# Operating manual

# SNS 552 GAPL

Programmable flow sensor for pipes from Ø 15 mm

with IO-Link

Use IO-Link
Universal · Smart · Easy

Manufacturer:
EGE-Elektronik Spezial-Sensoren GmbH
Ravensberg 34
D-24214 Gettorf
+49 4346 41580
info@ege-elektronik.com

CE

# Table of contents

(further subsections are mentioned at the beginning of each chapter)

# 1 Preliminary remarks

## 1.1 Target group

These operating instructions contain information and provisions for experts who are familiar with working on fluid and electrical installations.

## 1.2 Used symbols

| | |
|---|---|
|  | Additional information or notes, which are helpful for special application. |
|  | Warning |
|  | Numeric string, shown in the display of the device. |
|  | Device button |
|  | Device button |
|  | Device button |
|  | Apply power supply to sensor. |

## 2 Safety instructions

The sensor must only be installed by trained specialist personnel. Protect the sensor securely against mechanical damage. When working on electrical equipment the applicable rules must be observed. After use the sensor must be disposed professionally, it doesn't belong to the domestic waste.

## 3 Intended use

The sensor **SNS 552 GAPL** measures the velocity and the temperature of a running medium. The measuring tip must be immersed completely into the medium. The flow rate is calculated from the sensor data and the pipe diameter. The sensor is suitable for use in industrial environments.

## 4 Measuring principle of the flow sensor

The measuring principle of the sensor is calorimetric. A heated temperature measuring element is cooled by the passing medium. Another measuring element records the medium temperature. The temperature difference between the two measuring elements is a measure for the flow rate and is analysed electronically and digitally.

## 5 Useful hints

The extended functions can only be used after entering the super code SCd. If no super code has been programmed, the release is issued after confirming the 000 (factory setting) in the code query.

# 6 Application range

## 6.1 Monitoring of limit values

These measurands can be monitored:

- **Flow velocity** ***[m/s]***
- **Flow rate** ***[l/min] or. [m³/h]***
- **Temperature** ***[°C]***

### 6.1.1 Limit value monitoring (Hysteresis operation mode)

The outputs **S1** and **S2** can be managed independently of each other in the hysteresis operation modes Hno (normally open) and Hnc (normally closed). The configuration as PNP or NPN output can only be done for both outputs in common.

The flow rate or temperature are monitored with the limit values in SP1 and SP2. If the values falls below the limit or exceeds the limit the output status changes. The difference between the switch-on and the switch-off value is called hysteresis. It can be determined in the parameters HS1 and HS2. In addition a switch-on delay dS1 and dS2 and a switch-off delay dr1 and dr2 can be programmed. In the menu section „Extended functions“ the parameter U.S1 and U.S2 can be set to temperature °C or flow Flo.

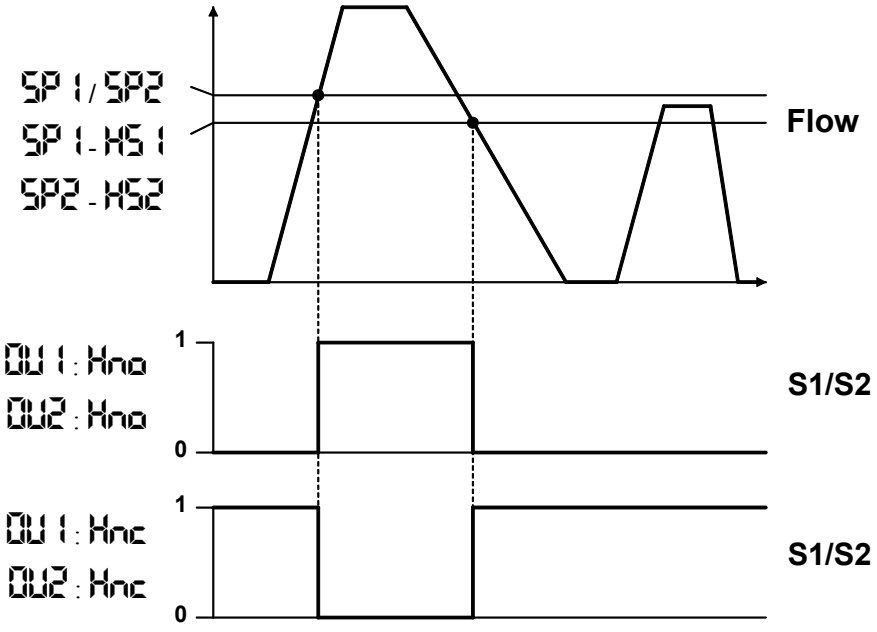



**Figure 1: Hysteresis operation mode**

### 6.1.2 Operation mode window monitoring

The outputs S1 and S2 can be managed independently of each other in the window operation modes Fno (normally open) and Fnc (normally close). The configuration as PNP or NPN output can only be done for both outputs in common.

The to be monitored window is defined by the lower limit values FL 1 / FL2 and the upper limit values FH 1 / FH2.

If the measured flow rate or temperature is inside the defined window, the corresponding output is activated or deactivated. In addition a switch-on delay d5 1 and d52 and a switch-off delay dr 1 and dr2 can be programmed. In the menu section „Extended functions“ the parameter U.S 1 and U.S2 can be set to temperature °C or flow Flo.

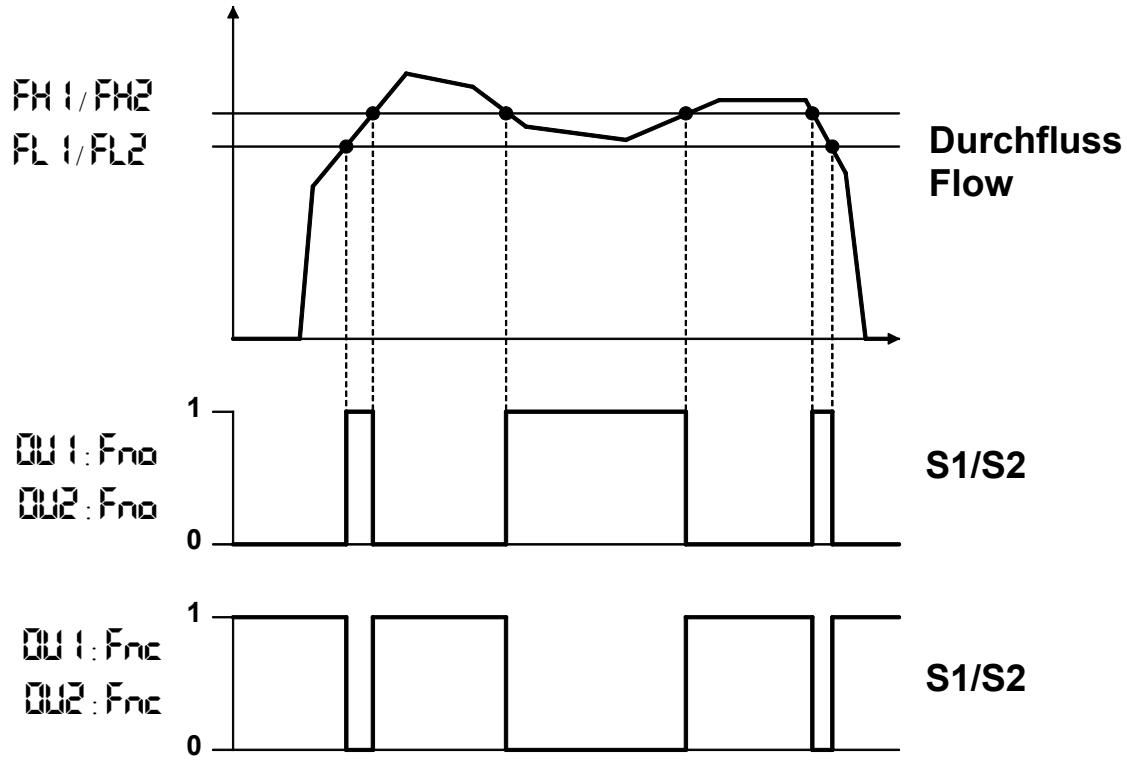



**Figure 2: Operation mode: window monitoring**

## 6.2 Measurement with analog output



These measurands can be measured analog:

- **Flow velocity** ***[m/s]***
- **Flow rate** ***[l/min] or [m³/h]***
- **Temperature** ***[°C]***

For the output of an analog value the pulsating output or the 4 to 20 mA output can be used.

### 6.2.1 Operating mode pulsating output

The output **S1** can be set up as pulse output for the flow rate in the programming menu by selecting PuL for the OU1 parameter. The pulse valance changes with the pipe diameter selected.

| Pipe diameter (inner) | Pulse valance |
|---|---|
| 15 … 50 | 100 ml / Puls |
| 51 … 100 | 500 ml / Puls |
| 101 … 250 | 2 l / Puls |

The pulse width is always 5 ms. The **S1** output operates as normally open.

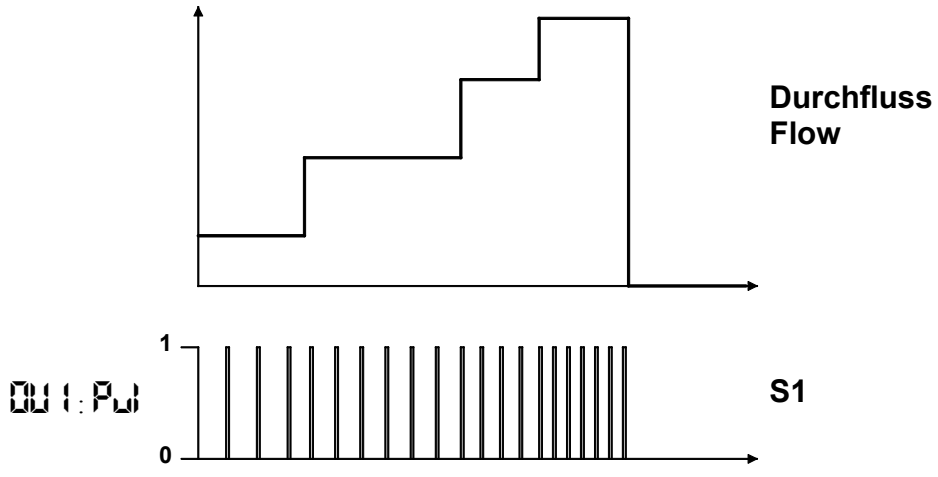



**Figure 3: Operating mode: pulsating output**

### 6.2.2 4…20 mA analog output

By selection of the parameter value 1 the output **S2** can be set to 4…20 mA output. The selection of temperature °C or Flo for the parameter U.A0 can be done in the menu section „Extended functions“.

The parameter A.St and A.En contain the reference values for the output of 4 mA and 20 mA. They are queried in the main menu.

