AccuMind®

Compact computer for flow measurements

Operating and assembly instructions

Valid from software version 1.0.0 and QAL-1.0.0

Attention:

For AccuMind® with firmware versions 15.xx.xx, 16.xx.xx, 17.xx.xx, 19.xx.xx, 2.xx.xx and 3.xx.xx, the corresponding operating and assembly instructions can be obtained from S.K.I. GmbH. These versions are not the subject of this manual.

Before commissioning, observe the instructions on pages 7 and 8!

Content

S.K.I. Schlegel & Kremer Industrieautomation GmbH
Hanns-Martin-Schleyer-Str. 22 – 41199 Mönchengladbach, Germany
Phone: +49 (0) 2166/62317-0

1 General information

1.1 Symbol explanation

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

Warning: Warning of dangerous electrical voltage
ISO3864, No. B.3.6

1.2 Intended Use

The AccuMind® compact computer is used to calculate the flow rate of liquid and gaseous media. The device may only be used for the purposes specified in these instructions. Unless expressly stated otherwise in this manual, all modifications to the device are the responsibility of the user.

1.3 Safety instructions

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

- This device may only be set up and operated in conjunction with this documentation.
- Proper and safe operation of this device requires proper transport, 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.
- During connection, assembly and operation, inspection documents, regulations and laws valid for your country must be observed.
- This device may only be installed and operated if qualified personnel have previously ensured that suitable power supplies (see type plate!) are used to ensure that no dangerous voltages can reach the device during normal operation or in the event of a fault in the system or system components. Therefore, improper handling of this device may result in serious bodily 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 have the appropriate qualifications for their job, e.g.:

- Training or instruction or authorization to commission, ground and label devices/systems in accordance with the standard of safety technology for electrical circuits.
- Training or instruction in the care and use of appropriate safety equipment in accordance with the standard of safety engineering.
- Training in first aid

1.5 Further information

For reasons of clarity, this manual does not contain all the detailed information on all types of product and cannot consider every conceivable application of operation or maintenance.

If you are interested in further information or if special problems are not dealt with in detail in the instructions, the necessary information can be requested directly from S.K.I. GmbH.

It should also be noted that the contents of this manual are not part of or intended to modify any prior or existing agreement, commitment or legal relationship. All obligations of the S.K.I. GmbH result from the respective purchase contract, which also contains the complete and only valid guarantee regulation.

These contractual warranty conditions are neither extended nor limited by the explanations in this manual.

The content reflects the state of the art 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. Before any intervention in the wiring, the system must be disconnected from the power supply.

Exceeding or falling below the permissible operating temperature: Suitable measures must be taken to ensure that the permissible operating temperature is not exceeded or fallen below.

Damage: The components must not be subjected to improper mechanical loads, such as those that occur during a fall, and no impermissible forces must be applied to them.

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

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

Other hazards: It must be ensured that the manufacturer's instructions for use are always observed.

1.7 Cleaning

The AccuMind® may only be cleaned with a dry cloth.

2 Technical data

2.1 Connections and Interfaces

Electrical connection	
Ordering option “AC”: AC power supply	100 … 240 V AC ±10 %; 50 … 60 Hz ±5 %
Ordering option “DC”: DC power supply	18 … 30 V DC ±10 %
Power consumption	max. 20 VA
Inputs	
Analog inputs	
Number	4 (2 of which have HART® capability[1])
Measuring range	0/4 … 20 mA
Percentage error	0.1 % of measured value or 0.05 % of upper range value
Burden	22 Ω (262 Ω for the HART®-enabled inputs)
Pt100/RTD inputs	
Number	2
Connection type	3- or 4-wire connection
Measuring range	–200 … +750 °C
Divergence	typ. ±0,005 K
Feed current	250 µA
Pulse/frequency inputs	
Number	2
Switching threshold	0 signal: 0 … 2 V; 1 signal: 3 … 24 V
Frequency range	0 … 10 kHz; EN 1434 Cl. IB, IC, ID, IE
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 upper range 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

Digital interfaces

USB port	logging function and updates
Ethernet interface	Modbus Slave TCP and web interface that displays the measured data
1st digital interface	Modbus Slave RTU or Modbus Master RTU or M-Bus (ordering option); (optional connection of an external converter to Profibus DP Slave or Profinet Slave)
2nd digital interface (optional)	Modbus Slave RTU or Modbus Master RTU (optional connection of an external converter to Profibus DP Slave or Profinet Slave)

Notes:

[1]: Compatible differential pressure transmitters for use with the HART® interface:

SKI AccuP 433

Siemens SITRANS P DS III, P320, P420

Krohne OPTIBAR DP 7060 C

Endress+Hauser Deltabar S PMD 75

ABB 266MST

VEGA VegaDif 65, VegaDif 85

Yokogawa DPharp EJX 110A

Rosemount 3051C

others on request

2.2 User interface

Touch display

Dimension	95 W × 53.5 H (in mm^2)
Aspect Ratio/Resolution	16:9; 480 pixels × 272 pixels
Technology	TFT color display with capacitive touch screen

2.3 Case

2.3.1 Panel mounting case (ordering option "PM")

Material	
Display front	plastic
Electronics housing	stainless steel
Dimensions	
Display front	144 W × 83 H × 14 T (in mm³)
Electronics housing	135 W × 65 H × 119 T (in mm³)
Panel breakout	136.5 ± 1 W × 70 ± 3 H (in mm²)
Degree of protection	
Display front	IP44
Electronics housing	IP20
Environmental conditions	
Operating temperature	–20 … 55 °C
Storage temperature	–40 … 85 °C
Relative air humidity	0 … 95 %; non-condensing
Installation height	up to 2000 m

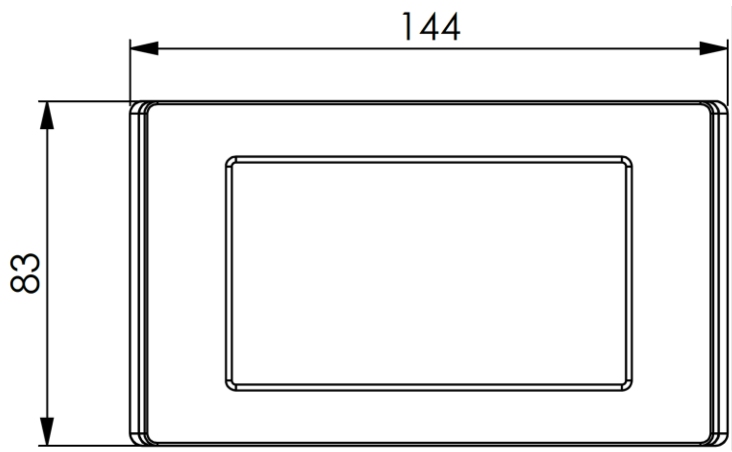


Figure 1: Front view

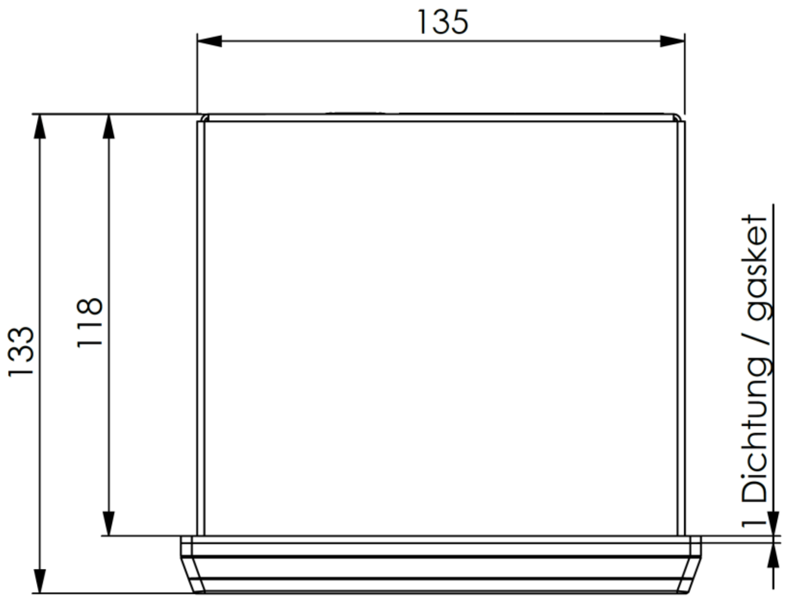


Figure 2: Top view

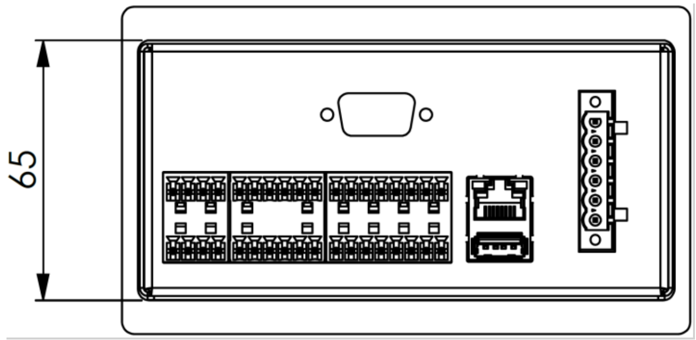


Figure 3: View from behind

2.3.2 Wall mounting case (ordering option "WM")

Material	
Display front	glass
Electronics housing	aluminum
Dimensions	
Case	299 W × 173 H × 60.2 T (in mm³)
Degree of protection	
Case	IP65
Environmental conditions	
Operating temperature	–20 … 55 °C
Storage temperature	–40 … 85 °C
Installation height	up to 2000 m

Figure 4: Photo of the wall mounting case

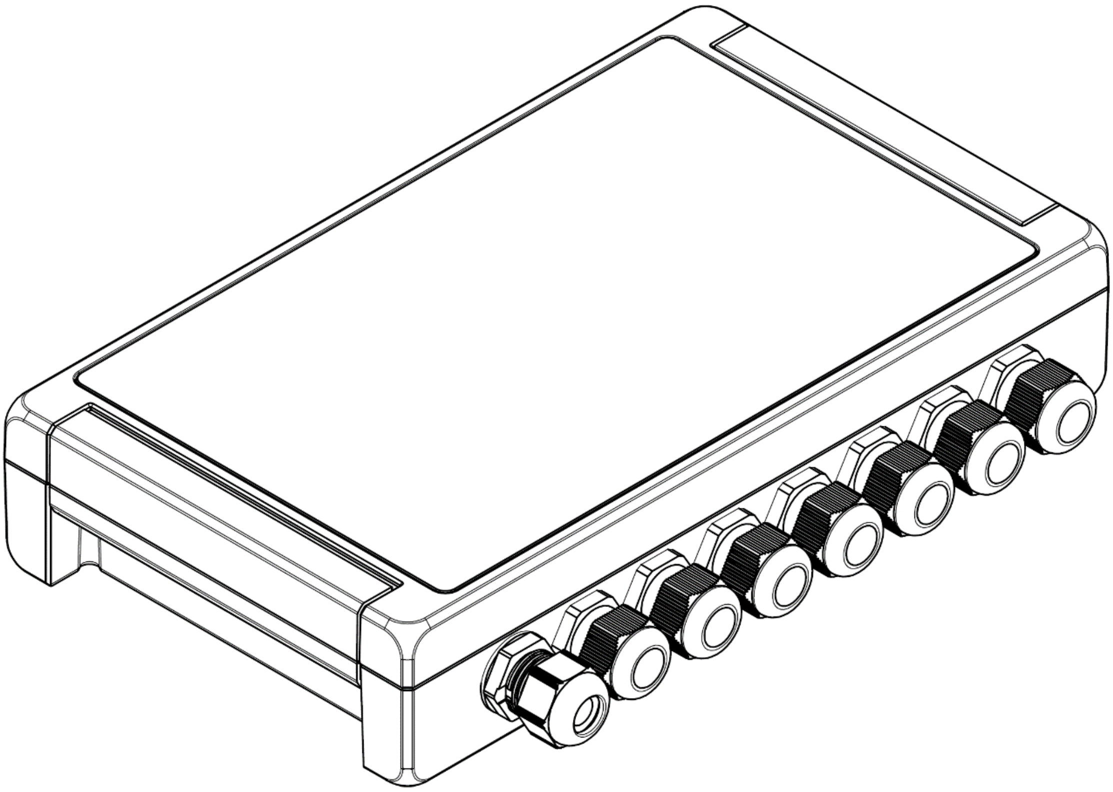


Figure 5: Wall mounting case with cable glands

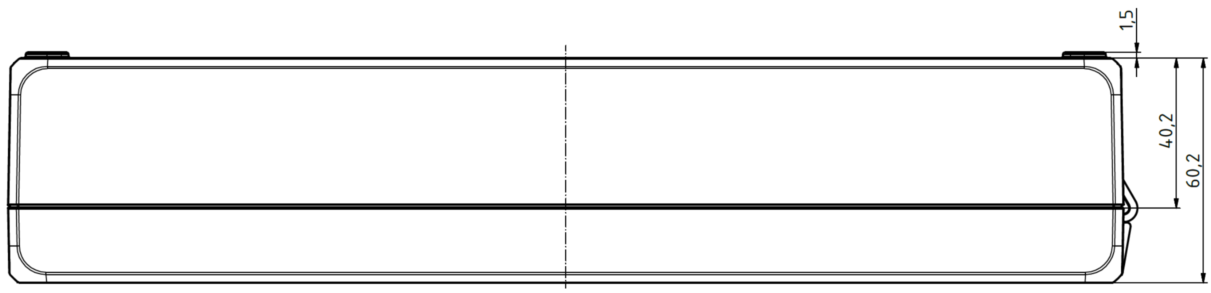


Figure 6: Top view

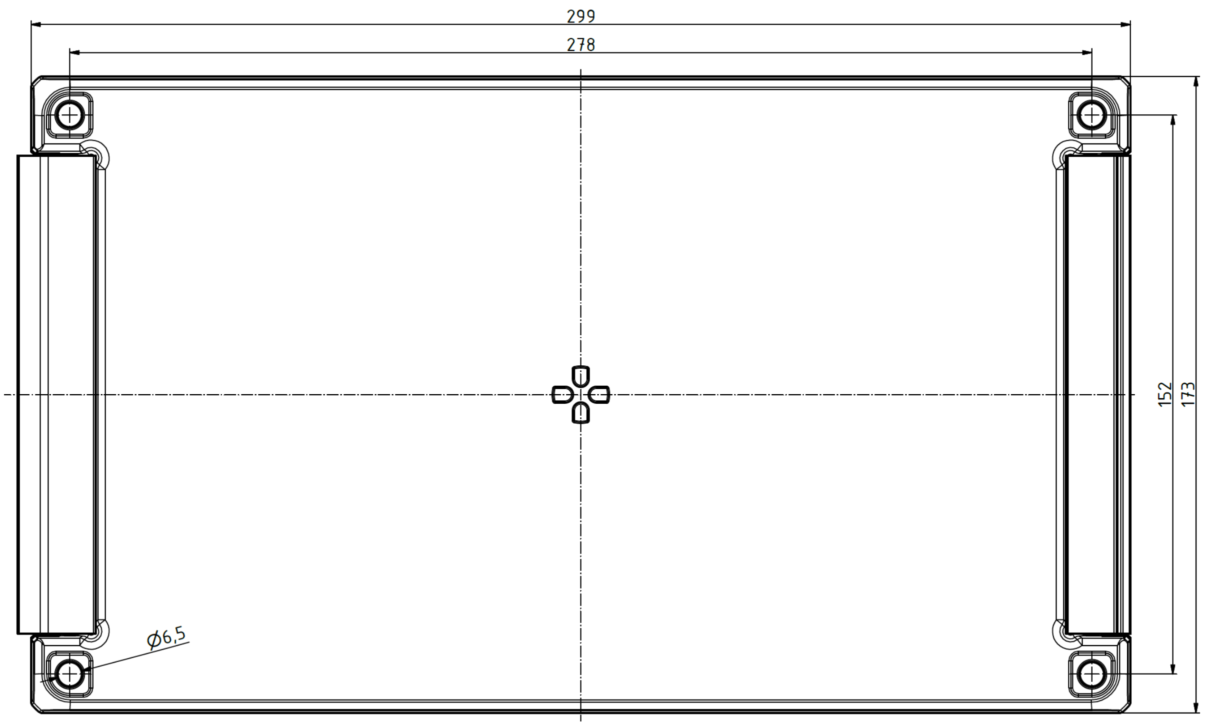


Figure 7: View of the lower part with mounting holes

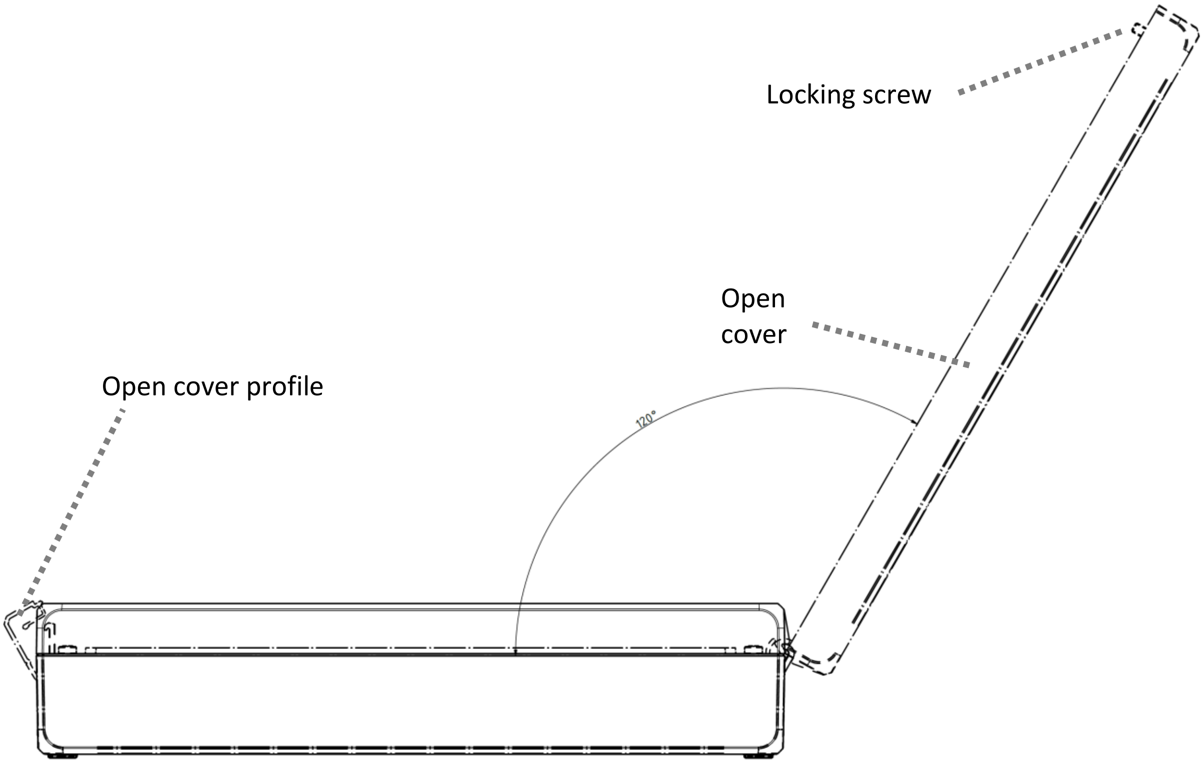


Figure 8: View with open cover

3 Use of the AccuMind®

3.1 General information

The AccuMind® is used for flow calculation and evaluation of volume flows of liquid and gaseous media.

