applying the power supply
Maintenance timer	Management of maintenance intervals

Table 15: "Diagnosis" menue

6.4.6.1 Min/Max values

The min/max values save the maximum and minimum values of the different measurands until they are reset by the user. The menue item that shows the min/max value, can also be used to reset it. Some of the min/max values are also directly accessible from the measured value display in the device data (see 6.2.1).

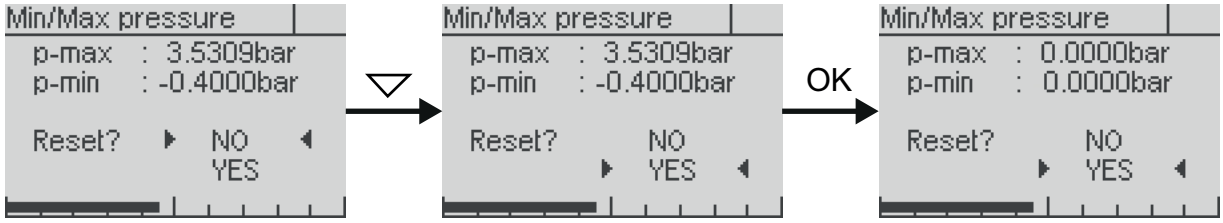


Figure 16: Display and resetting of the Min/Max values for pressure

6.4.6.2 The maintenance timer

Using the maintenance timer, the device can signal the need for maintenance after a freely selectable number of operating hours. The timer counts down from the start value. Maintenance need is indicated by an icon in the display (see 6.2.3) and, if necessary, the HART protocol.

When the maintenance timer has expired, the counter continues into the minus range thus the degree to which the interval has been exceeded is also visible.

Menue entry	Description
Current simulation	Setting a fixed current value
Pressure Simulation	Setting a fixed pressure value

Table 16: Maintenance timer" submenue

6.4.7 „Simulation“ menue

In the "Simulation" menue, you can simulate the pressure as well as the current to test the subsequent measuring chain.

Menue entry	Description
Current simulation	Setting a fixed current value
Pressure simulation	Setting a fixed pressure value

Table 17: "Simulation" menue

The current simulation influences only the current output. The pressure simulation takes all settings into consideration, including the damping and an active table function.

6.4.8 Communication menue

In the "Communication" menue the settings for the HART communication are summarised.

Menue entry	Description
HART address	Setting the HART address for device identification in multi-drop mode
Current mode	Setting the current mode (proportional/constant)
HART data	Display of HART information (HART tag, HART descriptor, etc.)
Send-preambles	Setting of the number of send-preambles for HART communication

Table 18: "Communication" menue

6.4.8.1 HART address

This address corresponds with the short address which is used for the HART-Communication. It can be set within a range of 0 to 63. Please note, that setting the short address between 1 and 63 will not automatically activate the constant current mode. This must be done under the menue “Current mode” (see Chapter 6.4.8.2).

6.4.8.2 Current mode

The current mode determines whether the output current of the device is set to respond proportionally to the pressure (selection “proportional”) or whether it should remain constant at 4 mA (selection “constant”). When the current mode “constant” is in use the measurement value can be read using HART only (e.g. for HART-multidrop-operation).

6.4.9 "System" menue

In the "System" menue, device-relevant functions are summarised.

Menue entry	Description
Device ID	Setting the device ID (e.g. to display a free-text in the display)
Device data	Display of device data (such as from measured value display)
Factory data reset	Reset to factory settings
Restart	Restarting the device (such as after a power outage)
Config.-memory	Configuration memory: reading, writing and status

Table 19: "System" menue

6.4.9.1 Device ID

Using the device ID, you can show a custom text in the display if you configure the display mode accordingly (see 6.2.4). For instance, you can show the tag number continuously in the display.

The device ID can be up to 16 characters long and consist of numbers, empty spaces, capital letters and special characters.

For the selection, the characters are arranged in the order shown below. From the end of the list (special character "@"), you are automatically guided back to the start (number "0").

Character set:

0123456789 ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_!“#$%&‘()*+,-./:;<=>?@

6.4.9.2 Factory reset

When carrying out a factory reset, all parameters are set to the state at the time of delivery. This also includes the pressure and current adjustment. Exceptions are the following operational parameters: “Min/max values”, “change counter” and “operation hours”.