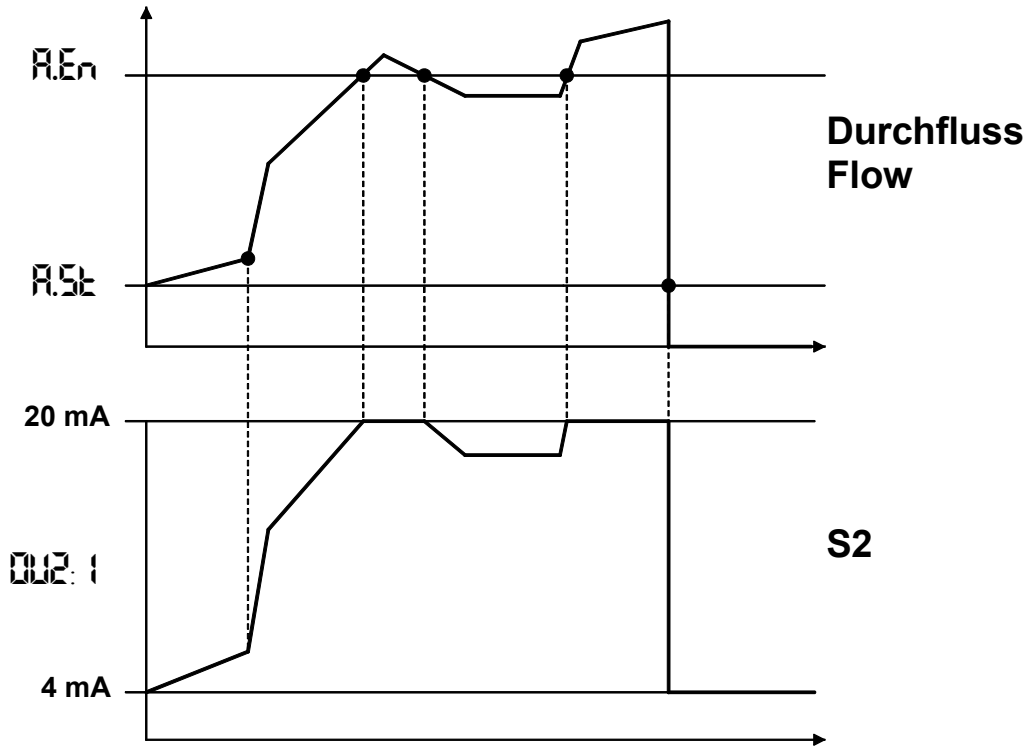



**Figure 4: Operating mode: analog output**

## 6.3 Fault detection with switching output

The output **S2** can be assigned the operating mode fault monitoring by selecting the parameter values Ena and Enc. If the device diagnosis detects a fault, the **S2** output is set (Ena / closer) or reset (Enc / opener). The Er.C parameter is described with a failure code providing information about the type of fault. This can be accessed in the main menu.

| | | |
|---|---|---|
| i | Failure codes and description | |
| | 4 | Medium temperature < 0°C |
| | 5 | Medium temperature > 80°C |
| | 7 | Short at one of the outputs |

## 6.4 Initiate teach-in function by external signal

By applying a voltage signal to the S2 output the sensor can be set into the teach mode for setpoint SP1. To this end the value tin must be selected for the output S2. Depending on the setting of parameter t.LO the current flow rate value is adopted for the setpoint SP1 with the rising edge of a pulse Pos or with the falling edge of a pulse nEG. More teach-in functions for other parameters can be selected with IO-Link commands.

# 7 Special functions

## 7.1 User profile

The sensor provides the option to restrict the scope of operation of a user group to the modification of certain parameters.

The sensor “administrator” sets up a “super code” giving him access to the extended functions. Parameters can be selectively blocked there.

| | |
|---|---|
| i | For example the plant manufacturer can release only one output for the user group “Plant operators” and operate the second output with a non-changeable operating mode. |
| | ➔ Locking menu functions p. 29 |

## 7.2 Manipulation monitoring

The sensor features a modification counter which is incremented with every parameterisation regardless of whether this takes place via the buttons or the IO-Link interface. Thus every modification of the device configuration can be detected. The counter is visible to user groups with access to the “Extended functions”. The counter cannot be reset.

| | |
|---|---|
| i | ➔13.3.13 Read out of modification counter p. 31 |

# 8 Installation

To achieve the specified accuracy, the installation requirements must be complied with. Prior to opening ensure that the line has been depressurised. Observe the applicable regulations.

## 8.1 Dimensions

(± 1,5 mm)

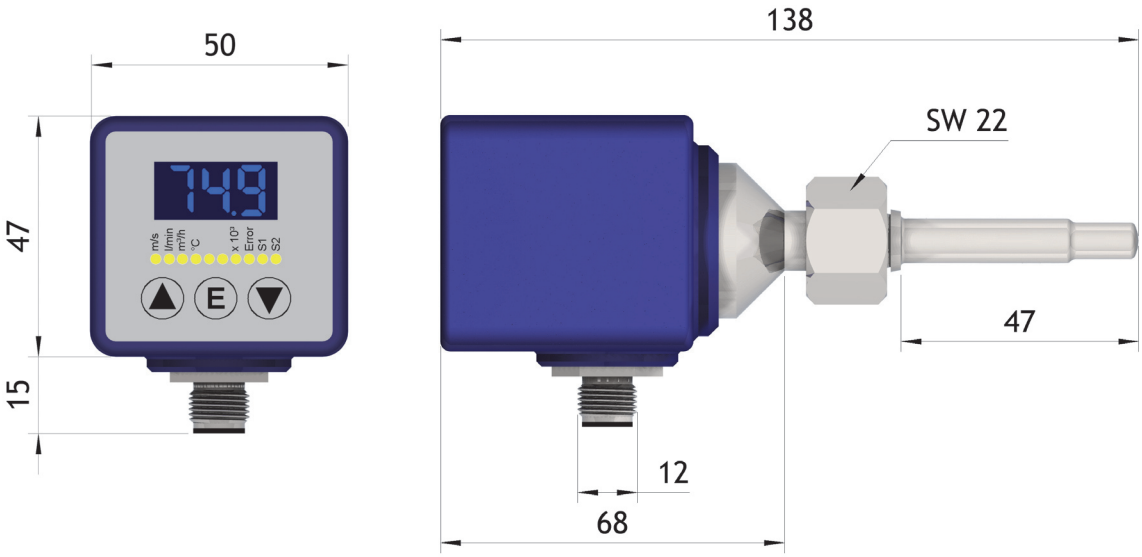


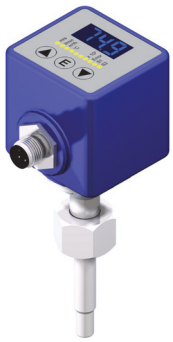

**Figure 5: Dimensions of SNS 552 GAPL**

## 8.2 Installation in pipe

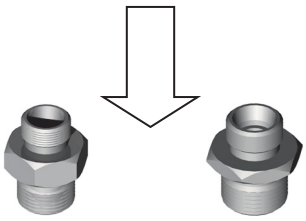
The flow profile developing near the measuring tip must match the profile during factory calibration (100 cm inlet path). Observe the inlet and outlet paths. Ensure an immersion depth of ≥15 mm for Ri ≤ 100 mm and 15% of Ri for Ri > 100 mm.

Turn display unit counterclockwise until stop.

Fix sensor shaft.

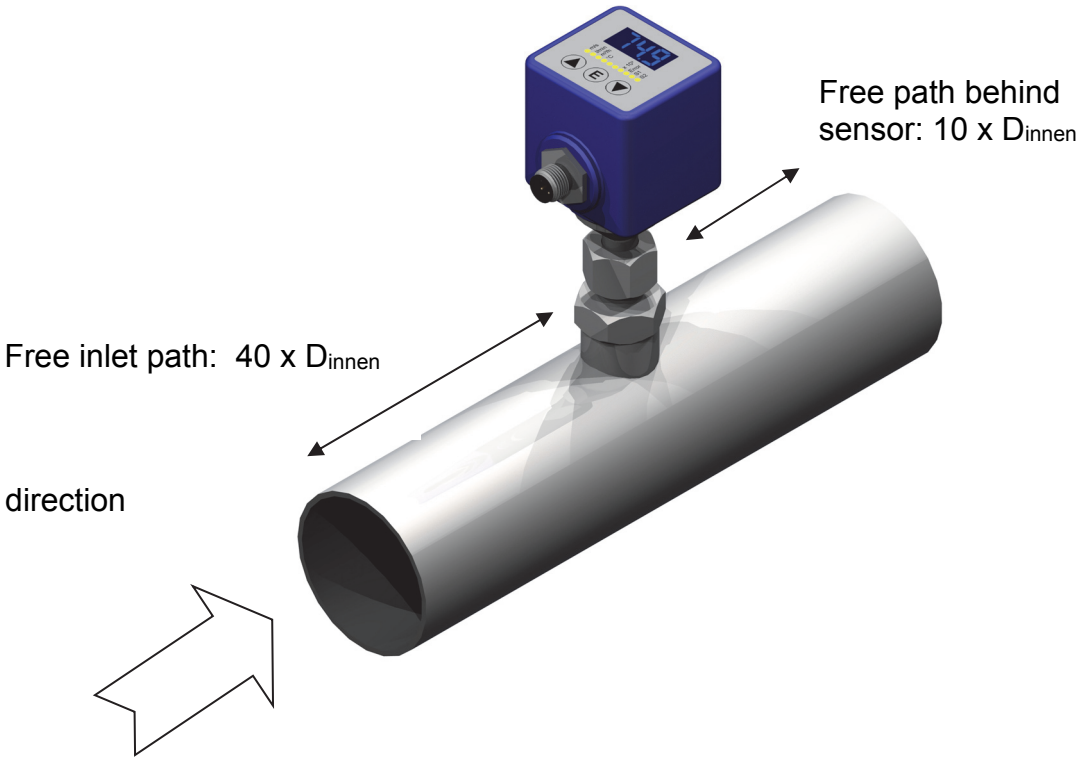


- Insert sensor into adapter.
- Position connector contrary to the flow direction.
- Fasten union nut. Use a wrench on the flats below the display unit to prevent sensor from rotating.
- After fastening move display unit into desired direction.



