AccuFlo®HMP

Highly accurate flow and mass flow measurement
for gas, liquids and steam

Operating and assembly instructions

Attention:

Before commissioning, follow the instructions on pages 5 and 6!

Contents

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1 General information

1.1 Explanation of symbols

Attention: Warning of a danger point (Attention, observe documentation!)
ISO 3864, No. B.3.1

Warning: Warning of dangerous electrical voltage
ISO 3864, No. B.3.6

1.2 Intended use

The AccuFlo®HMP is used for high-precision flow measurement of gas, vapor or liquid quantities. The device may only be used for the purposes specified in these instructions. Unless expressly mentioned in these instructions, all modifications to the device are the responsibility of the user.

1.3 Safety instructions

This appliance has left the factory in a technically safe condition. To maintain this condition and to ensure safe operation of the appliance, please observe the following instructions:

- This device may only be set up and operated in conjunction with this documentation.
- Proper and safe operation of this appliance requires proper transportation, storage, installation and assembly as well as careful operation and maintenance by qualified personnel.
- The device may only be used for the individual cases specified in the technical description and only in conjunction with third-party devices and components recommended or approved by S.K.I. GmbH.
- The test certificates, regulations and laws applicable in your country must be observed during connection, installation and operation.
- The appliance can be operated with high pressure as well as aggressive and hazardous media. Therefore, improper handling of this appliance may result in serious physical injury and/or considerable damage to property. This is particularly important if the appliance has been in use and is replaced.
- This appliance may only be installed and operated if qualified personnel have previously ensured that suitable power supplies (see nameplates) are used to ensure that no dangerous voltages can reach the appliance during normal operation or in the event of a fault in the system or system components. Therefore, improper handling of this appliance may result in serious injury and/or considerable damage to property.

1.4 Qualified personnel

Installation and commissioning may only be carried out by qualified personnel. These are persons who are familiar with the installation, assembly, commissioning and operation of the product and who have the appropriate qualifications for their work, e.g.:

- Training or instruction or authorization to commission, ground and label devices/systems in accordance with the safety engineering standard for electrical circuits.

- Training or instruction in accordance with safety engineering standards in the care and use of appropriate safety equipment
- First aid training

1.5 Further information

For reasons of clarity, the instructions do not contain all detailed information on all types of the product and cannot take into account every conceivable application for operation or maintenance.

If you are interested in further information or if you have specific problems that are not covered in detail in the instructions, you can request the necessary information directly from S.K.I. GmbH.

Furthermore, it is pointed out that the content of the instructions is not part of a previous or existing agreement, commitment or legal relationship or is intended to change these. All obligations of S.K.I. GmbH arise from the respective purchase contract, which also contains the complete and solely valid warranty regulation.

These contractual warranty provisions are neither extended nor limited by the explanations in the instructions.

The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

1.6 Special warnings

Electricity: Warning of electrical voltages. The system must be de-energized before any work is carried out on the wiring.

Exceeding or falling below the permissible operating temperature: Suitable measures must be taken to ensure that the temperature does not exceed or fall below the permissible operating temperature.

Damage: The components must not be subjected to any improper mechanical loads, such as those that occur in the event of a fall, and no impermissible forces must be exerted on them.

Excessive number of load cycles: Suitable measures must be taken to ensure that the permissible number of load cycles is not exceeded. The requirements of EN 13480-3; 10.2 c) must be observed with regard to load cycles.

Opening under pressure: Suitable measures must be taken to ensure that the pipeline is not opened under pressure.

Improper installation of the device: Suitable measures must be taken to ensure that the device, including all components, is installed properly.

Corrosion: Care must be taken to ensure that the components are used and deployed for their intended purpose.

Other hazards: Ensure that the manufacturer’s instructions for use are always observed.

2 Incoming goods inspection

Please check the scope of delivery for the following items:

<table>
<tr><th colspan="2">AccuFlo®HMP</th></tr>
<tr><td rowspan="4"> 
1. AccuFlo®HMP for gas, liquids OR

 
1. AccuFlo®HMP for steam

 
2 AccuMind®</td><td>1. AccuFlo®HMP for flow measurement</td></tr>
<tr><td>2. Flow computer AccuMind®</td></tr>
<tr><td>3. Documentation</td></tr>
<tr><td>4. Warnings for securing during transportation</td></tr>
</table>

3 Mounting instructions

When installing the AccuFlo®HMP, the following points must be observed:

- The AccuFlo®HMP must be installed so that the attached flow arrow points in the direction of flow of the medium.
- If the AccuFlo®HMP is a special version on customer request, the installation position can be seen from the approved drawing. The following paragraphs apply to all other versions:
- The AccuFlo®HMP must be installed with the extension facing downwards for applications in horizontal pipes with liquid media.
- For applications in vertical pipes with liquid media, the AccuFlo®HMP must be installed so that the extension is aligned laterally. The differential pressure transmitter must be at the lowest point.
- For applications in horizontal or vertical pipes with steam, the AccuFlo®HMP must be installed so that the extension is aligned laterally. The differential pressure transmitter must be at the lowest point.
- For applications in horizontal pipes with gaseous media, the AccuFlo®HMP must be installed with the extension facing upwards.
- For applications in vertical pipes with gaseous media, the AccuFlo®HMP must be installed so that the extension is aligned laterally. The differential pressure transmitter must be at the highest point.
- The AccuFlo®HMP must be installed flush with the existing piping system.
- As part of the leak test, all screw connections inside the AccuFlo®HMP must be checked and tightened if necessary.
- If unexpected problems occur during commissioning that cannot be solved with the help of these instructions, you will find further information in the supplementary documentation or contact the manufacturer.
- Special features of steam applications:

  - The AccuFlo®HMP must be fitted with thermal insulation to ensure that users are protected from impermissibly high temperatures and to ensure that condensation only occurs in the condensing vessels.
  - An AccuFlo®HMP for steam is always supplied with a compact head with integrated condensing vessels and a welded-on 5-way valve block. The horizontal alignment of the compact head can be checked very easily during installation using a spirit level. Due to the low condensate deposits, the condensing vessels integrated in the compact head must be filled with water via the blow-off valves integrated in the 5-way valve block (these are the two external valves) before the measurement is started up. The blow-off valves must be closed after filling.

  - Filling is only permitted if the water pressure is greater than the steam pressure, otherwise steam may escape. Therefore, filling should normally only be carried out with an unpressurized steam line. If filling is to take place under steam pressure, the valves to the transmitter must initially remain closed in order to protect the transmitter from overheating. When there is enough water in the system to fill the transmitter chambers, the valves to the transmitter must be opened. The condensing vessels must then be refilled. Due to the small volumes, only small amounts of water are required for filling.

Note: The middle valve may generally only be opened when the other valves are closed.

4 Electrical connections and installation of the flow computer

4.1 Installation location of the flow computer

The AccuFlo®HMP is supplied together with a flow computer (AccuMind®) (see Figure 1). This flow computer converts the data from the sensors into flow rates. It should be installed in an area protected from environmental influences.

Figure 1: Flow computer AccuMind®

Only the features of the AccuMind® that are relevant for operation with the AccuFlo®HMP are described below. A detailed description can be found in the separate AccuMind® manual.

4.2 Assembly of the flow computer

The flow computer is mounted in a panel cut-out measuring 136.5 mm × 70.0 mm (width × height). The permissible tolerances when making the cut-out are +/−1 mm in width and +/−3 mm in height.

For installation, the two brackets on the edge are removed by pushing them forwards. The device is then pushed into the control panel from the front. The brackets are then reinserted and the screws tightened.

4.3 Electrical connection

All electrical connections are described in the following chapter. These can be subdivided into the following parts:

- Supply of the AccuMind®
  - The AccuMind® requires a power supply of 90-250 V AC or 24 V DC according to the nameplate.

