SS500020

Operating instructions programmable flow sensor for pipes from Ø 15 mm with IO-Link

Use IO-Link
Universal · Smart · Easy

CE

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table of contents

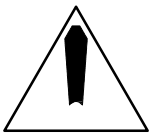
(Further subsections are listed at the beginning of the chapter)

1 Preliminary remarks

1.1 Target group

The operating instructions contain information and parameters for trained specialists who are familiar with working on electrical systems.

1.2 Symbols used

	Additional information or notes that are useful for special applications.
	Warning
	Character string shown on the display of the device.
	Device button
	Device button
	Device button
	Apply voltage supply to sensor

2 Safety instructions

The device may only be installed by trained specialists and must be protected against mechanical damage. The applicable regulations must be observed when working on electrical devices.

Disposal instructions: Do not dispose of in household waste, observe and comply with relevant laws and national regulations.

3 Intended use

The **SS500020** sensor measures the flow velocity and temperature of a flowing medium at the sensor tip. The test prod must be completely immersed in the liquid medium. The flow rate is calculated from the sensor data in relation to the internal pipe diameter. The sensor is suitable for use in industrial areas.

4 Measuring principle

The function of the flow sensor is based on the thermodynamic principle. The sensor is heated a few degrees Celsius from the inside in relation to the flow medium in which it is immersed. If the medium flows, the heat generated in the sensor is dissipated by the medium, i.e. the sensor is cooled. The temperature in the sensor is measured and compared with the temperature of the medium, which is also measured. The flow condition can be derived from the temperature difference obtained.

5 Useful notes

The extended functions can be used after entering the supercode . If no supercode is programmed, the release takes place after confirmation of the (factory settings) in the code query.

6 Areas of application

6.1 Limit value monitoring with switching output

These measured variables can be monitored:

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

6.1.1 Hysteresis operational mode (limit value monitoring)

Outputs **S1** and **S2** can be operated independently of each other in the hysteresis operational modes Hno (normally open) and Hnc (normally closed (nc)). The configuration as PNP or NPN output can only be carried out together for both outputs.

The measured flow and temperature values are monitored using the limit values SP 1 and SP2 . If the limit values are exceeded or undershot, a change in the initial state occurs. The difference between the switch-on and switch-off value is the hysteresis. It is defined with the parameters HS 1 and HS2 . In addition, a switch-on time delay d5 1 and d5 2 and a switch-off time delay dr 1 and dr 2 can be programmed. In the "Extended functions" menu, the parameters U.S 1 and U.S2 are used to select temperature °C or flow Flo as the measured variable.

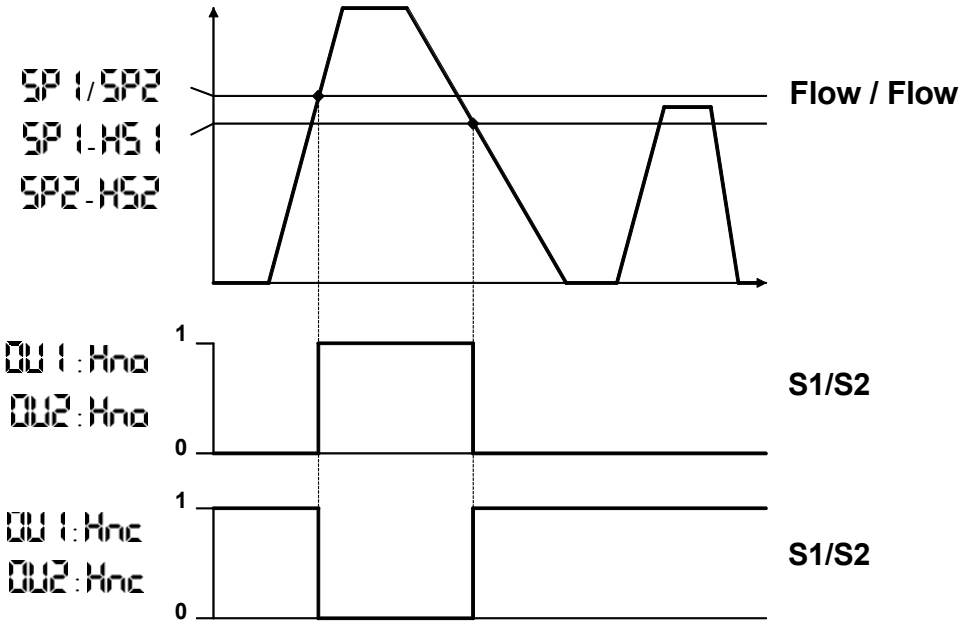


Figure 1: Hysteresis operational mode

6.1.2 Window monitoring operational mode

Outputs **S1** and **S2** can be operated independently of each other in the operational mode window monitoring Fno (normally open) and Fnc (normally closed (nc)). The configuration as PNP or NPN output can only be carried out together for both outputs.

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

If the measured flow or temperature value is within this range, the corresponding output is active or not active.

In addition, times for the switch-on delay d5 1 and d52 and a switch-off delay dr 1 and dr2 can be programmed. In the "Extended functions" menu, the parameters U.S 1 and U.S2 are used to select temperature °C or flow Flo as the measured variable.

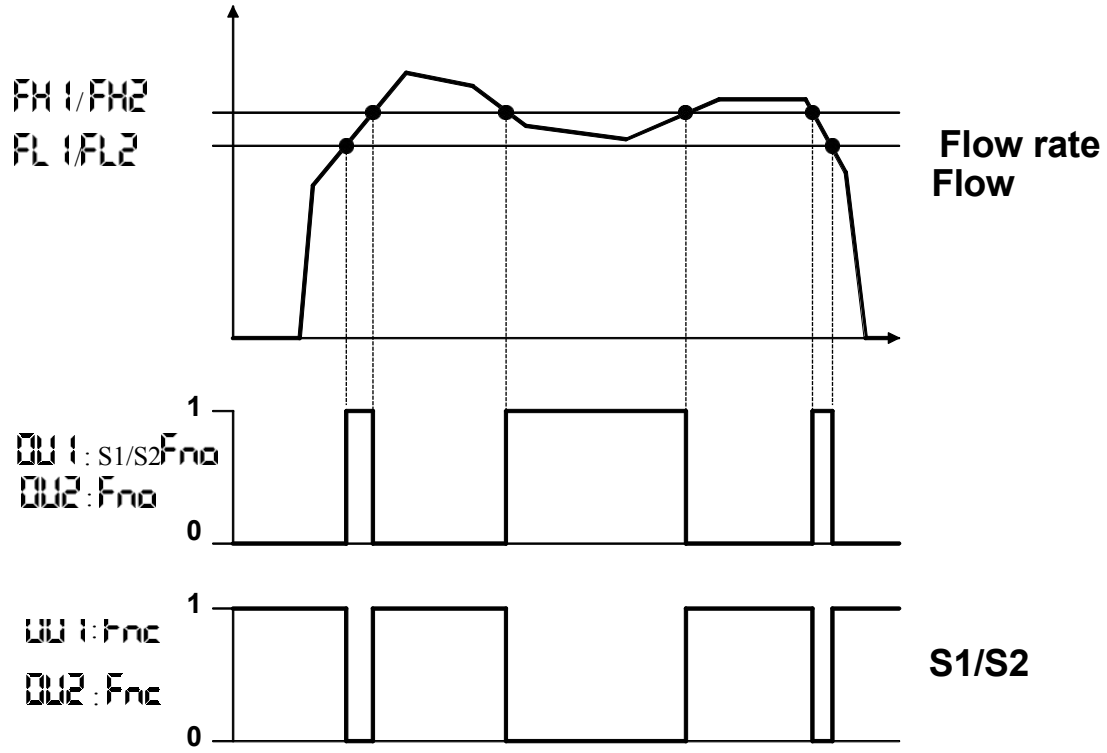


Figure 2: Window monitoring operational mode

6.2 Measurement with analog output

These measured variables can be output in analog form:

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

The pulse output or the 4...20 mA analog output can be used to output an analog value.

6.2.1 Pulse output operational mode

Output **S1** can be set up as a pulse output for the flow rate in the programming menu by selecting Pul for the parameter OU t. The pulse value depends on the set internal pipe diameter:

Pipe inner diameter	Pulse value
15 ... 50	100 ml / pulse
51 ... 100	500 ml / pulse
101 ... 250	2 l / pulse

The pulse length is always 5 ms. Output **S1** functions as a normally open contact.

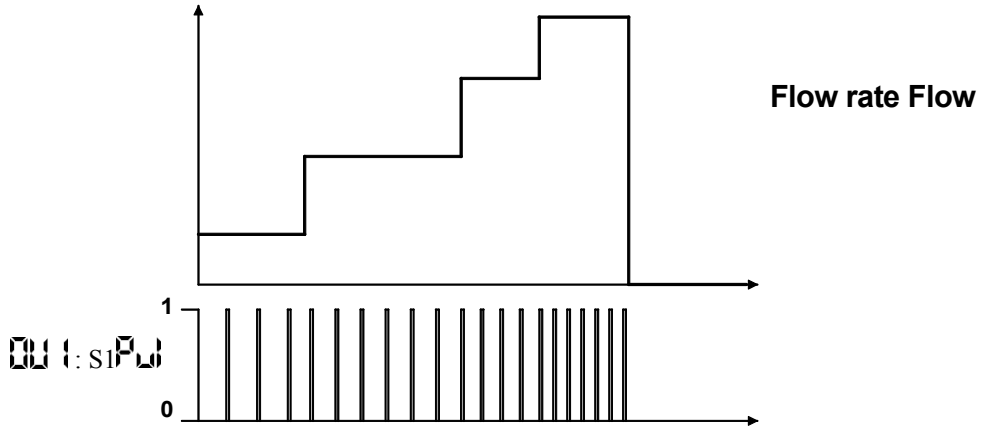


Figure 3: Pulse output operational mode

6.2.2 4...20 mA analog output

Output **S2** can be switched in the programming menu as analog output 4...20 mA by selecting the parameter value I can be switched. In the "Extended functions" menu, the temperature oC or the flow rate Flo can be assigned to it in the parameter U.A0

The parameters A.St and A.En contain the values for 4 mA and 20 mA. They are entered in the main menu.