Z01208 Z01201

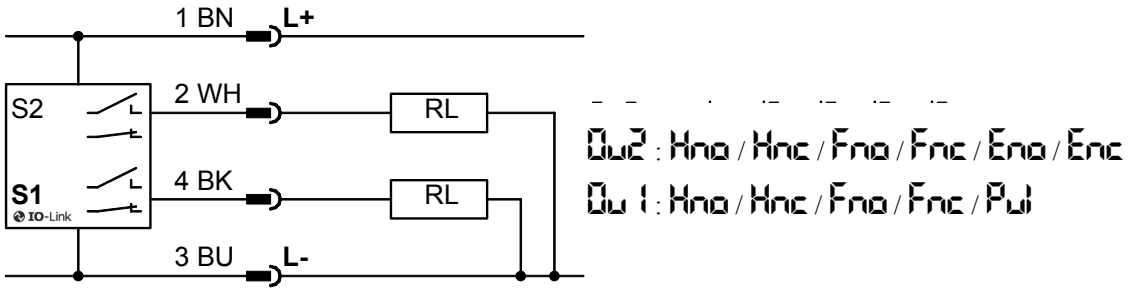
Install adapter in threaded coupling or T-piece



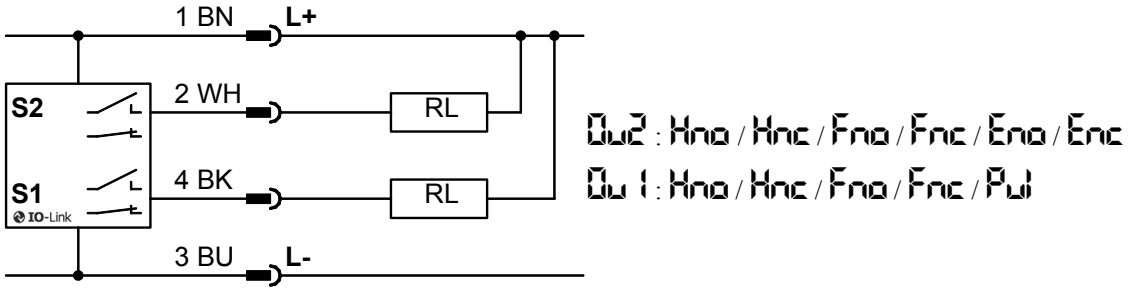
# 9 Electrical connection diagram

The selection of the operating mode for the output **S1** and the output **S2** occurs in the main menu.

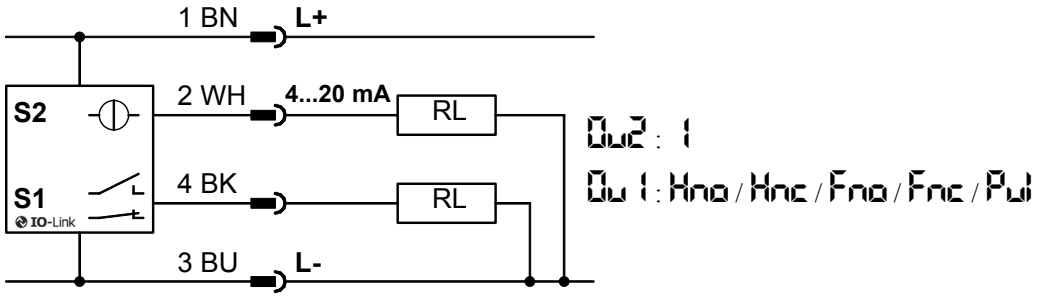
### S1 and S2: Switching output PNP-NO/NC



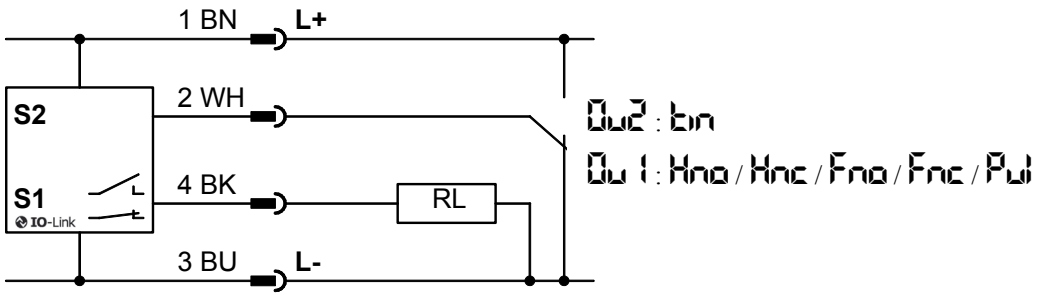

### S1 and S2: Switching output NPN-NO/NC




### S1: Switching output PNP-NO/NC, S2: Analog output 4…20 mA




### S1: Switching output, S2: Signal input for starting teach mode for SP1



# 10 Operating and display elements


**Figure 6: Front view of SNS 552 GAPL**

## 10.1 Display

In the 3-digit display the process parameters and values are displayed using alphanumeric characters and number sequences. The operating modes of the display during the display and operating mode can be selected in the menu “Extended functions”.

## 10.2 Unit and status LEDs

10 individual **LEDs** provide additional information to present the process values.

**LED1, LED2** or **LED3** indicates the unit of the displayed value for the current flow rate.

**LED4** illuminates if the temperature value is displayed. **LED5** and **LED6** are not used in this sensor type. In addition to the unit **LEDs**, **LED7** might illuminate. The displayed value must then be multiplied by 1000.

**LED8** illuminates if the internal diagnosis has detected a fault state.

**LED9** and **LED10** indicate the state of the outputs S1 and S2. They illuminate if the outputs **S1** and/or **S2** have been switched.

## 10.3 Buttons

| | |
|---|---|
|  | Change to the next parameter<br>Increase of parameter value<br>Change between given parameter values |
|  | Confirmation of the selection of a parameter or a parameter value<br>Switch between digits during entering of code number<br>Switch between parameters in the quick view<br>Immediate storage of consumption value |
|  | Change to the next parameter<br>Decrease of parameter value<br>Change between given parameter values |
|  <br>For min. 3 seconds | Start of programming mode |

# 11 Display and operating mode

## 11.1 Power-up procedure

After applying the operating voltage the sensor runs through the power-up procedure. The parameters contain the already configured values or factory settings. The device performs a self-test and is then in the display and operating mode.

During the power-up procedure all segments, the decimal points and the individual LEDs of the display are activated for approx. 0.5 seconds in a first step. Next the software revision is briefly displayed. Then the application tag appears. This is a customer-specific combination of characters which can be configured in the programming menu.

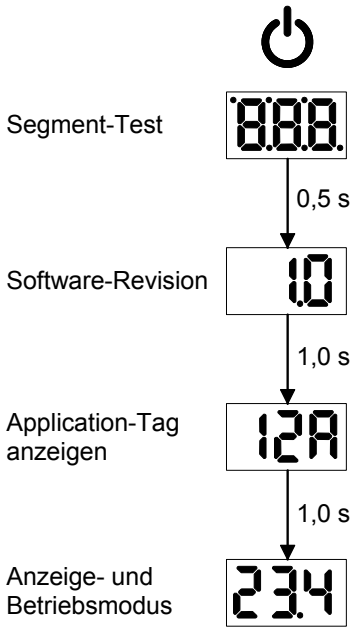



**Figure 7: Power-up procedure**

In the display the current measured value is displayed together with the corresponding LED for the unit.

## 12 Quick view of parameter values

The parameters and corresponding values can be displayed in the display and operating mode without entering the programming mode. By repeatedly pressing the Ⓔ button the parameters relevant for the configuration are successively accessed. If the Ⓔ button is not actuated for two seconds, the value belonging to the parameter appears in the display.

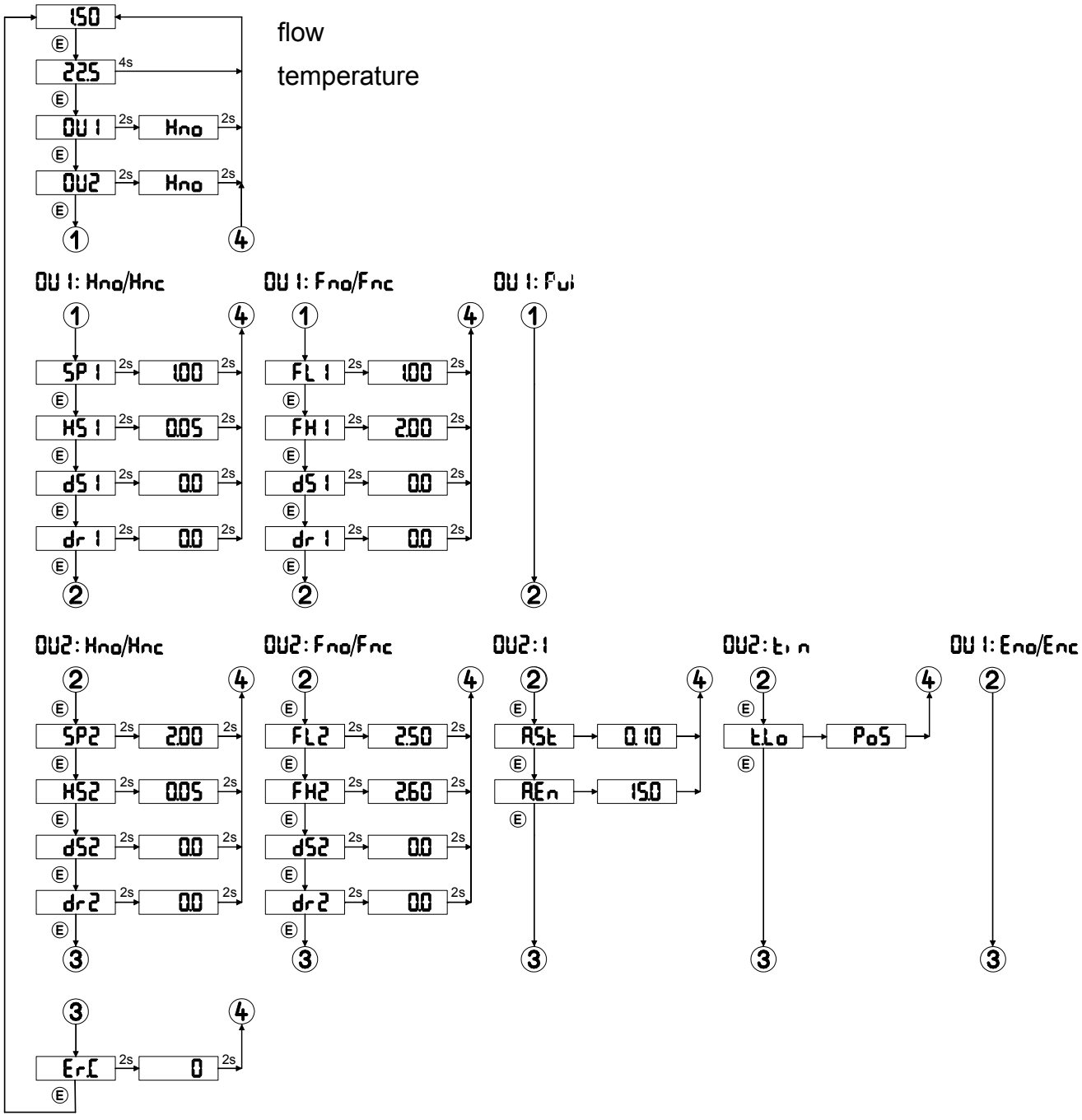



**Figure 8: Quick view of parameters**

# 13 Programming

The sensor is programmed via button inputs or via the standardised IO-Link interface. Programming using this interface has been described in a later chapter. The programming mode must be exited before shutting down the device.