- Supply of the AccuFlo®Zero
  - If an AccuFlo®Zero for automatic zero-point calibration is part of the AccuFlo®HMP, an additional 24 V DC power supply (e.g. a 24 V DC power supply unit with I = 1 A) is required. The power supply is provided via a 2-wire cable to the AccuFlo®HMP

- Cables from the AccuFlo®HMP to the AccuMind® can be combined in an 8 or 12-core system cable. This then contains the wires listed below:
  - 2 wires for the pressure transmitter
  - 4 wires for the resistance thermometer
  - 2 wires for the differential pressure transmitter
  - 4 wires for controlling the optional AccuFlo®Zero

- To the control system (PLC)
  - 2 wires for the analog 4-20 mA output
  - Further signals if required

4.4 Connections on the AccuMind®

The terminals/connections on the AccuMind® can be divided into four areas. These are shown in Figure 2 highlighted in color:

Range	Color
Power supply terminal	orange
Main terminal strip	blue
Ethernet connection/USB socket	green
D-Sub connection (optional)	red

The terminals for the power supply unit and the main terminal strip are pluggable. The power supply terminal is additionally secured with screws.

The terminals/connections are located on the back.

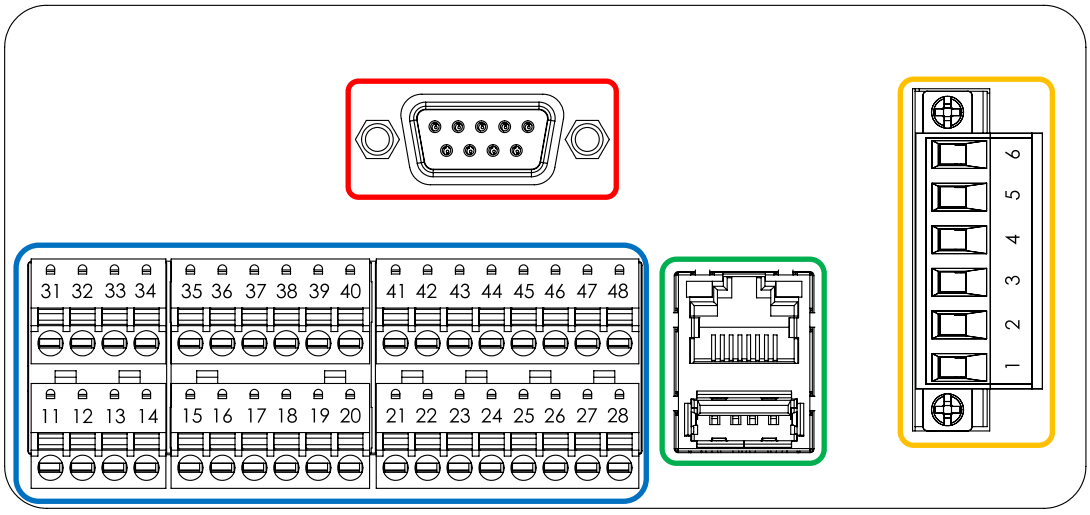

Figure 2: Back of the AccuMind®

4.5 Nameplate

Figure 3 shows an example of an AccuMind® nameplate. The nameplate is located on the top.

The serial number (“SN”) and the year of production (“Yr. of prod.”) of the AccuMind® can be read on the nameplate. The basic technical specifications can also be found. The terminal assignment can be found in the printed table. Further information on the connection can be found in the following sections.

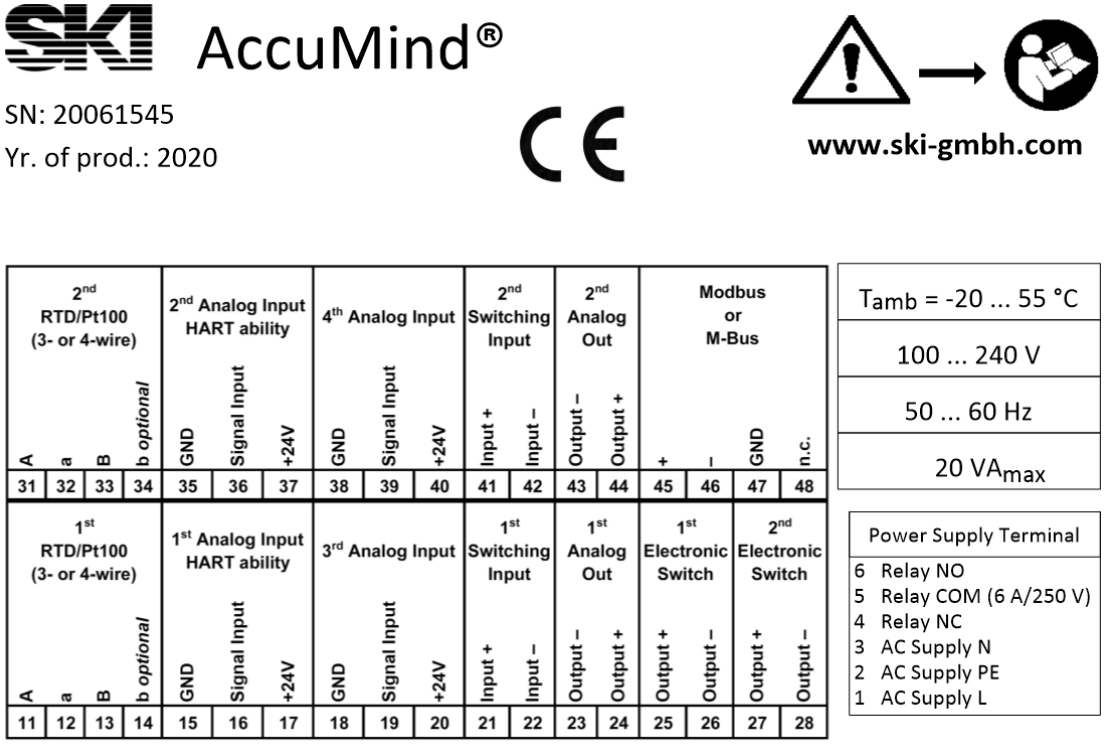

Figure 3: Nameplate of the AccuMind®

4.6 Power supply terminal for power supply

Power supply terminal for AC connection

Pin	Function
1	L
2	PE
3	N

Power supply terminal for DC connection

Pin	Function
1	Not used
2	GND
3	L+

The nameplate indicates whether the AccuMind® is for AC operation (alternating voltage) or DC operation (direct voltage). Only the information on the nameplate of the device applies.

4.7 The terminals in the AccuFlo®HMP

The terminals are located behind the round cover labeled “AccuFlo®HMP”. The right-hand (free) side of the terminal strip must be used. The two cable glands on the left and right side can be used.

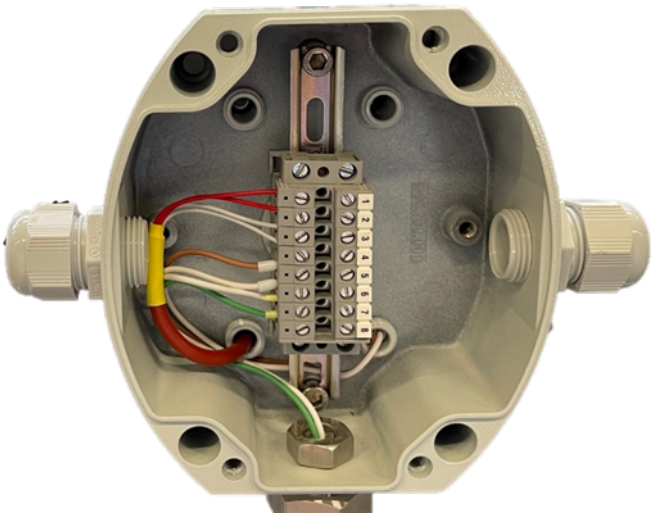

Figure 4: Terminals in the AccuFlo®HMP

4.8 Connection between the AccuFlo®HMP and the AccuMind®

Terminal in HMP	Terminal on the component	Terminal on the AccuMind (A) or power supply unit (PSU)	Function
1	red	A.11	Pt100 resistance thermometer in 4-wire circuit
2	red	A.12	
3	white	A.13	
4	white	A.14	
5	+	A.17	Differential pressure transmitter
6	–	A.16	
7	+	A.20	Pressure transmitter
8	–	A.19	
9	6, 9, T+	PSU.+	Drive of the AccuFlo®Zero (optional)
10	–	PSU.–	
11	10	A.21	
12	7	A.41	
13	+R	A.6	
14	+L	A.4	

4.9 Connection between the AccuMind® and the control system

Terminal on the AccuMind	Designation	Function
23	Output –	Analog output 1
24	Output +	

Terminal on the AccuMind	Designation	Function
43	Output −	Analog output 2 (if required)
44	Output +	
25	Output +	Electronic relay 1 (if required)
26	Output −	
27	Output +	Electronic relay 2 (if required)
28	Output −	
45	+	Modbus RTU or M-Bus (order option; if required)
46	−	
47	GND	

Modbus TCP can also be used via the Ethernet connection (if required).