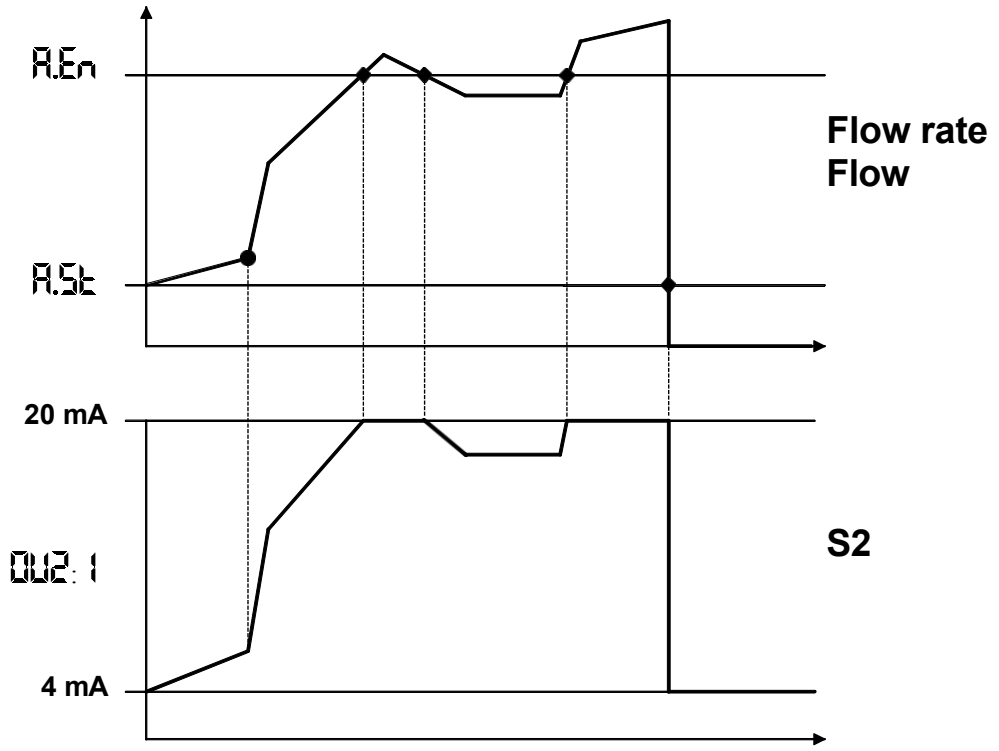


Figure 4: Analog output operational mode

6.3 Error recognition with switching output

The operational mode error control can be assigned to output **S2** by selecting the parameter values Ena and Enc . If the device diagnostics detects an error, output **S2** is activated (Ena / normally open) or deactivated (Enc / normally closed). The parameter Er.C contains an error code that provides information via the type of error. This can be read out in the main menu.

i	Error codes and description	
	4	Medium temperature < 0°C
	5	Medium temperature > 80°C
	7	Short circuit on a switching output

6.4 Teach-in SP1 via external control signal

The sensor can be set to teach-in mode for switching point SP1 by applying an external control signal. To do this, the parameter value tin is selected for output S2. Depending on the setting of the parameter t.LO, the current flow value is adopted as switching point SP1 on a rising edge (setting PoS) or on a falling edge (setting nEG) of the control signal at S2. Further teach-in processes for other parameters can be started via IO-Link commands.

7 Special functions

7.1 User profiles

The sensor offers the option of restricting the scope of operation of a user group to the modification of certain parameters.

The sensor "administrator" sets up a "supercode" that gives him access to the extended functions. The selective locking of parameters can be carried out there.

i	For example, it is possible for the system manufacturer to enable only one output for the "System operator" user group and to operate the second output with an operational mode that cannot be changed.
	Locking menu Functions 12.3.11 P. 29

7.2 Manipulation control

The sensor has a modification counter that is increased with every parameterization, regardless of whether this is done via the diffuse reflection sensors or the IO-Link interface. This means that every modification to the device configuration can be recognized. The counter is visible to user groups that have access to the "*Advanced functions*". The counter cannot be reset.

i	➔ 12.3.13 Reading out the modification counter p. 31

8 Installation

Installation parameters must be observed in order to achieve the specified accuracy. Observe applicable regulations.

8.1 dimensions

(± 1.5 mm)

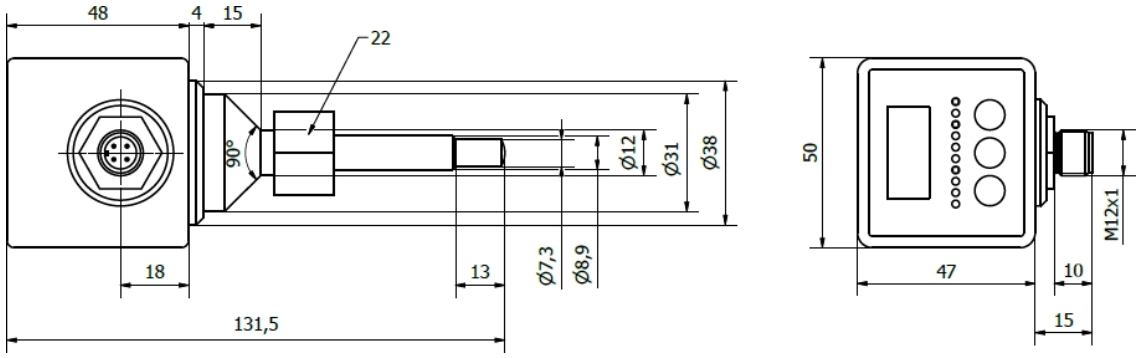


Figure 5: Dimensions

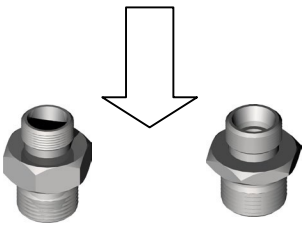
8.2 Installation in piping

The flow profile that forms in the area of the test prod must correspond to the profile at the factory calibration (100 cm straight inlet section). The specified inlet and outlet sections must be observed. Observe an immersion depth of the test prod of ≥ 15 mm for an internal pipe diameter of Ri ≤ 100 mm and 15% of the internal pipe diameter for Ri > 100 mm.

Turn display housing counterclockwise until limit stop is felt

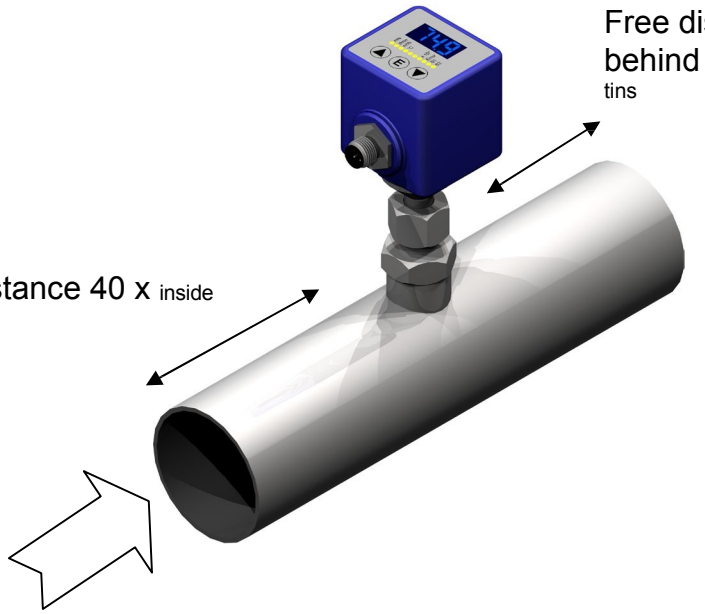
Fixing the sensor shank

- Insert sensor into adapter
- Position the connector against the direction of flow
- Firmly energize the union nut, use the wrench flats below the display housing to hold it in place
- Turn the display housing in the desired direction



AS000012; AS000013; AS00014

Fitting the adapter in the threaded connector/T-piece



Free distance behind sensor 10 x tins

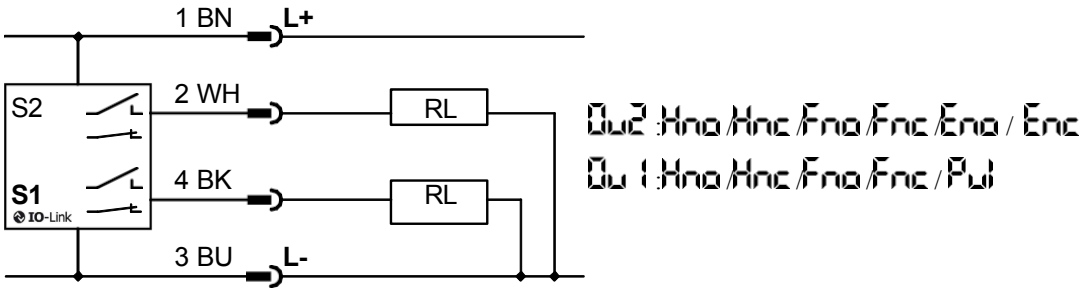
Pre-run distance 40 x inside

Flow direction

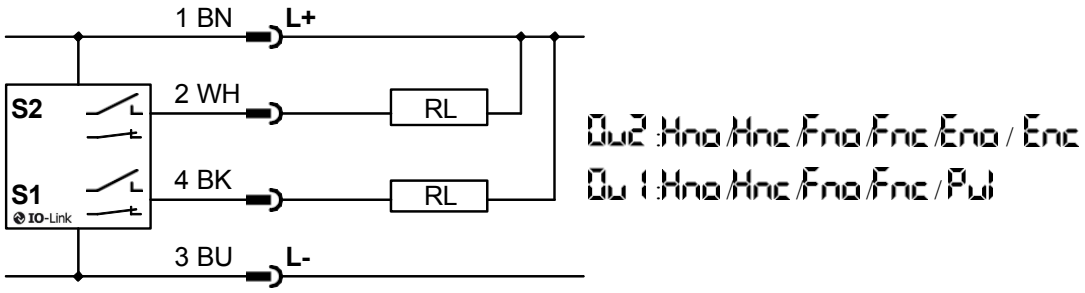
9 Electrical connection diagrams

The operational mode for output **S1** and output **S2** is selected in the programming menu.