## 13.1 Start of programming

The programming mode is entered by simultaneously pressing the ▲ and ▼ buttons for min. 3 seconds until the Cod string appears in the display. If no further buttons are pressed, a prompt to enter the four digit access code appears shortly after.

Using the ▲ and ▼ buttons the respective flashing digit can be changed. E confirms the entry and changes to the next digit. After entering the fourth digit the verification takes place and if the access code is correct the main menu is opened. After an incorrect entry Err is displayed for 1 second with a return to the display and operating mode.

| | |
|---|---|
| i | If the IO-Link mode is activated and a data transfer takes place, programming at the device is not possible. If programming is attempted, the message LoC appears in the display. |
| | Using an IO-Link function, parameterisation at the device can be blocked. If programming is attempted, LoC appears in the display. Manual parameterisation can only be released again via the IO-Link function. |

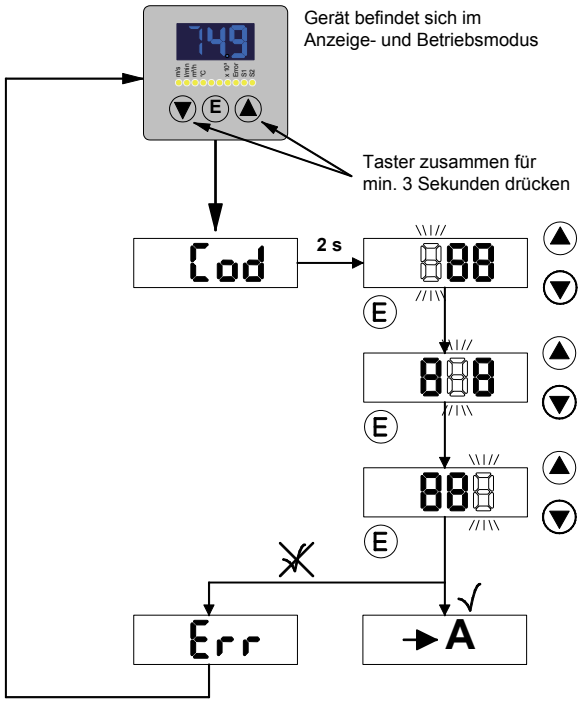



**Figure 9: Start of programming**

| | |
|---|---|
| i | A ➔ Figure 10: S. 21 |

## 13.2 Structure of main menu

The main menu follows after entering the access code correctly. Here the operating modes are first assigned to the outputs **S1** and **S2**. Depending on the operating mode, the values for the relevant parameters are queried.

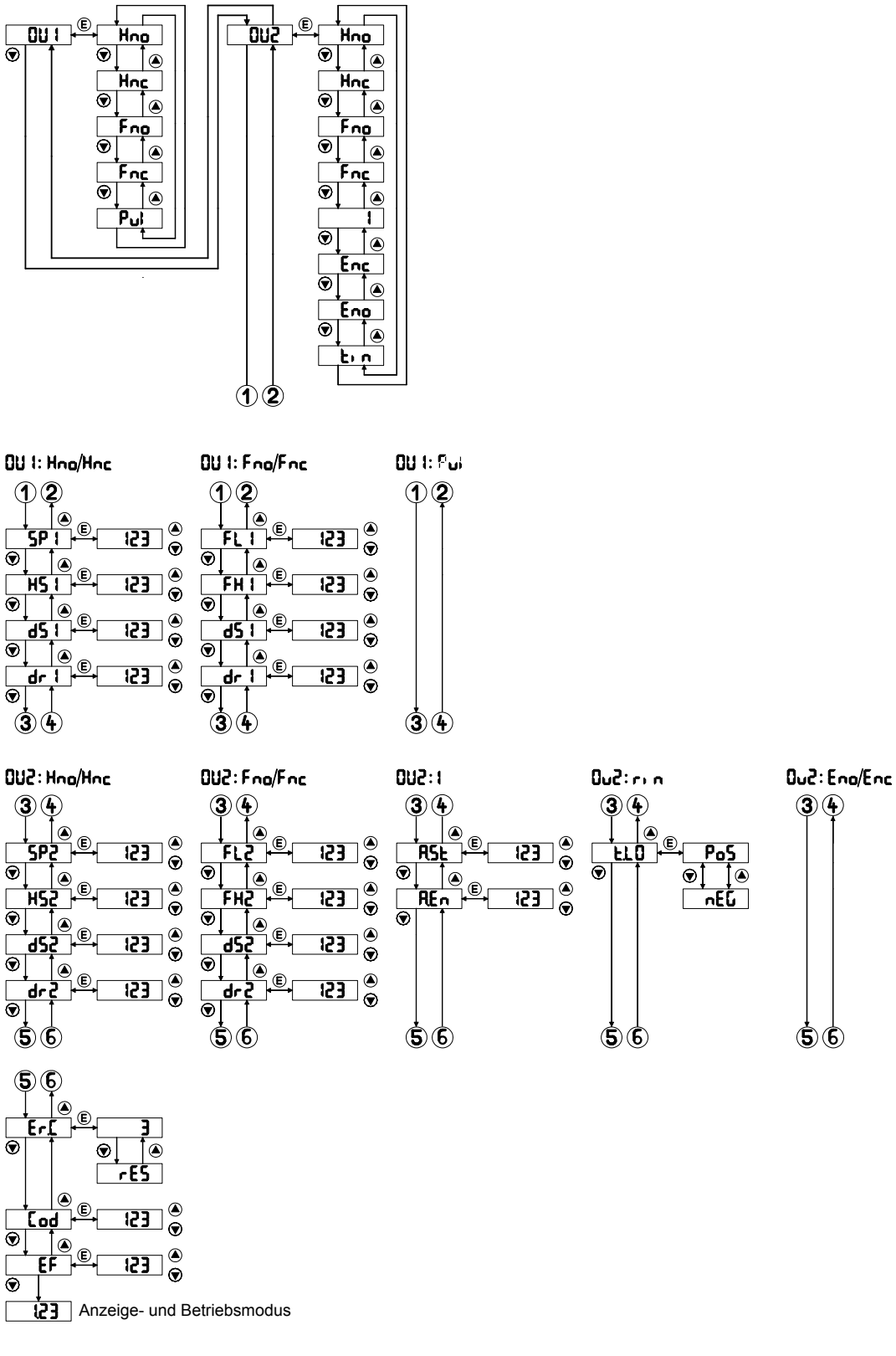



**Figure 10: Structure of main menu**

### 13.2.1 Read out/reset of failure code

The failure code is found in the Er.C parameter and can be queried in the main menu or in the quick view. Resetting is only possible in the programming mode in the main menu. To do so, the rES function is selected for the corresponding parameter.

### 13.2.2 Set up/modification of access code

To restrict access to the programming menu, an access code can be set up. This access code must differ from the factory setting of 000. To set up/modify it, the Cod parameter is selected and a corresponding 3 digit number combination entered.

## 13.3 Extended functions



The extended functions can be used after entering the super code SCd. If no super code has been programmed, the release is issued after confirming the 000 (factory setting) in the code query.

### 13.3.1 Entering of super code for „Extended functions“ menu

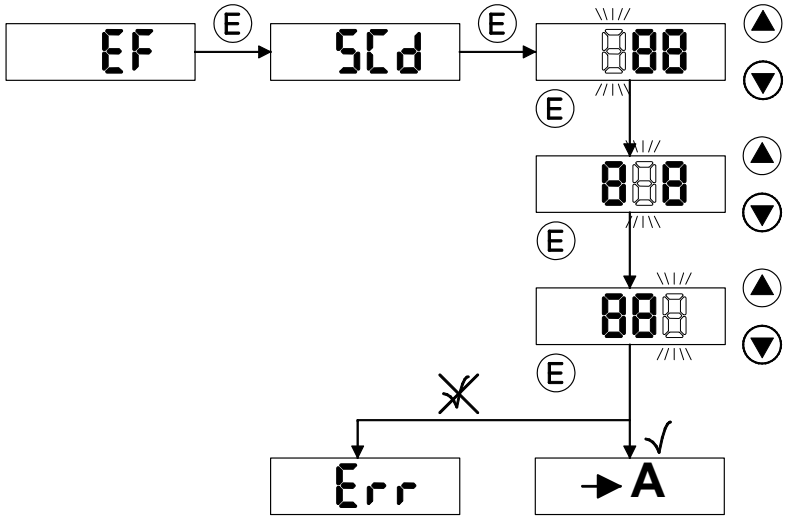
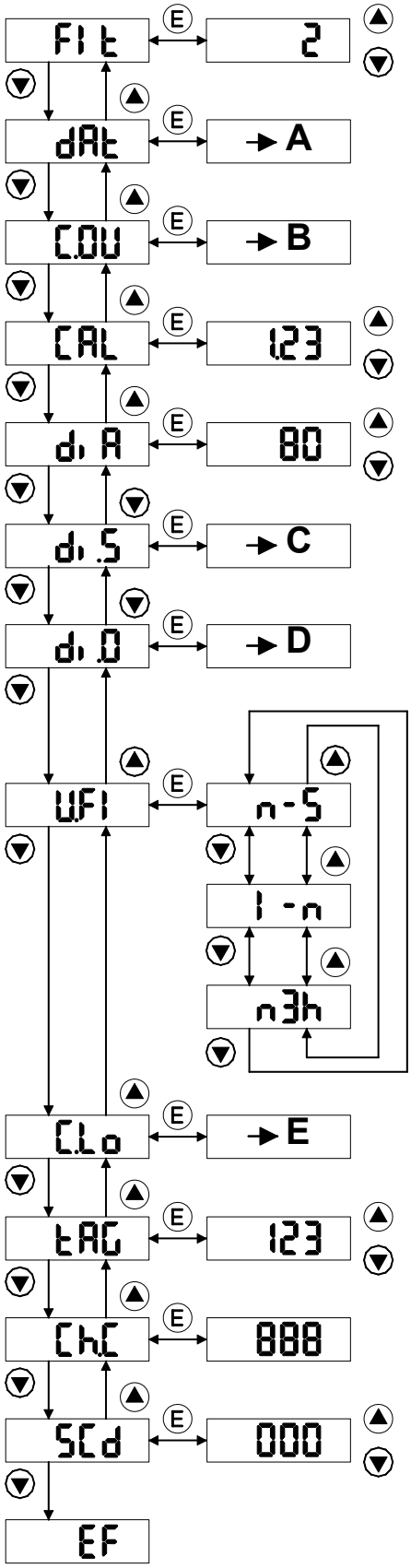



**Figure 11: Entering of Supercode**

| | |
|---|---|
| i | A: ➔Page 24 |

### 13.3.2 Structure of menu „Extended functions“




A: ➔ Data analysis, p. 26

B: ➔ Configuration of the outputs, p. 27

C: ➔ Configuration of the display, p. 28

D: ➔ Rotating of display, p. 29

E: ➔ Locking menu functions, p. 29

**Figure 12: Structure of „Extended Functions“**

### 13.3.3 Entering of filter value

The sensor features a function which generates the average value of the flow rate over a configurable time period. This average value is output continuously. The time period for the average value generation is entered in the menu “Extended functions” in the FIL parameter. 0, 1, 2, 4 and 8 seconds are available.

