OPERATING INSTRUCTIONS

SpeedFlow 2.0-Pipe

VELOCITY MEASUREMENT FOR SOLIDS

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1. System overview

A complete measuring point consists of the following components:

- MSE 300 in the DIN Rail housing or field housing
- Sensor
- C1-Box (optional)

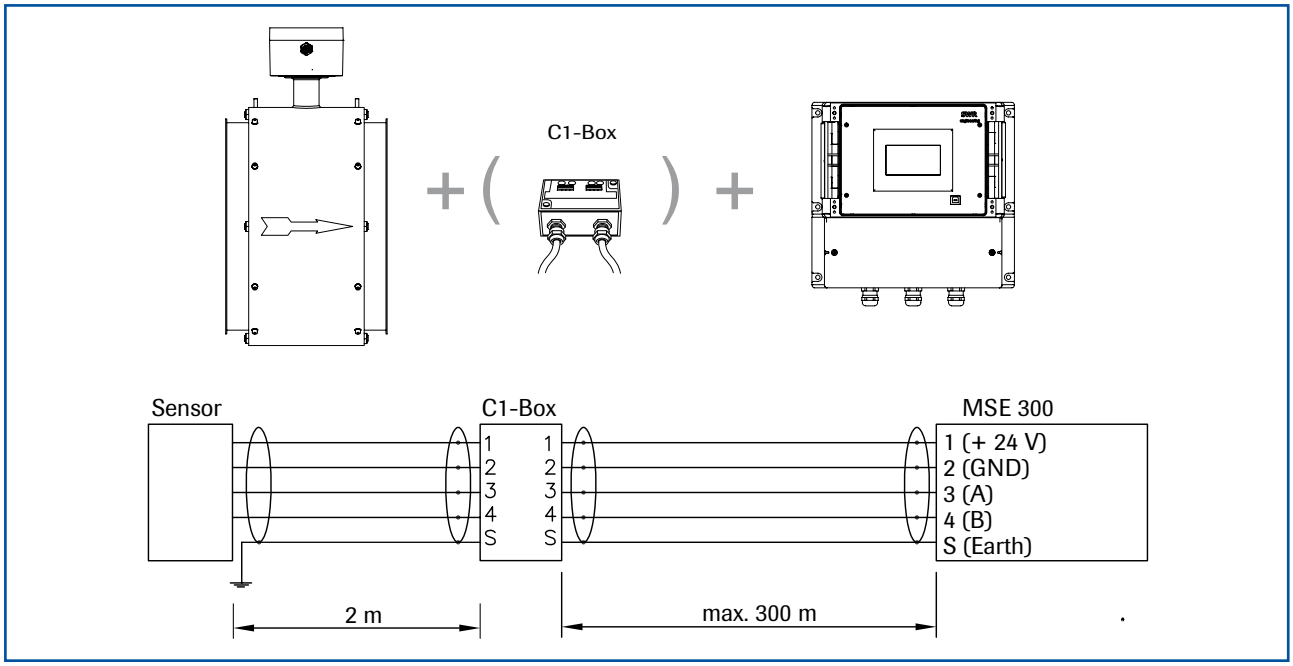


Fig. 1: Overview with C1-Box and field housing

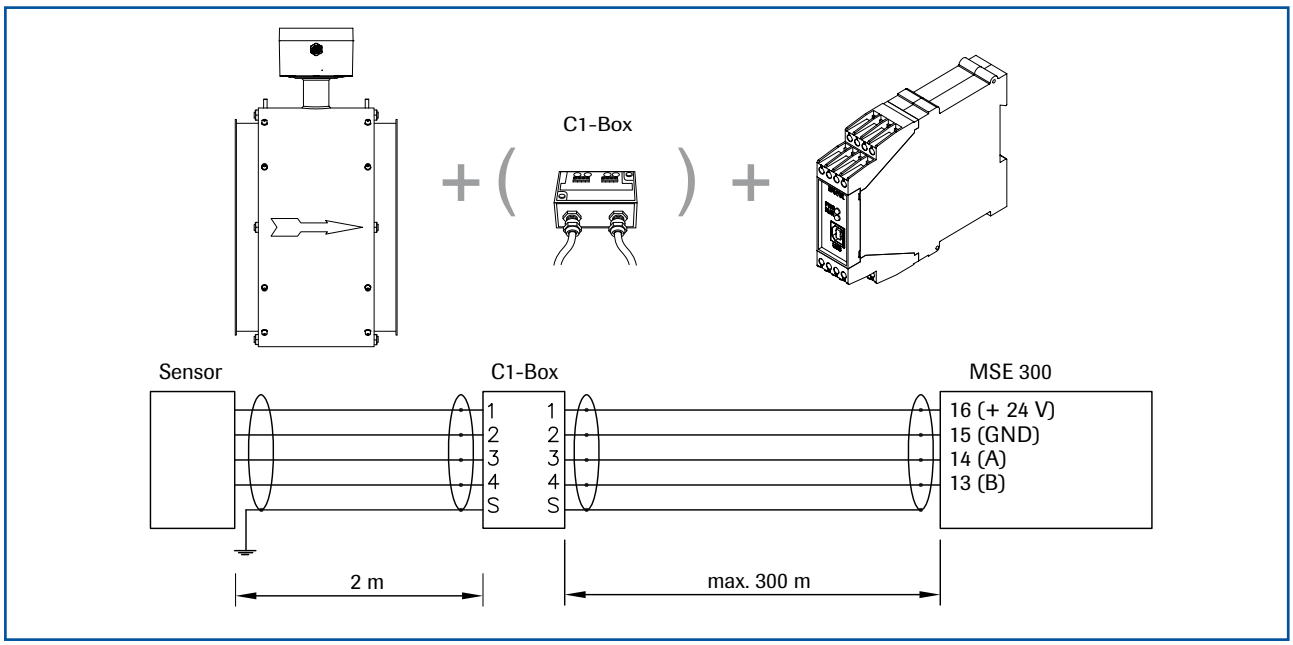


Fig. 2: Overview with C1-Box and DIN Rail

2. Function

- The SpeedFlow 2.0-Pipe is a measuring system which has been specially developed for measuring the speed of solids being transported.
- The sensor works according to the electrodynamic principle and can be used for the diameters: DN 80, DN 100, DN 120, DN 150, DN 200, DN 250, DN 350, other sizes in request.
- The electrodes used receive an electrical impulse from the passing solid particles. The received signals are evaluated by an autocorrelation procedure and the speed is calculated.
- The SpeedFlow 2.0-Pipe is used to measure solids in unpressurised air supply lines.
- The SpeedFlow 2.0-Pipe works even more efficiently and reliably due to the use of new processor technologies.