Note: Information on the digital interfaces can be found in section 10 of the AccuMind operating instructions.

4.10 Wiring overview

The following circuit diagrams show the general electrical wiring of the AccuFlo®HMP (without and including the optional AccuFlo®Zero) with the AccuMind® and the power supply.

Note: The system operator is responsible for converting this into a circuit diagram that takes into account the actual conditions on site (e.g. the terminals in the control cabinet).

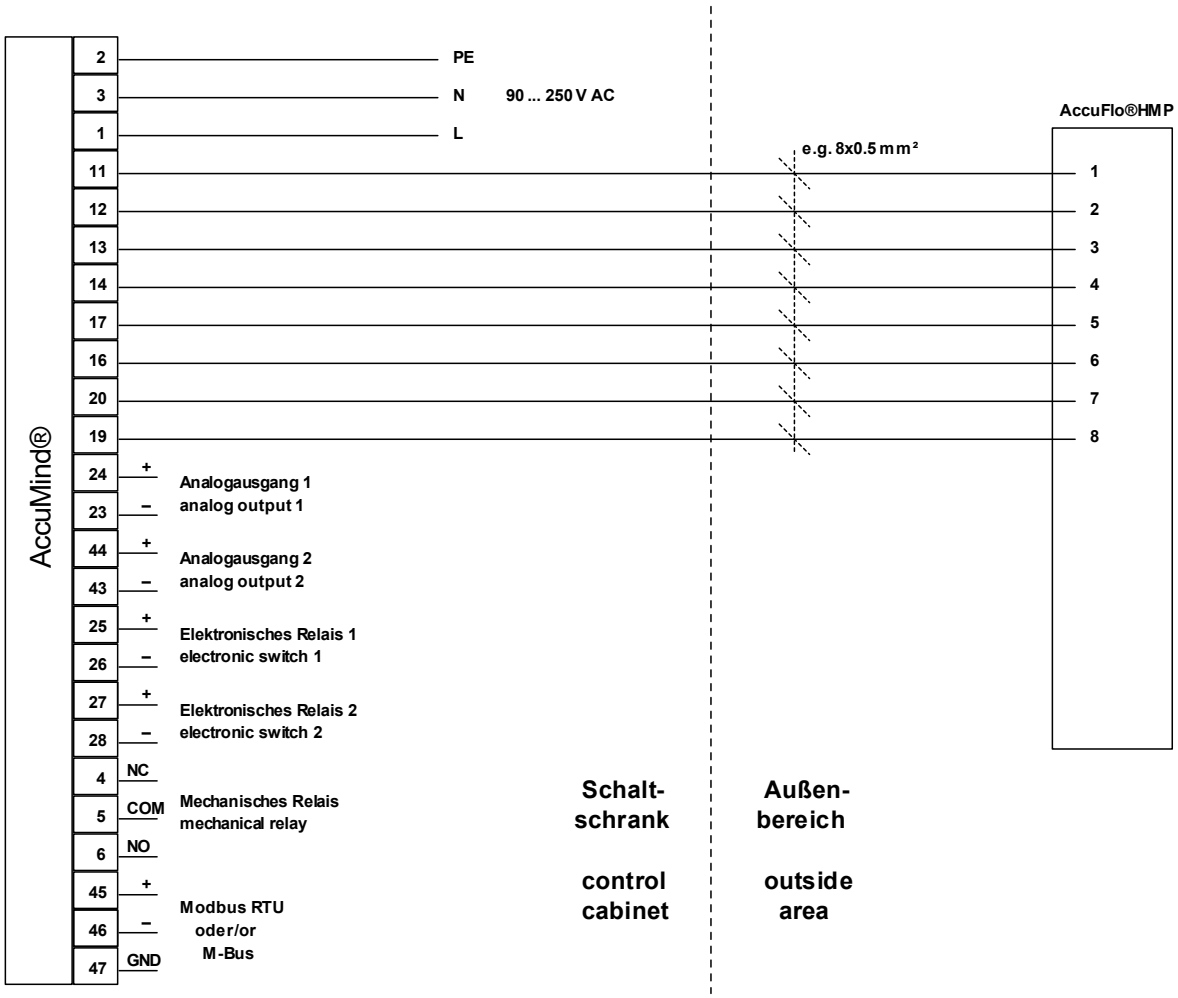

Figure 5: Overview of the wiring without AccuFlo®Zero

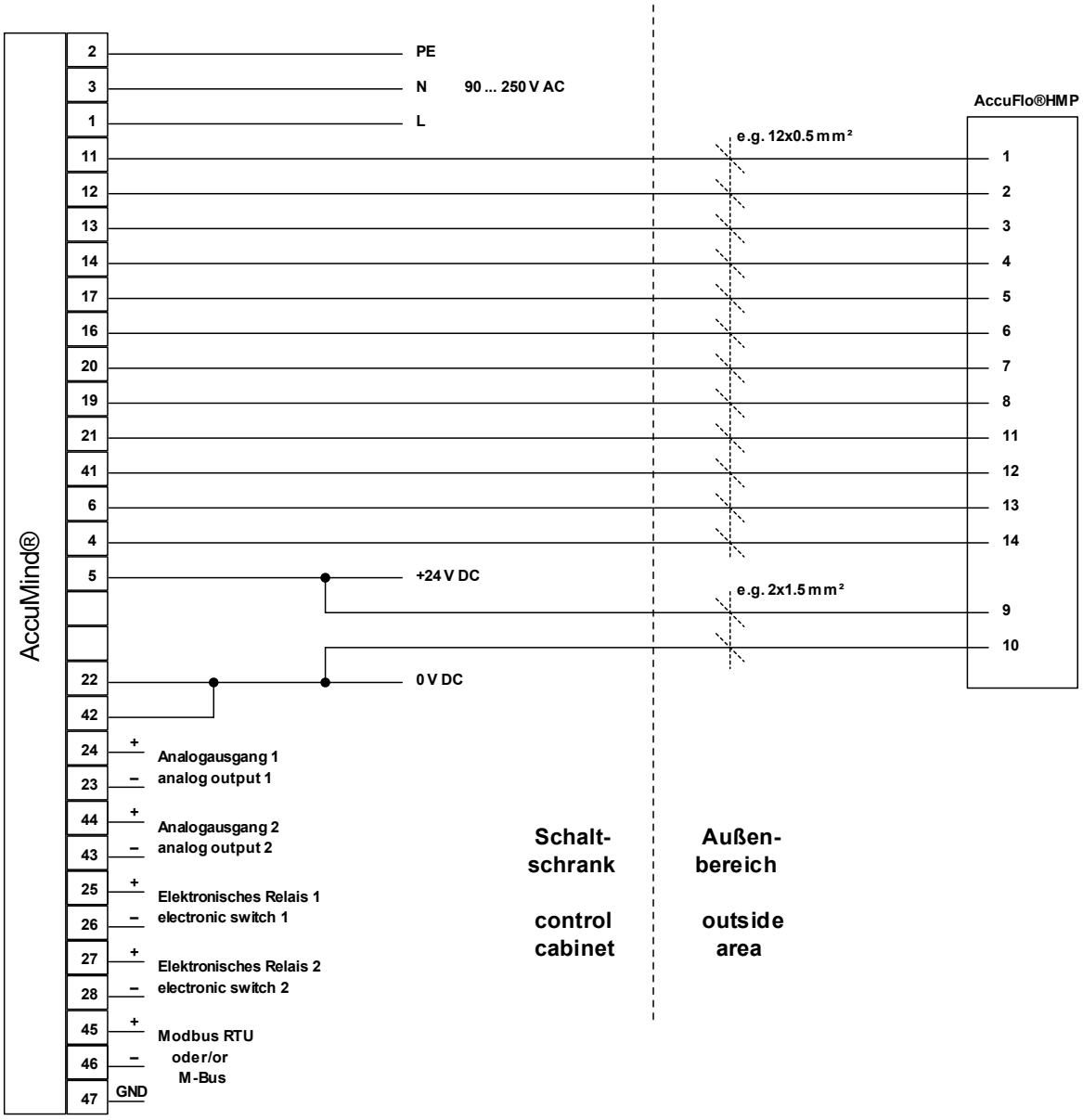

Figure 6: Overview of the wiring incl. AccuFlo®Zero

4.10.1 Technical data of the outputs

A list of all technical data can be found in the AccuMind® manual.