Differential pressure or volume flow sensors can be used as primary sensors.

3.2 QAL1 application (ordering option "QL")

The AccuMind® is available as a special version with the operating mode "QL" for QAL1 applications (see section 13).

The AccuMind® for QAL1 applications is used for flow determination in a QAL1-certified measuring system with SDF sensors.

Details on the use of the measuring system in conjunction with the AccuMind® can be found in the "Brief instruction AccuFlo®QAL" in the currently valid version.

The AccuMind® for QAL1 applications has its own firmware. The QAL functionality cannot be switched on or off via the menu.

Note: If there are QAL-specific deviations in the description of the AccuMind® in this manual, the relevant paragraph is marked as follows:

For QAL1 application
Explanation of the deviation.

3.3 Application with differential pressure sensor

The flow calculation for differential pressure transmitters in the AccuMind® is based on the following correlation for the mass flow (according to ISO 5167):

$$q_m = \frac{C}{\sqrt{1-\beta^4}} \cdot \varepsilon \cdot \frac{\pi}{4} \cdot d^2 \cdot \sqrt{2 \cdot \Delta p \cdot \rho}$$

Variable	Explanation
q_m	Mass flow
C	Flow coefficient
β	Diameter ratio
ε	Expansion number
d	Inner diameter of the bottleneck
Δp	Differential pressure
ρ	Density of the medium before the bottleneck

Alternatively, the calculation can also be performed according to AGA-3.

3.4 Application with volume flow sensor

The mass flow for a volume flow sensor results from this formula:

$$q_m = q_V \cdot \rho$$

Variable	Explanation
q_m	Mass flow
q_V	Volume flow
ρ	Density of the medium

Alternatively, an AGA-7 volume flow sensor can be used.

3.5 Supported media

The AccuMind® supports the following media:

Medium/characteristic	Explanation
Gas	Calculation of gas properties according to various equations of state: Ideal gas, Redlich-Kwong, Redlich-Kwong-Soave, Peng-Robinson.
	Calculation according to AGA-8 DC/GC, SGERG 88 and AGA-NX19
	Additional simplified mode with standard density query
Superheated steam	Calculation of properties according to IAPWS-97 Temperature and pressure measurement required

Medium/characteristic	Explanation
Saturated steam (p)	Calculation of properties according to IAPWS-97 Pressure measurement required
Saturated steam (T)	Calculation of properties according to IAPWS-97 Temperature measurement required
Water	Calculation of properties according to IAPWS-97
Heat transfer oil	Calculation of the properties depending on the oil temperature using tables of values. Import/export function for a user-defined oil
Simplified liquid	Indication of a constant density

3.6 Required sensors

If the AccuMind® has been ordered parameterized, the parameterization sheet provides information on which sensors are to be connected to which terminals.

For an unparameterized AccuMind®, the following description is used to determine which sensors are required. These sensors are then connected in accordance with section 5.

The differential pressure Δp generated by a differential pressure sensor is measured by a differential pressure transmitter and processed by the AccuMind®.

A volume flow sensor transmits the determined volume flow q_V directly to the AccuMind®.

The density is usually determined on the basis of the temperature and pressure of the medium. For the temperature T1 and the pressure p sensors can be used or fixed values can be parameterized.

A sensor is required for each quantity to be measured. The following table shows which connection options are available for the individual measured variables and when the respective sensor is NOT required:

Measurand	Connection options	not necessary for
Differential pressure Δp[1]	Analog inputs Ain1 to Ain4 (if the differential pressure is to be determined via HART®, only Ain1 and Ain2); see 5.4.2	Application with volume flow sensor
Volume flow q_V	Analog inputs Ain1 to Ain4; see 5.4.2 or frequency/pulse input 1; see 5.4.3	Application with differential pressure sensor
Temperature T1	Analog inputs Ain1 to Ain4; see 5.4.2 or 1st Pt100; see 5.4.1	Fixed value Saturated steam (p) Simplified liquid
Temperature T2[2]	Analog inputs Ain1 to Ain4; see 5.4.2 or 2nd Pt100; see 5.4.1	Fixed value No heat quantity application
Pressure p	Analog inputs Ain1 to Ain4; see 5.4.2	Fixed value Saturated steam (T) Liquids[3]

Notes:

[1]: Two transmitters may also be used for differential pressure: One covers the lower range and the other the upper range (split-range application).

[2]: A 2nd temperature (T2) is required for heat quantity calculations. The determination of the 1st temperature (T1) always takes place at the position of the actual flow measurement. The determination of the 2nd temperature (T2) takes place at the position in the pipe course where a heat supply or heat dissipation takes place. The heat quantity is output by the AccuMind® as an absolute value (regardless of whether cooling or heating is used). The 2nd temperature can also be parameterized as a fixed value. The default value is then 0 °C.

[3]: For water, a pressure sensor can optionally be used, otherwise the density is determined with a parameterizable design pressure.

For QAL1 application

Measurand	Connection options	not necessary for
Differential pressure Δp	Analog input Ain1; see 5.4.2	–
Temperature T1	Analog input Ain4; see 5.4.25.4.2 or 1st Pt100; see 5.4.1	Fixed value
Pressure p	Analog input Ain3; see 5.4.2	Fixed value

3.7 Functional enhancements

The AccuMind® can control certain external components and thus extend the functionality. See section 8 for details.

4 Mounting the AccuMind®

4.1 Panel mounting case (ordering option "PM")

This version of the AccuMind® is mounted by default in a panel cut-out (dimensions see 2.3).

For mounting, the two brackets at the side are removed by pressing them forward. The unit is then inserted into the front of the control panel. The brackets are then reinstalled, and the screws tightened. Ensure that the supplied gasket is firmly seated between the display unit and the control panel.

4.2 Wall mounting case (ordering option "WM")

This version of the AccuMind® is screwed for example to a wall using the four mounting holes provided (see Figure 7).

On the left side there is a cover profile which can be folded to the side. Below it there are two locking screws which connect the cover of the housing with the lower part. After loosening the two screws, the cover can be folded back (see Figure 8).

Notes:

The protection class of the housing is only guaranteed if the locking screws are retightened after closing the cover.

The left cable gland also serves to equalize the pressure of the case. It must not be replaced by a standard cable gland.

5 Terminal assignment and electrical connection

5.1 Connections at the AccuMind®

The terminals/connections on the AccuMind® can be divided into four areas. These are highlighted in color in Figure 9 and Figure 10.

Area	Color
Power supply terminal (Type of terminal: screw terminal; max. wire cross section: 3.3 mm²)	Orange
Main terminal strip (Type of terminal: spring clamp terminal; max. wire cross section: 1.3 mm²)	Blue
Ethernet connection/USB socket	Green
D-Sub connector (optional for panel mounting case, not available for wall mounting case)	Red

The terminals for the electrical connection are pluggable. The power supply terminal is additionally secured with screws.

5.1.1 Panel mounting case (ordering option “PM”)

The terminals/connections are located on the back of the panel mounting case.

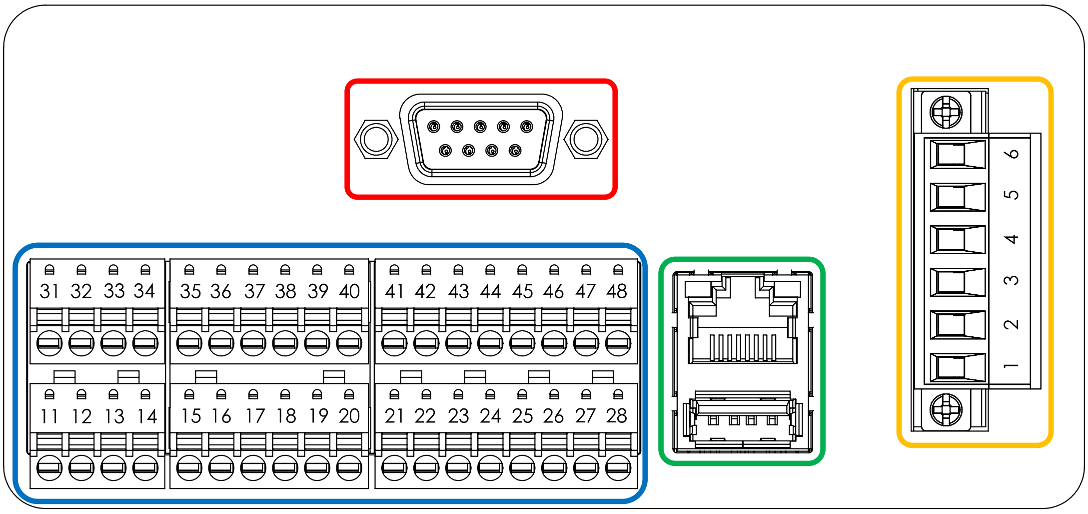


Figure 9: Rear side of the AccuMind®

5.1.2 Wall mounting case (ordering option “WM”)

The terminals/connections are located inside the wall mounting case. They are accessible after opening the cover.

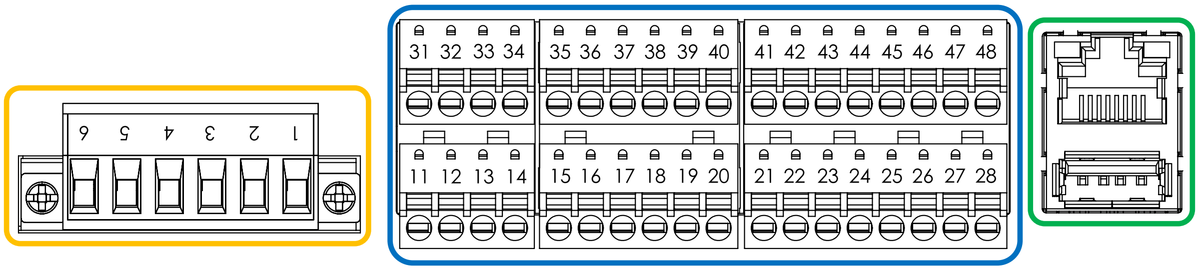


Figure 10: Connections inside the wall mounting case

5.1.3 Wall mounting case with third analog output (ordering option “WMA”)

With the “WMA” order option, there is an isolation amplifier inside the wall mounting case which provides a third analog output. This output delivers the unchanged analog input signal, which is present at the third analog input. For wiring see 5.4.5.

5.2 Nameplate

Figure 10 shows an example of an AccuMind® nameplate. The nameplate is located on the upper side of the panel mounting case, on the wall mounting case it is visible after opening the cover.

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

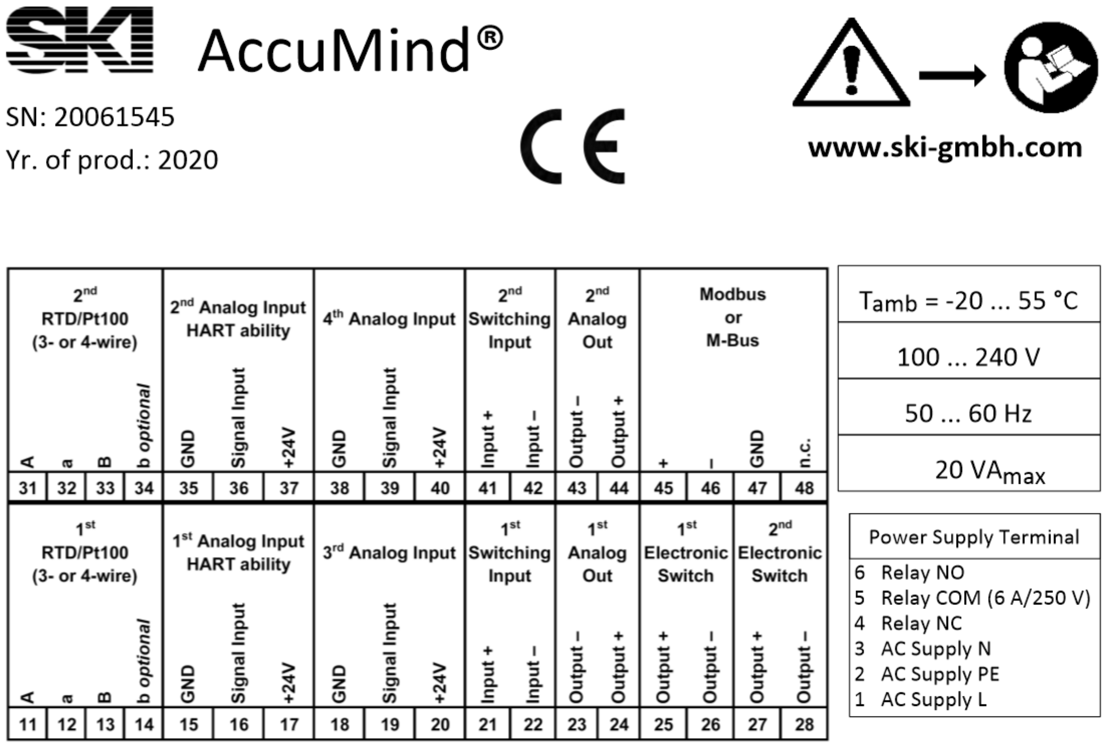


Figure 11: AccuMind® nameplate

5.3 Power supply terminal with relay

Power supply terminal for AC connection

Pin	Description
1	L
2	PE
3	N
4	Relay NC
5	Relay COM
6	Relay NO

Power supply terminal for DC connection

Pin	Description
1	Unused
2	GND
3	L+
4	Relay NC
5	Relay COM
6	Relay NO

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

The supply voltage is connected via the power supply terminal (with the “WMA” order option, the supply voltage to the power supply terminal is pre-wired; see 5.4.5). For the parameterization of the relay R see 9.2.4.

5.4 Main terminal strip

5.4.1 Connection of the Pt100/RTD

1st Pt100/RTD

Pin	Description
11	Port A
12	Port a
13	Port B
14	Port b (optional)

2nd Pt100/RTD

Pin	Description
31	Port A
32	Port a
33	Port B
34	Port b (optional)

The Pt100 temperature resistors (RTDs) can be connected in 3- or 4-wire connection.

The 3-wire connection for the 1st Pt100/RTD is as shown in the Figure 12. The 4-wire connection is illustrated in the Figure 13. The terminal assignments for the 2nd Pt100/RTD are given in brackets.

If the temperature sensor is equipped with a transmitter, the connection is made as described in 5.4.2.

For the parameterization of the temperature inputs see 9.2.2.4.

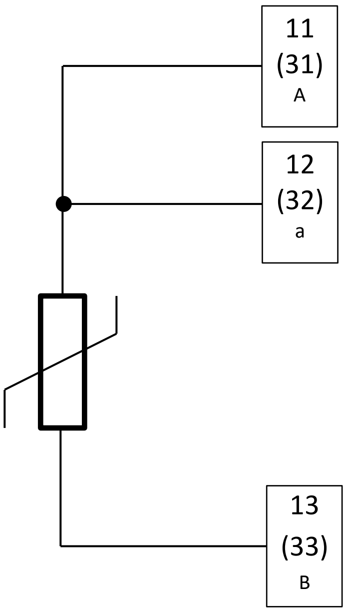


Figure 12: 3-wire connection

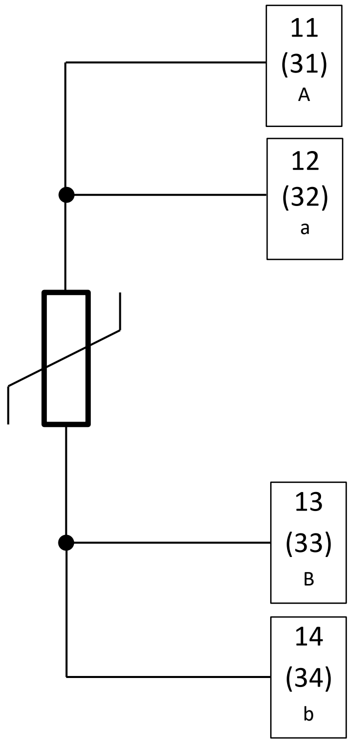


Figure 13: 4-wire connection

5.4.2 Transmitters at the analog inputs

1st analog input (Ain1); HART® capable

Pin	Description
15	Transmitter GND (for active tr.)
16	Signal input for **the 1st analog input**
17	Transmitter supply +24 V (for passive tr.)

2nd analog input (Ain2); HART® capable

Pin	Description
35	Transmitter GND (for active tr.)
36	Signal input for **the 2nd analog input**
37	Transmitter supply +24 V (for passive tr.)