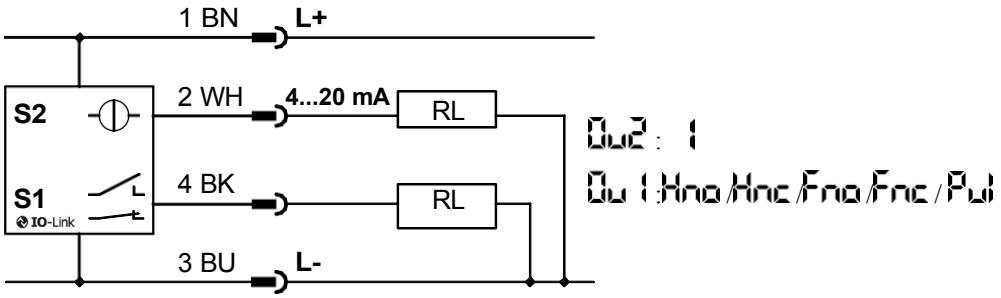
S1 and S2 as switching output PNP-NO/NC



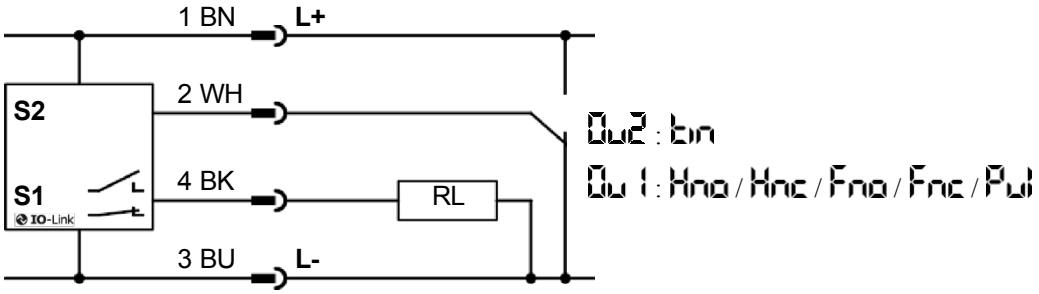
S1 and S2 as switching output NPN-NO/NC



S1 as switching output and S2 as analog output 4...20 mA



S1 as switching output and S2 as teach input



10 Operating and display elements

Figure 6: Front view

10.1 Display

The three-digit display shows the process parameters and values using alphanumeric characters and numeric sequences. The operational modes of the display during display and operational mode can be selected in the "Advanced functions" menu.

10.2 Unit and status LEDs

10 individual LEDs provide further information for displaying the process values.

LED1, **LED2 and LED3** signal the units of the displayed value for the current flow rate.

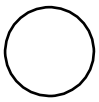
LED4 lights up when the measured temperature is shown on the display.

LED5 or **LED6** have no function with this sensor. **LED7** can light up in addition to the unit LEDs. The displayed value must then be multiplied by 1000.

LED8 lights up when the internal diagnostics have detected an error condition.

LED9 and **LED10** signal the status of outputs **S1** and **S2**. They light up when outputs **S1** and/or **S2** are switched.

10.3 diffuse reflection sensor

	Change to the next parameter Increase a parameter value Switch between predefined parameter values
	Confirming the selection of a parameter or parameter value Switching between digits when entering a code Switch between parameters in the quick view Quick saving of the consumption value
	Change to the next parameter Decrease a parameter value Switch between predefined parameter values
 for at least 3 seconds	Start programming mode

11 Display and operational mode

11.1 Switch-on procedure

The sensor runs through the switch-on procedure after the operating voltage is applied. The parameters contain the values already set or the factory settings. The device performs a self-test and is then in display and operational mode.

During the switch-on procedure, all segments, the decimal points and the individual LEDs of the display are activated for approx. 0.5 seconds in the first step. The software revision is then briefly displayed. The application tag then appears. This is a customer-specific combination of characters that can be set in the programming menu.

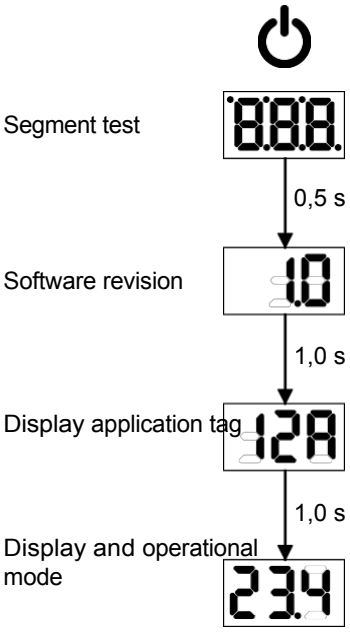


Figure 7: Switch-on procedure

The current measured value is now shown on the display.

11.2 Quick display of parameter values

The parameters and the associated values can be displayed in display and operational mode without entering programming mode. By repeatedly pressing the Ⓔ diffuse reflection sensor, the parameters relevant to the configuration are called up one after the other. If the Ⓔ diffuse reflection sensor is not pressed for two seconds, the value associated with the parameter appears on the display.

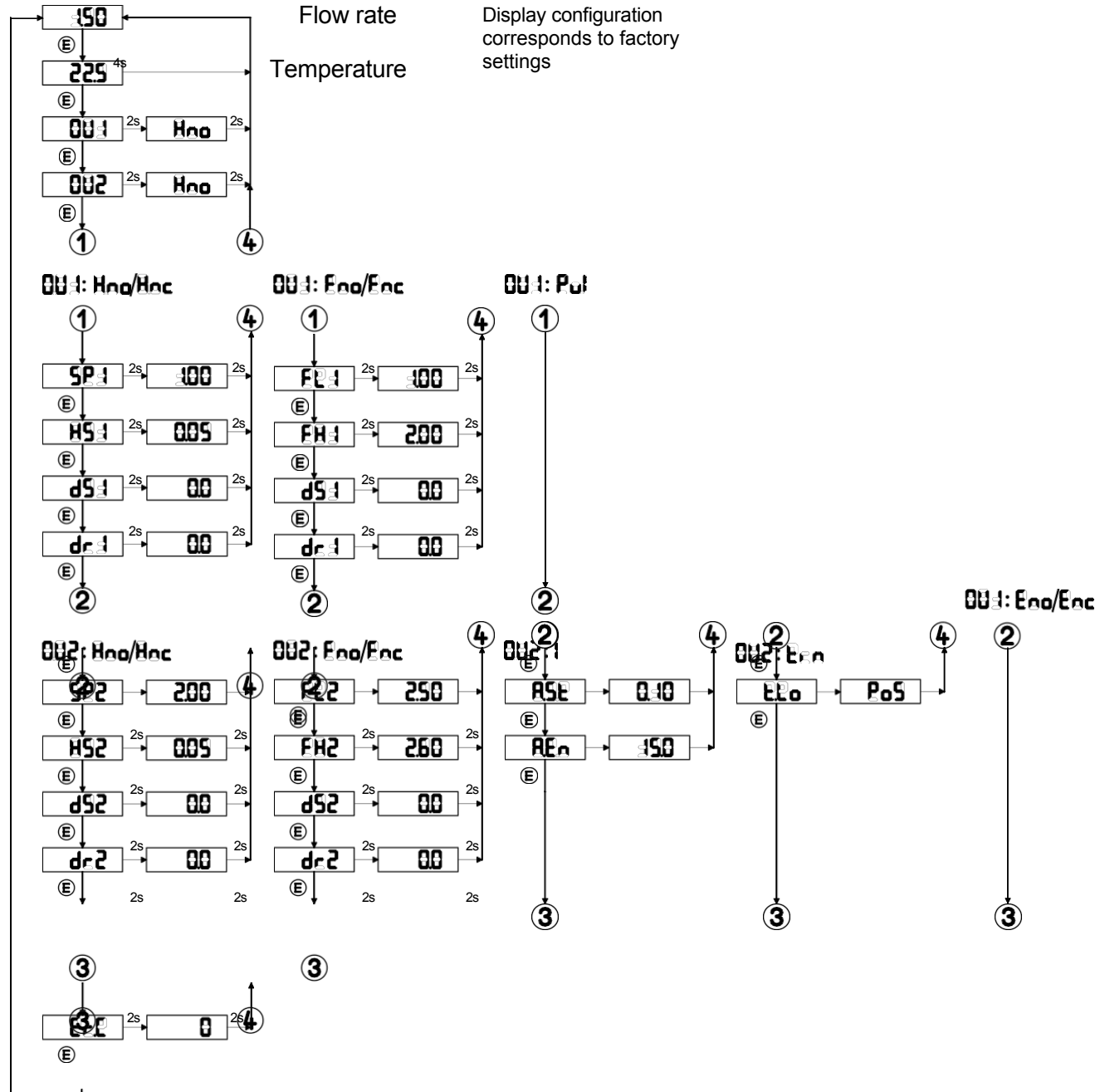


Figure 8: Quick display of the parameters

12 Programming

The flow sensor is programmed via keyboard entries or via the standardized IO-Link interface. Programming via this interface is described in a subsequent chapter. Exit programming mode before switching off the device.

12.1 Start programming mode

To enter programming mode, press the ▼ and ▲ diffuse reflection sensors simultaneously for at least 3 seconds until the character sequence Cod appears on the display. If no further diffuse reflection sensor is pressed, you will be prompted to enter the three-digit access code shortly afterwards.

Use the ▼ and ▲ buttons to change the flashing digit. Use the diffuse reflection sensor E to confirm the entry and move to the next digit. After entering the third digit, verification takes place and, if the access code is correct, the main menu is accessed. If an incorrect entry is made, Err is displayed for 1 second and the system branches back to display and operational mode.

i	If IO-Link mode is activated and data transfer is taking place, programming on the device is not possible. If programming is attempted, the message LoC appears on the display.
	Parameterization on the device can be blocked via an IO-Link function. The display shows LoC when programming is attempted. Manual parameterization can only be enabled again via the IO-Link function.