Outputs

Analog outputs

Number	2
Output range	0/4 ... 20 mA; output voltage 15 V
Percentage error	0.1 % of the output value or 0.05 % of the measuring range end value
Burden	max. 500 Ω

Switching outputs

Number	3
1 × mechanical relay (normally open/normally closed)	230 V AC; 6 A
1 × electronic relay (normally open)	40 V AC/60 V DC; 120 mA; max. switching frequency: 150 Hz
1 × electronic relay (normally closed)	40 V AC/60 V DC; 120 mA; max. switching frequency: 150 Hz

5 Commissioning

5.1 Making the device ready for operation

Once all components are connected, please switch on the power supply. The flow computer AccuMind® is parameterized ex works according to your specifications. Check the display of the flow computer for plausible values.

5.2 Zero-point calibration

To ensure that the measurement can be carried out correctly, zero-point calibration must first be carried out on the differential pressure transmitter.

5.2.1 Zero-point calibration for AcuFlo®HMP with AccuFlo®Zero

The AccuMind® controls the AccuFlo®Zero component. This automatically performs zero-point calibration during operation. If the differential pressure displayed by the differential pressure transmitter at zero-point conditions deviates too far from “zero” (which may be the case after installation), an initial zero-point calibration must be carried out via the AccuMind® menu. See section 8.4

5.2.2 Zero-point calibration for AcuFlo®HMP without AccuFlo®Zero

- Close the two outer valves on the 3-way valve block and then open the middle valve. On a 5-way valve block (AccuFlo®HMP for steam), all valves must be closed. The middle valve must then be opened.
- If the display of the differential pressure transmitter is not visible (optional), remove the cover to the display of the transmitter. The display is located under the round cap (marked red in Figure 7) on the side of the transmitter not labeled “FIELD TERMINALS”. The cap can be unscrewed by hand.
- Open the button cover of the transmitter (see blue marking in Figure 7): To do this, loosen the screw on the right-hand side and turn the cover upwards. Figure 8 shows the now open transmitter.

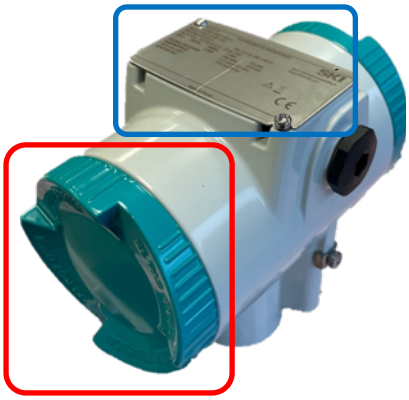

Figure 7: Closed transmitter

Figure 8: Open transmitter

Figure 9: Front view of the open transmitter

- There are four buttons under the button cover of the transmitter, which are labeled as follows: ◁, ,△▽ and ▷ (see green marking in Figure 8). These buttons are used to operate the transmitter.
- Figure 9 shows the front view of the open transmitter with the process view. By default, the currently measured differential pressure is displayed here.
- Press the button ▷ to access the transmitter menu. Figure 10 shows menu item 1 (indicated by the “01” at the bottom right).

Figure 10: Menu item 1

Figure 11: Menu item 7

Figure 12: Process view

- Now press the ▽ button repeatedly until “07” appears at the bottom of the display (see Figure 11).
- Now press the button ▷ . “EDIT” starts to flash.
- Now press the ▷ button again. “EDIT” stops flashing. The zero-point has been set.
- Press the button ◁. This takes you back to the process view (see Figure 12). The value displayed there should now be close to “zero”. Depending on the parameterized display unit (“mbar” in the example), small fluctuations are possible.
- After successfully setting the zero-point, the middle valve on the 3-way valve block must be closed and the outer valves must then be opened! On the 5-way valve block (AccuFlo®HMP for steam), the middle valve must be closed and then the second and fourth valves must be opened! The two outer valves on the 5-way valve block always remain closed during operation. They are only used to fill the condensate containers.
- Then close the button cover and secure the cover of the transmitter.

Note: The middle valve may generally only be opened when the other valves are closed.

6 Individual settings

6.1 Settings on delivery

The settings at the time of delivery can be found in the parameterization sheet of the AccuMind®. If you want to make individual settings, you will find information on this in the following sections. Further details can be found in the detailed instructions for the AccuMind®.

6.2 Saving changed settings

To retain changed settings permanently, they must be saved. See the “Save config.” entry in 9.3.

6.3 General operation

Five different display pages (process screens) are available to the user in the default state. There are process screens with one, two, three, five and six fields for displaying one result each (display tiles; see Figure 13).

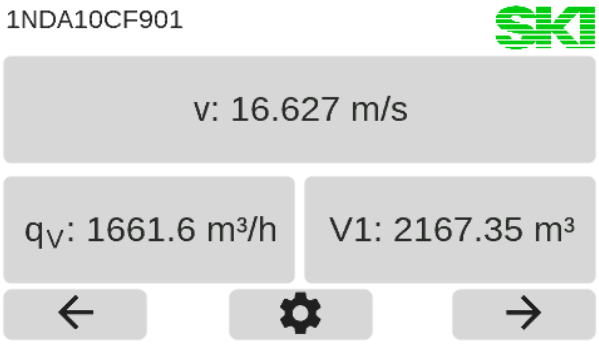

Figure 13: Process screen with three display tiles

The AccuMind® is operated using a touch display. Context-dependent buttons appear at the bottom of the display.

Buttons	
	Show the previous display page
	Show the next display page
	Call up the parameterization/special functions menu (see 0)
	Accept a setting and switch to the higher-level menu
	Do not apply changed settings and switch to the higher-level menu
	Exit a menu level

6.4 Rights management

All operating operations that go beyond advancing the process screens (and displaying error messages, see 7.2) require the entry of a code.

Note: The codes can be changed. See the AccuMind® instructions.

There are three levels with preset codes. A higher level includes the rights of the lower levels.

Level	Code	Access options
1	8941	Operation: Reset counter, trigger zero-point calibration or purging cycle, display parameterization
2	5624	Simple settings: Change process settings, customize display tiles, set time, save/load configuration, load factory configuration, import/export configurations via USB flash drive
3	9376	Advanced settings: Calibration, change of basic settings within the scope of the activated functionality of the AccuMind®

As soon as it is required, the code is queried (see Figure 14). Automatic logout takes place 10 minutes after the last user input.

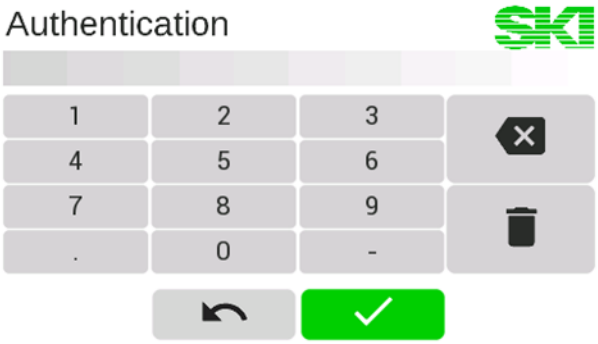

Figure 14: Code query

6.5 Adaptation of the process value display

The displayed size of a display tile can be changed by pressing on the relevant tile. Various properties can now be adjusted for each tile (see Figure 15).