3rd analog input (Ain3)

Pin	Description
18	Transmitter GND (for active tr.)
19	Signal input for **the 3rd analog input**
20	Transmitter supply +24 V (for passive tr.)

4th analog input (Ain4)

Pin	Description
38	Transmitter GND (for active tr.)
39	Signal input for **the 4th analog input**
40	Transmitter supply +24 V (for passive tr.)

For the assignment of the inputs to the measured variables see 9.2.1. For the parameterization of the transmitter settings see 9.2.2.

For QAL1 application

Fixed assignment of analog inputs

Ain1: Differential pressure transmitter
Ain2: External triggering (see 5.8.2)
Ain3: Pressure transmitter
Ain4: Temperature transmitter

If the temperature is determined with a Pt100 (without transmitter), the connection is made according to 5.4.1.

Passive transmitters are connected with their plus terminal to the +24 V supply output of the respective analog input. The minus terminal is connected to the respective signal input. The Figure 14 shows an example of a differential pressure transmitter at the 1st analog input.

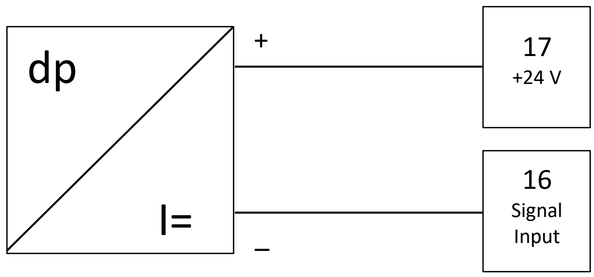


Figure 14: Connection of a passive transmitter

Active transmitters are connected with their plus terminal to the signal input contact of the respective analog input. The minus terminal is connected to the respective GND contact. The Figure 15 shows an example of a pressure transmitter at the 3rd analog input. "AE" stands for the auxiliary energy with which the transmitter is supplied.

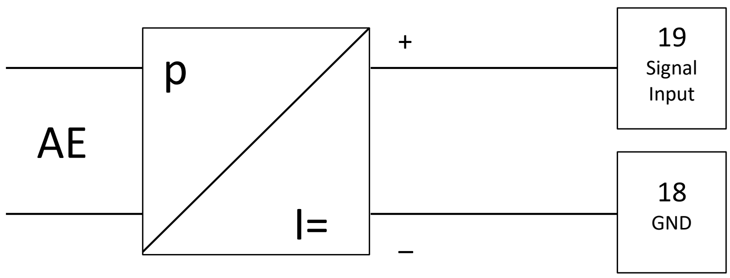


Figure 15: Connection of an active transmitter

5.4.3 Switching and frequency inputs

1st switch/frequency input

Pin	Description
21	Connection +
22	Connection –

2nd switch/frequency input

Pin	Description
41	Connection +
42	Connection –

These inputs are used, for example, to connect a volumetric flow sensor (1st input; see 9.2.2.2) if it has a frequency output or an AGA-7 sensor (see 9.2.2.3). They are also used when connecting functional extensions.

5.4.4 Connection of the analog outputs

1st analog output

Pin	Description
23	Connection –
24	Connection +

2nd analog output

Pin	Description
43	Connection –
44	Connection +

Process variables can be output as 0/4…20 mA signals via the analog outputs. For the parameterization of the outputs see 9.2.4.

5.4.5 Third analog output with "WMA" order option

The wiring of the isolation amplifier installed for order option "WMA" is shown below. The components drawn through are part of the order option. The isolation amplifier and the additional terminal strip are located inside the wall mounting case. The components are wired at the factory. The dashed connection illustrates the connection of an external pressure transmitter. This transmitter is supplied with 24 V from the AccuMind®. The analog signal (4 ... 20 mA) of the transmitter is available for the AccuMind® at the 3rd analog input (Ain3) and externally via terminals 9 (+) and 10 (-).

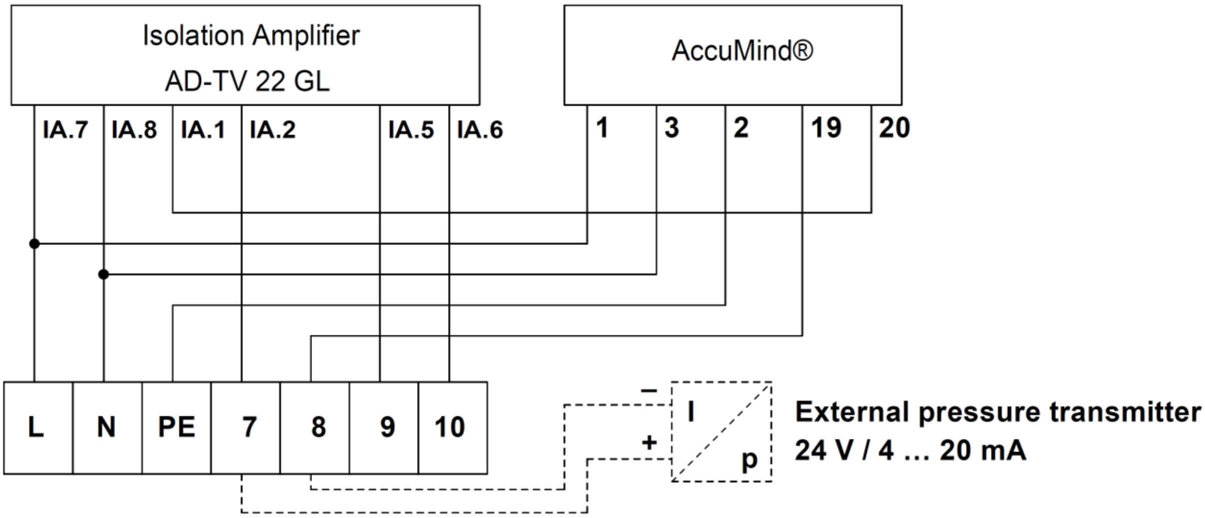


Figure 16: Wiring option "WMA" for AC connection

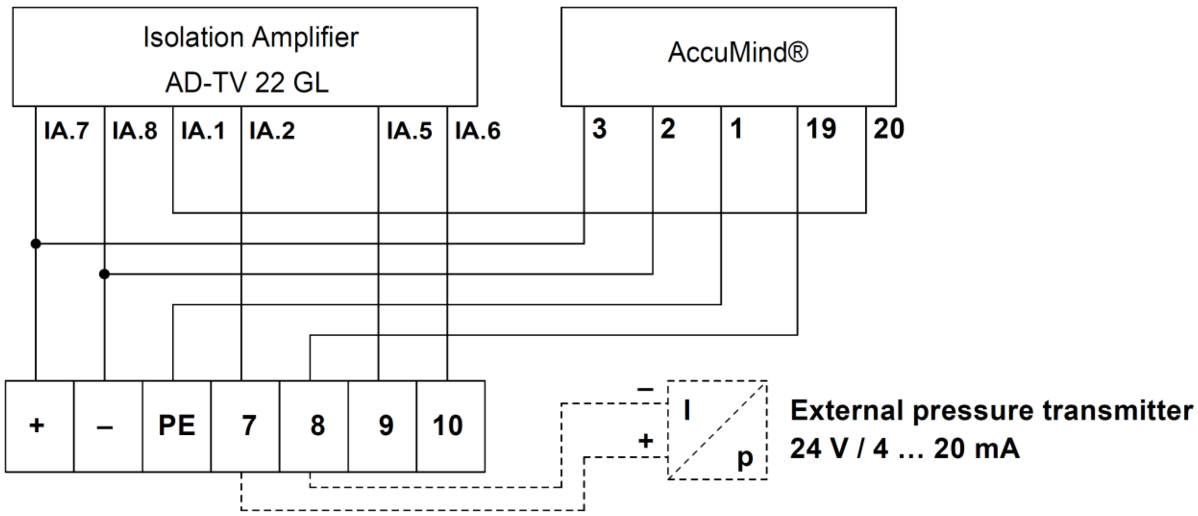


Figure 17: Wiring option "WMA" for DC connection

The extended nameplate shows the assignment of the terminals. In particular, the type of supply voltage must be observed. See Figure 18.

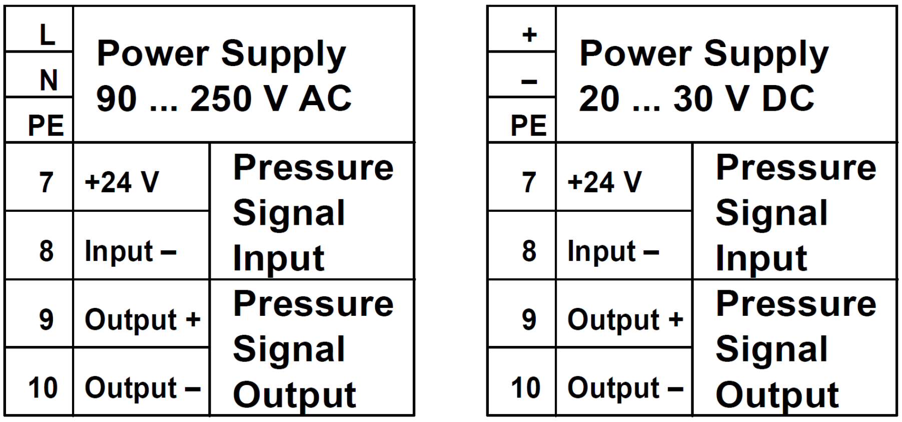


Figure 18: Extended nameplates AC or DC connection with “WMA” order option

5.4.6 Electronic relays

1st electronic relay (NO)
“switching output S1”

Pin	Description
25	Connection + (COM)
26	Connection – (NO)

2nd electronic relay (NC)
“switching output S2”

Pin	Description
27	Connection + (COM)
28	Connection – (NC)

The AccuMind® offers two electronic relays/switches. These are used, for example, for the output of status signals or as frequency/pulse outputs. For the parameterization of the electronic relays see 9.2.4. Figure 19 shows a connection recommendation for the 1st electronic relay. The resistance R should be 5 to 10 kΩ. The 2nd electronic relay is connected in the same way.

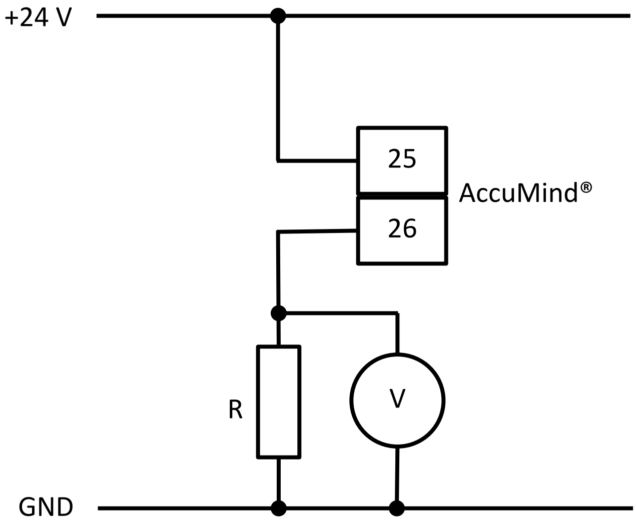


Figure 19: Connection recommendation for 1st electronic relay

5.4.7 Modbus/M-Bus (Serial 1)

Pin	Description
45	Connection +
46	Connection –
47	GND connection

The AccuMind® offers an interface for Modbus/M-Bus. The interface assignment must be selected when ordering (“1st Interface”, see section 13). For the parameterization of the interface see 9.2.5.

5.5 Ethernet interface

The AccuMind® offers an Ethernet interface. This allows access to the web server of the AccuMind® and provides Modbus TCP. A standard Ethernet cable is required for the connection. For the parameterization of the interface see 9.2.5.

5.6 D-Sub connector (Serial 2)

Pin	Description
5	GND connection
8	Connection +
9	Connection –

A standard serial cable with 1:1 wiring is required for the optional D-Sub connection (“2nd Interface”, see section 13). For the parameterization of the interface see 9.2.5.

5.7 Interface converter for Profibus/Profinet

An interface converter for the first or second serial interface of the AccuMind® is used for communication via Profibus DP Slave or Profinet.

When using the first serial interface (option PB/PN for “1st Interface”, see section 13), a corresponding D-Sub connector with screw terminals is supplied to create a connecting cable.

When using the second serial interface (option PB/PN for “2nd Interface”, see section 13), a corresponding connecting cable (length approx. 2 m) is supplied.

5.7.1 Technical data of the interface converter

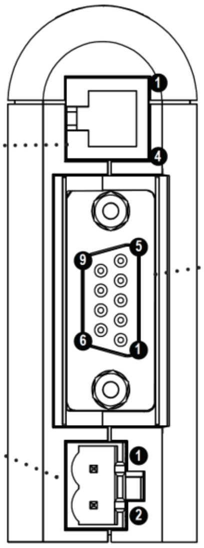
Technical specifications	
Power supply	24 V DC ±10 %
Current consumption	max. 300 mA, typical 100 mA
Dimensions (mm)	27 W × 120 H × 75 T (in mm³)
Degree of protection	IP20
Mounting	DIN rail TH 35 (Top hat rail IEC/EN 60715 35 × 7.5 mm²)
Operating temperature	0 … 55 °C
Storage temperature	–40 … 85 °C
Relative air humidity	0 … 95 %; non-condensing

Technical specifications

Installation altitude	up to 2000 m

5.7.2 Electrical connection of the interface converter

The interface converter is connected to the power supply and the AccuMind®. See Figure 20.



Power supply terminal

Pin	Description
1	+24 V DC
2	GND

D-Sub socket

Pin	Description
5	GND connection
8	Connection +
9	Connection –

Figure 20: Interface converter (bottom view)

The connection between the interface converter and the control station is made via the socket located on the front: D-Sub socket for the Profibus version and RJ45 socket for the Profinet version.

5.8 Connection of an LSE-HD (functional extension)

5.8.1 General wiring

For the connection of the optional air purging unit LSE-HD (options “LS”/“LA”, see section 13), the connection is as shown in the Figure 21. The remaining electrical connections are the same as in the previous sections.

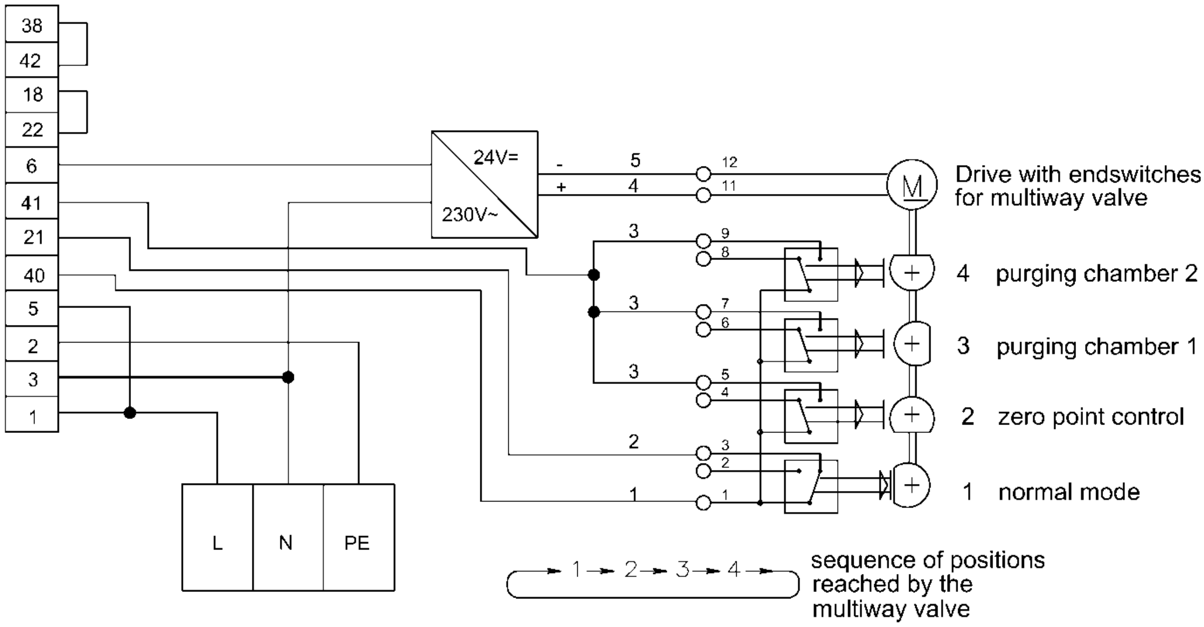


Figure 21: Wiring diagram for LSE connection

5.8.2 External triggering

If an external triggering of the purging cycle is desired, the connection for this is realized as shown in the Figure 22. The resistor R must be between 5 and 10 kΩ.

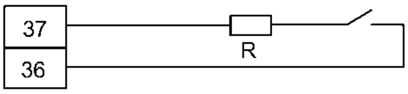


Figure 22: Connection of the external triggering of the LSE

The two terminals 36 and 37 are used as standard. The triggering is then parameterized for the 2nd analog input Ain2. Alternatively, another analog input can also be used. The terminals for transmitter supply and signal input of the respective analog input must then be used (see 5.4.2) and the parameterization must be changed (see 9.2.1).

For QAL1 application

The external triggering is a fixed parameter for Ain2.

5.9 Connection of an AccuFlo®Zero (functional extension)

The connection of the optional AccuFlo®Zero zero-point correction device is described in the "AccuFlo®Zero Operating and Mounting Instructions". An external triggering of the zero-point calibration takes place as described under 5.8.2.

6 Operation

If the AccuMind® was ordered preconfigured, it displays the respective process values after connection with all necessary sensors and subsequent establishment of the power supply of the device.

The general operation of the device is described in 6.1

The display of the process values can be adjusted according to 6.2

If not all electrical connections have been made during commissioning, the AccuMind® will issue corresponding error messages. See section 7.

The operation of functional extensions (e.g. the automatic air purge unit LSE) is explained in section 8.

If the AccuMind® has been ordered unconfigured or if the parameters are to be adjusted, this is done according to section 9.

Refer to section 10 for details on the use of the digital interfaces.