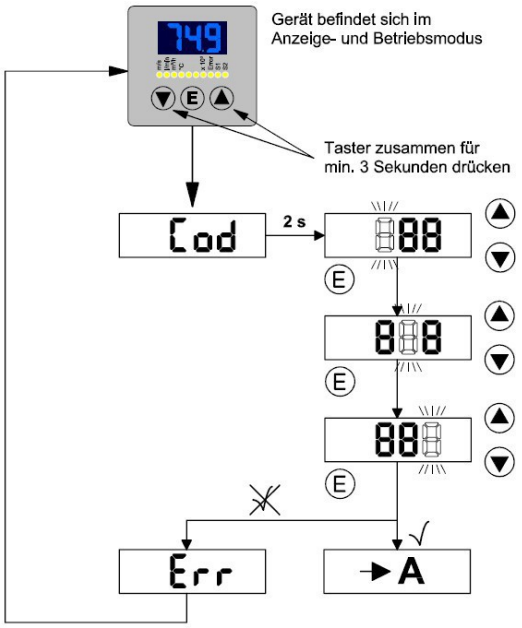


Figure 9: Start programming

i	A ➔ Figure 10: Main menu structure p. 21

12.2 Main menu structure

The main menu appears in connection with the correct entry of the access code. The operational modes are initially assigned to outputs S1 and S2. Depending on the selected operational mode, the values for the relevant parameters are inquired.

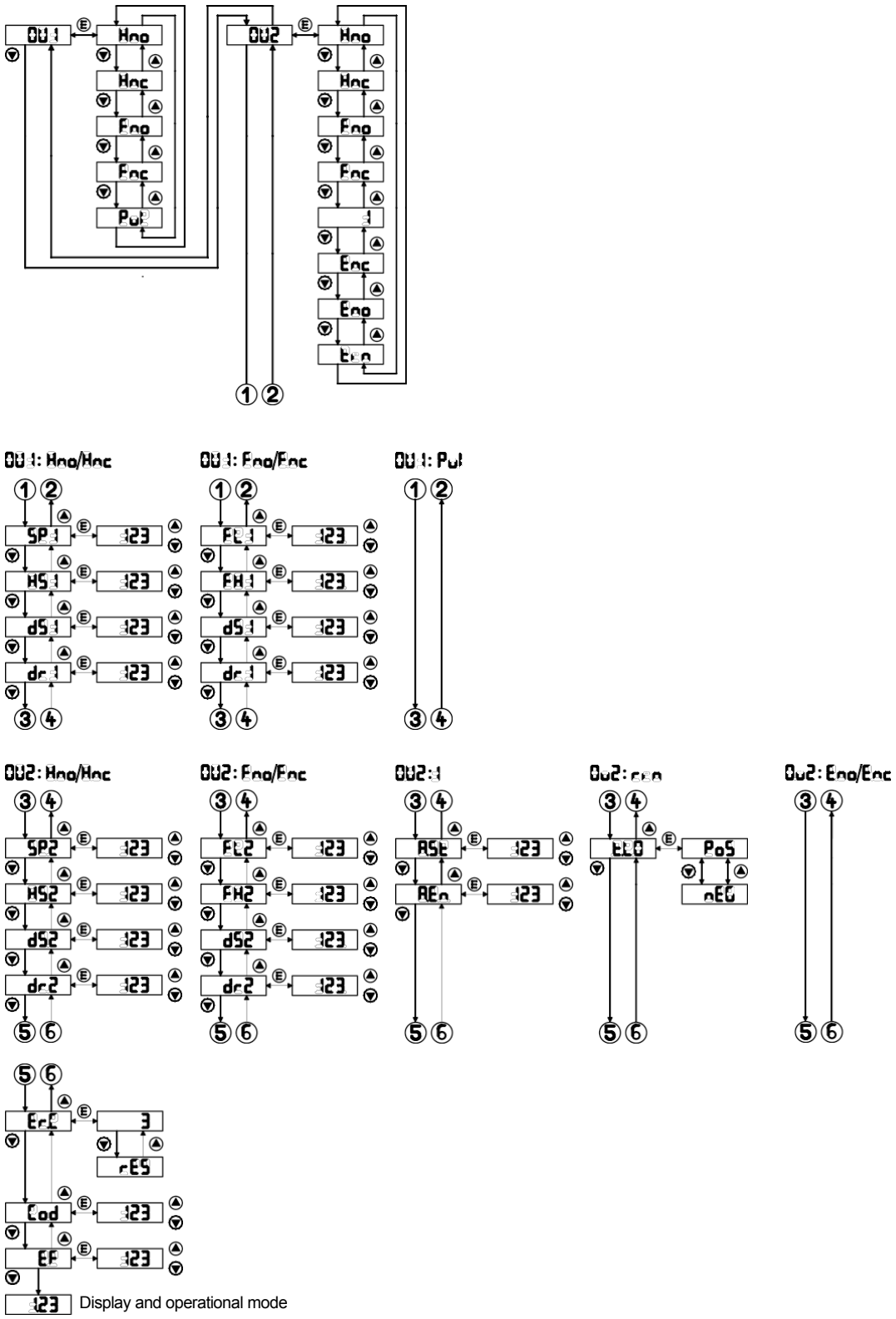


Figure 10: Main menu structure

12.2.1 Read out and reset error code

The error code can be found in the parameter Er.C and can be read out in the main menu or in the quick view. Resetting is possible in programming mode in the main menu.
To do this, the reset function rES is selected for the corresponding parameter.

12.2.2 Set up and change access code

To restrict access to the programming menu, it is possible to set up an access code. This access code must be different from the factory settings 000. To set up/change, select the parameter Cod and enter a corresponding 3-digit number combination.

12.3 Advanced functions

The extended functions can be used after entering the supercode SCd. If no supercode is programmed, the release takes place after confirmation of the 000 (factory settings) in the code query.

12.3.1 Enter supercode for EF menu

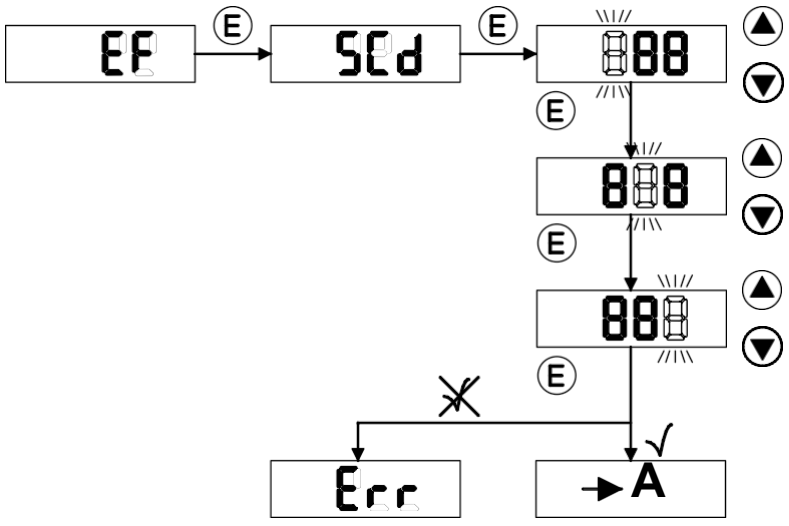
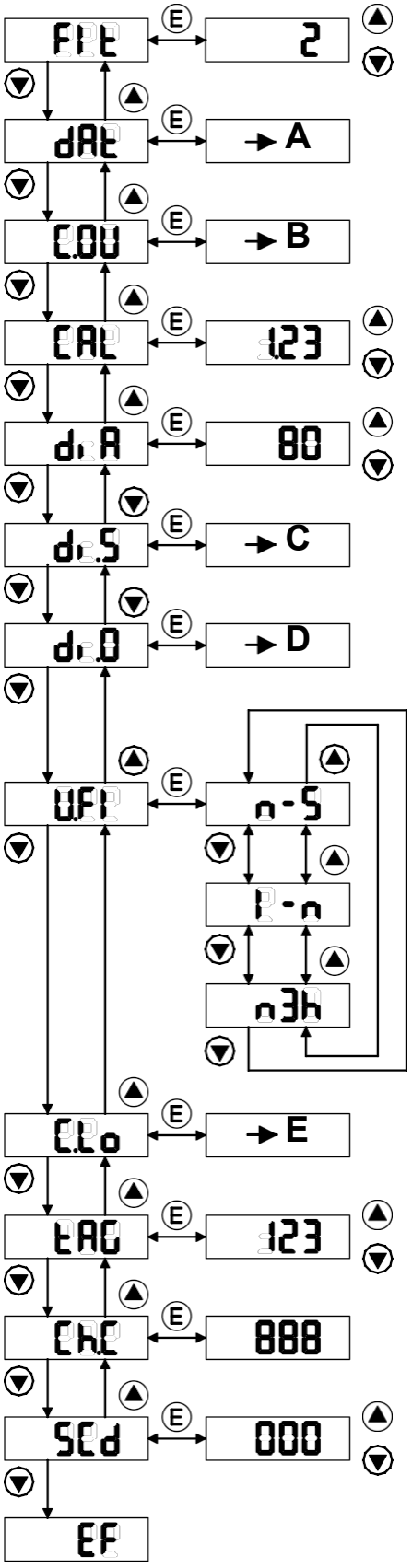


Figure 11: Supercode input

i	A: ➔Page 24

12.3.2 Advanced functions" menu structure



A: ➔ Data analysis, p. 26

B: ➔ Configuration of the outputs, p. 27 C:

➔ Configuration of the display, p. 28

D: ➔ Flipping/mirroring the display, p. 29

E: ➔ Lock menu functions, p. 29

Figure 12: "Advanced functions" menu structure

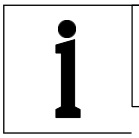
12.3.3 Entering the filter values

The sensor has a function that averages the flow rate via an adjustable time period (moving average). This average value is output continuously. The time period for averaging is entered in the "Advanced functions" menu in the parameter . You can choose between 0, 1, 2, 4 and 8 seconds.

12.3.4 Data analysis

The lowest and highest measured values for the flow rate and temperature since the last reset are saved in the parameters , ,L.FH.FL.°C andH.°C . In addition, the average of the measured values is calculated via a period of the last 24 hours. The data is saved when the device is switched off.