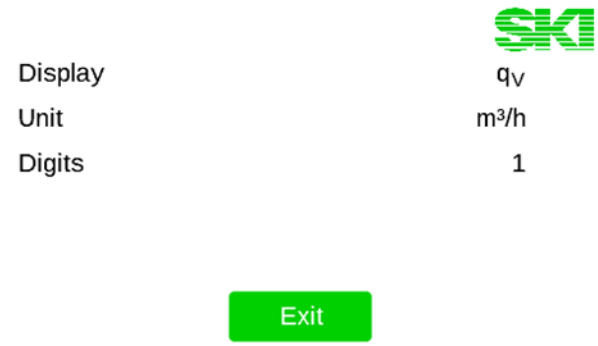

Figure 15: Overview page for the display tile

Clicking on a property line opens another subpage with the query of the respective variables (for the value “Display” there is a query of the category beforehand, see Figure 16). In the example, the “Volume flow q_V” was selected as the display value from the “Process values” category. Clicking on the “Clear” category generates an empty tile.

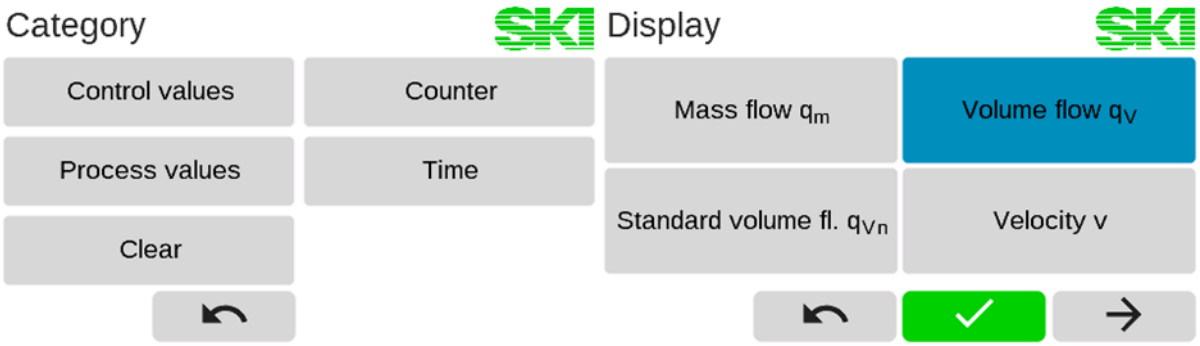

Figure 16: Query the category and the desired display value

Currently selected values are highlighted in blue. Pressing another value selects it. Figure 17 shows the query of the units of measurement and the decimal places.

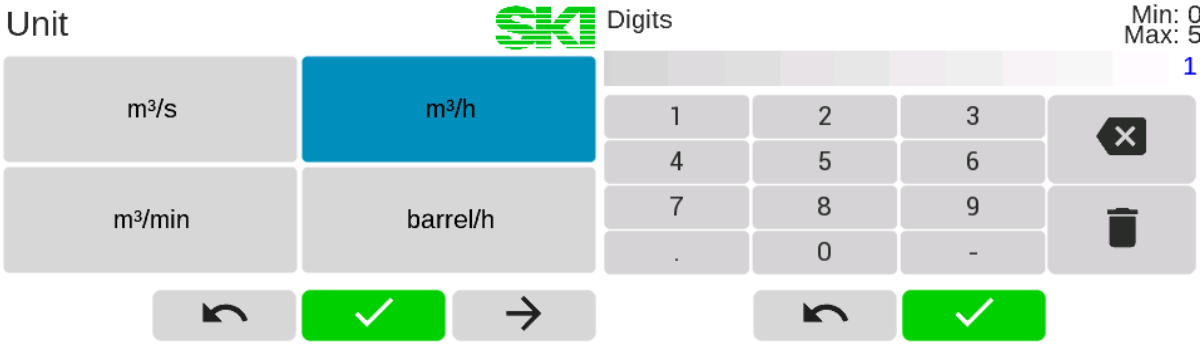

Figure 17: Query of unit of measurement and decimal places

6.6 The menu selection of the AccuMind®

After pressing the gear symbol, the AccuMind® menu selection will show up. From here, you can branch to the corresponding submenus (see Figure 18). There, the AccuMind® parameters can be displayed or changed (see section 9).

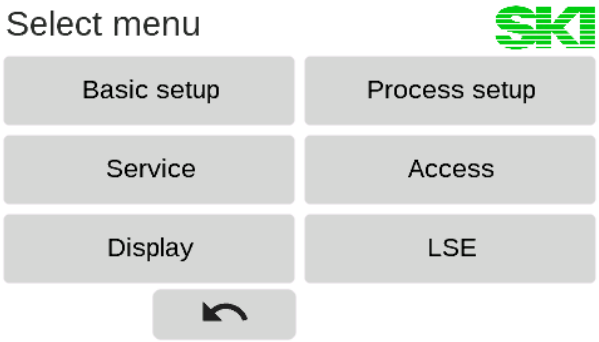

Figure 18: Menu selection

6.7 Operation of the submenus

The submenus are arranged in a tree structure. On the right side of the display there are buttons for control:

Buttons	
	Scroll up

Buttons	
	Scroll down
	Collapse the expanded tree structure

Values that have a [+] or [-] on the right in the tree structure are used to expand or collapse the tree structure branches. When the tree structure is unfolded, the display content is moved so that the branch to be unfolded is at the top. The values in the branches are given two leading points for each lower level (see Figure 19).

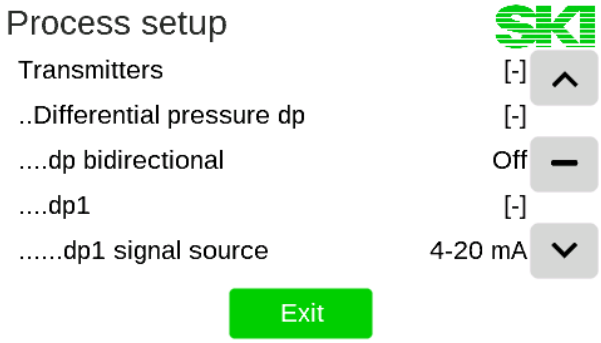

Figure 19: Expanded tree structure

To adjust a value, click on the corresponding line. The value is then toggled (if there are only two options for the setting in question), a selection page opens with several selection tiles or an input mask for direct value input appears (analogous to the adaptation of the process value display; see Figure 17).

Note: If the text of a branch of the tree structure is displayed in gray, the corresponding parameter cannot be changed. This occurs when another option means that this parameter may not be changed.
Similarly, if the text on a selection tile is grayed out, the corresponding option cannot be selected.

7 Output of warnings and errors

7.1 General information

The AccuMind® shows statuses that deviate from the standard status on its display and also outputs corresponding signals via the electronic/mechanical relays, the digital interfaces and/or the analog outputs as selected.