Note: Changes to the settings are not saved automatically. Thus, it is possible to use a new parameterization for test purposes and to return to the old parameterization by restarting or pressing “Load config” (see 9.3). The changes are permanently accepted via the service menu (“Save config.”; see 9.3).

6.1 General operation

In the basic state, the user has five different display screens (process screens) at his disposal. There are process screens with one, two, three, five and six fields for displaying one result each (display tiles; see Figure 23).

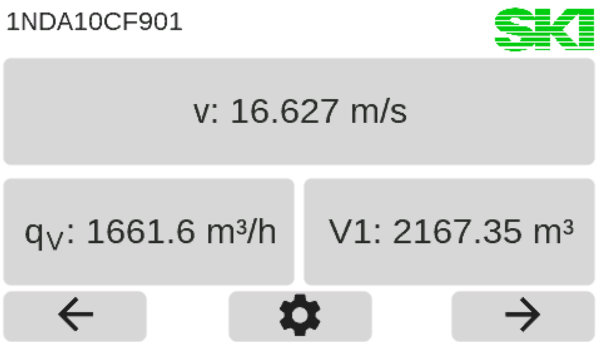
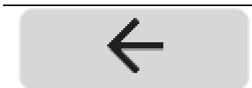
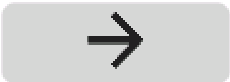
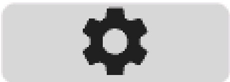
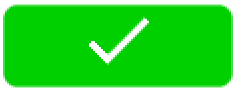
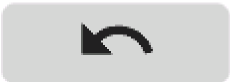
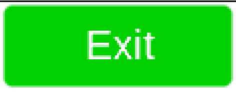


Figure 23: Process screen with three display tiles

The AccuMind® is operated via a touch display. Depending on the context, buttons are shown at the bottom of the display.

	Buttons
	Show the previous screen
	Show the next screen
	Call up the parameterization/special functions menu (see 6.4).
	Accept a setting and switch to the higher-level menu
	Do not accept changed settings and switch to the higher-level menu

	Buttons
	Exit a menu level

6.2 Rights management/Authentication

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

Note: The codes can be changed. See 9.4.

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

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

As soon as it is necessary, the code is requested (see Figure 24). An automatic logout occurs 10 minutes after the last user input.

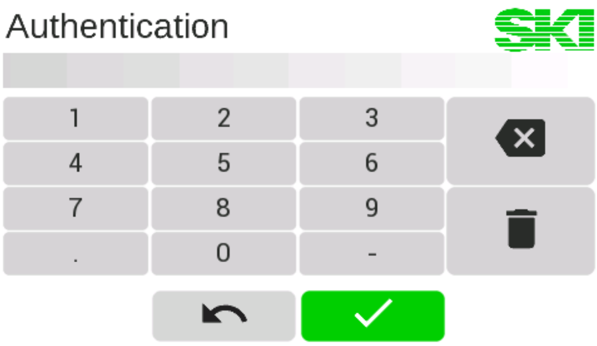


Figure 24: Code query

6.3 Adaptation of the display screens

The displayed value of a display tile can be changed by pressing on the corresponding tile. For each tile various properties can be adapted (see Figure 25).

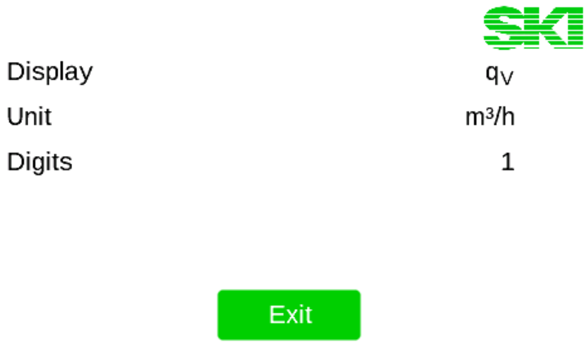


Figure 25: Overview page for one display tile

Pressing a property line opens another subpage with the query of the respective variables (for the value “Display” there is a query of the category before, see Figure 26). In the example, “Volume flow q_V” was selected from the “Process values” category as the display value. A press on the category “Clear” creates an empty tile.

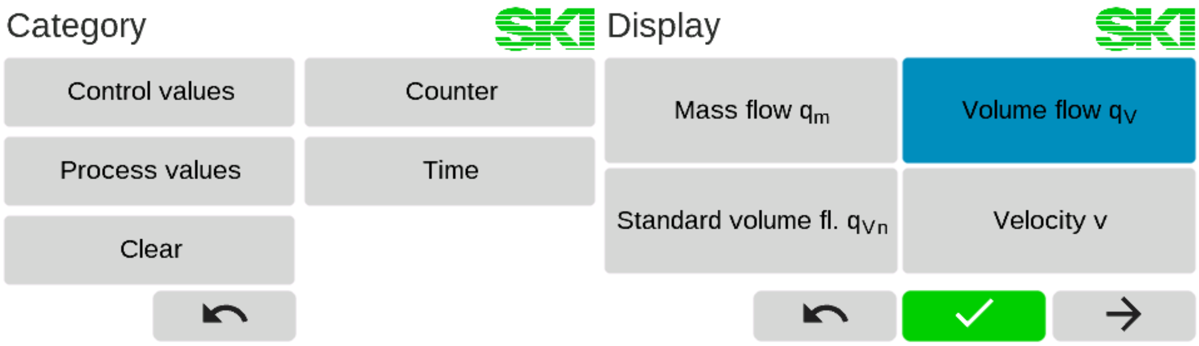


Figure 26: Requesting the category and the desired display value

Currently selected values are highlighted in blue. Pressing another value selects it. Figure 27 shows the query of the units of measurement and the decimal places.

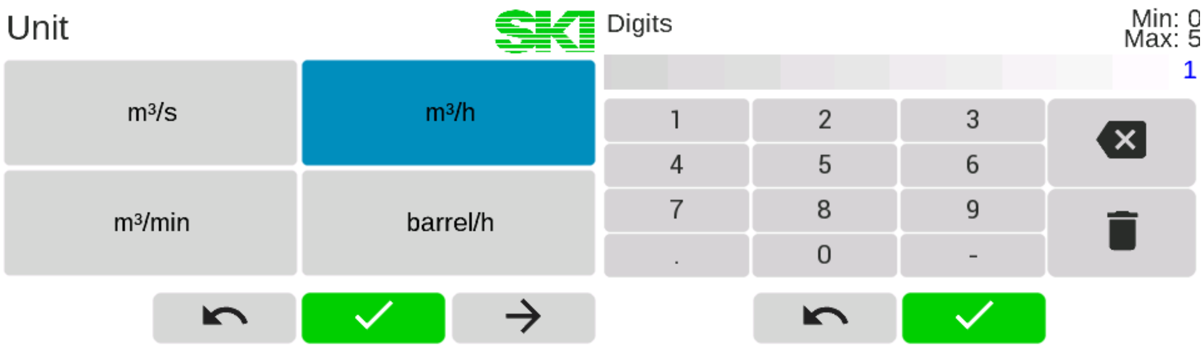


Figure 27: Query of unit of measurement and decimal places

6.4 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 28). There, functional extensions can be invoked (see section 8) and the AccuMind® parameters can be displayed or changed (see section 9).

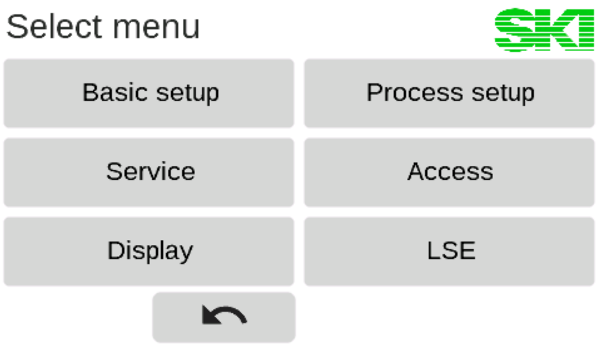
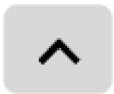


Figure 28: Menu selection

6.5 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
	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 29).

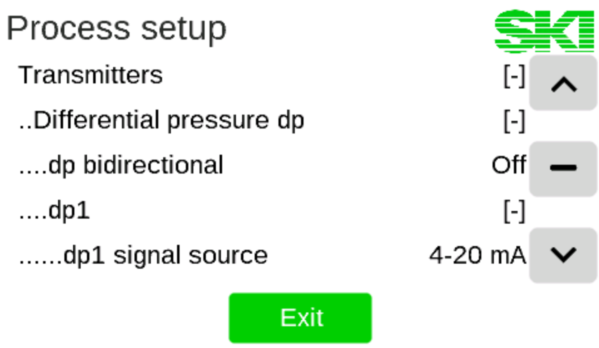


Figure 29: Expanded tree structure

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 27).

There are also lines that trigger a function (e.g. a purging process).

Note: If the text of a branch of the tree structure is grayed out, the corresponding parameter cannot be changed. This occurs when another option causes this parameter not to be changeable.
If the text on a selection tile is grayed out, the corresponding option cannot be selected. Either the

function is deactivated by another option or the respective function is not activated (for activation of functions see 9.3.4).

7 Output of warnings and errors

7.1 General information

The AccuMind® signals states deviating from the standard state in its display, via the electronic/mechanical relays, the digital interfaces and/or the analog outputs.

7.2 Display indication

Figure 30: Information text above the display tiles

As shown in Figure 30 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 31). Warnings are displayed in yellow and errors in red.

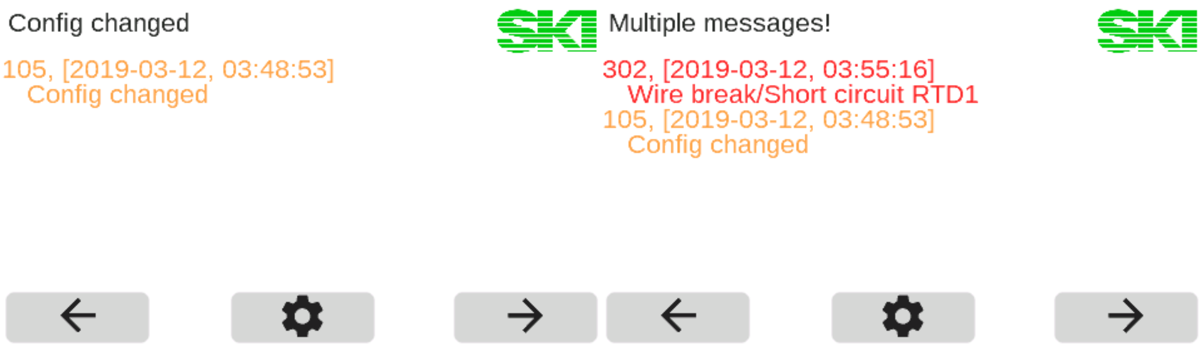


Figure 31: Overview page for messages

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® outputs warnings in the display. The following table lists the possible warnings:

Warning	Explanation
Config changed	There are unsaved changes. If these are to be accepted, 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.
AinX: Current too low/high	At current input AinX, the 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. 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 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 (see 9.1.3.2).

7.4 Error messages in the display

The AccuMind® outputs error messages in the display. The following table lists the possible error messages:

Error	Explanation
Wire break/short circuit RTDX	There is an error at Pt100 input X. Check the wiring. If no fallback value[1] is parameterized, the calculation is stopped.
No X source	No input has been assigned for one of the measurands “X”. “X” can stand for: “dp1”, “dp2”, “q_V”, “T1”, “T2” or “p” If no fallback value[1] is parameterized or no fallback value can be parameterized for the relevant measurand, the calculation is stopped. An input must be parameterized for the respective measured variable (see 9.2.1).
AinX: Wire break	No transmitter is detected at the relevant signal input AinX or the current from the transmitter is too low (AinX ≤ 3.65 mA[2]). The wiring must be checked. If no fallback value[1] is parameterized, the calculation is stopped. This error cannot be detected with signal input 0 … 20 mA.
AinX: Short circuit	The transmitter at signal input AinX emits a current that is too high (AinX ≥ 20.95 mA[2]) or there is a short circuit. Check the wiring and/or the transmitter. If no fallback value[1] is parameterized, the calculation is stopped.

Error	Explanation
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 current signal. If the transmitter is not HART®-capable, the signal source of the analog input should be changed accordingly (see 9.2.2.1).
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 (see 9.1.3.2).
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.

Notes:

[1]: For the pressure and temperature inputs, fallback values can be parameterized. This fallback value is then used in the event of a wire break, defect or short circuit of the sensor concerned. See 9.2.2.4.

[2]: A hysteresis of ±0.02 mA applies.

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

Error messages concerning the functional extensions are listed separately when these extensions are described.

7.5 Signaling of errors via the outputs

Errors are also signaled via the outputs.

Output	Explanation
Fallback current at analog output X	If a flow calculation is not possible (see 7.4) and a flow value is to be output at analog output X, this outputs a parameterizable fallback value (see 9.2.4).
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 9.2.4). The collective alarm is triggered if there is an error (see 7.4).

Note: Additional signals may occur with the functional extensions, these are listed in the description of the extensions.

8 Functional extensions

Functional extensions can be used and adapted starting from the menu selection (see 6.4).

8.1 Air purging unit LSE

8.1.1 Background

The AccuMind® can control the optional LSE-HD air purge unit. Details on the LSE can be found in the separate instructions “Purging facility LSE-HD (basic version with drive, without control)” in the respective valid version.

Note: A purging cycle is only carried out if there is a valid temperature reading for T1 (i.e. T1 is not “nan”) and if T1 < 400 °C.

8.1.2 Display

If the LSE functionality is activated in the basic setup (see 9.1.6), there is an additional screen (see Figure 32). This screen displays the status of the LSE and offers two additional tiles for the display of process values. In the home or normal position, which corresponds to the measuring mode, the remaining time until the next purge is displayed in the status area (if the timer mode is deactivated, the message “Waiting for external triggering” appears).

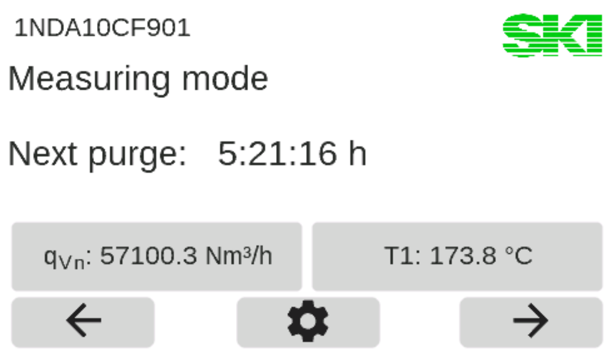


Figure 32: Display with information about the LSE

8.1.3 Sequence of a purging cycle

Note: During a purging cycle, the differential pressure transmitter is not connected to the process. Pressure and temperature measurement can also be influenced by the purging process. Therefore, no current flow rate can be determined during the cycle. The input values for differential pressure, pressure and temperature are thus frozen during the entire purging cycle. The display values and the outputs also retain their last state. Counters continue to count constantly, and pulse/frequency outputs continue to output the last valid values constantly. It is possible to send a status signal to the control station during the purging cycle (see 8.1.6).

If only the current value output by the dp transmitter is required in the control station, it can also be output directly via Aout1 (see 9.2.4). The previously measured current value is then frozen during a purging cycle.

After a parameterized duration (in timer mode) or following an external triggering, a purging cycle is carried out. The following table illustrates a purging cycle:

Output at AccuMind®	**Explanation**	**Approx. duration**
Going to zero-point check	The rotary drive of the LSE is switched on to move to the zero-point control position.	8 s
Zero-point check	The zero-point control position has been reached. The zero-point is checked/corrected.	**"Auto zero-point": On:** 10 s **Off:** Value set at menu entry "Zero-point check duration [s]"
Going to chamber 1	The rotary drive of the LSE is switched on to approach the first chamber.	8 s
Purging chamber 1	The position for purging the first chamber has been reached. The first chamber is purged.	Value set at menu entry "Purging duration [s]"
Going to chamber 2	The rotary drive of the LSE is switched on to approach the second chamber.	8 s
Purging chamber 2	The position for purging the second chamber has been reached. The second chamber is purged.	Value set at menu entry "Purging duration [s]"
Going to the home position	The rotary drive of the LSE is switched on to approach the home position.	8 s
Waiting for settling	The home position has been reached. The transmitter is granted time to settle back to the process conditions.	Value set at menu entry "Settling duration [s]"

Note: While the LSE is moving to a position, the message "Motor timeout: 36 s / 40 s" also appears. The "40 s" in this example indicate the maximum time that may elapse until the next position is reached. The "36 s" indicate the current remaining time. If this remaining time has expired – i.e. the LSE has not approached a defined position within 40 s – the LSE is defective. The message "Error: Destination not reached! Check motor!" will appear.

The drive may only be inspected when it is disconnected from the supply voltage.

Note: While the LSE is in one of the states "Zero-point check", "Purging chamber 1", "Purging chamber 2" or "Waiting for settling", a "Remaining time: 17 s / 20 s" is also displayed. The "20 s" in this example indicate the parameterized duration of the respective process. The "17 s" indicate the current remaining time. If automatic zero-point correction is activated (see note under 8.1.4), no remaining time is displayed in the "zero-point check" state because the correction is carried out depending on the parameterization and the behavior of the transmitter.

8.1.4 Parameterization and manual control

The LSE menu (see Figure 33) can be called up from the menu selection (see 6.4). The general operation of the submenus is described in 6.5

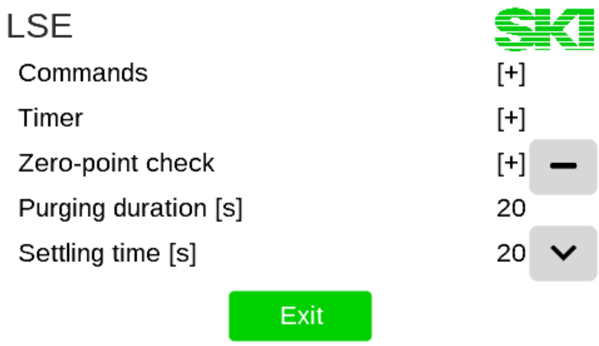


Figure 33: The LSE menu

Notes:

The LSE can be operated in two modes: With or without automatic zero-point correction. If the "LA" option is activated (see section 13), the automatic zero-point correction can be switched on. If there are differences in the output or operation between the two variants, a distinction is made between the two in the following tables.