6.4.9.3 Configuration memory

You can store all device parameters in the configuration memory of the display module. You can transfer the data back to the device or to another device. Transferring a configuration to another device requires a compatible target device. The same nominal range is not necessary. It is sufficient if the measuring range of the stored configuration is equal or smaller than the nominal range of the target device.

The configuration memory contains the parameter setting of the device at the time of storage. If you change a device parameter afterwards, the stored configuration will not be updated automatically.

The status screen of the configuration memory contains the following information:

- Available — YES: the display module contains a stored configuration
  NO: no stored configuration
- Source — this device: the stored configuration originates from the connected device
  Serial#: the stored configuration originates from the device with the listed serial number.
- Up-to-date — YES: The device configuration has not been changed since the parameter set has been stored in the display module
  NO: The device configuration has been changed

The transfer of a configuration takes approx. 25 seconds. If you use a table function with many support points the transfer can take up to 50 seconds.

6.4.10 Overview with menue tree and device functions

Quick Setup	
Language…	Select menu language
Pressure unit…	Select unit for measured pressure
Temperature unit…	Select unit for sensor temperature
Lower range value…	Setting of the pressure value that should correspond to 4 mA (start of range)
Upper range value…	Setting of the pressure value that should correspond to 20 mA (end of range)
Damping…	Setting the damping of the output signal
Device ID…	Setting the device ID
Config.-memory	Configuration memory: reading, writing and status
Adjustment	
Pressure adjustment	Adjustment of the pressure measurement
Zero point…	Set device at ambient pressure to zero (0 bar rel) (only for gauge pressure devices)
Position correction	Correct zero point error due to installation position (only for gauge pressure devices)
Pos.corr on/off…	Activate/deactivate position correction
Pos.corr adjust…	Correct position error at ambient pressure
Lower adjustment…	Offset correction with applied reference pressure
Upper adjustment…	Span correction with applied reference pressure
Current adjustment	Adjustment of the current output
4 mA…	Justieren des Stromausgangs auf 4 mA am Ende der Messkette
20 mA…	Justieren des Stromausgangs auf 20 mA am Ende der Messkette
Display	
Language…	Select menu language
Units	Select units for measured values
…	*Select units for pressure and temperature*
Display mode	Configuration of the display layout and content
Screen layout…	Define screen structure and layout
1st value…	Content for 1st value in the selected layout
…	*Content for further values (up to five)*
Decimal point…	Selection of the decimal places by specifying the decimal point
Backlight…	Switch backlight on/off
Measurement/Output	
Damping…	Setting the damping of the output signal
Measuring rate…	Setting of the measuring rate (20 or 100 Hz)
Output function…	Setting the output function (linear, inverse, square root, table)
Lower range value…	Setting of the pressure value that should correspond to 4 mA (start of range)
Upper range value…	Setting of the pressure value that should correspond to 20 mA (end of range)
Table	Specifying the interpolation points for the table function
Number of points…	Number of interpolation points (2..64)
Table values…	Interpolation points of table function
Alarm current…	Selection of the alarm current: High (>21 mA) or low (<3.6 mA)
Lower current limit…	Limit of the lower output current (3.8…4.0 mA)
Upper current limit…	Limit of the upper output current (20…21 mA)
Diagnosis	
Counters…	Display of operating hour counter and maintenance timer
Min/max-values	Display and reset of min/max-values
…	*Display and reset the different min/max-values*
Last error…	Display and reset of the last critical error
Self test…	Self test of the device like after applying the power supply
Maintenance timer	Management of maintenance intervals
Status…	Displaying and stopping the maintenance timer
Set interval…	Setting and starting the maintenance timer
Simulation	
Loop-test…	Setting a fixed current value
Pressure simulation…	Setting a fixed pressure value
Communication	
HART address…	Setting the HART address for device identification in multi-drop mode
Current mode…	Setting the current mode (proportional/constant)
HART data…	Display of HART information (HART tag, HART descriptor, etc.)
Send-preambles…	Setting of the number of send preambles for HART communication
System	
Device ID…	Setting the device ID (e.g. to display a free-text in the display)
Device data…	Display of device data (same as from measured value display)
…	Various screens with device data
Factory reset…	Reset to factory settings
Device reset…	Restarting the device (such as after a power outage)
Config.-memory	Configuration memory: reading, writing and status