7.2 Display indication

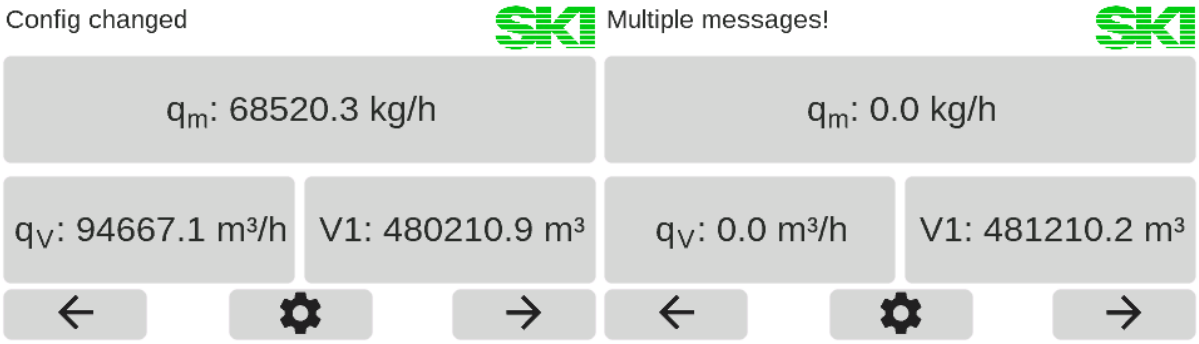

Figure 20: Information text above the display tiles

As shown in Figure 20 warnings or error messages appear above the display tiles. If there is only one message, it is displayed directly (in the example: “Config changed”). If several occur, the message “Multiple messages!” appears. Pressing the message text opens an overview page with the time at which the warnings or errors occurred (see Figure 21). Warnings are displayed in yellow and errors in red.

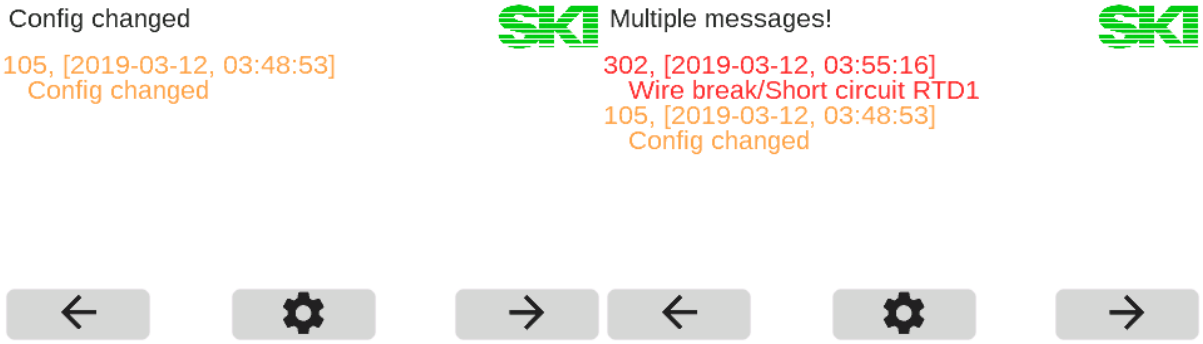

Figure 21: Overview page for messages

Note: If the reason for the corresponding message is no longer given, the corresponding message also disappears.

7.3 Warnings in the display

The AccuMind® issues warnings on the display. The following table lists the possible warnings:

Warning	Explanation
Config changed	There are unsaved changes. If these are to be adopted, they must be saved (see 9.3).
Small flow rate	The parameterized minimum flow rate has not been reached. The flow rate is set to 0.

Warning	Explanation
AinX: Current too low/high	At signal input AinX, the electric current value is outside the regular measuring range (lower than normal under range or higher than normal over range), but not yet in an error range. It should be checked whether the limits of the transmitter can be adjusted. Electric current ranges for warnings at signal input 4 … 20 mA: 3.65 mA < AinX < 3.85 mA and 20.45 mA < AinX < 20.95 mA Electric current range for warning at signal input 0 … 20 mA: 20.45 mA < AinX < 20.95 mA Note: A hysteresis of ±0.02 mA applies.
Saturated steam mode	Relevant for the medium “superheated steam”. If the temperature falls below the minimum temperature for the steam state (for the respective current pressure value), the AccuMind® continues to calculate in “Saturated steam (p)” mode .
Values are frozen	The manual freezing of all values via the service menu is active. In this case, the AccuMind® no longer calculates any values. In addition, no warnings or error messages are removed during this time. This only takes place again once the freeze has been removed.

7.4 Error messages on the display

The AccuMind® shows error messages on the display. The following table lists the possible error messages:

Error	Explanation
Wire break/short circuit RTDX	There is an error at Pt100/RTD input RTDX. The wiring must be checked. If no fallback value[1] is parameterized, the calculation is stopped.
No X source	No input has been assigned for one of the variables “X”. “X” can stand for: “dp1”, “dp”, “qV”, “T1”, “T2” or “p” If no fallback value[1] is parameterized or no fallback value can be parameterized for the relevant variable, the calculation is stopped. An input must be parameterized for the respective variable.
AinX: Wire break	No transmitter is detected at the relevant signal input AinX or the electric current from the transmitter is too low (AinX ≤ 3.65 mA[2]). Check the wiring. If no fallback value[1] is parameterized, the calculation is stopped. This error cannot be detected with signal input 0 ... 20 mA.

[1] Fallback values can be parameterized for the pressure and temperature inputs. This fallback value is then used in the event of a wire break, defect or short-circuit in the relevant sensor.
[2] A hysteresis of ±0.02 mA is used.

Error	Explanation
AinX: Short circuit	The transmitter at signal input AinX emits an electric current that is too high (AinX ≥ 20.95 mA[2]) or there is a short circuit. The wiring and/or the transmitter must be checked. If no fallback value[1] is parameterized, the calculation is set.
AinX: No HART comm.	HART® communication cannot be established with the transmitter at signal input AinX. In this case, the measured values are determined via the electric current signal. Here it is assumed that the electric current signal is present as a 4...20 mA signal. If the transmitter is not HART®-capable, the signal source of the analog input should be changed accordingly
Differential pressure greater than pressure	Relevant for flow sensor type “dp device ISO 5167” and “AGA-3”: If the determined differential pressure is greater than the absolute pressure, no more calculation can take place. The parameterization and the connections of the transmitters must be checked.
ISO 5167 calculation aborted	Relevant for flow sensor type “dp device ISO 5167”: If no convergence is achieved in the calculation according to ISO 5167, no further calculation can take place. The parameterization and the connections of the transmitters must be checked.
Invalid p or T value	Relevant for medium “water” or “steam”: If the values for pressure or temperature are outside a range defined according to IAPWS-97, no further calculation can be performed. The parameterization and the connections of the transmitters must be checked.
Water alarm	Relevant for medium “superheated steam”: If the current pressure/temperature combination results in the aggregate state water, a water alarm is issued and the calculation is stopped.
Steam alarm	Relevant for medium “water”: If the current pressure/temperature combination results in the aggregate state steam, a steam alarm is output and the calculation is stopped.
AGA-NX19 out of limits	AGA-NX19 has the following limits of use: 0 bar ≤ Pressure ≤ 137.9 bar; -40.0 °C ≤ Temperature ≤ 115.6 °C; 0.554 ≤ relative Density ≤ 0.75; 0.716 $\frac{\text{kg}}{\text{m}^3}$ ≤ Standard density ≤ 0.970 $\frac{\text{kg}}{\text{m}^3}$; 0 ≤ CO_2 mol fraction ≤ 0.15; 0 ≤ N_2 mol fraction ≤ 0.15 If the values are outside this limit, an error message is displayed.

Notes:

When the calculation is stopped, “nan” is displayed for all calculated values.

Error messages relating to the function extensions are listed separately in the description of these extensions.

7.5 Signaling of errors via the outputs

Errors are also signaled via the outputs.

Error	Explanation
Fallback current at analog output X	If a flow calculation is not possible (see 7.4) and a flow rate value is to be output at analog output X, this outputs a parameterizable fallback value (see 9.2)
Signal at electronic relay (switching output) 1 or 2 or at mechanical relay	Parameterization of the collective alarm for one of the switching outputs or the relay (see 9.2) The collective alarm is triggered if an error occurs (see 7.4)

8 Automatic zero-point calibration AccuFlo®Zero

8.1 Background

The AccuMind® can control the optional AccuFlo®Zero automatic zero-point calibration.