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

Value	Option	Remark
Commands	*fold-out function*	
..Start purging	function release	Starts a purging cycle
..Move to zero-point position	function release	The LSE is moved to the zero-point control position. The current value or differential pressure output by the transmitter is then displayed. A zero-point calibration can be carried out on the differential pressure transmitter after installation and afterwards if required. If the "LA" option is activated, the zero point can also be set via "..Set zero point" (see next point).
..Set zero-point	function release	Will set the zero-point. This command is only active if the LSE is in zero-point control position (see previous point). Only available when the "LA" option is activated; "HART" must be selected as the differential pressure transmitter signal source (see 9.2.2.1). The zero point is set independently of the displayed value (i.e. the previously set zero-point of the transmitter).
..Move to home position	function release	The LSE is moved back from the zero-point control position to the home position.
Timer	*fold-out function*	
..Timer active	On Off	Activates or deactivates timer operation

Value	Option	Remark
..Timer duration [min]	numerical value	Indication of the waiting time between two purging cycles. Only visible when timer operation is active
Zero-point check	*fold-out function*	
..Auto zero-point	On Off	Activates or deactivates the automatic zero-point correction. If the function is active, HART must be selected as the signal source for the differential pressure transmitter (see 9.2.2.1).

Menu entries for: “Auto zero-point”: On

Value	Option	Remark
..Zero-point max. dev.	numerical value	Indication of the maximum permissible zero-point deviation BEFORE the zero-point calibration. If the deviation of the zero point (in comparison 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.

Menu entries for: “Auto zero-point”: Off

Value	Option	Remark
…Zero-point check duration [s]	numerical value	Indication of the duration of the zero-point check. The transmitter must be given the opportunity to settle to zero. This duration depends mainly on the damping of the transmitter.
..Zero-point I.min	numerical value	The minimum permissible current output value of the transmitter at zero-point condition
..Zero-point I.max	numerical value	The maximum permissible current output value of the transmitter at zero-point condition

Continuation for any setting of “Auto zero-point”

Value	Option	Remark
Purging duration [s]	numerical value	Duration of the purging of each chamber
Settling duration [s]	numerical value	Indication of the duration of settling in the measuring (home) position. The transmitter must be given the opportunity to settle to the measured value. This duration depends mainly on the damping of the transmitter.
Motor timeout [s]	numerical value	The maximum time the motor may turn until it has reached the target position.

8.1.5 Error messages in the display

For further information see the explanation under 7.2

Error	Explanation
Zero-point failure	For “Auto zero-point: On”: The error is output if the automatic zero-point correction could not be carried out. Possible causes: After installation, no initial zero point calibration was carried out (see 8.1.4); the value for the max. zero-point deviation is parameterized too small or there is a defect. For “Auto zero-point: Off”: The error is output if a deviation of the current value that is too large was detected during the zero-point check. To correct the error, a manual zero-point calibration must be carried out on the differential pressure transmitter.
Autom. zero-point needs HART	Automatic zero-point correction can only be performed if the differential pressure transmitter is connected to a HART®-compatible analog input (Ain1 or Ain2) (see 5.4.2) and HART has been selected as the signal source for the differential pressure transmitter (see 9.2.2.1).
Drive failure	The target position could not be reached. The calculation is stopped. The drive/wiring of the LSE must be checked.
Wire break LSE	A target position could not be reached. The LSE is in the home position again. The drive/wiring of the LSE must be checked.
	The drive/wiring may only be inspected when it is disconnected from the supply voltage.

8.1.6 Signaling to the control station/another LSE

The errors listed under 8.1.5 will result in the output signals described under 7.5.

The AccuMind® can output additional signals to the control system and to another LSE (with AccuMind®) via the switching outputs S1/S2 and the relay R. The drive of the LSE is also controlled. The parameterization of the switching outputs and the relay is explained under 9.2.4.

Signal name	Explanation
Motor control switch	This signal is used to control the drive of the LSE. By default, the relay R is used for this purpose.
LSE operating indicator	During a purging cycle and during manual control, this signal indicates that the measured values are frozen.
LSE error	This signal is output if there is an error concerning the LSE (see 8.1.5).
Next LSE	If two (or more) LSE are to be used at one measuring point, one LSE controls one further LSE at a time. This ensures that current measured values are always available for at least one flow measurement at an LSE position, since never more than one LSE performs a purging cycle at the same time.

For QAL1 application

Since the switching outputs S1/S2 in QAL1 applications are assigned to a fixed function, only the "Motor control switch" signal is available on the relay R.

8.2 Automatic zero-point calibration AccuFlo®Zero

8.2.1 Background

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

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

Details on the AccuFlo®Zero can be found in the separate "Installation and Operating Instructions AccuFlo®Zero" in the currently valid version.

In the AccuMind®, the name "AccuFlo®Zero" is shortened to "Zero" for display reasons.

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

If the "AZ" option is activated (see section 13), the automatic zero-point calibration can be switched on. "HART" must be selected as the signal source of the differential pressure transmitter (see 9.2.2.1).

8.2.2 Display

If the zero functionality is activated in the basic settings (see 9.1.6), there is an additional display page (see Figure 34). This screen displays the status of the AccuFlo®Zero and provides two additional tiles for displaying process values. In the normal status, which corresponds to the measuring mode, the remaining time until the next zero-point calibration is displayed in the status area (if the timer mode is deactivated, the message "Waiting for external triggering" appears).

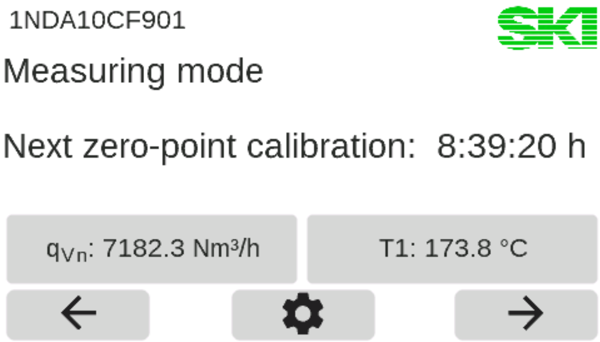


Figure 34: Display with information about the AccuFlo®Zero

8.2.3 Sequence of a zero-point calibration

Note: During a zero-point calibration, the differential pressure transmitter is not connected to the process. Therefore, no current flow rate can be determined during the calibration. The input values for differential pressure, pressure and temperature are frozen during the entire calibration process. Thus, the display values and the outputs also retain their last state. Counters continue to count constantly and pulse/frequency outputs continue to output the last valid values constantly. It is possible to send a status signal to the control station during calibration (see 8.2.6).

If only the current value output by the dp transmitter is required in the control station (measured by the AccuMind® at Ain1), it can also be output directly via Aout1 (see 9.2.4). The previously measured current value is then frozen during calibration.

After a parameterized duration (in timer mode), with relevant changes in cell temperature or system pressure or following an external triggering, a zero-point calibration is carried out. The following table illustrates a sequence:

Output at AccuMind®	**Explanation**
Establishing zero-point condition	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 calibration	The transmitter is given time to settle to zero. If the transmitter delivers a constant measured value close to the old zero-point, this value is set as the new zero-point.
Establishing measurement condition	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.

8.2.4 Parameterization and manual control

The Zero menu (see Figure 35) can be called from the menu selection (see 6.4). The general operation of the submenus is described in 6.5

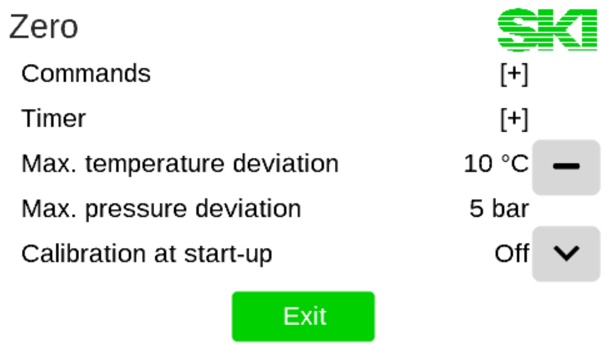


Figure 35: The Zero Menu

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 release	Starts a zero-point calibration
..Establish zero-point condition	function release	The AccuFlo®Zero establishes the zero point condition: the transmitter is disconnected from the process and the two chambers of the transmitter are connected. The differential pressure output by the transmitter is then displayed.
..Set zero-point	function release	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 release	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.
..Execute ventilation	function release	The valves in the AccuFlo®Zero are switched several times to remove any air bubbles. Only available for hardware type “solenoid valves”; only for medium steam or liquid
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

Value	Option	Remark
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.
Calibration at start-up	On Off	Indicates whether an zero-point calibration should be carried out after the power supply has been restored (e.g. after system maintenance).
Ventilation	*fold-out function*	*Sub-item only available for hardware type "solenoid valves"; only for medium steam or liquid*
..Ventilation cycles	numerical value	The number of times the valves are to be switched for venting
..Ventilation at startup-up	On Off	Indicates whether venting should be performed 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.
..Timeout [s]	numerical value	The maximum time granted to the transmitter to reach a stable zero point.
..Max. dp deviation	percentage	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. Indication in percent of the measuring range end value of the transmitter. Example: Measuring range end value = 23.5 mbar; max. dp deviation = 0.1 %. → max. dp value before calibration = 0.0235 mbar
..Hardware type	Rotary actuator Solenoid valves	The type of AccuFlo®Zero used: version with rotary actuator or version with solenoid valves
..Duration with "0 s" damping [s]	numerical value	The damping of the transmitter is read out before the zero-point calibration. It is then set to "0 s" so that the transmitter quickly settles to the zero point condition. (The original damping value is restored after the calibration.)
..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.

Value	Option	Remark
..Max. fluctuation during calibration	percentage	The maximum fluctuation of the zero-point during the zero-point calibration. The zero point reading shall not fluctuate by more than x percent of the full scale during the control period.
..Check duration [s]	numerical value	The duration during which the zero-point must not fluctuate by more than the max. allowed value.

8.2.5 Error messages in the display

See also the explanation under 7.2.

Error	Explanation
Zero-point error	The error is output if the automatic zero-point calibration could not be carried out. Possible causes: No initial calibration was carried out after installation (see 8.2.4); 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 performed if the differential pressure transmitter is connected to a HART®-compatible analog input (Ain1 or Ain2) (see 5.4.2) and HART has been selected as the signal source for the differential pressure transmitter (see 9.2.2.1).
Measurement condition not established	The measurement condition (connection of the transmitter to the process; no connection between the chambers of the transmitter) is not established. There may be a wiring error or a defect. The calculation is stopped.
No connection to Zero	The AccuMind® cannot communicate with the AccuFlo®Zero. There may be a wiring error or a defect.
	The wiring may only be checked when it is disconnected from the supply voltage.

8.2.6 Signaling to the control system

The errors listed under 8.2.5 will result in the output signals described under 7.5.

The AccuMind® can output additional signals to the control system via the switching outputs S1/S2 and the relay R. The parameterization of the switching outputs and the relay is explained under 9.2.4.

Signal name	Explanation
Zero error	This signal is output if one of the errors from 8.2.5 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.

For QAL1 application

Since the switching outputs S1/S2 in QAL1 applications are assigned to a fixed function, only relay R is available.

9 Setting the parameters

The parameters can be displayed and adjusted from the menu selection (see 6.4). The general operation of the submenus is described in 6.5.

In order to parameterize the AccuMind®, it is recommended to proceed from “top to bottom”. All relevant data are entered in the menus one after the other. This procedure is usually so intuitive that the explanations in the following sections often only need to be consulted as a reference.

The AccuMind® menu is structured in such a way that settings made further up in the tree structure can influence menu items further down. If, for example, “Steam” was defined for the selection of the medium, no gas components are queried afterwards (as would happen if a gas were selected).

In this analogy, the basic settings lie above the process settings. Changed basic settings can therefore influence the process settings.

An exception to this rule relates to the selection of the units to be displayed (see 9.2.3). All unit-related values are converted internally to SI units and then stored. You can therefore adjust the units to be displayed at any time.

Note: If basic settings (e.g. the medium type) are changed, the other settings must then be checked from “top to bottom”.

9.1 Basic setup

Note: The basic settings are used for the basic determination of, for instance, the medium to be measured and the flow sensor.

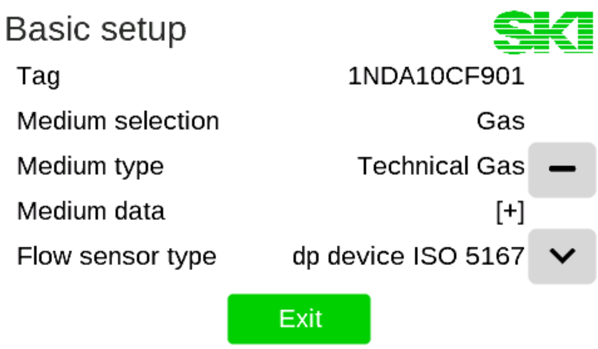


Figure 36: Basic setup

The individual basic settings vary depending on the basic settings already made. A case distinction may therefore be made in the description of the following sub-items.

For QAL1 application
The following values are fixed in the main level of the basic settings:
Medium selection: “Gas” Medium type: “Technical gas” Flow sensor: “dp device ISO 5167”

The following values can be parameterized in the basic settings (see Figure 36):

9.1.1 Tag and medium selection

Value	Option	Remark
Tag	free text	The text entered here appears at the top of the result displays.
Medium selection	Gas Steam Liquid	The medium to be measured can be selected

9.1.2 Type of medium

***Medium type* for basic setting: Medium selection “Gas”**

Value	Option	Remark
Medium type	Technical gas AGA-8 DC AGA-8 GC SGERG 88 AGA-NX19	The type of gas can be selected

For parameterization of the medium data of the gases see 9.1.3.1

***Medium type* for basic setting: Medium selection “Steam”**

Value	Option	Remark
Medium type	Superheated steam Saturated steam (p) Saturated steam (T)	The type of steam can be selected

See 9.1.3.2 parameterization of the medium data for “superheated steam”. For “saturated steam (p)” and “saturated steam (T)” no further medium data need to be entered.

***Medium type* for basic setting: Medium selection “Liquid”**

Value	Option	Remark
Type of medium	Water Heat transfer oil Simplified liquid	The type of liquid can be selected

For the parameterization of the medium data for “Heat transfer oil” and “Simplified liquid” see 9.1.3.3. For “Water” no further medium data have to be entered.

9.1.3 Medium data

9.1.3.1 Medium data for gases

Medium data **for basic setting: Medium selection "Gas"**

Value	Option	Remark
Medium data	*fold-out function*	
..Reference pressure	numerical value	The reference pressure for the desired standard conditions
..Reference temperature	numerical value	The reference pressure for the desired standard conditions

Note: The output of the standard volume flow q_{Vn} always refers to the standard conditions entered here.

Medium data **for basic setting: Medium selection "Gas"; Medium type "Technical gas".**

Value	Option	Remark
Medium data	*fold-out function*	
..Simple mode	On Off	Toggles between standard density query and gas component query. (If a standard density is used, only "Simplified prim. device" and "Simplified pitot tube" of the ISO 5167 devices can be used.)
..Standard density	numerical value	The standard density of the gas mixture (for simple mode: On). The standard density refers to the standard conditions entered under 9.1.3.1 (Table *Medium data* for basic setting: Medium selection "Gas")
..Dew point temperature	numerical value	The dew point temperature of the humid gas mixture (for simple mode: Off)
..Eq. of state	Ideal Gas Redlich-Kwong Redlich-Kwong-Soave Peng-Robinson	Selection of the equation of state to calculate the properties of the gas mixture (for simple mode: Off)
..Gas components	*fold-out function*	*(for simplified mode: Off)*
….Selection from list	Custom comp. List with gases	If you select "Custom comp.", you can create your own gas mixture. Alternatively, a predefined gas (mixture) can be selected from the list.
….Edit mode	On Off	In the edit mode all selectable gas components are displayed (also such with "0 %"). (only if "Custom comp." is selected)
….Normalize	function release	The gas components are normalized in such a way that the sum of all components is 100%. (only if "Custom comp." is selected)

Value	Option	Remark
….Components	*fold-out function*	
……Component x	percentage	The percentage values of the individual gas components.

For QAL1 application
Only the input of a standard density is intended. The setting for the "Simple mode" is therefore fixed to "On".

***Medium data* for basic setting: Medium selection "Gas"; Medium type "AGA-8 DC".**

Value	Option	Remark
Medium data	*fold-out function*	
..AGA-8 DC components	*fold-out function*	
….Component x	percentage	The percentage values of the individual gas components

***Medium data* for basic setting: Medium selection "Gas"; Medium type "AGA-8 GC".**

Value	Option	Remark
Medium data	*fold-out function*	
..AGA-8 GC parameters	*fold-out function*	
….Method	1 2	Calculation method 1 or 2
….Relative density	numerical value	The relative density
….CO2 concentration	percentage	The concentration of CO_2 in mol %
….Calorific value	numerical value	The calorific value of the gas (method 1 only)
….N2 concentration	percentage	The concentration of N_2 in mol % (method 2 only)

***Medium data* for basic setting: Medium selection "Gas"; Medium type "SGERG-88"**

Value	Option	Remark
Medium data	*fold-out function*	
..SGERG-88 parameter	*fold-out function*	
….CH concentration	percentage	The concentration of CH in mol %
….N2 concentration	percentage	The concentration of N_2 in mol %
….CO2 concentration	percentage	The concentration of CO_2 in mol %
….CO concentration	percentage	The concentration of CO in mol %

….Calorific value	numerical value	The calorific value of the gas

***Medium data* for basic setting: Medium selection "Gas"; Medium type "AGA-NX19"**

Value	**Option**	**Remark**
Medium data	*fold-out function*	
..Standard density	numerical value	The standard density of the gas. The standard density refers to the standard conditions entered under 9.1.3.1 (Table *Medium data* for basic setting: Medium selection "Gas")
..AGA-NX19 parameters	*fold-out function*	
….CO2 concentration	percentage	The concentration of CO_2 in mol %
….N2 concentration	percentage	The concentration of N_2 in mol %
….Calorific value	numerical value	The calorific value of the gas

9.1.3.2 Medium data for steam

***Medium data* for basic setting: Medium selection "Steam"; Medium type "Superheated steam"**

Value	**Option**	**Remark**
Medium data	*fold-out function*	
..Water/steam error limit	numerical value	If the temperature for the current pressure value falls below the minimum temperature for the steam state, the AccuMind® continues to calculate in the "Saturated steam (p)" mode. It can be parameterized how far the minimum temperature may be undercut. A water alarm is triggered if the value falls below the limit (see 7.4).