All data can be reset via the keypad.

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

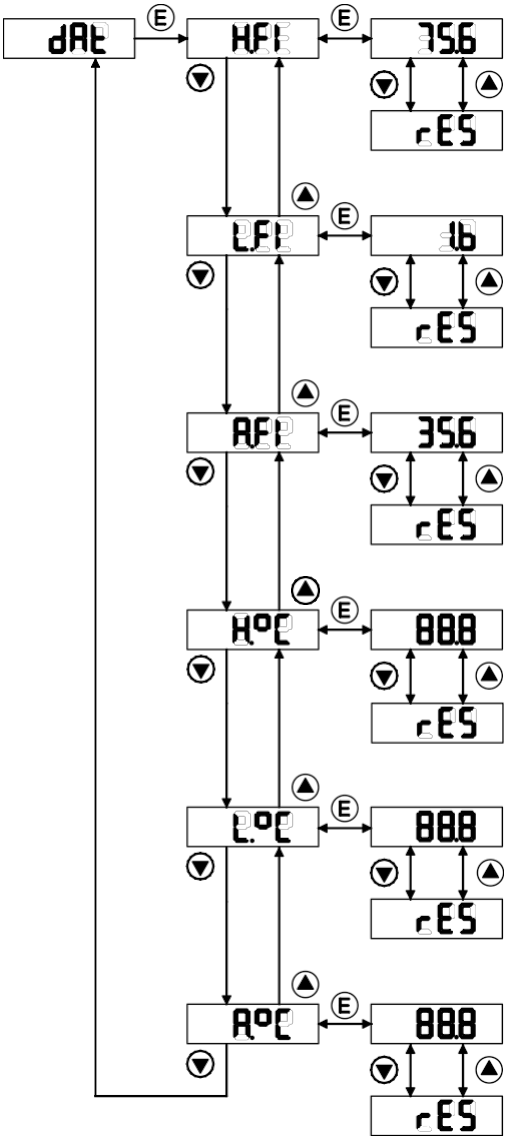


Figure 13: Data analysis

12.3.5 Configuration of the outputs

The measured variable for outputs **S1** and **S2 is** selected in the configuration menu C.OU using the parameters ,U.S1 U.S2 and U.AO . The electrical switching behavior of the outputs **S1** and **S2 is** defined in the parameter -Pn . PNP is set with the value PnP and NPN is set with the value .nPn

Flow rate → Flo

Temperature → °C

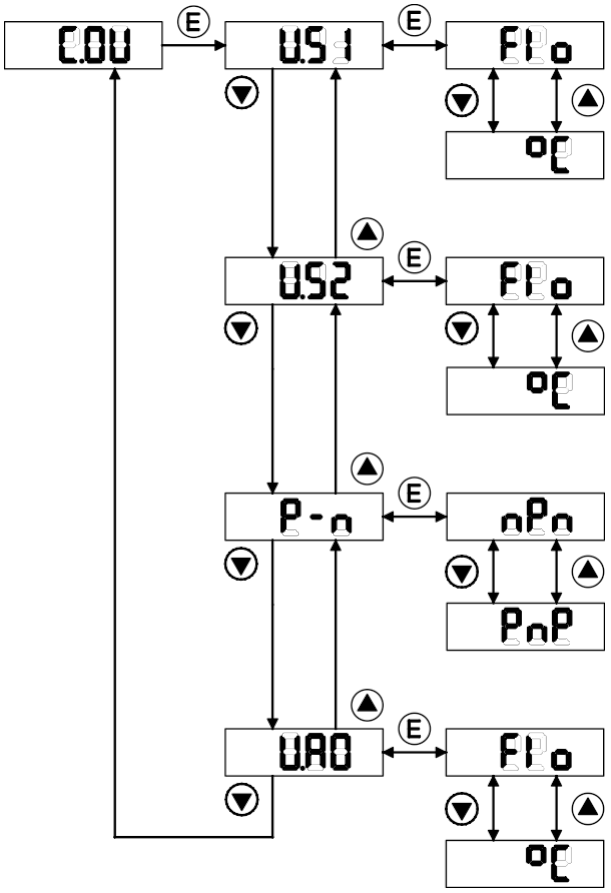


Figure 14: Configuration of the outputs

12.3.6 Calibration function

A calibration factor in the range 50 ... 150% can be entered for the parameter CAL . This allows the sensor display to be compared with a reference.

12.3.7 Input pipe inside diameter

An internal pipe diameter in the range of 15...250 mm can be entered for the parameter dIA. The device uses the entered value to calculate the volume flow in l/min or m3/h.

12.3.8 Configuration of the display

The measured variable shown in the display is determined in the configuration menu d.S. If oFF is selected, the display goes out after a short time if no input is made. Pressing any diffuse reflection sensor reactivates the display.

The following display options are available:

Flow rate → Flo

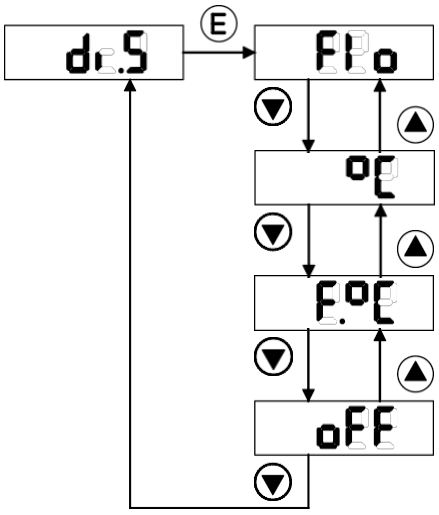
Temperature → °C

Flow rate 10 s & temperature 2 □→F.

°C Display dark, right decimal point

□□□□□□

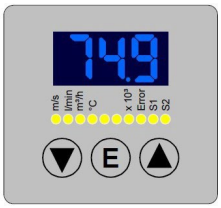
□□→ oFF



12.3.9 Flipping/mirroring the display

In the configuration menu d.0, the 7-segment display can be flipped/mirrored by 180°. The button functions are not interfered with.

The following display options are available:



→ 0

→ 180

12.3.10 Selecting the measuring unit for the flow rate

The measuring unit for the flow rate is set in the menu U.FL The

following options are available:

m/s → m-S

l/min → l-n

m3/h → m3h

12.3.11 Lock menu Functions

In the lock menu C.Lo, functions can be blocked for a user group that only has the access code for the main menu.

Locking access to the parameters OU1 and OU2 locks all parameters that depend on them. These will then also not appear in the menu.

To lock a parameter, select Loc. Parameters that should be accessible are assigned to FrE

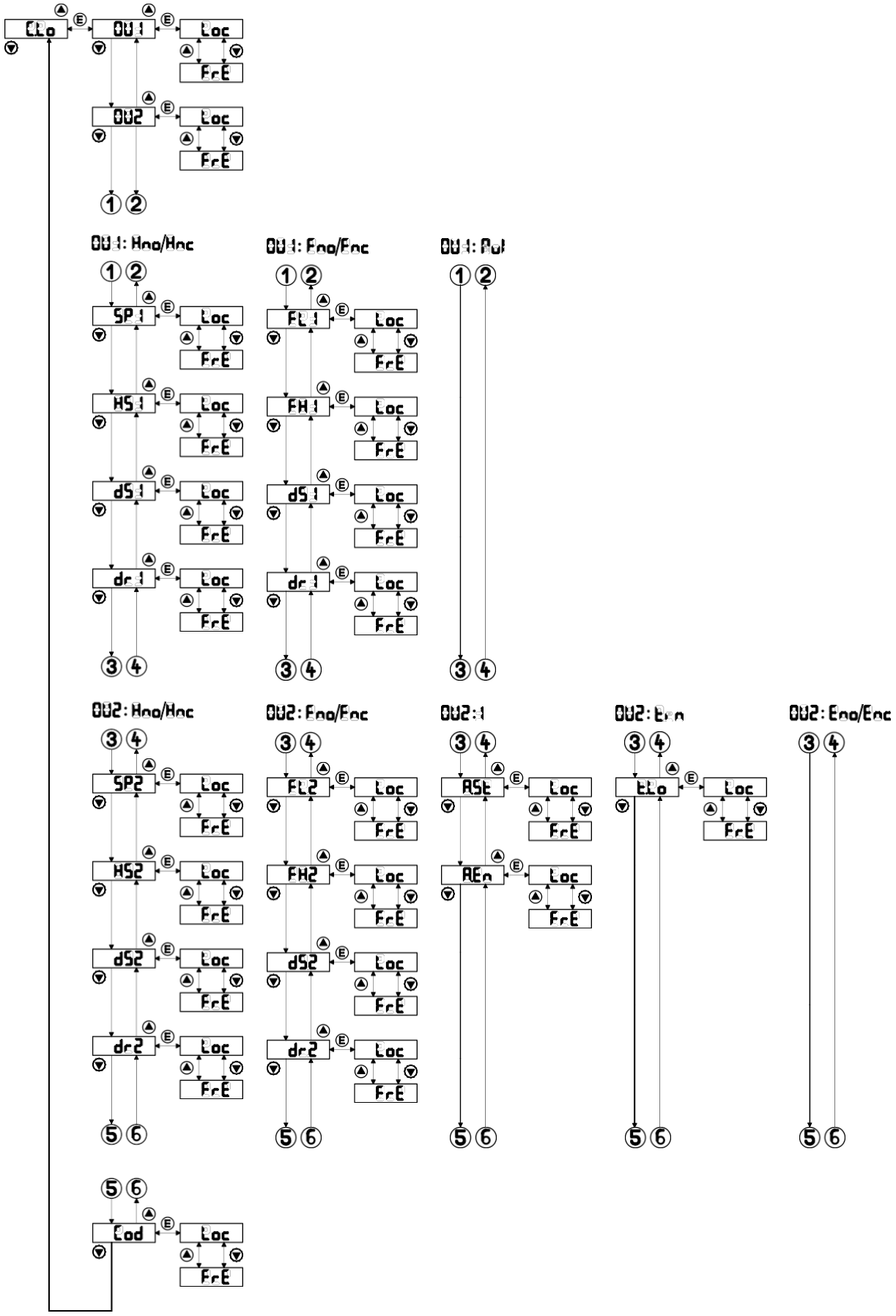


Figure 15: Parameter lock menu

12.3.12 Enter the customer-specific TAG identifier

The parameter TAG can be used to enter a 3-digit device or system-specific TAG number.
The following characters can be displayed:

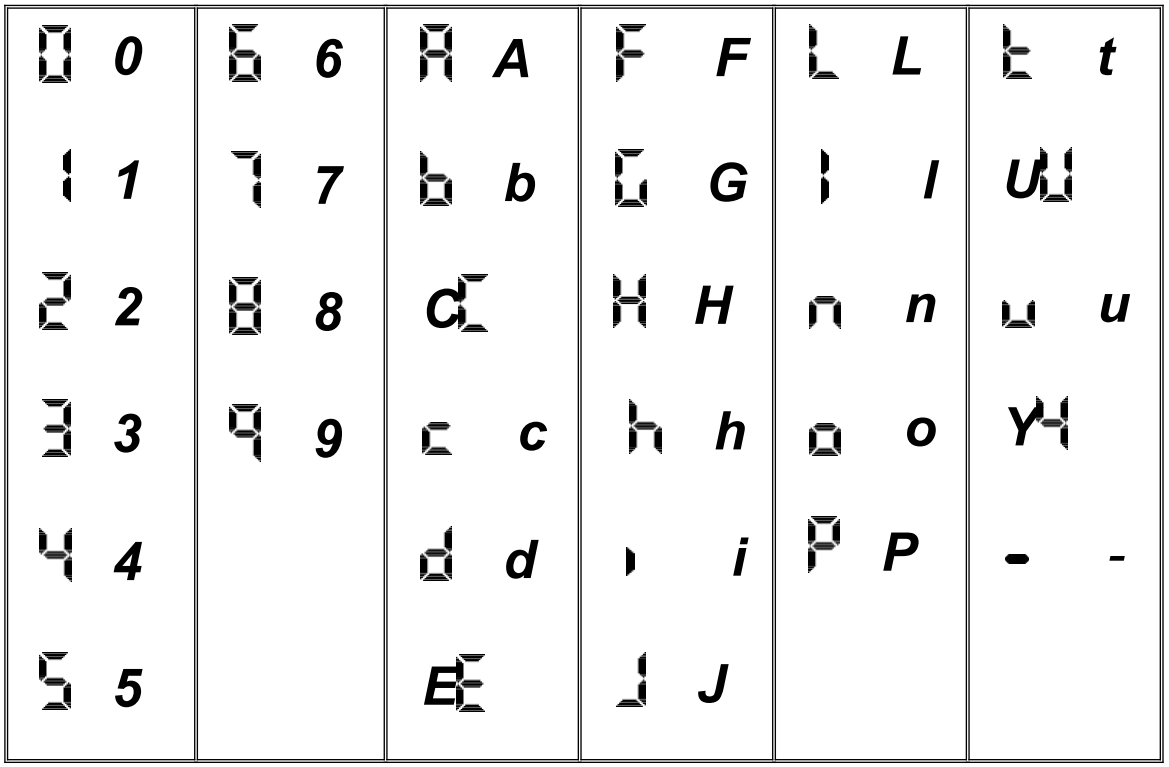


Figure 16: Displayable characters

12.3.13 Read out modification counter

The modification counter CNT contains the number of parameterizations carried out since the sensor was delivered. For modifications via the diffuse reflection sensors, each individual change is registered; for programming via the IO-Link interface, each access to the device is registered. The counter cannot be reset.

12.3.14 Change supercode

Access to the "Advanced functions" can be restricted by setting up a supercode for other users. The supercode must not be 000 . This is the factory setting. The supercode can also be used to access the main menu.

12.3.15 Resetting to factory settings

If it is necessary to reset the device to the factory settings, this can be done after switching the device back on by simultaneously pressing the diffuse reflection sensor and then entering the access code.

If a super code is set up for the extended functions, which is different from the normal access code, this is required to reset **all** parameters.

	Access to parameterization with code, The "Advanced functions" menu is not released, supercode not known	**Input code:** Reset to factory settings only for Enabled parameters in the main menu	
□	Access to parameterization with code, Supercode for menu access "Advanced functions" is available, Supercode is known	**Input code:** Reset to factory settings only for released Parameters in the Main menu	**Input Supercode:** Reset to factory settings for all parameters in the Main menu and Advanced" menu Functions"
	Access to parameterization with code, Supercode corresponds to the code	**Enter code or supercode:** Reset to factory settings for all Parameters in the main menu and menu "Advanced functions"	

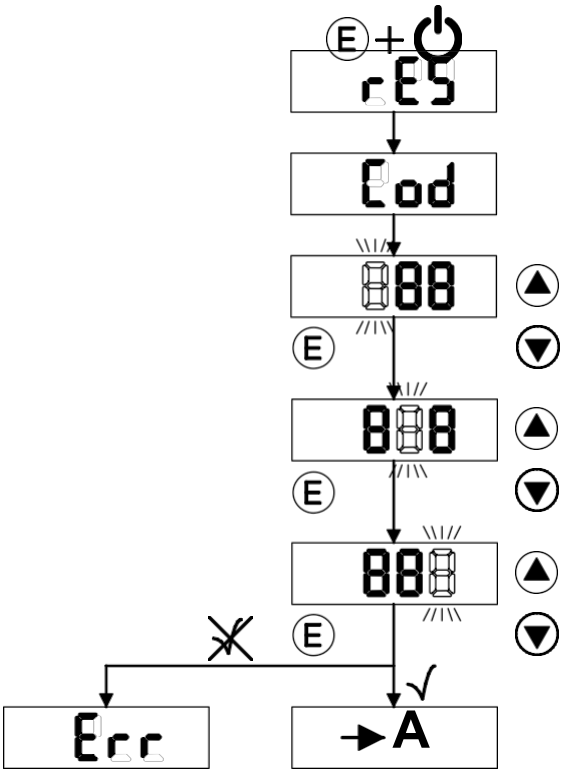


Figure 17: Resetting to factory settings

13 IO-Link

13.1 General information

The device has a communication interface via the IO-Link standard V1.1. An IO link master with the corresponding functionalities is required to operate this interface.

With the USB IO link master VY000005, IPF electronic offers all the components required for convenient and simple configuration of the flow sensor. The sensor can be conveniently parameterized using the master software and the device description (IODD) belonging to the sensor. The associated operating instructions must be used to operate the master and the configuration software.

Any other IO link master that meets the specifications of IO link version 1.1 can also be used.

The sensor is set to IO-Link mode by a wake-up signal immediately after the connection to the IO-Link master is established. It starts transmitting 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 device with switching and analog output.

13.2 IODD

The IODD (Input Output Device Description) required for configuration is available on the website

www.ipf.de

can be downloaded from the IO-Link-capable products area.

13.3 Device data

Vendor ID [dec/hex] .....780 / 0x2BF

Device ID [dec] .....

.....3307522 IO link device revision 1

Bit rate COM2

Minimum cycle time3 .....5 ms

SIO mode.....Supports

Block parameterization .....Supports

Data storage. .....supports

13.4 Process data

Overall length: 32 bits

Name	description	Data type	Bit offset	Value range	Gradient	Unit
Flow rate	Current flow velocity	Int16	16	0 ... [4501]	0,01	m/s
Temperature	Current media temperature	Int14	2	0 ... 800	0,1	°C
S2	Switching state S1	Bool	1	true (active) false (inactive)		
S1	Switching state S2	Bool	0	true (active) false (inactive)		

[1] The process data for the flow velocity take into account a possible application of the CAL function.

13.5 Standard commands

The commands are written to index 2 and must have data type Uint8.

Value	description
130	Resetting to factory settings
160	Teach-in switching point 1 flow rate
161	Lower window limit 1 Teach-in flow rate
162	Upper window limit 1 Teach-in flow rate
163	Switching point 2 Teach-in flow rate
164	Lower window limit 2 Teach-in flow rate
165	Upper window limit 2 Teach-in flow rate
166	Start value analog output (4 mA) Teach-in flow rate
167	Teach-in final value analog output (20 mA) flow rate
168	12mA Teach-in flow rate value
169	Teach in switching point 1 temperature
170	Lower window limit 1 Teach-in temperature
171	Upper window limit 1 Teach-in temperature
172	Teach-in switching point 2 temperature
173	Lower window limit 2 Teach-in temperature
174	Upper window limit 2 Teach-in temperature
175	Start value analog output (4 mA) Teach-in temperature
176	Teach-in final value analog output (20 mA) Temperature
177	Reset MAX flow rate
178	Reset MIN flow rate
179	Restart averaging flow rate
180	Reset MAX temperature
181	Reset MIN temperature
182	Restart averaging temperature
183	Reset error code register

13.6 On-request data

Data types

.....RRecord 16 bit
B .....Boolean
S .....String
.....S32String 32 byte
I16.....nteger16
U8 .....UInteger8
U16 .....UInteger16
U32 .....UInteger32
U64 .....UInteger64

Access

.....RWRead/Write (write and read)
.....RORead Only (read only)
.....WOWrite Only (write only)

Index	Bit	Name	description	Data type	Access	factory setting	Value range	Gradient	Unit
12		Device Access Locks		R	RW				
12	1	Data management		B	RW	0	0: not blocked 1: blocked		
12	3	Local parameterization		B	RW	0	0: not blocked 1: blocked		
16		Manufacturer name		S	RO	Ipf electronic gmbh			

17		Manufacturer text		S	RO	www.ipf.de	
18		Product name		S	RO	Flow Meter SS50	
19		Product ID		S	RO	SS500020	
20		Product text		S	RO	Flow meter	
21		Serial number		S	RO		
22		Hardware version		S	RO		
23		Firmware version		S	RO		
24		Customer-specific identifier		S32	RW		
36		Device status		U8	RO	0: no error 2: Temperature > 80 °C or < 0°C 4: Short circuit at S2	
64		OU1	Operational modes for output S1	U8	RW	1	1: Hysteresis function normally open contact Hno 2: Hysteresis function normally closed (nc) Hnc 3: Normally open window function Fno 4: Window function normally closed (nc) Fnc 5: Pulse function Pul