### 13.3.4 Data analysis

In the parameters L.FI, H.FI, L.°C and H.°C the lowest and highest measured value for the flow rate and temperature since the last reset are stored. An average of the measured values over a time period of the last 24 hours is also generated. The data are stored when the device is shut down.

All data can be reset via the keypad.

| | |
|---|---|
| i | To determine the correct max. and min. values, the parameters should be reset manually after switching on the supply voltage. |

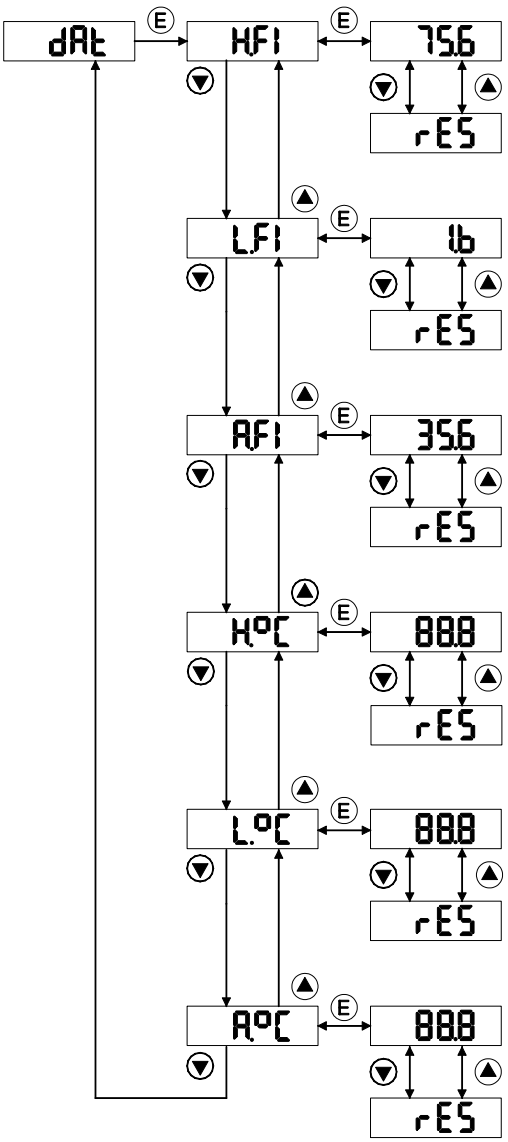



**Figure 13: Data analysis**

### 13.3.5 Configuration of the outputs

In the configuration menu C.Ou the measuring variable for the outputs **S1**and **S2** is selected with the parameters U.S1, U.S2 and U.AU. The electrical switching behaviour of the outputs **S1** and **S2** is defined in the parameter P-n. PNP is defined with the PnP value and NPN with the nPn value.

Flow → Flo

Temperature → oC

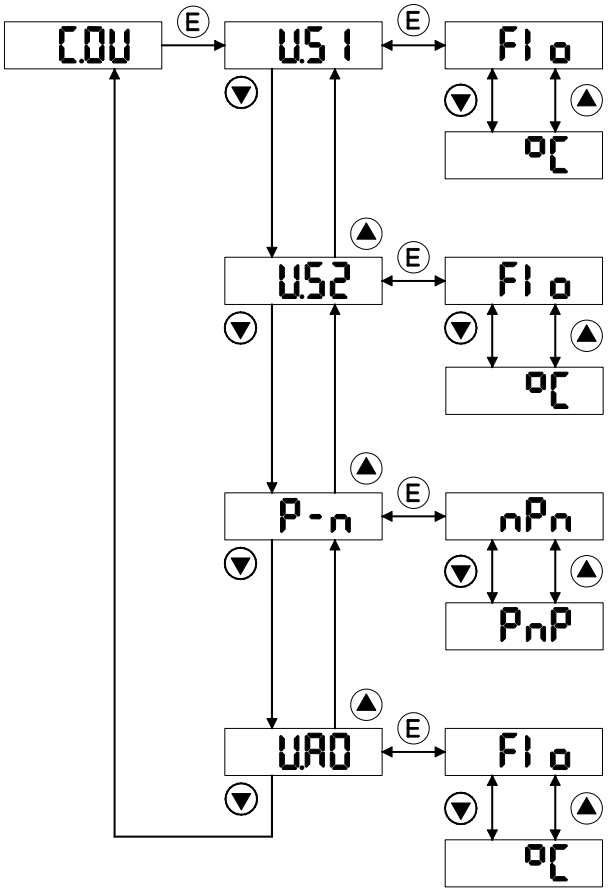



**Figure 14: Configuration of outputs**

### 13.3.6 Calibration function

For the CAL parameter a calibration factor in the range of 50% to 150% can be entered. So the displayed value can be adjusted with a reference if necessary.

### 13.3.7 Entering of the internal pipe diameter

For the dA parameter a value in the range of 15 mm to 250 mm can be entered. That value is for calculation of the flow rate in l/min or m3/h.

### 13.3.8 Configuration of the display

In the display configuration menu d.S the measuring variables to be displayed in the display are defined. When selecting oFF the display goes out after a brief period of time if no entry is made. Any key actuation re-activates the display.

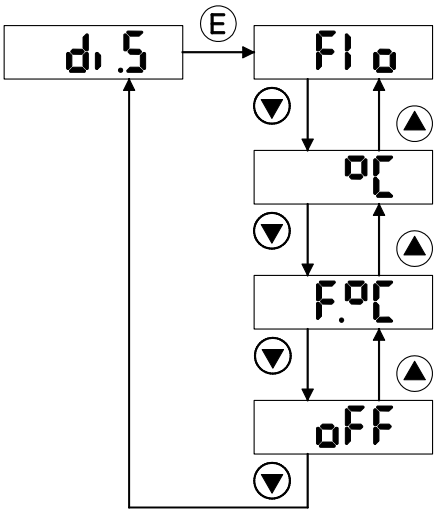
The following display options are available:

Flow → Flo

Temperature → °C

Flow 10 s & Temperature 2 s → F.°C

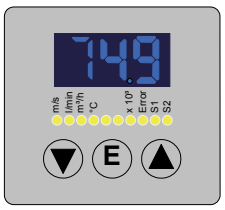
Display dark, right decimal point flashes → oFF



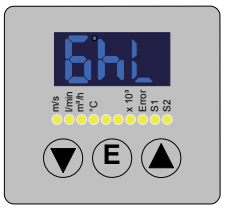
### 13.3.9 Rotating of display

In the configuration menu d.0 the orientation of 7-segment-display can be selected. The functionality of the buttons is not influenced by this parameter.

There are two display options:




→ 0




→ 180

### 13.3.10 Selecting the measuring unit for the flow rate

The measuring unit for the flow rate is parameterised in the “Extended functions” menu. The unit is defined in the parameter U.FI.

m/s → m-S

l/min → l-m

m3/h → m3h

### 13.3.11 Locking menu functions

In the locking menu C.Lo functions can be locked for a user group with only an access code for the main menu.

The locking of access to the parameters Lu1 and Lu2 results in the locking of all dependent parameters. These then also no longer appear in the menu.

To lock, LoC is selected; parameters to be accessible are assigned FrE.

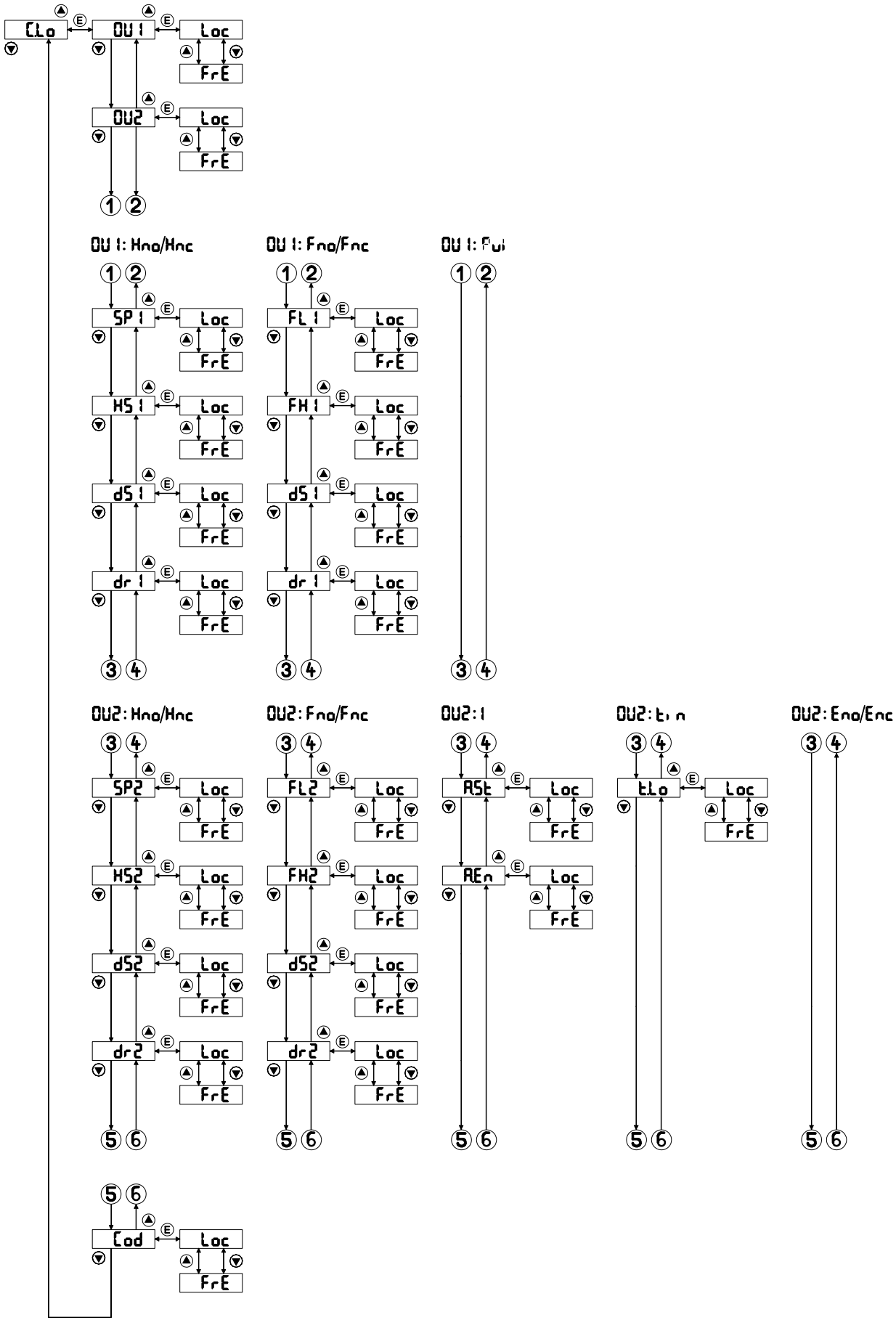



**Figure 15: Parameter lock menu**

### 13.3.12 Entering of customized TAG number

The parameter TAG can be used for entering a 3 digit device- or plant-specific TAG number. The following characters can be displayed:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 6 | 6 | A | A | F | F | L | L | t | t |
| 1 | 1 | 7 | 7 | b | b | G | G | I | I | U | U |
| 2 | 2 | 8 | 8 | C | C | H | H | n | n | u | u |
| 3 | 3 | 9 | 9 | c | c | h | h | o | o | Y | Y |
| 4 | 4 | | | d | d | i | i | P | P | - | - |
| 5 | 5 | | | E | E | J | J | | | | |

**Figure 16: Displayable characters**

### 13.3.13 Read out of modification counter

The modification counter CH.C contains the number of parameterisations carried out since the delivery of the sensor. With modifications via the buttons each individual change is registered, with programming via the IO-Link interface each access to the device. The counter cannot be reset.