9.1.3.3 Medium data for liquids

***Medium data* for basic setting: Medium selection "Liquid"; Medium type "Heat transfer oil"**

Value	**Option**	**Remark**
Medium data	*fold-out function*	
..Oil selection	List of heat transfer oils Custom oil	A predefined heat transfer oil can be selected from the list. Alternatively, you can select "Custom oil" (user-defined oil).
..Name	display value	The name of the custom oil is displayed. (Only for "Custom oil")

Note: The data of a user-defined oil are imported/exported via the USB menu (see 9.3.3).

Medium data **for basic setting: Medium selection "Liquid"; Medium type "Simplified liquid"**

Value	Option	Remark
Medium data	*fold-out function*	
..Density	numerical value	The density of the liquid

9.1.4 Flow sensor

Value	Option	Remark
Flow sensor type	dp device ISO 5167 Volume flow AGA-3 AGA-7	The flow sensor type can be selected

The measurement design for "dp device ISO 5167" or "AGA-3" is as per 9.1.5.1. For "volume flow" or "AGA-7" as per 9.1.5.3.

9.1.5 Measurement design

9.1.5.1 Measurement design for dp devices according to ISO 5167

Measurement design (ISO 5167) **for basic setting: Flow sensor type "dp device ISO 5167"**

Value	Option	Remark
Measurement design (ISO 5167)	*fold-out function*	
..Device type	Pitot type flow meter Orifice corner tappings Orifice D-D/2 Orifice flange tappings ISA1932 nozzle Long radius nozzle Venturi nozzle CVT machined CVT rough welded CVT cast Cone flowmeter Simplified prim. device Simplified pitot tube	Selection of the differential pressure sensor

Value	Option	Remark
..Material	316L Hastelloy Cxx Inconel Monel 15Mo3 P22 P91/92 No thermal expansion	Selection of the material used for the differential pressure sensor (relevant for the thermal expansion of the differential pressure sensor)
..Throttle opening d	numerical value	The throttle opening of the differential pressure sensor (for all primary elements except “Pitot type flow meter” and “Simplified pitot tube”)
..Flow coefficient C	numerical value	Flow coefficient C (only for primary element “Simplified prim. device”; C is calculated for the other differential pressure sensors)
..Metering factor k	numerical value	The k-factor of the pitot tube (only for primary elements “Pitot type flow meter” and “Simplified pitot tube”)
..Expansion factor eps	numerical value	The expansion factor ε to consider the compressibility of the fluid (only for the primary elements “Simplified prim. device” and “Simplified pitot tube”; ε is calculated for the other differential pressure sensors).
..Pipe	*fold-out function*	
….Material	Carbon steel 316L Monel 15Mo3 P22 P91/92 No thermal expansion	Selection of the material used for the pipe (relevant for the thermal expansion of the pipe)
….Shape	Round Rectangular	Selection of the tube shape
….Inner diameter D	numerical value	The inside diameter of the pipe (only for round shape)
….Duct width	numerical value	Width of the duct (only for rectangular shape)
….Duct height	numerical value	Height of the duct (only for rectangular shape)
..Damping value [%]	numerical value	The damping in percent (the last valid flow rate value is calculated with x percent weighted with the current flow rate value; related to a cycle time of 0.5 s)
..Small flowrate cutoff	*fold-out function*	
….Reference	q_m; q_V; q_{Vn}; v	Reference value for minimum quantity suppression

Value	Option	Remark
….Minimum flowrate	numerical value	The minimum quantity below which the flow value is set to 0
..Sampling points Reynolds number	numerical values	Value pairs from Reynolds number and correction factor can be entered in table form. The table is automatically sorted in ascending order by Reynolds number. For Reynolds numbers that are smaller than the smallest value in the table, the correction factor of the smallest value is used. The correction factor is interpolated linearly between two Reynolds numbers. For Reynolds numbers larger than the largest value in the table, the correction factor of the largest value is used. (Only available if Reynolds numbers can be calculated for the current medium.)

For QAL1 application

The setting for the “Device type” is fixed to “Simplified pitot tube”. The expansion number is fixed at “1.0”.

9.1.5.2 Measurement design for dp devices according to AGA-3

Measurement design (AGA-3) **for basic setting: Flow sensor type “AGA-3”**

Value	Option	Remark
Measurement design (AGA-3)	*fold-out function*	
..Tapping type	Flange tapping Corner tapping	The tapping type of the AGA-3 orifice
..Orifice material	Carbon steel 316L Monel Custom	Selection of the material used for the orifice (relevant for the thermal expansion of the orifice) If “Custom” is selected, the thermal expansion coefficient α is queried (see next item)
..Alpha Orifice	numerical value	The thermal expansion coefficient α, which characterizes the thermal expansion of the orifice plate (only for orifice material “Custom”)
..Throttle opening d	numerical value	The throttle opening of the orifice
..Pipe material	Carbon steel 316L Monel Custom	Selection of the material used for the pipe (relevant for the thermal expansion of the orifice) If “Custom” is selected, the thermal expansion coefficient α is queried (see next item)

Value	Option	Remark
..Alpha pipe	numerical value	The thermal expansion coefficient α, which characterizes the thermal expansion of the pipe (only for pipe material “Custom”)
..Inner diameter D	numerical value	The inside diameter of the pipe
..Base pressure	numerical value	The AGA-3 base pressure
..Base temperature	numerical value	The AGA-3 base temperature
..Damping value [%]	numerical value	The damping in percent (the last valid flow rate value is calculated with x percent weighted with the current flow rate value; related to a cycle time of 0.5 s)
..Small flowrate cutoff	*fold-out function*	
….Reference	q_m; q_V; q_{Vn}; v	Reference value for minimum quantity suppression
….Minimum flowrate	numerical value	The minimum quantity below which the flow value is set to 0
..Sampling points Reynolds number	numerical values	Value pairs from Reynolds number and correction factor can be entered in table form. The table is automatically sorted in ascending order by Reynolds number. For Reynolds numbers that are smaller than the smallest value in the table, the correction factor of the smallest value is used. The correction factor is interpolated linearly between two Reynolds numbers. For Reynolds numbers larger than the largest value in the table, the correction factor of the largest value is used. (Only available if Reynolds numbers can be calculated for the current medium.)

9.1.5.3 Measurement design for volume flow sensor and AGA-7 sensor

Measurement design (flow rate) **for basic setting: Flow sensor type “Volume flow” or “AGA-7”**

Value	Option	Remark
Measurement design (volume flow) or Measurement design (AGA-7)	*fold-out function*	
..Base pressure	numerical value	The AGA-7 base pressure (AGA-7 only)
..Base temperature	numerical value	The AGA-7 base temperature (AGA-7 only)
..Use pipe data	On Off	Should the pipe data be considered? If “Off” is set, the flow velocity is not calculated.

Value	Option	Remark
..Pipe	*fold-out function*	*(only available for "Use pipe data": On)*
….Material	Carbon steel 316L Monel 15Mo3 P22 P91/92 No thermal expansion	Selection of the material used for the pipe (relevant for the thermal expansion of the pipe)
….Shape	round rectangular	Selection of the tube shape
….Inner diameter	numerical value	The inside diameter of the pipe (only for round shape)
….Duct width	numerical value	Width of the duct (only for rectangular shape)
….Duct height	numerical value	Height of the duct (only for rectangular shape)
..Damping value [%]	numerical value	The damping in percent (the last valid flow rate value is calculated with x percent weighted with the current flow rate value; related to a cycle time of 0.5 s)
..Small flowrate cutoff	*fold-out function*	
….Reference	q_m; q_V; q_{Vn}; v	Reference value for minimum quantity suppression
….Minimum flowrate	numerical value	The minimum quantity below which the flow value is set to 0

9.1.6 Functional enhancement and interfaces

Value	Option	Remark
Functional enhancement	Zero LSE None	Selection of the functional enhancement to be controlled
Interfaces	*fold-out function*	
..Serial 1	Deactivated Modbus Slave Modbus Master M-Bus Slave	Selection of the assignment of the interface "Serial 1" (see 5.4.7)
..Serial 2	Deactivated Modbus Slave Modbus Master	Selection of the assignment of the interface "Serial 2" (see 5.6)

9.2 Process setup

Note: Once the basic settings have been defined (see 9.1), the process settings can be used to acquire the parameters for the inputs, transmitters, units, outputs and interfaces.
The individual process settings vary depending on the selected basic or already made process settings. A case distinction may therefore be made in the description of the following sub-items.

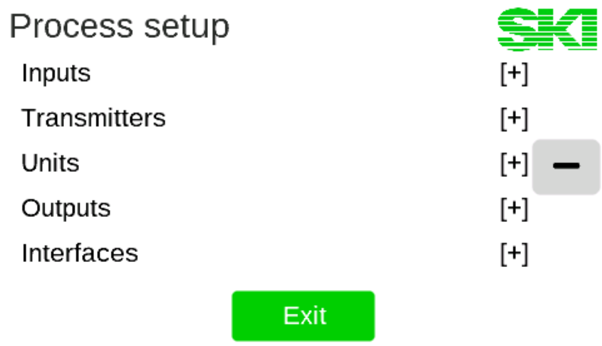


Figure 37: Process setup

The following values can be parameterized in the process setup (see Figure 37):

9.2.1 Inputs

Value	Option	Remark
Inputs	*fold-out function*	
..Analog input AinX	dp1 dp2 q_V T1 T2 p LSE/Zero ext. Deactivated	For each of the four analog inputs Ain1 to Ain4 it may be selected which measurand is to be determined. Ain1 and Ain2 are HART® compatible

For QAL1 application

The assignment of the inputs is fixed (see 5.4.2). The menu item “Inputs” is not visible.

9.2.2 Transmitters

9.2.2.1 Transmitter settings for dp devices according to ISO 5167 and AGA-3

***Transmitters* for basic setting: Flow sensor “dp device ISO 5167” or “AGA-3”**

Value	Option	Remark
Transmitters	*fold-out function*	
..Differential pressure dp	*fold-out function*	
….dp bidirectional	On; Off	Activate/deactivate bidirectional measurement
….dp1	*fold-out function*	

Value	Option	Remark
……dp1 signal source	HART 4-20 mA 0-20 mA Constant[1]	The signal source used for the first differential pressure value
……dp1 square rooting	by flow computer by transmitter	Indication of where the root extraction of the differential pressure signal takes place
……dp1.min	numerical value²	The differential pressure at 0/4 mA
……dp1.max	numerical value²	The differential pressure at 20 mA
……dp1.offset	numerical value	Input option for a constant deviation (e.g. due to the installation situation)
….dp2 (lower range for split-range)	*fold-out function*	
……dp2 signal source	HART 4-20 mA 0-20 mA Constant[1] Deactivated	The signal source used for the second differential pressure value Only relevant for split-range applications
……dp2 square rooting	by flow computer by transmitter	Indication of where the root extraction of the differential pressure signal takes place
……dp2.min	Numeric value²	The differential pressure at 0/4 mA
……dp2.max	Numeric value²	The differential pressure at 20 mA
……dp2.offset	numerical value	Input option for a constant deviation (e.g. due to the installation situation)

9.2.2.2 Transmitter settings for volume flow transmitters

***Transmitters* for basic setting: Flow sensor "Volume flow"**

Value	Option	Remark
Transmitters	*fold-out function*	
..Volume flow q_V	*fold-out function*	
….q_V signal source	4-20 mA 0-20 mA Frequency Constant[1]	The signal source used for the volumetric flow sensor

***Transmitters* for basic setting: flow sensor "volume flow"; signal source "0/4-20 mA".**

Value	Option	Remark
….q_V.min	numerical value	The flow value at 0/4 mA
….q_V.max	numerical value	The flow value at 20 mA

***Transmitters* for basic setting: flow sensor "volume flow"; signal source "frequency"**

Value	Option	Remark
….q_V.min	numerical value	The flow rate value at the lower end of the measuring range
….q_V.min frequency	numerical value	The frequency at the lower end of the measuring range
….q_V.max	numerical value	The flow value at the upper end of the measuring range
….q_V.max frequency	numerical value	The frequency at the upper end of the measuring range

9.2.2.3 Transmitter settings for AGA-7 sensors

***Transmitters* for basic setting: Flow sensor "AGA-7"**

Value	Option	Remark
Transmitters	*fold-out function*	
.. Volume flow q_V (AGA-7)	*fold-out function*	
….Pulse value	numerical value	The value to correspond to a pulse. For example 1 pulse = 5 m³
….Calibration data	numerical values	Value pairs of volume flow (q_V) and corresponding deviation can be entered in table form. The table is automatically sorted in ascending order by q_V. For flow values smaller than the smallest value in the table, the deviation of the smallest value is taken. The deviation between two flow values is interpolated linearly. For flow values greater than the largest value in the table, the deviation of the largest value is taken.
….q_Vr.min	numerical value	The minimum rated volume flow rate
….q_Vr.max	numerical value	The maximum rated volume flow rate

9.2.2.4 Transmitter settings: Continued for any basic setting

***Transmitters* (Continued for any Basic setup)**

Value	Option	Remark
..Temperature T1	*fold-out function*	
….T1 type	Pt100 3-wire Pt100 4-wire 4-20 mA 0-20 mA Constant[1]	The signal source used for the first temperature value In the “Saturated steam (p)” application, the first temperature is not queried.
….T1.min	numerical value	The temperature at 0/4 mA (not available when selecting a Pt100)
….T1.max	numerical value	The temperature at 20 mA (not available when selecting a Pt100)
….T1.offset	numerical value	Input possibility for a constant deviation
….T1 use fallback	On Off	A fallback value can be parameterized for the event of a wire break or short circuit.
….T1.fallback	numerical value	The fallback value
….T1 use std. coefficients	On Off	For t ≥ 0 °C different coefficients can be specified[3] (when selecting a Pt100)
….Coefficient A	numerical value	Coefficient A
….Coefficient B	numerical value	Coefficient B
..Temperature T2	*fold-out function*	
….T2 type	Pt100 3-wire Pt100 4-wire 4-20 mA 0-20 mA Constant[1]	The signal source used for the second temperature value If a second temperature measurement is not necessary, any fixed value can be set.
….T2.min	numerical value	The temperature at 0/4 mA (not available when selecting a Pt100)
….T2.max	numerical value	The temperature at 20 mA (not available when selecting a Pt100)
….T2.offset	numerical value	Input possibility for a constant deviation
….T2 using fallback	On Off	A fallback value can be parameterized for the event of a wire break or short circuit.
….T2.fallback	numerical value	The fallback value
….T2 use std. coefficients	On Off	For t ≥ 0 °C different coefficients can be specified[3] (when selecting a Pt100)
….Coefficient A	numerical value	Coefficient A
….Coefficient B	numerical value	Coefficient B

Value	Option	Remark
..Pressure p	*fold-out function*	
....p type	Absolute 4-20 mA Relative 4-20 mA Absolute 0-20 mA Relative 0-20 mA Constant[1]	The signal source used for the pressure value For the media “Heat transfer oil”, “Simplified liquid” and “Saturated steam (T)”, the pressure is not queried. The pressure sensor can be deactivated for the medium “Water”.
....p.design (abs)	numerical value	The design pressure for the density calculation (only with medium “Water” and deactivated pressure sensor)
....p position	Pipe Plus chamber Minus chamber	Mounting position of the pressure transmitter; serves to correct the pressure value (only with primary element “Pitot type flow meter” or “Simplified pitot tube”)
....p.min[4]	numerical value	The pressure at 0/4 mA
....p.max[4]	numerical value	The pressure at 20 mA
....p.offset	numerical value	Input possibility for a constant deviation
....p use fallback	On Off	A fallback value can be parameterized for the event of a wire break or short circuit.
....p.fallback[4]	numerical value	The fallback value
....p.environment[5]	numerical value	Ambient pressure (only for relative pressure measurement)

Notes:

[1]: If “Constant” is selected, this value is queried in the form “Value x.const”. The further specifications for this value (min/max etc.) are then no longer queried.

[2]: With a HART® connection to the transmitter, the lower/upper limits are determined automatically. If HART® communication is lost, they serve as a fallback option (see 7.4).

[3]: The temperature determination for the Pt100 measurement for t ≥ 0 °C is carried out according to:
$R_t = 100\Omega \cdot (1 + At + Bt^2)$ with the standard coefficients:
$A = 3{,}9083 \cdot 10^{-3} °C^{-1}$ and $B = -5{,}775 \cdot 10^{-7} °C^{-2}$

[4]: When selecting the pressure transmitter types “Absolute 4-20 mA” or “Absolute 0-20 mA”, absolute pressures are expected as input values. When selecting the pressure transmitter types “Relative 4-20 mA” or “Relative 0-20 mA”, relative (gauge) pressures are expected as input values.

[5]: The ambient pressure is queried as absolute pressure.

For QAL1 application

The menu items for “T2” are not available.