65		OU2	Operational modes for output S2	U8	RW	1	1: Hysteresis function normally open contact Hno 2: Hysteresis function normally closed (nc) Hnc 3: Normally open window function Fno 4: Window function normally closed (nc) Fnc 5: Current output I 6: Error message normally closed (nc) Eno 7: Error message normally open contact Enc 8: Teach signal input t in		
66		SP1	Limit value switching output S1 Flow rate	I16	RW	100	4...450	0,01	m/s
67		HS1	Hysteresis for switching output S1 Flow rate	I16	RW	5	1...50	0,01	m/s
68		FL1	Lower limit value Window operational mode S1 Flow rate	I16	RW	100	4...449	0,01	m/s
69		FH1	Upper limit value Window operational mode S1 Flow rate	I16	RW	105	5...450	0,01	m/s
70		SP2	Limit value switching output S2 Flow rate	I16	RW	150	4...450	0,01	m/s
71		HS2	Hysteresis for switching output S2 Flow rate	I16	RW	5	1...50	0,01	m/s
72		FL2	Lower limit value Window operational mode S2 Flow rate	I16	RW	150	4...449	0,01	m/s
73		FH2	Upper limit value Window operational mode S2 Flow rate	I16	RW	155	5...450	0,01	m/s
74		SP1	Limit value for switching output S1 Temperature	I16	RW	200	2...800	0,1	°C

75		HS 1	Hysteresis for switching output S1 Temperature	I16	RW	10	2...200	0,1	°C

76		FL 1	Lower limit value Window operational mode S1 Temperature	I16	RW	200	2...799	0,1	°C
77		FH 1	Upper limit value Window operational mode S1 Temperature	I16	RW	210	4...800	0,1	°C
78		SP2	Limit value for switching output S2 Temperature	I16	RW	400	2...800	0,1	°C
79		HS2	Hysteresis for switching output S2 Temperature	I16	RW	10	2...200	0,1	°C
80		FL2	Lower limit value Window operational mode S2 Temperature	I16	RW	400	2...799	0,1	°C
81		FH2	Upper limit value Window operational mode S2 Temperature	I16	RW	410	4...800	0,1	°C
82		dS 1	Switch-on delay switching output S1	I16	RW	0	0...500	0,1	s
83		dr 1	Switch-off delay Switching output S1	I16	RW	0	0...500	0,1	s
84		dS2	Switch-on delay switching output S2	I16	RW	0	0...500	0,1	s
85		dr2	Switch-off delay switching output S2	I16	RW	0	0...500	0,1	s
86		A.St	Start value 4 mA Analog output flow rate	I16	RW	0	0...200	0,01	m/s
87		A.En	Final value 20 mA analog output flow rate	I16	RW	300	100...450	0,01	m/s
88		A.St	Start value 4 mA Analog output temperature	I16	RW	0	0...600	0,1	°C

89		A.En	Final value 20 mA Analog output temperature	I16	RW	800	200...800	0,1	°C
90		FIt	Duration averaging for flow rate	U8	RW	16	0, 1, 2, 4, 8	1	s
91		dA	Pipe inside diameter	U8	RW	50	15...250	1	mm
92		CAL	Calibration factor	U8	RW	100	50...150	1	%
94		di.S	Measured variable for display	U8	RW	0	0: Flow rate Flo 1: Temperature °C 2: Alternating flow rate (10s) and temperature (2s) F. °C 3: Display switched off oFF		
95		U.S 1	Measured variable SP1 or window 1	U8	RW	0	0: Flow rate Flo 1: Temperature °C		
96		U.S2	Measured variable SP2 or window 2	U8	RW	0	0: Flow rate Flo 1: Temperature °C		
97		P-n	Output polarity	U8	RW	0	0: PNP PnP 1: NPN nPn		
98		U.A0	Measured variable analog output	U8	RW	0	0: Flow rate Flo 1: Temperature °C		
99		Loc	Locking individual menu items	U32	RW	0			
99	0	Loc	OU 1	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	1	Loc	OU2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	2	Loc	SP 1	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	3	Loc	HS 1	B	RW	0	0: not blocked FrE 1: blocked Loc		

99	4	Loc	FL 1	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	5	Loc	FH 1	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	6	Loc	dS 1	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	7	Loc	dr 1	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	8	Loc	SP2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	9	Loc	HS2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	10	Loc	FL2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	11	Loc	FH2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	12	Loc	dS2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	13	Loc	dr2	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	14	Loc	A.Str	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	15	Loc	A.End	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	16	Loc	t.LO	B	RW	0	0: not blocked FrE 1: blocked Loc		
99	17	Loc	Cod	B	RW	0	0: not blocked FrE 1: blocked Loc		
100		U.FI	Unit Flow rate display	U8	RW	0	0: m/s n-S 1: l/min l n 2: m3/h n3h		
101		d.O	Display orientation	U8	RW	0	0: 0° 1: 180°		

103		Cod	Access code programming, main menu	I16	RW	0	0...999		
104		SCd	Access code EF menu and main menu	I16	RW	0	0...999		
105		t.LO	Configuration of the input pin for teaching SP1	U8	RW	0	0: rising edge PoS 1: falling edge nEG		
106			Result of the teach-in process	U8	RO	0	0: Idle 1: Teach-in-Success 5: Busy Teach Error: 7: Signal too unstable 8: Range error 9: Temperature above detection range 10: Temperature below detection range 11: Flow rate above detection range		
107			Current volume flow resulting from the flow rate and the set internal pipe diameter	Int32	RO			0,1	l/min
108		Er.C	Error code	U8	RO	--	--	--	--
109		Ch.C	Total number of changes to the parameter set since delivery	I16	RO	--	--	--	--
110		H.FI	Maximum flow rate since last reset	I16	RO	--	--	0,01	m/s
111		L.FI	Minimum flow rate since last reset	I16	RO	--	--	0,01	m/s

112		A.FI	Average flow rate since last reset (max. 24 hours)	I16	RO	--	--	0,01	m/s
113		H.oC	Maximum temperature value since last reset	I16	RO	--	--	0,1	°C
114		L.oC	Minimum temperature value since last reset	I16	RO	--	--	0,1	°C
115		A.oC	Average temperature since last reset (max. 24 hours)	I16	RO	--	--	0,1	°C

13.7 Events

Code	Name	Type	description
0x7710	Short circuit	Error	Short circuit at OUT2 (WH)
0x8C10	T_Medium_High	Warning	Medium temperature < 0°C
0x8C30	T_Medium_Low	Warning	Medium temperature > 80°C
0x8DF0	Test event1	Warning	For internal testing purposes only
0x8DF1	Test event2	Warning	For internal testing purposes only

13.8 Error messages

Error code	description
0x8011	Access to a non-existent index
0x8012	Access to a non-existent subindex
0x8020	Function is currently not available
0x8030	Parameter does not fit into the specified grid
0x8031	Parameter is too large
0x8032	Parameter is too small
0x8033	Written parameter length too long
0x8034	Written parameter length too small
0x8035	System command is not supported by the device
0x8040	Invalid block parameterization

14 Descriptions (in alphabetical order)

Representation in the display	Kind	description	Reference
A			
A.En	Parameters	Final value of the analog output 20 mA	Main menu
A.FI	Parameters	24h Average value of the flow rate	Advanced functions
A.°C	Parameters	24h average temperature	Advanced functions
A.St	Parameters	Start value of the analog output 4 mA	Main menu
C			
CAL	Parameters	Calibrate display value	Advanced functions
C.Lo	Configuration	Configure access rights for parameters	Advanced functions
C.OU	Configuration	Configure operational modes for output	Advanced functions
Ch.C	Parameters	Modification counter, number of accesses to parameter settings	Advanced functions
Cod	Parameters	Access code programming	Main menu
d			
dAt	Configuration	MIN/MAX/mean value configuration	Advanced functions
dIA	Value	Pipe inner diameter	Advanced functions
di.S	Value	Display selection	Advanced functions

d.0	Value	Display orientation (rotate display 180°)	Advanced functions
dr 1	Parameters	Switch-off delay for output S1	Main menu
dr2	Parameters	Switch-off delay for output S2	Main menu
dS 1	Parameters	Switch-on delay for output S1	Main menu
dS2	Parameters	Switch-on delay for output S2	Main menu
E			
EF	function	Call up the "Advanced functions" menu	Main menu
Eno	Value	Device error monitoring, output S1 has make contact function	Main menu
Enc	Value	Device error monitoring, output S1 has normally closed function	Main menu
Err	Value	Incorrect input	
Er.C	Parameters	Contains the error code	Main menu
F			
Flt	Parameters	Parameterize filter duration	Advanced functions
F.oC	Value	Display flow rate and temperature alternately (10 s/2 s)	Advanced functions
Flo	Value	Display flow rate	Advanced functions
Fno	Value	Window comparator, output S1/S2 has NO contact function	Main menu
Fnc	Value	Window comparator, output S1/S2 has	Main menu

		Opener function	
FH 1	Parameters	Upper limit value of the window comparator for output S1	Main menu
FH2	Parameters	Upper limit value of the window comparator for output S2	Main menu
FL 1	Parameters	Lower limit value of the window comparator for output S1	Main menu
FL2	Parameters	Lower limit value of the window comparator for output S2	Main menu
H			
H.FI	Parameters	Maximum value of the flow rate	Advanced functions
H.°C	Parameters	Maximum temperature value	Advanced functions
Hnc	Value	Limit value monitoring with hysteresis, output S1/S2 has normally closed function	Main menu
Hno	Value	Limit value monitoring with hysteresis, output S1/S2 has NO contact function	Main menu
HS 1	Parameters	Hysteresis for output S1	Main menu
HS2	Parameters	Hysteresis for output S2	Main menu
I			
I	Value	Current output 4 ... 20mA	Main menu
L			
Loc	Value	Parameter blocked	Advanced functions