### 13.3.14 Change of super code

Access to the “Extended functions” can be restricted for other users by setting up a super code. The super code must not be 000. This is the factory setting. The super code also provides access to the main menu.

### 13.3.15 Reset to factory settings

If it is necessary to reset the device to factory settings, this is possible after reactivation of the device with simultaneously pressing the Ⓔ button and then entering the access code.

If a super code for extended functions has been set up, which differs from the normal access code, it is required for the reset of all parameters.

| | | | |
|---|---|---|---|
| i | Access to parameterisation with code, menu “Extended functions” is not released, super code not known | **Code input:**<br>Reset to factory settings only for released parameters in the main menu | |
| | Access to parameterisation with code, super code for access to “Extended functions” is available, super code is known | **Code input:** Reset to factory settings only for released parameters in the main menu | **Super code input:** Reset to factory settings for all parameters in the main menu and “Extended functions” menu |
| | Access to parameterisation with code, super code matches the code | **Code or super code input:**<br>Reset to factory settings for all parameters in the main menu and “Extended functions” menu | |

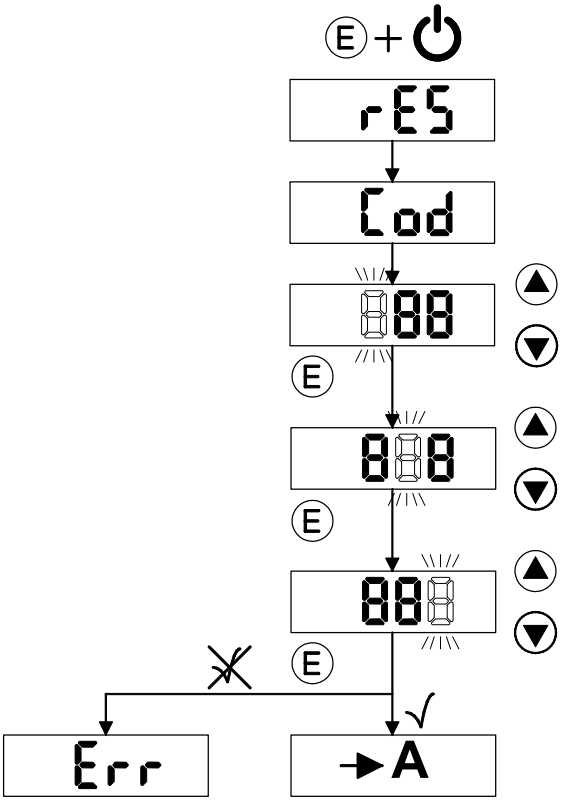



**Figure 17: Reset to factory settings**

# 14 IO-Link



## 14.1 General

The devise has a communication interface according to the IO link standard. For operation of the interface an IO link master unit with the appropriate functionality is needed.

With the USB IO-Link master set (Z01216) EGE offers all the components required for a comfortable and simple configuration of the flow sensor. Using the master software and the device description for the sensor (IODD) the sensor can be comfortably parameterized.

For operating the master and the configuration software use the related operating manual.

Any other IO-Link master meeting the specifications of the IO-Link version 1.1 can also be used.

The sensor is set into IO-Link mode by a wake-up signal as soon as the connection to the IO-Link master has been established. It starts sending process data and is ready to receive commands and parameters.

If the sensor is not connected to a master, it is in SIO mode (standard input/output) and can be used as a standard device with switching and analogue output.

## 14.2 IODD

The IODD (Input Output Device Description) required for configuration can be downloaded from the Internet page

**www.ege-elektronik.com**

in the area of the "IO-Link products".

## 14.3 Device data

Vendor ID [dez/hex] .....703 / 0x2BF

Device ID [dez].....218

IO-Link Revision.....1.1

Bitrate.....COM2

Minimum Cyle Time .....3,5 ms

SIO-Mode.....supported

Block parameterization.....supported

Data storage.....supported

## 14.4 Process data

Overall length: 32 Bit

| Name | Description | Data type | Bit-Offset | Range of values | Gradient | Unit |
|---|---|---|---|---|---|---|
| Flow | Current Flow speed | Int16 | 16 | 0 … 450[1] | 0,01 | m/s |
| Temperature | Current medium temperature | Int14 | 2 | 0 … 800 | 0,1 | °C |
| S2 | Switching status of S2 | Bool | 1 | true (active)<br>false (inactive) | | |
| S1 | Switching status of S1 | Bool | 0 | true (active)<br>false (inactive) | | |

[1] The process data consider a possible application of the CAL function

## 14.5 Standard commands

The commands have to be written into index 2. The data type of the value is uint8.

| Wert | Beschreibung |
|---|---|
| 130 | Reset to factory settings |
| 160 | Teach-in of flow rate switching point SP1 |
| 161 | Teach-in of “lowest window value” for flow 1 |
| 162 | Teach-in of “highest window value” for flow 1 |
| 163 | Teach-in of flow rate switching point SP1 |
| 164 | Teach-in of “lowest window value” for flow 2 |
| 165 | Teach-in of “highest window value” for flow 2 |
| 166 | Teach-in of output start value for flow |
| 167 | Teach-in of output end value for flow |
| 168 | Teach-in of mid range (12 mA) value for flow |
| 169 | Teach-in temperature switching point SP1 |
| 170 | Teach-in of “lowest window value” for temperature 1 |
| 171 | Teach-in of “highest window value” for temperature 1 |
| 172 | Teach-in temperature switching point SP2 |
| 173 | Teach-in of “lowest window value” for temperature 2 |
| 174 | Teach-in of “highest window value” for temperature 2 |
| 175 | Teach-in of output start value for temperature |
| 176 | Teach-in of output end value for temperature |
| 177 | Reset of MAX flow rate |
| 178 | Reset of MIN flow rate |
| 179 | Restart of averaging of flow rate measurement |
| 180 | Reset of MAX temperature |
| 181 | Reset of MIN temperature |
| 182 | Restart of averaging of temperature measurement |
| 183 | Reset of failure code register |

## 14.6 On-Request Data

Types of data

R .....Record 16 bit
B.....Boolean
S.....String
S32.....String 32 Byte
I16 .....Integer16
U8 .....UInteger8
U16 .....UInteger16
U32 .....UInteger32
U64 .....UInteger64