9.2.3 Units

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

9.2.4 Outputs

Value	Option	Remark
Outputs	*fold-out function*	
.. Analog Aout1[1]	*fold-out function*	
….Aout1 assignm.	q_m; q_V; q_{Vn}; v; T1; T2; p_{abs}; p_{rel}; dQ; Analog input Ain 1; Deactivated	The process variable to be output via analog output 1 If "Analog input Ain1" is selected, the current measured at Ain1 is output 1:1 at Aout1. See also 8.1.3 or 8.2.3
….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 current value output in the event of a fault (see 7.5)
..Switching output S1[2]	*fold-out function*	
….S1 behavior	Counting pulse[3] MIN switch MAX switch Frequency output[3] Collective alarm Motor control switch LSE operating indicator LSE error Next LSE Zero error Zero operating indicator 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 For the items "Motor switch", "LSE operating indicator", "LSE error" and "Next LSE" see 8.1.6 For the items "Zero error" and "Zero operating indicator", see 8.2.6

For QAL1 application

The setting for “....S1 behavior” is fixed to “QAL combination”.

“QAL combination” stands for:
“Collective alarm” or “LSE/Zero operating indicator” or maintenance* or hard fault or power loss

The electronic relay S1 is open under one of the above conditions. In normal operation it is closed.

*: Maintenance means that the parameter menu has been called up. However, the calculation is still carried out and the values (at the analog outputs etc.) are still output.

The setting for “....S2 behavior” is fixed to “MIN switch”.

If the functional extension “LSE” is active, the setting for “....R behavior” will be fixed to “Motor control switch”.

Outputs **for S1 behavior: Counting pulse[3]**

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[3]**

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]	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	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

For QAL1 application

The setting for "....S2 assignment" is fixed to "Velocity v".
The setting for "....S2 switching value" is fixed to "2 m/s".
The setting for "....S2 hysteresis" is fixed to "0 m/s".

***Outputs* for S1 behavior: all except counting pulse and frequency output**

Value	Option	Remark
….S1 normally[4]	Open Closed	Determination of the switching state for the normal state.

For QAL1 application

The setting for "....S1 normally" is fixed to "Closed".
The setting for "....S2 normally" is fixed to "Open".

Notes:

[1]: The settings for analog output Aout2 are analogous to Aout1.

[2]: The settings for switching output S2 and relay R must be made analogous to S1.

[3]: No counting pulse or frequency output can be parameterized for relay R.

[4]: For relay R there is no setting of the normal state. The following applies to an AccuMind® disconnected from the supply voltage independently of the parameterization: S1 is open (NO) and S2 is closed (NC) (see 5.4.6).

9.2.5 Interfaces

Value	Option	Remark
Interfaces	*fold-out function*	
..Ethernet	*fold-out function*	
….IP address	free text	Input option for the IP address
….Subnet mask	free text	Input option for the subnet mask
….MAC address	free text	Input option for the MAC address

Value	Option	Remark
….Default gateway	free text	Input option for the standard gateway
….DHCP	On Off	Will activate/deactivate DHCP. If DHCP is switched on, the Ethernet configuration (IP address, subnet mask and standard gateway) is obtained automatically.
..Serial 1[1]	*fold-out function*	
….Serial 1 parity	None Even Odd	Selection of parity for the 1st serial interface
….Serial 1 bit count	7 bit; 8 bit	Selection of the number of bits
….Serial 1 baud rate	4800; 9600; 19200; 38400; 57600; 115200	Selection of baud rate
….Serial 1 address	numerical value	Address selection
….Serial 1 stop bits	1 bit; 2 bit	Selection of the number of stop bits

Notes:

[1]: The setting options for the 2nd serial interface are the same as for the 1st. The serial interfaces are only available if they are enabled in the basic setup (see 9.1).

For the output capabilities of the digital interfaces see section 10.

When connecting the interface converter (see 5.7), the following values must be parameterized for the 2nd serial interface:

Parameter	Input
….Serial 2 parity	None
….Serial 2 bit count	8 bit
….Serial 2 baud rate	38400
….Serial 2 address	1
….Serial 2 stop bits	1 bit

9.3 Service menu

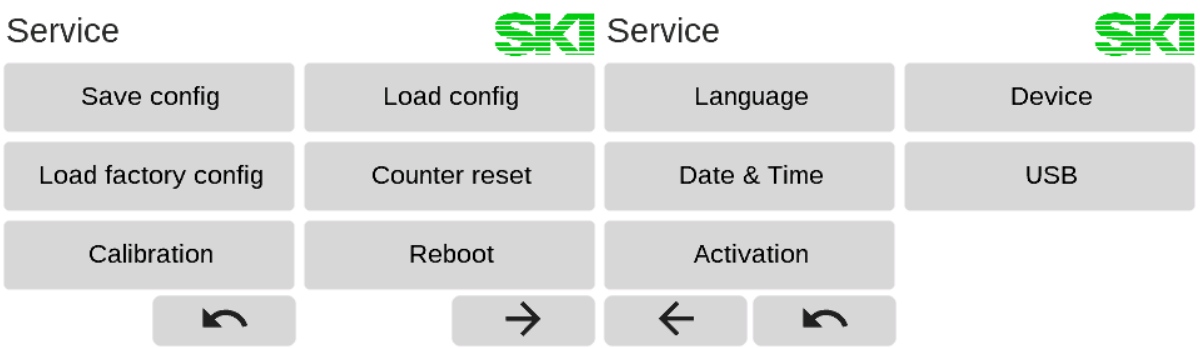


Figure 38: The service menu

The following entries can be made in the service menu (see Figure 38):

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.

9.3.1 Restart incl. update function

A new firmware file can be provided by S.K.I. GmbH. This file "a.bin" is then copied to a USB flash drive formatted with FAT32.

Each time the AccuMind® is restarted, it checks whether a USB flash drive with a new firmware is available at the USB port. If a new firmware was found, the message "Found USB … trying to flash new firmware" appears. Then the AccuMind® restarts.

The AccuMind® is designed in such a way that the settings and counter readings are retained during an update, but it is still strongly recommended to save the settings and counter readings of the AccuMind® before the update process (see 9.3.3).

9.3.2 Calibration menu

The AccuMind® is delivered calibrated as standard. In this menu it is possible to calibrate the inputs and outputs.

9.3.3 USB menu

In this menu, the settings and counter readings of the AccuMind® can be exported to a USB flash drive (FAT32 formatted) and imported from there. The logging on a USB flash drive can also be parameterized. During logging, a filled red circle appears in the upper right corner of the display.

Value	Option	Remark
Parameters	*fold-out function*	
..Import parameters	function release	Import parameters from USB flash drive
..Export parameters	function release	Export parameters to the USB flash drive

Value	Option	Remark
Calibration	*fold-out function*	
..Import calibration	function release	Import calibration from USB flash drive
..Export calibration	function release	Export the calibration to the USB flash drive
Counter values	*fold-out function*	
..Import counter values	function release	Import counter values from USB flash drive
..Export counter values	function release	Export counter values to the USB flash drive
Heat transfer oil	*fold-out function*	
..Import heat transfer oil	function release	Imports custom oil from USB flash drive
..Export heat transfer oil	function release	Exports the custom oil to the USB flash drive
Logging	*fold-out function*	
..Active	On Off	Switches logging on or off
..Interval	numerical value	Specification of the storage interval

Notes:

The settings and counter readings are stored on the USB flash drive as JSON files in the root directory. The assignment is as follows:

File name	Content
PARAMS.JSO	Parameters
CALIB.JSO	Calibration
COUNTER.JSO	Counter values

The values for the heat transfer oil are stored in a CSV file "custom_oil.csv" in the root directory. This file has the following form:

```
Name of the oil
T [K],rho [kg/m³],eta [Pa*s],cp [J/(kg*K)]]
273.15,842.7,0.02842,2007
283.15,836.1,0.01751,2043
…
```

Any liquid for which the above-mentioned substance data are available in tabular form can be imported as an "oil".

The logging function creates CSV files in a subfolder called "Recorder". A new file is created for each day. The files contain columns for all process and control values, including those that may not be required by the current AccuMind® application. Such values can then be output with "0" or "nan".

9.3.4 Activation menu

The AccuMind® can be ordered with various options. The ordering code (see section 13) reflects these options. Functions from the “Operating mode”, “Functional extension” and “2nd interface” areas can be enabled via the activation menu. The code for the activation of the respective values can be obtained from S.K.I. GmbH.

For QAL1 application

The AccuMind® for QAL1 applications has its own firmware. The “Operating mode” can therefore not be changed

The code for an option is entered via the menu according to the following table. If the options are not enabled, the digit “0” is displayed. The code is displayed for functions that have already been activated.

Value	Option	Remark
Operating mode	*fold-out function*	
..TG	numerical value	
..NG	numerical value	Also includes TG
Function extension	*fold-out function*	
..AZ	numerical value	
..LA	numerical value	
2nd interface	*fold-out function*	
..MS	numerical value	Also necessary for PB or PN (connection of the interface converter; this option is automatically enabled when PB or PN is ordered for 2nd interface)
..DA	numerical value	
..MN	numerical value	

9.4 Access menu

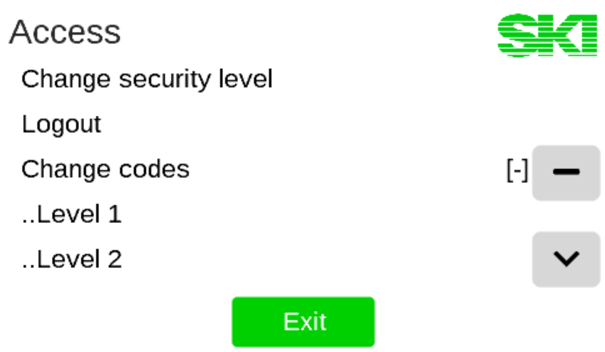


Figure 39: Access menu

In the access menu (see Figure 39) you can change to another access level (see 6.2). The codes can also be changed.

Value	Option	Remark
Change security level	code request	After entering the corresponding code, the system changes to the desired access level.
Logout	function release	The user is logged out. The system returns to the process screen.
Change codes	*fold-out function*	
..Level 1	code request	Enter a new code for level 1*
..Level 2	code request	Enter a new code for level 2*
..Level 3	code request	Enter a new code for level 3*

*: The code can be changed for the current access level and all lower levels.

9.5 Display setup menu

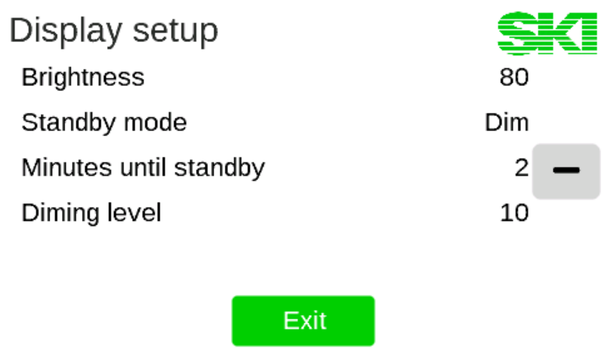


Figure 40: Display settings

The brightness of the display can be adjusted in the display setup menu (see Figure 40).

Value	Option	Remark
Brightness	numerical value	Setting range from 0 (= dark) to 100 (= light)
Standby mode	Deactivated Dim Turn off	A standby mode for the display can be parameterized: After the corresponding waiting time, the display is dimmed or switched off.
Minutes until standby	numerical value	The duration until dimming / switching off
Dimming level	numerical value	The brightness in the dimmed state: Setting range from 0 (= dark) to 100 (= light)

Notes:

When the AccuMind® display is in standby mode (i.e., the display is dimmed or turned off), a brief touch anywhere on the display will cause it to light up again at the default brightness, and subsequent touch input will be processed normally.

If the AccuMind® responds poorly to touch input or performs other functions than expected, it may be necessary to calibrate the touchscreen.

Each time the AccuMind® is restarted, the company logo "SKI" is displayed full-screen. Pressing this logo starts the calibration mode of the display.

A dot will appear on the display (see Figure 41), which must be pressed with the finger. The dot then disappears and a second dot appears. When the second dot is pressed, a third dot will appear and, after pressing it, the calibration of the display is completed. After that, the AccuMind® will show the normal process display.

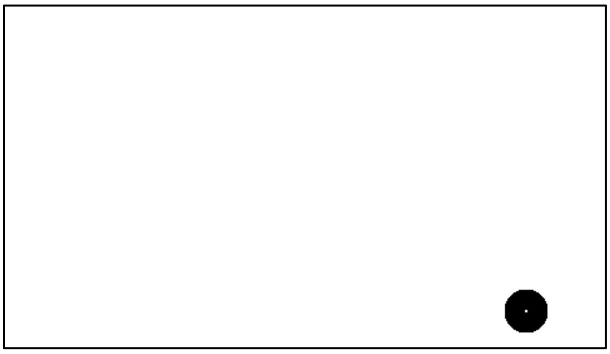


Figure 41: Display of the AccuMind® in calibration mode

10 Digital interfaces

10.1 Web server

Requirements: The AccuMind® has been connected to the network (see 5.5) and the interface parameters have been set accordingly (see 9.2.5).

Via a web browser, an overview screen with process data, meter readings, etc. can be called up after entering the IP address of the AccuMind®. Remote configuration of the AccuMind® is not provided for security reasons. There is only read access.

10.2 Modbus

Requirements: The AccuMind® has been connected to the network (for Modbus TCP see 5.5; for Modbus RTU see 5.4.7) and the interface has been parameterized accordingly (see 9.2.5). The port number for Modbus TCP is 502.

The following sections show the assignment tables required for communication.

10.2.1 Input Registers

Note: The counters each consist of an integer portion and a decimal portion. The values are transferred as follows: Big endian, high byte first, high word first.

MODULE	ID	Start address	End address	Hint	Bits	Type
RESERVED	0	0	17		288	
Firmware version	18	18	19	MMmmrr	32	int
Heat totalizer 1	20	20	23	Q1	64	int
Heat totalizer fraction 1	24	24	25	Q1 fract	32	IEEE754 FLOAT
RESERVED	26	26	27		32	
Heat totalizer 2	28	28	31	Q2	64	int
Heat totalizer fraction 2	32	32	33	Q2 fract	32	IEEE754 FLOAT

MODULE	ID	Start address	End address	Hint	Bits	Type
RESERVED	34	34	35		32	
Unit heat totalizer	36	36	36	1105=[kWh] fix.	16	int
Standard volume totalizer 1	37	37	40	V_n1	64	int
Standard volume totalizer fraction 1	41	41	42	V_n1 fract	32	IEEE754 FLOAT
RESERVED	43	43	44		32	
Standard volume totalizer 2	45	45	48	V_n2	64	int
Standard volume totalizer fraction 2	49	49	50	V_n2 fract	32	IEEE754 FLOAT
RESERVED	51	51	52		32	
Unit standard volume	53	53	53	400=[Nm³] fix.	16	int
Actual volume totalizer 1	54	54	57	V1	64	int
Actual volume totalizer fraction 1	58	58	59	V1 fract	32	IEEE754 FLOAT
RESERVED	60	60	61		32	
Actual volume totalizer 2	62	62	65	V2	64	int
Actual volume totalizer fraction 2	66	66	67	V2 fract	32	IEEE754 FLOAT
RESERVED	68	68	69		32	
Unit actual volume	70	70	70	300=[m³] fix.	16	int
Standard volume flow	71	71	72	q_{Vn}	32	IEEE754 FLOAT
RESERVED	73	73	74		32	
Unit standard volume flow	75	75	75	201=[Nm³/h] fix.	16	int
Actual flow	76	76	77	q_V	32	IEEE754 FLOAT
RESERVED	78	78	79		32	
Unit actual flow rate	80	80	80	101=[m³/h] fix.	16	int
Mass totalizer line 1	81	81	84	m1	64	int
Mass totalizer fraction 1	85	85	86	m1 fract	32	IEEE754 FLOAT
RESERVED	87	87	88		32	
Mass totalizer 2	89	89	92	m2	64	int
Mass totalizer fraction 2	93	93	94	m2 fract	32	IEEE754 FLOAT
RESERVED	95	95	96		32	
Unit mass totalizer	97	97	97	901=[kg] fix.	16	int
Mass flow	98	98	99	q_m	32	IEEE754 FLOAT
RESERVED	100	100	101		32	
Unit mass flow	102	102	102	804=[kg/h] fix.	16	int
Temperature 1	103	103	104	T1	32	IEEE754 FLOAT
RESERVED	105	105	106		32	
Unit temperature 1	107	107	107	501=[°C] fix.	16	int

MODULE	ID	Start address	End address	Hint	Bits	Type
Temperature 2	108	108	109	T2	32	IEEE754 FLOAT
RESERVED	110	110	111		32	
Unit temperature 2	112	112	112	501=[°C] fix.	16	int
Temperature difference	113	113	114	ABS(T2 – T1)	32	IEEE754 FLOAT
RESERVED	115	115	116		32	
Unit temperature difference	117	117	117	2700=[K] fix.	16	int
Differential pressure	118	118	119	dp	32	IEEE754 FLOAT
RESERVED	120	120	121		32	
Unit differential pressure	122	122	122	703=[mbar] fix.	16	int
Absolute pressure	123	123	124	p	32	IEEE754 FLOAT
RESERVED	125	125	126		32	
Unit absolute pressure	127	127	127	604=[bar] fix.	16	int
Density 1	128	128	129	rho1	32	IEEE754 FLOAT
RESERVED	130	130	131		32	
Unit density 1	132	132	132	1800=[kg/m³] fix.	16	int
Density 2	133	133	134	rho2	32	IEEE754 FLOAT
RESERVED	135	135	136		32	
Unit density 2	137	137	137	1800=[kg/m³] fix.	16	int
Flow velocity	138	138	139	v	32	IEEE754 FLOAT
RESERVED	140	140	141		32	
Unit flow velocity	142	142	142	2200=[m/s] fix.	16	int
Compressibility	143	143	144	Z	32	IEEE754 FLOAT
RESERVED	145	145	146		32	
Supercompressibility	147	147	148	Zn	32	IEEE754 FLOAT
RESERVED	149	149	150		32	
Specific enthalpy 1	151	151	152	h1	32	IEEE754 FLOAT
RESERVED	153	153	154		32	
Unit specific enthalpy 1	155	155	155	2800=[kJ/kg] fix.	16	int
Specific enthalpy 2	156	156	157	h2	32	IEEE754 FLOAT
RESERVED	158	158	159		32	
Unit specific enthalpy 2	160	160	160	2800=[kJ/kg] fix.	16	int
Heat power	161	161	162	dQ	32	IEEE754 FLOAT
RESERVED	163	163	164		32	
Unit heat power	165	165	165	1001=[kW] fix.	16	int
Offset:	**0**	**Shorts:**	**156**		**312**	

10.2.2 Input Status

MODULE	ID	Address (Bit)	Type
STATUS OK	0	0	bool
STATUS WARNING	1	1	bool
STATUS FAILURE	2	2	bool

10.2.3 Units

Parameter	Value	Unit
q_V (actual flow rate)	101	m³/h
q_{Vn} (standard volume flow)	201	Nm³/h
V (volume)	300	m³
V_n (standard volume)	400	Nm³
T (temperature)	501	°C
p (pressure)	604	bar
dp (differential pressure)	703	mbar
q_m (mass flow)	804	kg/h
m (mass)	901	kg
dQ (actual heat power)	1001	kW
Q (heat totalized)	1105	kWh
rho (density)	1800	kg/m³
v (velocity)	2200	m/s
t_{diff} (temperature difference)	2700	K
h (specific enthalpy)	2800	kJ/kg

10.3 M-Bus

Requirements: The AccuMind® has been connected to the network (see 5.4.7) and the interface parameters have been set accordingly (see 9.2.5).