L.oC	Parameters	Minimum temperature value	Advanced functions
L.FI	Parameters	Minimum value of the flow rate	Advanced functions
Hn	Value	Unit l/min	Advanced functions
n			
nEG	Value	Teach-in with negative edge	Main menu
nPn	Value	NPN, output S1/S2 switch to minus	Advanced functions
n-S	Value	Unit m/s	Advanced functions
n3h	Value	Unit m3/h	Advanced functions
O			
oFF	Value	Display switches off 10s after last action, heartbeat LED (last decimal place) flashes.	Advanced functions
OU1	Parameters	Contains operational mode output S1	Main menu
OU2	Parameters	Contains operational mode output S2	Main menu
P			
Pn	Parameters	Output logic S1/S2: PNP/NPN	Advanced functions
PnP	Value	PNP, output S1/S2 switch to positive	Advanced functions
PoS	Value	Teach-in with positive edge	Main menu

PuI	Value	Pulse output operational mode	Main menu
r			
rES	function	Reset parameter	
S			
SCd	Parameters	Access code for menu "Advanced functions"	Advanced functions
SP 1	Parameters	Limit value for output S1	Main menu
SP2	Parameters	Limit value for output S2	Main menu
t			
tAG	Parameters	TAG identifier (adjustable by user)	Advanced functions
tin	Value	Configuring the teach-in input	Main menu
t.LO	Parameters	Logic of the teach-in function	Main menu
U			
U.FI	Parameters	Configuration of the unit for flow rate	Advanced functions
U.S 1	Parameters	Signal source for output S1 (hysteresis and window function)	Advanced functions
U.S2	Parameters	Signal source for output S2 (hysteresis and window function)	Advanced functions

U.AO	Parameters	Signal source for analog output	Advanced functions
°C	Value	Temperature	Advanced functions

15 technical data

15.1 Electrical data

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

Output 1 and 2.....PNP/NPN
Output 1.....Normally closed (nc)
Switching current [mA].....≤ 150
Output 2.....Normally closed (nc)
Switching current [mA].....≤ 150
Analog [mA] .....4...20 (RL ≤ 500 Ω)
Input voltage high level [VDC] .....9 ≤ U_{IN} ≤ $U_{Operation}$
Input voltage low level [VDC] ..... 0 ≤ U_{IN} ≤ 4

Medium temperature [°C] .....0...80

15.2 Flow measurement

measuring range

Flow rate [m/s] ..... 0.05...3.00

Deviation[5]

Measured value [± %].....8
Measuring range end value [± %].....2
Repeatability [≤ %].....2

Setting ranges[6]

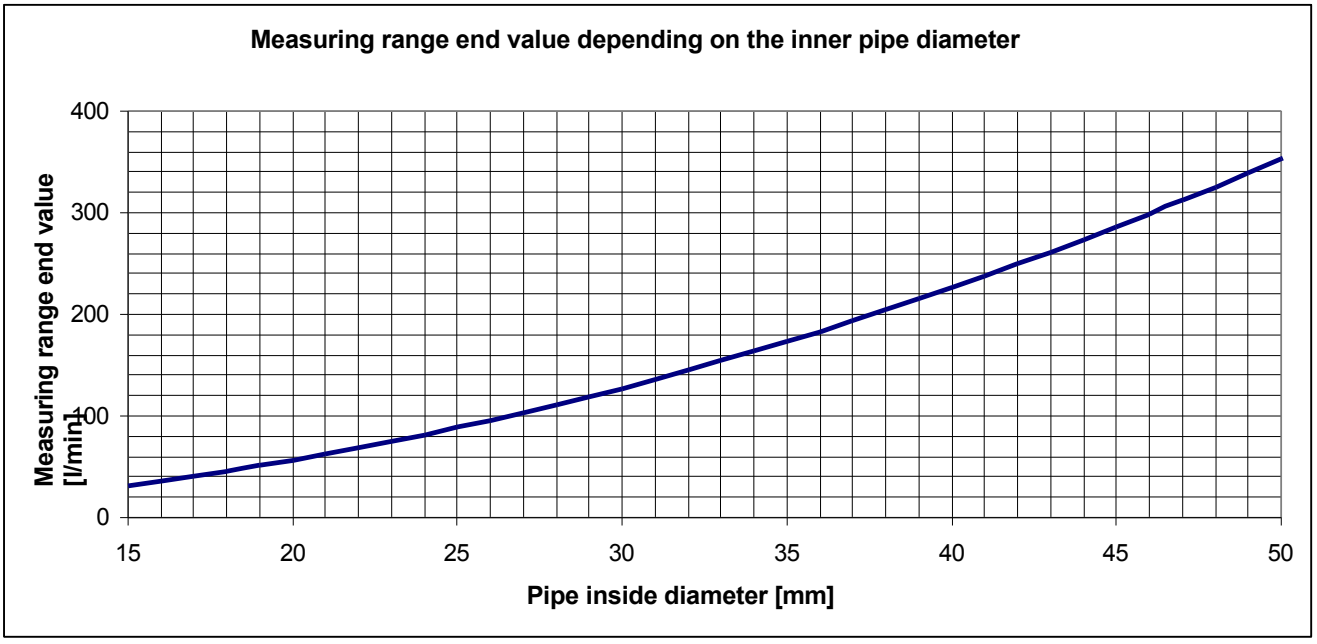
Switching point SP1 and SP2 [m/s] ..... 0.06...3.00
Hysteresis HYS1 and HYS2 [m/s] ..... 0.01...0.50
Lower limit values FL1 and FL2 [m/s]..... 0.06...2.99

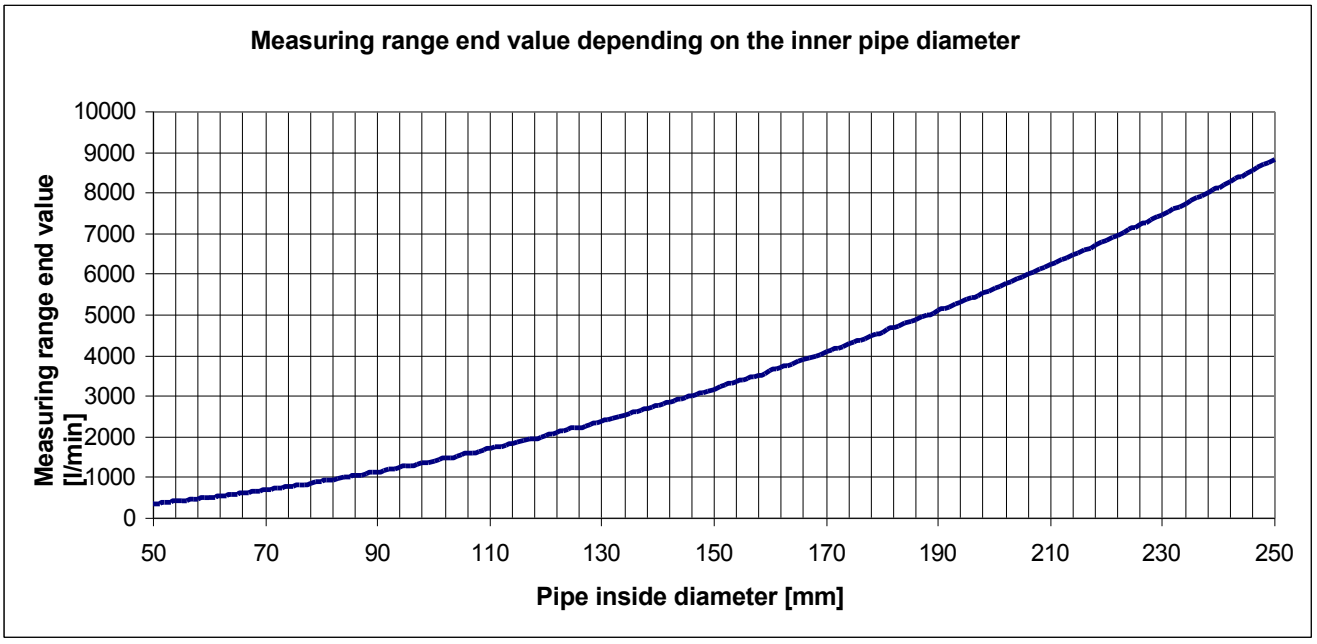
[5] under reference conditions

[6] If the calibration factor is not 100%, the adjustment ranges are also scaled by the factor.

Upper limit values FH1 and FH2 [m/s].....0,07...3,00
Start value 4 mA [m/s]..... 0.00...2.00
Final value 20 mA [m/s]..... 1.00...3.00
Step size [m/s] 0,01

Inner pipe diameter [mm] .....15...250
Calibration factor [%].....50...150





Pulse output

Pulse valency at $_{ri}$[7] = 15...50 mm [ml/pulse] 100

Pulse valency at $_{ri}$ = 51...100 mm [ml/pulse] 500

Pulse valency at $_{ri}$ = 100...250 mm [ml/pulse] 2000

Pulse duration [ms] 5

15.3 Temperature measurement

measuring range

Temperature [°C] ..... 0.0...80.0

Deviation8

Measured value [± °C] 2

Adjustment ranges

Switching point SP1 and SP2 [°C]..... 0.1...80.0

Hysteresis HYS1 and HYS2 [°C] ..... 0.1...20.0

Lower limit values FL1 and FL2 [°C] ..... 0.1...79.9

Upper limit values FL1 and FL2 [°C] ..... 0.2...80.0

Start value 4 mA [°C] ..... 0.0...40.0

Final value 20 mA [°C] ..... 20.0...80.0

Step size [°C].....0,1

15.4 Response times

Reaction time [s].....≤ 0.5

Averaging [s].....0, 1, 2, 4, 8

Switch-on time delay OUT1/OUT2 [s] ..... 0.0...50.0

Switch-off delay OUT1/OUT2 [s] ..... 0.0...50.0 Step width [s] 0.5

[7] $_{ri}$: Pipe inner diameter

[8] Minimum flow rate: 30% of the measuring range end value

15.5 IO link device

Version 1.1

Data .....transmissionCOM2 (38.4 kBaud)

Device ID [decimal].....3307522

Cycle time min. [ms] 3,5

Process data [byte].....4

15.6 Mechanical data

Max. operating pressure [bar] 60

Protection .....classP 67

Sensor materials (in contact with media)

.....HousingStainless steel 1.4404

Housing materials

Upper part of housing .....PBT

Front sticker.....Polyester

Connector part.....1.4305

Plug insert.....PA