The AccuMind® continuously monitors the cell temperature of the differential pressure transmitter. If a change in this value is detected that is outside an adjustable limit value, an automatic zero-point calibration is carried out. Similarly, pressure changes in the system are monitored. If no impermissible deviations in cell temperature or system pressure are detected within an adjustable time interval, a zero-point calibration is also carried out after the interval has expired to avoid an impermissible long-term drift. To determine the system pressure, the value for the static pressure transmitted by the differential pressure transmitter is used (if the transmitter measures this value and makes it available via the HART® interface), otherwise the pressure transmitter is used. If no pressure transmitter is present and the differential pressure transmitter does not transmit a pressure value, the pressure value is not monitored.

In AccuMind® the designation “AccuFlo®Zero” is shortened to “Zero” for display reasons.

The AccuMind® can control two differential pressure transmitters (“split-range operation”); in this case, the automatic zero-point calibration is carried out for both transmitters. For the sake of simplicity, only one transmitter is referred to in the following sections, but the information also refers to operation with two transmitters.

“HART” must be selected as the signal source for the differential pressure transmitter.

8.2 Display

If the Zero functionality is activated in the basic settings, there is an additional display page (see Figure 22). This display page shows the status of the AccuFlo®Zero and also provides two fields for displaying process values. One of these fields is occupied by the digitally read differential pressure of the first differential pressure transmitter (“Ddp1”). If there are two differential pressure transmitters, the second field is filled with the digitally read differential pressure of the second differential pressure transmitter (“Ddp2”). The values “Ddp1” and “Ddp2” always represent the values currently measured by the transmitters; the differential pressure “dp”, which is derived from these values and which is frozen during zero-point calibration, is used for the flow calculation. In the basic position, which corresponds to measuring mode, the remaining time until the next zero-point calibration is displayed in the status area (if timer mode is deactivated, the message “Wait for external triggering” appears).

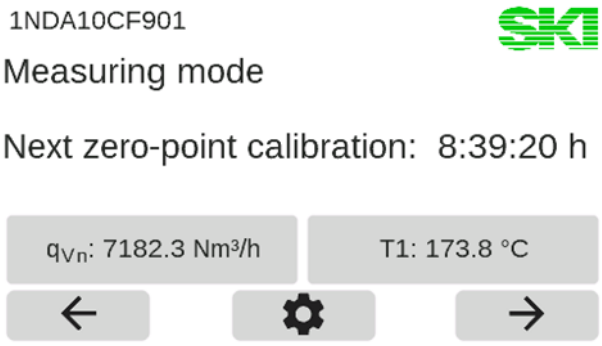

Figure 22: Display with information about the AccuFlo®Zero

8.3 Zero-point calibration procedure

Note: During zero-point calibration, the differential pressure transmitter is not connected to the process. Therefore, no current flow rate can be determined during the adjustment. The input values for differential pressure, pressure and temperature are frozen during the entire calibration process. This means that the display values and the outputs also retain their last status. Counters continue to count constantly and pulse/frequency outputs continue to output the last valid values. It is possible to send a status signal to the control center during calibration (see 8.6).

If only the electric current value output by the dp transmitter is required in the control center (measured by AccuMind® at Ain1), this can also be output directly via Aout1 (see 9.2). The previously measured current value is then frozen during the calibration.

A zero-point calibration is performed after a parameterized duration (in timer mode), in the event of relevant changes in cell temperature or system pressure or following an external trigger. The following table illustrates a zero-point calibration:

Output on AccuMind®	Explanation
Going to zero-point check	The AccuFlo®Zero physically establishes the zero-point condition: The transmitter is disconnected from the process and then the two chambers of the transmitter are connected.
Zero-point check	The transmitter is given time to adjust to the zero-point. If the transmitter outputs a constant differential pressure value with a smaller deviation compared to the old zero-point than the maximum permissible deviation (parameterizable value "..max. dp deviation"; section 8.4), this value is set as the new zero-point.
Going to the home position	The AccuFlo®Zero physically establishes the measurement condition: The connection between the two chambers of the transmitter is disconnected and then the transmitter is reconnected to the process.
Waiting for settling	The transmitter is granted time to settle back into the process conditions.

8.4 Parameterization and manual control

The Zero menu (see Figure 23) can be opened from the menu selection (see 6.6). The general operation of the submenus is described in 6.7.

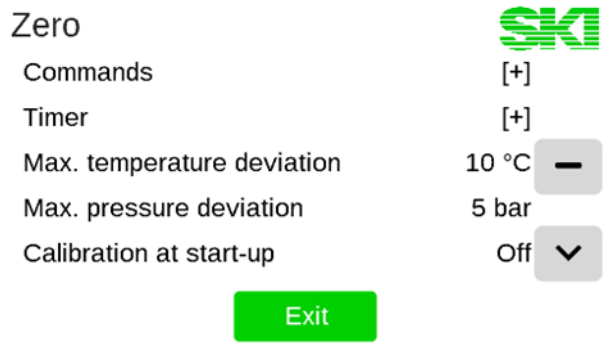

Figure 23: The Zero menu

Note: After installation, an initial zero-point calibration must be carried out (see explanation of the "Set zero-point" command in the following table).

Value	Option	Remark
Commands	*fold-out function*	
..Start zero-point calibration	function triggering	Starts a zero-point calibration
..Establish zero-point condition	function triggering	The AccuFlo®Zero establishes the zero-point condition: the transmitter is disconnected from the process and the two chambers of the transmitter are connected.
..Set zero-point	function triggering	Set the zero-point. This command is only active if the zero-point condition was previously established. The zero point is set independently of the displayed value (i.e. the previously set zero-point of the transmitter).
..Establish measurement condition	function triggering	The AccuFlo®Zero restores the measurement condition: the connection between the two chambers is disconnected and the connection to the process is restored. After a settling time, the measurement is enabled again.
Timer	*fold-out function*	
..Timer active	On Off	Activates or deactivates timer operation
..Timer duration [min]	numerical value	Indication of the waiting time between two zero-point calibrations. Only visible when timer operation is active
Max. temperature deviation	numerical value	The value for the maximum permissible temperature deviation of the transmitter's measuring cell in comparison to the last zero-point calibration
Max. pressure deviation	numerical value	The value for the maximum permissible pressure deviation of the transmitter's measuring cell compared to the last zero-point calibration. Only visible when system pressure can be measured.

Value	Option	Remark
Calibration at start-up	On Off	Indicates whether a zero-point calibration should be carried out after the power supply has been restored (e.g. after system maintenance).
Default settings	*fold-out function*	
..Settling duration [s]	numerical value	Indication of the duration of the settling time in the measuring position. The transmitter must be given the opportunity to settle to the measured value. This duration depends mainly on the damping of the transmitter.
..Max. dp deviation	numerical value	Indication of the maximum permissible zero-point deviation BEFORE zero-point calibration. If the deviation of the zero-point (compared to the last calibration) is too large, there may be a defect in the differential pressure transmitter. The zero-point calibration is not carried out if the deviation is too large.
..Damping during calibration [s]	numerical value	During the actual calibration, the damping of the transmitter is set to this value. This is how averaging takes place. This is useful, for example, when the system is subject to vibrations.
..Max. fluctuation during calibration	numerical value	The maximum fluctuation of the zero-point during the zero-point calibration.
..Check cycles	numerical value	Number of cycles for which the zero-point must not fluctuate by more than the max. allowed value. Cycles corresponds to approx. 250 ms.
..Timeout [s]	numerical value	The maximum time granted to the transmitter to reach a stable zero point.

8.5 Error messages on the display

See also the explanation under 7.2

Error	Explanation
Zero-point failure	The error is output if the automatic zero-point calibration could not be performed. Possible causes: No initial zero-point calibration was carried out after installation (see 8.4); the value for the “max. dp deviation” or the “Max. fluctuation during calibration” is parameterized too small or there is a defect.
Automatic calibration only with HART	Automatic calibration can only be carried out if the differential pressure transmitter is connected to a HART®-capable analog input (Ain1 or Ain2) and “HART” has been selected as the signal source of the differential pressure transmitter.

Error	Explanation
Drive failure	None of the target positions could be reached or the measurement position was left during normal operation. The calculation is stopped. The drive/wiring of the AccuFlo®Zero must be checked.
	The wiring of the AccuFlo®Zero may only be checked when it is de-energized.