Access

RW .....Read/Write
RO.....Read Only
WO.....Write Only

| Index | Bit | Name | Description | Data type | Access | Factory setting | Range of values | Gradient | Unit |
|---|---|---|---|---|---|---|---|---|---|
| 12 | | Device Access Locks | | R | RW | | | | |
| 12 | 1 | Data storage | | B | RW | 0 | 0: free<br>1: locked | | |
| 12 | 3 | Local parameterization | | B | RW | 0 | 0: free<br>1: locked | | |
| 16 | | manufacturers name | | S | RO | EGE-Elektronik Spezial-Sensoren GmbH | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 17 | | Manufacturer text | | S | RO | www.ege-elektronik.com | | | |
| 18 | | Product name | | S | RO | SNS 552 GAPL | | | |
| 19 | | Product ID | | S | RO | P11389 | | | |
| 20 | | Product text | | S | RO | Flow sensor | | | |
| 21 | | Serial number | | S | RO | | | | |
| 22 | | Hardware version | | S | RO | | | | |
| 23 | | Firmware version | | S | RO | | | | |
| 24 | | Customized tag | | S32 | RW | | | | |
| 36 | | Device Status | | U8 | RO | 0: no failure detected<br>2: Temperature > 80 °C or < 0°C<br>4: Short circuit at S2 | | | |
| 64 | | OU1 | Operating mode for output S1 | U8 | RW | 1 | 1: hysteresis function normally open Hno<br>2: hysteresis function normally close Hnc<br>3: Window function normally open Fno<br>4: Window function normally close Fnc<br>5: Pulsating function PuL | | |
| 65 | | OU2 | Operating mode for output S2 | U8 | RW | 1 | 1: hysteresis function normally open Hno<br>2: hysteresis function normally close Hnc<br>3: window function normally open Fno<br>4: window function normally close Fnc<br>5: Current output I<br>7: failure message normally open Eno<br>8: failure message normally close Enc<br>9: Signal input Reset tin | | |
| 66 | | SP1 | Limit value switching point S1 flow rate | I16 | RW | 100 | 4...450 | 0,01 | m/s |
| 67 | | HS1 | Flow rate parameter value for hysteresis S1 | I16 | RW | 5 | 1...50 | 0,01 | m/s |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 68 | | FL 1 | Flow rate “low” limit value window operating mode S1 | I16 | RW | 100 | 4...449 | 0,01 | m/s |
| 69 | | FH 1 | Flow rate “high” limit value window operating mode S1 | I16 | RW | 105 | 5…450 | 0,01 | m/s |
| 70 | | SP2 | Flow rate Limit value switching point S2 | I16 | RW | 150 | 4...450 | 0,01 | m/s |
| 71 | | HS2 | Flow rate parameter value for hysteresis S2 | I16 | RW | 5 | 1...50 | 0,01 | m/s |
| 72 | | FL2 | Flow rate “low” limit value window operating mode S2 | I16 | RW | 150 | 4...449 | 0,01 | m/s |
| 73 | | FH2 | Flow rate “high” limit value window operating mode S2 | I16 | RW | 155 | 5…450 | 0,01 | m/s |
| 74 | | SP 1 | Temperature Limit value switching point S1 | I16 | RW | 200 | 2…800 | 0,1 | °C |
| 75 | | HS 1 | Temperature parameter value for hysteresis S1 | I16 | RW | 10 | 2…200 | 0,1 | °C |
| 76 | | FL 1 | Temperature “low” limit value window operating mode S1 | I16 | RW | 200 | 2…799 | 0,1 | °C |
| 77 | | FH 1 | Temperature “high” limit value window operating mode S1 | I16 | RW | 210 | 4…800 | 0,1 | °C |
| 78 | | SP2 | Temperature Limit value switching point S2 | I16 | RW | 400 | 2…800 | 0,1 | °C |
| 79 | | HS2 | Temperature parameter value for hysteresis S2 | I16 | RW | 10 | 2…200 | 0,1 | °C |
| 80 | | FL2 | Temperature “low” limit value window operating mode S2 | I16 | RW | 400 | 2…799 | 0,1 | °C |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 81 | | FH2 | Temperature “high” limit value window operating mode S2 | I16 | RW | 410 | 4…800 | 0,1 | °C |
| 82 | | dS 1 | Switch-on delay S1 | I16 | RW | 0 | 0…500 | 0,1 | s |
| 83 | | dr 1 | Switch-off delay S1 | I16 | RW | 0 | 0…500 | 0,1 | s |
| 84 | | dS2 | Switch-on delay S2 | I16 | RW | 0 | 0…500 | 0,1 | s |
| 85 | | dr2 | Switch-off delay S2 | I16 | RW | 0 | 0…500 | 0,1 | s |
| 86 | | A.St | Flow rate Start value 4 mA Analog output | I16 | RW | 0 | 0…200 | 0,01 | m/s |
| 87 | | A.En | Flow rate Final value 20 mA Analog output | I16 | RW | 300 | 100…450 | 0,01 | m/s |
| 88 | | A.St | Temperature Start value 4 mA Analog output | I16 | RW | 0 | 0…600 | 0,1 | °C |
| 89 | | A.En | Temperature Final value 20 mA Analog output | I16 | RW | 800 | 200…800 | 0,1 | °C |
| 90 | | FIt | Duration of averaging | U8 | RW | 16 | 0, 1, 2, 4, 8 | 1 | s |
| 91 | | diA | Internal pipe diameter | U8 | RW | 50 | 15…250 | 1 | mm |
| 92 | | CAL | Calibration factor | | | 100 | 50...150 | 1 | % |
| 94 | | d.S | Measurand for display | | | 0 | 0: Flow Flo<br>1: Temperature °C<br>2: Flow (10s) und Temperature (2s) in alternation F. °C<br>3: Display off oFF | | |
| 95 | | U.S 1 | Unit SP1 or window values 1 | U8 | RW | 0 | 0: Flow Flo<br>1: Temperature °C | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 96 | | U.S2 | Unit SP2 or window values 2 | U8 | RW | 0 | 0: Flow Flo<br>1: Temperature °C |
| 97 | | P-n | Output polarity | U8 | RW | 0 | 0: PNP PnP<br>1: NPN nPn |
| 98 | | U.A0 | Unit analog output | U8 | RW | 0 | 0: Flow Flo<br>1: Temperature °C |
| 99 | | Loc | Locking of parameters | U32 | RW | 0 | |
| 99 | 0 | Loc | OU1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 1 | Loc | OU2 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 2 | Loc | SP1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 3 | Loc | HS1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 4 | Loc | FL1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 5 | Loc | FH1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 6 | Loc | dS1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 7 | Loc | dr1 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 8 | Loc | SP2 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 9 | Loc | HS2 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 10 | Loc | FL2 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |
| 99 | 11 | Loc | FH2 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 99 | 12 | Loc | d52 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC | | |
| 99 | 13 | Loc | dr2 | B | RW | 0 | 0: not locked FrE<br>1: locked LoC | | |
| 99 | 14 | Loc | A.Str | B | RW | 0 | 0: not locked FrE<br>1: locked LoC | | |
| 99 | 15 | Loc | A.End | B | RW | 0 | 0: not locked FrE<br>1: locked LoC | | |
| 99 | 16 | Loc | t.LO | B | RW | 0 | 0: not locked FrE<br>1: locked LoC | | |
| 99 | 17 | Loc | Cod | B | RW | 0 | 0: not locked FrE<br>1: locked LoC | | |
| 100 | | U.FI | Unit displayed flow rate value | U8 | RW | 0 | 0: m/s n-S<br>1: l/min l-n<br>2: $m^3/h$ n3h | | |
| 101 | | d.O | Display orientation | U8 | RW | 0 | 0: 0°<br>1: 180° | | |
| | | | | | | | | | |
| 103 | | Cod | Access code programming main menu | I16 | RW | 0 | 0…999 | | |
| 104 | | SCd | Access code programming extended functions menu | I16 | RW | 0 | 0…999 | | |
| 105 | | t.LO | Configuration of signal input | U8 | RW | 0 | 0: rising edge PoS<br>1: falling edge nEG | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 106 | | | status of teach-in process | U8 | RO | 0 | 0: idle<br>1: teach-in-success<br>5: busy<br>Teach-in process error:<br>7: signal too turbulent<br>8: range error<br>9: temperature above detection range<br>10: temperature below detection range<br>11: flow rate above detection range | | |
| 107 | | | Flow rate calculated with diameter | Int32 | RO | | | 0,1 | l/min |
| 108 | | Er.C | Error code | U8 | RO | -- | -- | -- | -- |
| 109 | | Ch.C | Counter for modifications since fabrication | I16 | RO | -- | -- | -- | -- |
| 110 | | H.FA | Maximum flow rate since last reset | I16 | RO | -- | -- | 0,01 | m/s |
| 111 | | L.FA | Minimum flow rate since last reset | I16 | RO | -- | -- | 0,01 | m/s |
| 112 | | A.FA | Average flow rate since last reset (max 24 h) | I16 | RO | -- | -- | 0,01 | m/s |
| 113 | | H.oC | Maximum temperature since last reset | I16 | RO | -- | -- | 0,1 | °C |
| 114 | | L.oC | Minimum temperature since last reset | I16 | RO | -- | -- | 0,1 | °C |
| 115 | | A.oC | Average temperature since last reset (max 24 h) | I16 | RO | -- | -- | 0,1 | °C |

## 14.7 Events

| Code | Name | Type | Description |
|---|---|---|---|
| 0x7710 | Short circuit | Error | Short circuit at OUT2 (WH) |
| 0x8C10 | T_Medium_High | Warning | Medium temperature > 80°C |
| 0x8C30 | T_Medium_Low | Warning | Medium temperature < 0°C |
| 0x8DF0 | Testevent1 | Warning | Only for internal tests |
| 0x8DF1 | Testevent2 | Warning | Only for internal tests |

## 14.8 Error messages

| Errorcode | Description |
|---|---|
| 0x8011 | index not available |
| 0x8012 | sub-Index not available |
| 0x8020 | service currently not available |
| 0x8030 | parameter outside of valid range |
| 0x8031 | parameter above valid range |
| 0x8032 | parameter below valid range |
| 0x8033 | parameter too long |
| 0x8034 | parameter too short |
| 0x8035 | function not available |
| 0x8040 | invalid parameter |

# 15 Descriptions (in alphabetical order)

| Display | Type | Description | Reference |
|---|---|---|---|
| A | | | |
| A.En | Parameter | Final value of flow rate output 20 mA | Main menu |
| A.FA | Parameter | 24h Average of flow rate | Extended functions |
| A.tC | Parameter | 24h Average of temperature | Extended functions |
| A.St | Parameter | Start value of flow rate output 4 mA | Main menu |
| C | | | |
| CAL | Parameter | Calibration of flow rate value | Extended functions |
| C.Lo | Configuration | Access right management | Extended functions |
| C.OU | Configuration | Configuration of operation mode of outputs | Extended functions |
| Ch.C | Parameter | Modification counter, Number of accesses | Extended functions |
| Cod | Parameter | Access code for programming of device | Main menu |
| d | | | |
| dAt | Configuration | MIN-/MAX-/Average-configuration | Extended functions |
| dA | Value | Inner diameter of pipe | Extended functions |
| d.S | Value | Display selection | Extended functions |

| | | | |
|---|---|---|---|
| d.0 | value | Display orientation (turn display by 180°) | Extended functions |
| dr 1 | Parameter | Switch-off delay output S1 | Main menu |
| dr2 | Parameter | Switch-off delay output S2 | Main menu |
| dS 1 | Parameter | Switch-on delay output S1 | Main menu |
| dS2 | Parameter | Switch-on delay output S2 | Main menu |
| E | | | |
| EF | Function | Selection of menu „extended functions“ | Main menu |
| Eno | Value | Monitoring of device error, Output S1 – normally open | Main menu |
| Enc | Value | Monitoring of device error, Output S1 – normally close | Main menu |
| Err | Value | Wrong input | |
| Er.C | Parameter | Contains device error code | Main menu |
| F | | | |
| Fit | Parameter | Average time | Extended functions |
| F.oC | Value | Display alternating flow rate and temperature (10 s/2 s) | Extended functions |
| Flo | Value | Display flow rate | Extended functions |
| Fno | Value | Window comparator, Output S1/S2 – normally open | Main menu |
| Fnc | Value | Window comparator, Output S1/S2 – normally close | Main menu |

| | | | |
|---|---|---|---|
| FH1 | Parameter | „High“-level of window comparator for output S1 | Main menu |
| FH2 | Parameter | „High“-level of window comparator for output S2 | Main menu |
| FL1 | Parameter | „Low“-level of window comparator for output S1 | Main menu |
| FL2 | Parameter | „Low“-level of window comparator for output S2 | Main menu |
| H | | | |
| H.A | Parameter | Maximum flow rate since reset | Extended functions |
| H.°C | Parameter | Maximum temperature since reset | Extended functions |
| Hnc | Value | Monitoring of limit value with hysteresis, Output S1/S2 – normally close | Main menu |
| Hno | Value | Monitoring of limit value with hysteresis, Output S1/S2 – normally open | Main menu |
| HS1 | Parameter | Hysteresis of output S1 | Main menu |
| HS2 | Parameter | Hysteresis of output S2 | Main menu |
| I | | | |
| I | Value | Current output 4 .. 20mA | Main menu |
| L | | | |
| Loc | Value | Parameter locked | Extended functions |
| L.°C | Parameter | Minimum temperature since reset | Extended functions |

| | | | |
|---|---|---|---|
| L.A | Parameter | Minimum flow rate since reset | Extended functions |
| l-n | Value | Unit l/min | Extended functions |
| n | | | |
| nEG | Value | Teach-in with negative edge | Main menu |
| nPn | Value | NPN, output S1/S2 switches to ground | Extended functions |
| n-S | Value | unit m/s | Extended functions |
| n3h | Value | unit $m^3/h$ | Extended functions |
| O | | | |
| oFF | Value | Display switches off 10s after last action, Heartbeat LED (right decimal point flashes) | Extended functions |
| OU1 | Parameter | Operation mode of output S1 | Main menu |
| OU2 | Parameter | Operation mode of output S2 | Main menu |
| P | | | |
| P-n | Parameter | Output logic S1/S2: PNP/NPN | Extended functions |
| PnP | Value | PNP, output S1/S2 switches to supply | Extended functions |
| PoS | Value | Teach-in with positive edge | Main menu |
| PuL | Value | Operation mode pulse output | Main menu |
| r | | | |

| | | | |
|---|---|---|---|
| rES | Function | Reset of parameter value | |
| S | | | |
| SCd | Parameter | Access code for „Extended functions“ | Extended functions |
| SP1 | Parameter | Limit value for SP1 | Main menu |
| SP2 | Parameter | Limit value for SP2 | Main menu |
| t | | | |
| tAG | Parameter | TAG identifier (to be set by user) | Extended functions |
| tin | Value | Configuration of teach-in input | Main menu |
| t.LO | Parameter | Logic of teach-in input | Main menu |
| U | | | |
| U.FI | Parameter | Unit for flow rate | Extended functions |
| U.S1 | Parameter | Signal source for output S1 (Hysteresis- and window function) | Extended functions |
| U.S2 | Parameter | Signal source for output S2 (Hysteresis- and window function) | Extended functions |
| U.AO | Parameter | Signal source for analog output | Extended functions |
| | | | |
| °C | Value | Temperature | Extended functions |