The following table shows the data sets for M-Bus

10.3.1 Data sets

Data set	Variable	Description	Unit
1	q_m	mass flow	kg/h
2	q_V	volume flow	m³/h
3	q_{Vn}	standard volume flow	m³/h
4	dQ	heat power	kW
5	p	absolute pressure	bar
6	T1	temperature 1	°C
7	T2	temperature 2	°C
8	dp	differential pressure	mbar
9	m1	mass 1	t
10	m2	mass 2	t
11	Q1	heat quantity 1	kWh
12	Q2	heat quantity 2	kWh
13	V_n1	standard volume 1	m³
14	V_n2	standard volume 2	m³
15	V1	volume 1	m³
16	V2	volume 2	m³

10.4 Profibus/Profinet

Requirements: The AccuMind® has been connected to the interface converter (see 5.7.2) and the 2nd serial interface has been parameterized accordingly (see 9.2.5).

The table under 10.4.4 shows the assignment of the modules for Profibus/Profinet.

10.4.1 Status messages and parameterization of the Profibus converter

The Profibus converter has 6 LEDs for status indication. It also has two rotary switches for setting the Profibus station address (see Figure 42).

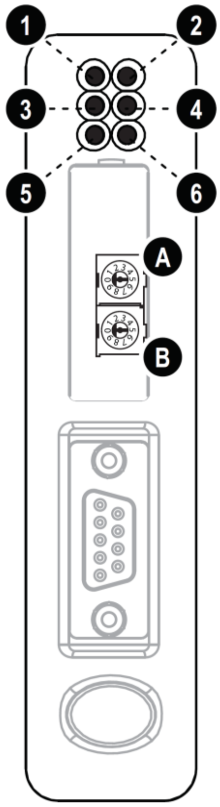


Figure 42: Profibus module with status LEDs and rotary switches

The following table describes the status displays:

LED	Indication	Meaning
1 (Online)	Green Off	Online Not online
2 (Offline)	Red Off	Offline Not offline
3 (Not used)	-	-
4 (Fieldbus Diagnostics)	Off Red flashing (1 Hz) Red flashing (2 Hz) Red flashing (4 Hz)	No diagnostics present Configuration error User parameter data error Initialization error
5 (Subnet Status)	Flashing green Green Red	Running, but one or more transaction errors Running Transaction error/timeout or subnet stopped

LED	Indication	Meaning
6 (Device Status)	Off	Power off
	Alternating red/green	Invalid or missing configuration
	Green	Initializing
	Flashing green	Running
	Red	Bootloader mode
	Flashing red	Defective

Note: Rotary switches A and B are located behind a cover that can be carefully opened with a flat screwdriver.

The station address is set via the two rotary switches A and B according to the following relationship: Station address = 10 × B + A

An example for address 42 is shown in Figure 43: Station address = 10 × 4 + 2 = 42

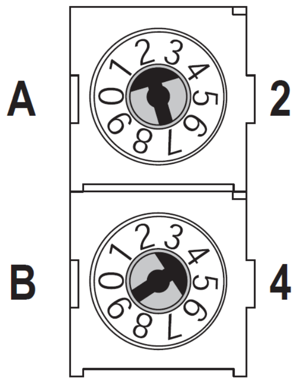


Figure 43: Example configuration: Address 42

The station address may only be changed when the converter is disconnected from the supply voltage.

10.4.2 Status messages of the Profinet converter

The Profinet converter has 6 LEDs for status indication (see Figure 44).

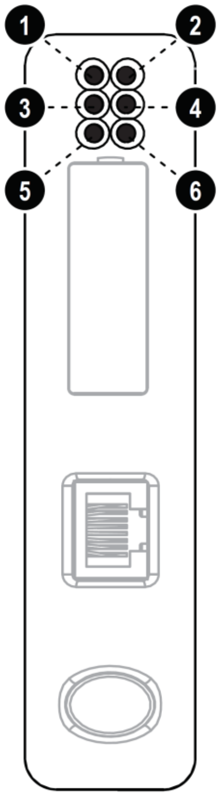


Figure 44: Profinet Module with Status LEDs

LED	Indication	Meaning
1 (Communication Status)	Off	Not online
	Green	Online, connection with IO established, IO controller in run state
	Flashing Green	Online, connection with IO established, IO controller in stop state
2 (Module status)	Off	No power / Not initialized
	Green	Initialized, no errors
	1 Sequential Green Blink	Diagnostic data available
	2 Sequential Green Blinks	Used by engineering tool to identify the module
	1 Sequential Red Blink	Configuration error
	3 Sequential Red Blinks	No station name or no IP address assigned
	4 Sequential Red Blinks	Internal error
3 (Link, activity)	Off	No link
	Green	Connected to an Ethernet network
	Flashing Green	Packets are received or transmitted
4 (Not used)	-	-
5 (Subnet Status)	Flashing green	Running, but one or more transaction errors
	Green	Running
	Red	Transaction error/timeout or subnet stopped

LED	Indication	Meaning
6 (Device Status)	Off	Power off
	Alternating red/green	Invalid or missing configuration
	Green	Initializing
	Flashing green	Running
	Red	Bootloader mode
	Flashing red	Defective

10.4.3 Integration of General Station Description files

In order to integrate the AccuMind® into the control system, General Station Description files (GSD files) are provided.

For Profibus: “HMSB1803.gsd” and “Master.gcf”.

For Profinet: “GSDML-V2.3-HMS-ABC_PROFINET_IO-20141127.xml”

10.4.4 Assignment of modules

Note: The counters each consist of an integer portion and a decimal portion.

MODULE	ID	Start address	End address	Hint	Bits	Type
Firmware version	0	0	3	MMmmrr	32	int
Heat totalizer 1	4	4	11	Q1	64	int
Heat totalizer fraction 1	12	12	15	Q1 fract	32	IEEE754 FLOAT
Heat totalizer 2	16	16	23	Q2	64	int
Heat totalizer fraction 2	24	24	27	Q2 fract	32	IEEE754 FLOAT
Unit heat	28	28	29	1105=[kWh] fix.	16	int
Standard volume totalizer 1	30	30	37	V_n1	64	int
Standard volume totalizer fraction 1	38	38	41	V_n1 fract	32	IEEE754 FLOAT
Standard volume totalizer 2	42	42	49	V_n2	64	int
Standard volume totalizer fraction 2	50	50	53	V_n2 fract	32	IEEE754 FLOAT
Unit standard volume	54	54	55	400=[Nm^3] fix.	16	int
Actual volume totalizer 1	56	56	63	V1	64	int
Actual volume totalizer fraction 1	64	64	67	V1 fract	32	IEEE754 FLOAT
Actual volume totalizer 2	68	68	75	V2	64	int
Actual volume totalizer fraction 2	76	76	79	V2 fract	32	IEEE754 FLOAT
Unit actual volume	80	80	81	300=[m^3] fix.	16	int
Standard volume flow	82	82	85	q_{Vn}	32	IEEE754 FLOAT
Unit standard volume flow	86	86	87	201=[Nm^3/h] fix.	16	int
Actual flow	88	88	91	q_V	32	IEEE754 FLOAT
Unit actual flow rate	92	92	93	101=[m^3/h] fix.	16	int
Mass totalizer line 1	94	94	101	m1	64	int

MODULE	**ID**	**Start address**	**End address**	**Hint**	**Bits**	**Type**
Mass totalizer fraction 1	102	102	105	m1 fract	32	IEEE754 FLOAT
Mass totalizer 2	106	106	113	m2	64	int
Mass totalizer fraction 2	114	114	117	m2 fract	32	IEEE754 FLOAT
Unit mass	118	118	119	901=[kg] fix.	16	int
Mass flow	120	120	123	q_m	32	IEEE754 FLOAT
Unit mass flow	124	124	125	803=[kg/h] fix.	16	int
Temperature 1	126	126	129	T1	32	IEEE754 FLOAT
Unit Temperature 1	130	130	131	501=[°C] fix.	16	int
Temperature 2	132	132	135	T2	32	IEEE754 FLOAT
Unit Temperature 2	136	136	137	501=[°C] fix.	16	int
Temperature difference	138	138	141	ABS(T2 - T1)	32	IEEE754 FLOAT
Unit temperature difference	142	142	143	2700=[K] fix.	16	int
Differential pressure	144	144	147	dp	32	IEEE754 FLOAT
Unit differential pressure	148	148	149	703=[mbar] fix.	16	int
Absolute pressure	150	150	153	P	32	IEEE754 FLOAT
Unit absolute pressure	154	154	155	604=[bar] fix.	16	int
Density 1	156	156	159	rho1	32	IEEE754 FLOAT
Unit density 1	160	160	161	1800=[kg/m^3] fix.	16	int
Density 2	162	162	165	rho2	32	IEEE754 FLOAT
Unit density 2	166	166	167	1800=[kg/m^3] fix.	16	int
Flow velocity	168	168	171	v	32	IEEE754 FLOAT
Unit flow velocity	172	172	173	2200=[m/s] fix.	16	int
Compressibility	174	174	177	Z	32	IEEE754 FLOAT
Supercompressibility	178	178	181	Zn	32	IEEE754 FLOAT
Specific enthalpy 1	182	182	185	h1	32	IEEE754 FLOAT
Unit specific enthalpy 1	186	186	187	2800=[kJ/kg] fix.	16	int
Specific enthalpy 2	188	188	191	h1	32	IEEE754 FLOAT
Unit specific enthalpy 2	192	192	193	2800=[kJ/kg] fix.	16	int
Heat power	194	194	197	dQ	32	IEEE754 FLOAT
Unit heat power	198	198	199	1001=[kW] fix.	16	int
STATUS OK	200	200	200		8	bool
STATUS WARNING	201	201	201		8	bool
STATUS FAILURE	202	202	202		8	bool
Offset:	**0**	**Shorts:**	**203**		**203**	

10.4.5 Units

Parameter	Value	Unit
q_V (actual flow rate)	101	m³/h
q_{Vn} (standard volume flow)	201	Nm³/h
V (volume)	300	m³
V_n (standard volume)	400	Nm³
T (temperature)	501	°C
p (pressure)	604	bar
dp (differential pressure)	703	mbar
q_m (mass flow)	804	kg/h
m (mass)	901	kg
dQ (actual heat power)	1001	kW
Q (heat totalized)	1105	kWh
rho (density)	1800	kg/m³
v (velocity)	2200	m/s
t_{diff} (temperature difference)	2700	K
h (specific enthalpy)	2800	kJ/kg

11 Declaration of Conformity

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

Universeller Durchflussrechner Universal Flow Computer Calculateur universel	**AccuMind®**

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
2014/30/EU	EMV Richtlinie EMC Directive Directive CEM	EN 61326-1:2013 IEC61000-4-2:2009, IEC61000-4-3:2006+A1:2007+A2:2010, IEC61000-4-4:2012, IEC61000-4-5:2014, IEC61000-4-6:2013, IEC61000-4-11:2004 EN55011:2009+A1:2010 CISPR 11:2009+A1:2010
2014/35/EU	Niederspannungsrichtlinie Low-voltage Directive Directive Basse tension	EN60950-1:2006 + A2:2013

Die technische Dokumentation, die zur Gewährleistung der Einhaltung der EG Richtlinien benötigt wird, wurde erstellt und liegt zur Überprüfung durch eine autorisierte Stelle bereit.

The technical documentation required to demonstrate that the products meet the requirements of the above EC directives has been compiled and is available for inspection by relevant enforcement authorities.

La documentation technique exigée pour démontrer que les produits répondent aux exigences des directives ci-dessus de CE a été compilée et estdisponible pour l'inspection par des autorités chargées de l'application ppropriées.

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	Kategorie Category Catégorie	Benannte Stelle Notified Body Organisme notifié		Nr. No. Nr.
2014/30/EU	n. a.	n. a.	CE	n. a.
2014/35/EU	n. a.	n. a.	CE	n. a.

Mönchengladbach, den 23.09.2024

(Daniel Schlegel, GF)

(Christian Peggen, QS/QA)

ADQ-Konf_AccuMind-2439.xlsx

12 Declaration of RoHS-Compliance

RoHS-Konformitätserklärung
Declaration of RoHS-Compliance

Elektronischen Baugruppen und Geräte, die von der
Electronic assemblies and devices delivered by

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

geliefert wurden, erfüllen die RoHS Richtlinie 2011/65/EU und beinhalten keine oder nur die in den Grenzen nach Artikel 4 zulässigen 0,1 Gewichtsprozente (1000 ppm) an Flammenhemmer und Schwermetalle.
Im Einzelnen betrifft das

comply with the RoHS Directive 2011/65 / EU and do not contain or only contain 0.1 per cent by weight permitted within the limits of Article 4 (1000 ppm) of flame retardants and heavy metals.
In detail, this concerns

Blei (Pb)	Lead (Pb)
Quecksilber (Hg)	Mercury (Hg)
Cadmium (Cd; nur 100 ppm)	Cadmium (Cd, only 100 ppm)
Hexavalentes Chrom (CrVI)	Hexavalent chromium (CrVI)
Polybromierte Biphenyle (PBB)	Polybrominated biphenyls (PBB)
Polybromierte Diphenylether (PBDE)	Polybrominated diphenyl ethers (PBDE)
Di(2-ethylhexyl)phthalat (DEHP)	Di(2-ethylhexyl) phthalate (DEHP)
Butylbenzylphthalat (BBP)	Butylbenzyl phthalate (BBP)
Dibutylphthakat (DBP)	Dibutyl phthacate (DBP)
Diisobutylphtalat (DIBP)	Diisobutyl phthalate (DIBP)

Diese Erklärung erfolgt nach bestem Wissen und Gewissen durch die S.K.I. Schlegel & Kremer Industrieautomation GmbH. Sie basiert teilweise auf den Informationen, die der S.K.I. Schlegel & Kremer Industrieautomation GmbH durch seine Lieferanten zur Verfügung gestellt wurden.

This declaration is made to the best of our knowledge and belief by S.K.I. Schlegel & Kremer Industrieautomation GmbH. In part it is based on information provided by suppliers to S.K.I. Schlegel & Kremer Industrieautomation GmbH.

Mönchengladbach, den 23.09.2024

C. Peggen

(Christian Peggen, QMB)

ADQ-Konf_RoHS-2439.xlsx

13 Ordering codes

AccuMind	_ _	_ _	_ _	_ _	_ _	_ _	_ _	_ _	
Housing & User Interface									
	PM								Panel mounting, 4.3" TFT touch display
	WM								Wall mounting, IP65, 4.3" TFT touch display
	WMA								as option “WM”; with additional third analog output
Operating modes									
		HB							Heat flow computer for steam, water and heat transfer fluids (mass flow, heat output and quantity) and ideal gas computer
		QL							QAL1 incl. ideal gas calculation
		TG							Technical gases (mass flow, heat totalizing; computing of gas properties)
		NG							Natural gases (AGA-8 (DC92/G1/G2), NX-19, SGERG-88, gas properties ISO-20765-1)
Power Supply									
			AC						Wide range supply (integrated), 100 … 250 V AC (50 … 60 Hz)
			DC						DC supply, 18 … 30 V DC
Functional extension									
				NA					None
				AZ					Controller for AccuFlo®Zero for automated zero-point calibration on standard HART-compatible differential pressure transmitters (one interface “DA” required)
				LS					Controller for LSE-HD air purging unit
				LA					Controller for LSE-HD air purging unit with integrated automated zero-point calibration
1st Interface (Terminal Strip)									
					MS				Modbus Slave RTU
					MB				M-Bus
					DA				Modbus for functional extension AZ
					MN				Modbus Master RTU
					PB				Profibus DP Slave
					PN				Profinet Slave
2nd Interface (D-Sub)									
						NA			None
						MS			Modbus Slave RTU
						DA			Modbus for functional extension AZ
						MN			Modbus Master RTU
						PB			Profibus DP Slave
						PN			Profinet Slave
Custom Settings									
							FC		Device with standard parameters (no custom setup)
							CP		Customized setup
							CC		Device with standard parameters and factory calibration certificate (5 points, **no** custom setup)
							CA		Device with custom setup and factory calibration certificate (5 points, **with** custom setup)
Tag Number									
								DI	Tag number in display
								KK	Tag number in display and on enclosed metal plate

Note:
Certain options can be enabled via the “Activation” menu (see 9.3.4).

S.K.I. Schlegel & Kremer
Industrieautomation GmbH

P.O. Box 41 01 31
D-41241 Mönchengladbach
Germany

Hanns-Martin-Schleyer-Str. 22
D-41199 Mönchengladbach
Germany

Tel: +49 (0) 2166/62317-0
Web: www.ski-gmbh.com
E-mail: info@ski-gmbh.com

BA-AccuMind-v1q-en-2439

Operating and assembly instructions