8.6 Signaling to the control center

The errors listed under 8.5 will result in the output signals described under 7.5.

The AccuMind® can also output signals to the control system via the switching outputs S1/S2. The parameterization of the switching outputs is described in 9.2.

Signal name	Explanation
Zero error	This signal is output if one of the errors from 8.5 is present.
Zero operating indicator	During a zero-point calibration or during a manual zero-point check, it is signaled that the measured values are frozen

9 Setting the parameters

The parameters can be displayed and adjusted from the menu selection (see 6.6). The general operation of the submenus is described in 6.7. In the following, only the parameterization of the measurement units and the outputs will be discussed, as the values for the input variables and the measuring point design were already entered before delivery and do not usually change. If adjustments are required in this area, the information can be found in the AccuMind® manual. The parameters are set in the “Process setup” submenu.

The digital interfaces are described in the AccuMind manual.

9.1 Units

Value	Option	Remark
Units	*fold-out function*	
..Process variable x	list of corresponding units	The measurement unit to be displayed can be selected for the process variables used in the AccuMind®

9.2 Outputs

Value	Option	Remark
Outputs	*fold-out function*	
..Analog Aout1[3]	*fold-out function*	

[3] The settings for analog output Aout2 must be made in the same way as for Aout1.

Value	Option	Remark
….Aout1 assignm.	q_m; q_V; q_{Vn}; T1; T2; p_{abs}; p_{rel}; dQ; v; Current Ain1; Current Ain2; Current Din1; Current Din2 ; Deactivated	The process variable to be output via analog output 1 If “Current AinX” is selected, the electric current measured at AinX is output 1:1 at Aout1. The behaviour for the digitally received electric current DinX via HART is equivalent to this.
….Aout1 signal type	4-20 mA 0-20 mA	Selection of the characteristic of the 1st analog output
….Aout1.min	numerical value	The output value at 0/4 mA
….Aout1.max	numerical value	The output value at 20 mA
….Aout1.fallback	numerical value	The electric current value that is output in the event of a fault (see 7.5)
…switching output S1[4]	*fold-out function*	
….S1 behavior	Counting pulse[5] MIN switch MAX switch Frequency output[5] Collective alarm Zero operating indicator Zero error Deactivated	Selection of the switching behavior for the electronic relay 1 Depending on the selection made, further parameters are queried (see following tables) For item “Collective alarm”, see 7.5

[4] The settings for switching output S2 and relay R must be made in the same way as for S1.
[5] No counting pulse and no frequency output can be parameterized for relay R.

***Outputs* for S1 behavior: Counting pulse**[5]

Value	Option	Remark
….S1 assignment	m1; m2; m abs; Q1; Q2; Q abs; V1; V2; V abs; V_n1; V_n2; V_n abs	Selection of the value to be output via the counting pulse. For flow direction 1 (“positive flow”) or 2 (“negative flow”; only relevant with bidirectional transmitter). When selecting a quantity with “abs”, pulses are output with both positive and negative flow.
….S1 pulse value	numerical value	The value to correspond to a pulse. For example: 1 pulse = 5 m³
….S1 pulse width [ms]	numerical value	The duration that a pulse takes and at the same time the minimum duration between two pulses

***Outputs* for S1 behavior: Frequency output**[5]

Value	Option	Remark
….S1 assignment	q_V 1; q_V 2; q_V abs; q_{Vn} 1; q_{Vn} 2; q_{Vn} 2 abs; q_m 1; q_m 2; q_m abs; dQ 1; dQ 2; dQ abs	Selection of the quantity to be output via a frequency. For flow direction 1 (“positive flow”) or 2 (“negative flow”; only relevant with bidirectional transmitter). When selecting a quantity with “abs”, a frequency is output with both positive and negative flow.
….S1 max. value	numerical value	The maximum value of the quantity to be output.
….S1 f.max [Hz] [6]	numerical value	The maximum frequency (this corresponds to the maximum value of the quantity to be output)

***Outputs* for S1 behavior: MIN/MAX switch**

Value	Option	Remark
….S1 assignment	q_m; q_v; q_{Vn}; T1; T2; p_{abs}; p_{rel}; dQ; v ; dp	Selection of the measured value to be monitored
….S1 switching value	numerical value	If the MIN switch is selected, S1 is switched if the measured value is lower than or equal to the switching value (“≤”). If the MAX switch is selected, switching takes place if the measured value is greater than or equal to the switching value (“≥”).
….S1 hysteresis	numerical value	Indication of the hysteresis for the switching value

[6] A maximum switching frequency of 150 Hz applies for switching output 1 and switching output 2. This must not be exceeded by the process.

***Outputs* for S1 behavior**

Value	Option	Remark
....S1 normally[7]	Open Closed	Definition of the switching state for the normal state.

9.3 Service menu

The service menu can be opened from the menu selection (see 6.6) can be displayed.

Figure 24: The service menu

The following entries can be made in the service menu (see Figure 24):

Value	Option
Save config	The current settings are stored permanently after a confirmation.
Load config	The last configuration is loaded after confirmation (unsaved changes are reset).
Save factory config	The factory configuration is loaded after confirmation (the delivery status of the parameterization is restored).
Counter reset	The counter readings are reset after a confirmation.
Calibration	Calling up the calibration menu.
Reboot	After a confirmation, the AccuMind® is restarted.
Language	The language is switched between English and German.
Device	The serial number, the hardware ID and the software version are displayed.
Date & Time	The date and time can be adjusted.
USB	The USB menu is displayed.
Activation	The activation menu is called up.
Freeze values	Freezes the calculation until the tile is pressed again.

[7] There is no normal state setting for relay R. With a voltage-free AccuMind® , the following applies regardless of the parameterization: S1 is open (NO) and S2 is closed (NC).

Konformitätserklärung
Declaration of Conformity
Déclaration de conformité

Wir, die Firma
We, the company
Nous, la société

S.K.I. Schlegel und Kremer Industrieautomation GmbH
Hanns-Martin-Schleyer-Straße 22, 41199 Mönchengladbach, Germany

erklären in alleiniger Verantwortung, dass das Produkt
declare with full responsibility that the product
déclarons sous notre seule responsabilité que le produit

Messstrecke measuring section Ligne de mesure	**ACG / ACL / ACS** **(AccuFloLPD/HMP)**

auf das sich diese Erklärung bezieht, mit folgender Richtlinie und Norm übereinstimmt:
which this declaration applies to, suits directive and standard:
qui fait objet de cette déclaration, est conforme à la directive et norme:

Richtlinie/Directive/Directive		Norm/Standard/Norme
2014/68/EU	Druckgeräterichtlinie Pressure Equipment Derective Directive équipments sous pression	EN13480

Bei maximalem Betriebsdruck unter 0,5 bar in Anlehnung an Art. 4.3 der Richtlinie 2014/68/EU.
Since the maximum operating pressure is below 0,5 bar similar to article 4 (3) of directive 2014/68/EU.
En cas de pression de service maximale inférieures á 0,5 bar, en référence á l'article 4 (3) de la directive 2014/68/EU.

Die Kennzeichnung des Geräts enthält folgende Angabe:
The equipment name plates contain the following information:
La plaque signalétique de l'euqipement contient,

				Kennzeichnung/Marking/Repères	
Richtlinie Directive Directive	Konformitätsbewertung Assessment Evaluation de conformité	Kategorie Category Catégorie	Benannte Stelle Notified Body Organisme notifié		Nr. + Kategorie No. + Category Nr. + Catégorie
2014/68/EU	Art. 4.3	Art. 4.3	n. a.	n. a.	n. a.
	Mod. A	I	n. a.	CE	./K1
	Mod. D1	II	TÜV Rheinland	CE	0035/K2
	Mod. H	III	TÜV Rheinland	CE	0035/K3

Mönchengladbach, den 18.10.2016

(Gerald Papperitz, QMB)

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BA-AccuFloHMP-KA-en-2409

Operating and assembly instructions