# 16 Technical data

## 16.1 Electrical data

Supply voltage [VDC] ..... 18…30
Current consumption [mA] ..... ≤ 150
Ambient temperature [°C] ..... -10…60

Output S1 and S2 ..... PNP/NPN
Output S1 ..... NC/NO
Switching current S1 [mA] ..... ≤ 150
Output S2 ..... NC/NO
Switching current S2 [mA] ..... ≤ 150
Analog [mA] ..... 4…20 (RL ≤ 500 Ω)
Input voltage high-level [VDC] ..... $9 \leq U_{IN} \leq U_{supply}$
Input voltage low-level [VDC] ..... $0 \leq U_{IN} \leq 4$

Medium temperature [°C] ..... 0…80

## 16.2 Flow measurement

**Measuring range**

Flow speed [m/s] ..... 0,05…3,00

**Deviation[2]**

Deviation of measured value [± %] ..... 8
Deviation of full range value [± %] ..... 2
Precision (Reproducibility) [≤ %] ..... 2

**Adjustment ranges[3]**

Limit values SP1 and SP2 [m/s] ..... 0,06…3,00
Hysteresis values HYS1 and HYS2 [m/s] ..... 0,01…0,50
„Low“-level limit value FL1 and FL2 [m/s] ..... 0,06…2,99
„High“-level limit value FH1 and FH2 [m/s] ..... 0,07…3,00

[2] Under reference conditions: straight inlet pipe 130 cm, internal pipe diameter: 26 mm

[3] If the calibration factor unlike 100 %, the adjustment ranges are scaled as well.

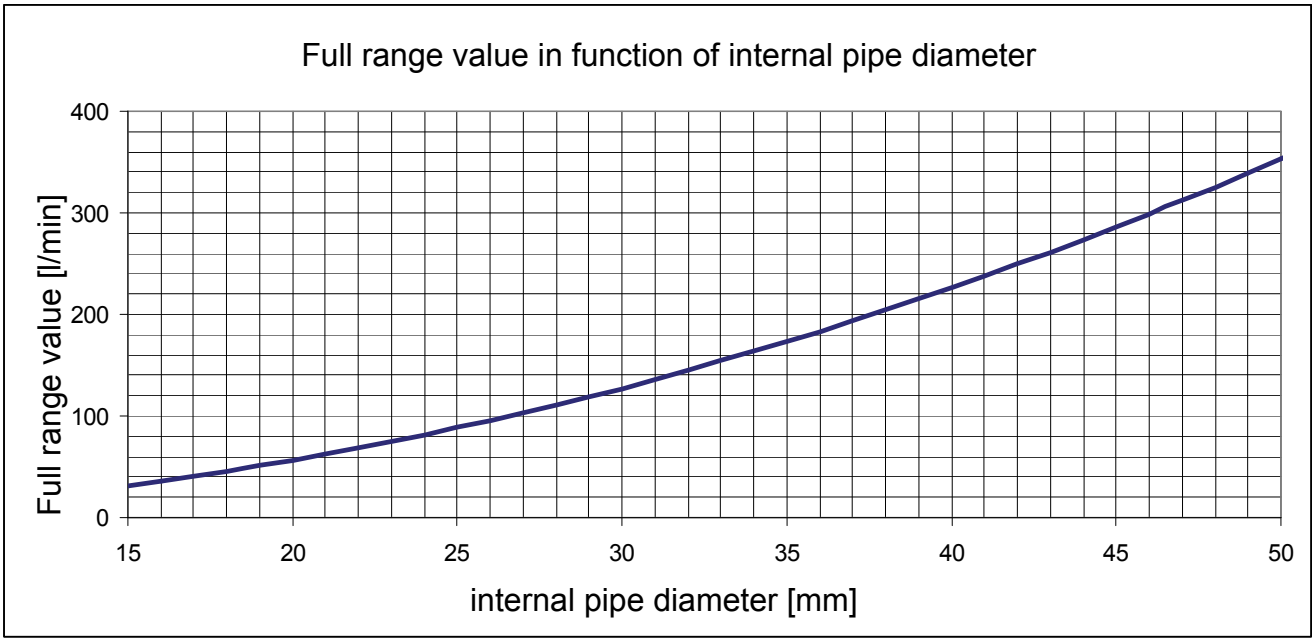
Start value for 4 mA [m/s]..... 0,00…2,00

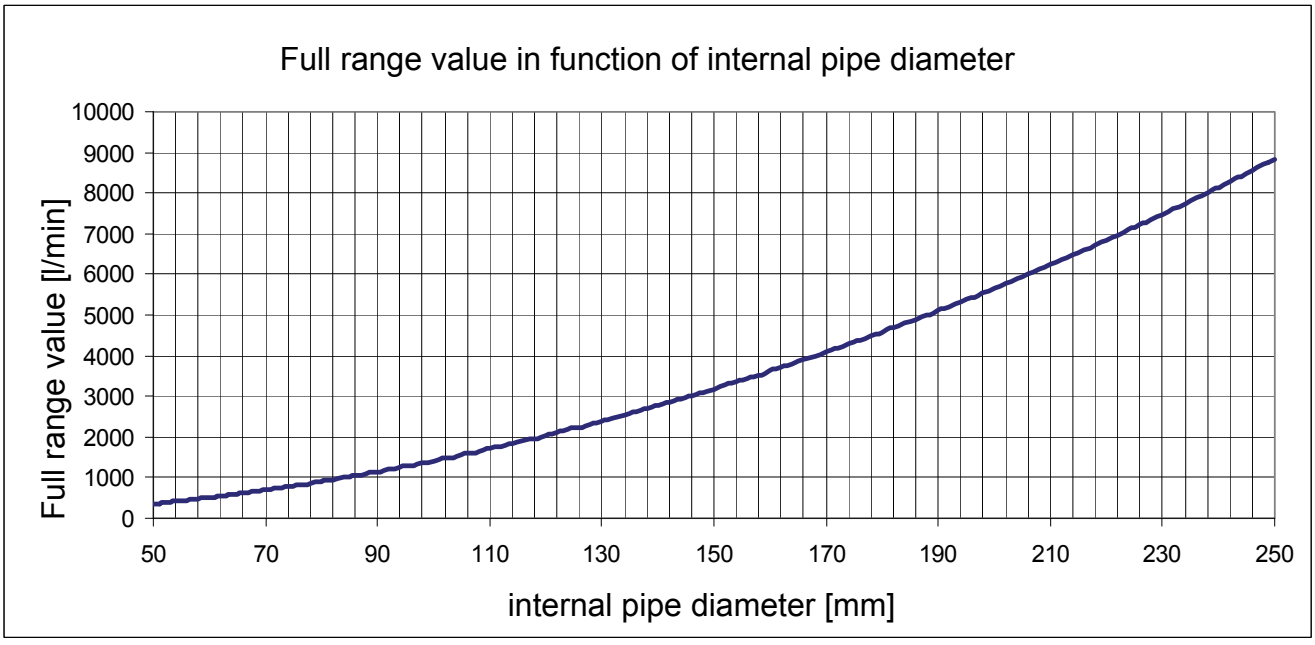
Final value for 20 mA [m/s] ..... 1,00…3,00

Step width [m/s]..... 0,01

Internal pipe diameter [mm]..... 15…250

Calibration factor [%]..... 50…150



**Pulse output**

Pulse valance at $r_i$[4] = 15…50 mm [ml/Pulse] ..... 100

Pulse valance at $r_i$ = 51…100 mm [ml/Pulse] ..... 500

Pulse valance at $r_i$ = 100…250 mm [ml/Pulse] ..... 2000

Puls duration [ms] ..... 5

## 16.3 Temperature measurement

**Measurement range**

Temperature [°C] ..... 0,0…80,0

**Deviation[5]**

Deviation of measured value [± °C] ..... 2

**Adjustment range**

Limit values SP1 and SP2 [°C] ..... 0,1…80,0

Hysteresis values HYS1 and HYS2 [°C] ..... 0,1…20,0

„Low“-level limit value FL1 and FL2 [°C] ..... 0,1…79,9

„High“-level limit value FH1 and FH2 [°C] ..... 0,2…80,0

Start value for 4 mA [°C] ..... 0,0…40,0

Final value for 20 mA [°C] ..... 20,0…80,0

Step width [°C] ..... 0,1

## 16.4 Response time

Reaction time [s] ..... ≤ 0,5

Average time [s] ..... 0, 1, 2, 4, 8

Switch-on delay time OUT1/OUT2 [s] ..... 0,0…50,0

Switch-off delay time OUT1/OUT2 [s] ..... 0,0…50,0

Step width [s] ..... 0,5

[4] $r_i$: Internal pipe diameter

[5] Minimum flow rate: 30% of full range

## 16.5 IO-Link-Device

Release ..... 1.1

Data communication ..... COM2 (38,4 kBaud)

Device-ID [dezimal] ..... 218

Cycle time min. [ms] ..... 3,5

Prozess data [Byte] ..... 4

## 16.6 Mechanical data

Operational pressure max. [bar] ..... 60

Degree of protection ..... IP 67

**Material of sensor (touched by medium)**

Sensor tip and shaft ..... Stainless steel 1.4404

**Material of housing**

Display unit ..... PBT

Front label ..... Polyester

Connector ..... 1.4305

Connector insert ..... PA