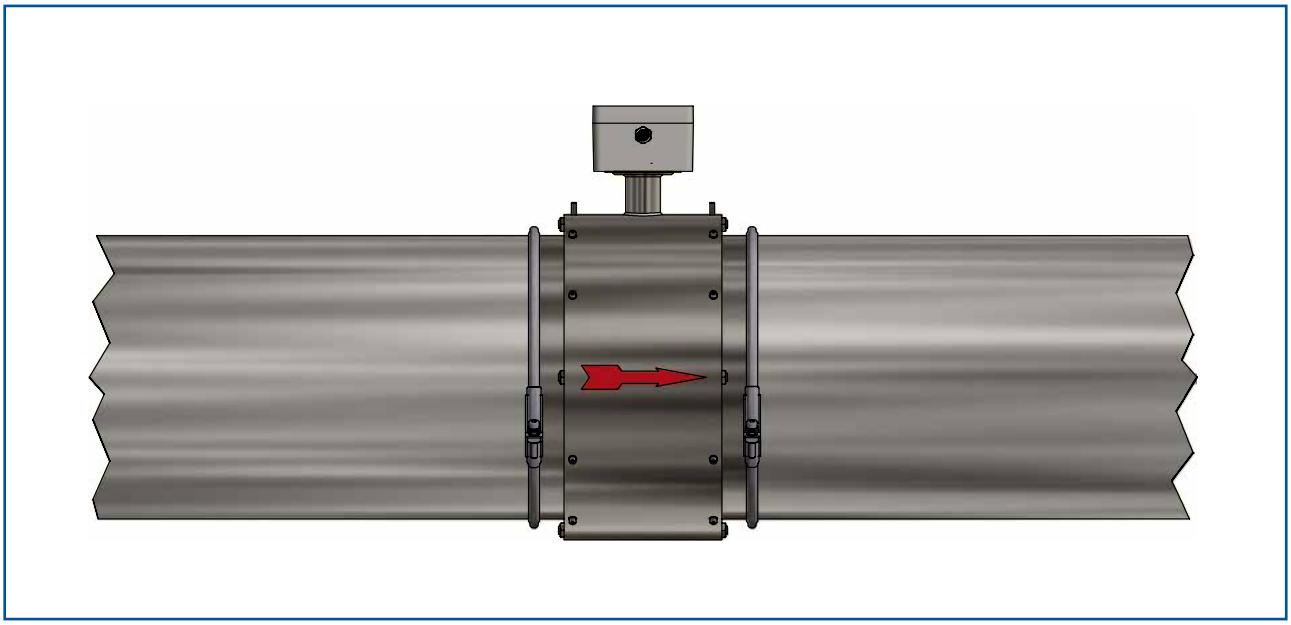


Fig. 3: SpeedFlow 2.0-Pipe sensor in the pipeline

3. Safety

The SpeedFlow 2.0-Pipe measuring system has a state of the art, reliable design. It was tested and found to be in a perfectly safe condition when leaving the factory. Nevertheless, the system components may present dangers to personnel and items if they are not operated correctly.
Therefore, the operating manual must be read in full and the safety instructions followed to the letter.
If the device is not used correctly for its intended purpose the manufacturer's liability and warranty will be void.

3.1 Normal use

- The measuring system may only be installed in metallic pipes to measure the speed of the medium passing through them.
  It is not suitable for any other use or measuring system modifications.
- Only genuine spare parts and accessories from ENVEA Process may be used.

3.2 Identification of hazards

- Possible dangers when using the measuring system are highlighted in the operating manual with the following symbols:

Warning!

- This symbol is used in the operating manual to denote actions which, if not performed correctly may result in death or injury.

Attention!

- This symbol is used in the operating manual to denote actions which may result in danger to property.

3.3 Operational safety

- The measuring system may only be installed by trained, authorised personnel.
- During all maintenance, cleaning and inspection work on the pipelines or components of ENVEA Process, make sure that the system is in an unpressurised state.
- Switch off the power supply before performing any maintenance work, cleaning work or inspections on the pipelines or the SpeedFlow 2.0-Pipe components.
- The sensor must be taken out of the pipeline before any welding work is performed.
- The components and electrical connections must be inspected for damage at regular intervals. If any signs of damage are found, they must be rectified before the devices are used again.

3.4 Technical statement

- The manufacturer reserves the right to adjust technical data concerning technical developments without notice. ENVEA Process will be delighted to provide information about the current version of the operating manual, and any amendments made.

4. Mounting and installation

4.1 Typical components of the measurement point:

- MSE 300 in the DIN Rail housing or field housing
- Sensor
- Installation instructions
- Optional: C1-Box

4.2 Required tools

- Tested tools for the electrical connection
- Appropriate tools for integrating the sensor

4.3 Mounting of the sensor

Proceed as follows to install the sensor:

- Decide on the installation position in your line routeing. For horizontal or inclined pipelines, the terminal box should always be aligned facing upwards.
- The sensor should be installed as strain-free as possible.
- The SpeedFlow 2.0-Pipe must be installed in the direction of the flow.
- The distances apply to vertical and horizontal installations.
- Ensure that the measurement point is at an adequate distance from valves, manifolds, blowers and bucket wheel feeders and other measurement ports such as those used for pressure and temperature sensors, etc. (See fig. 4)

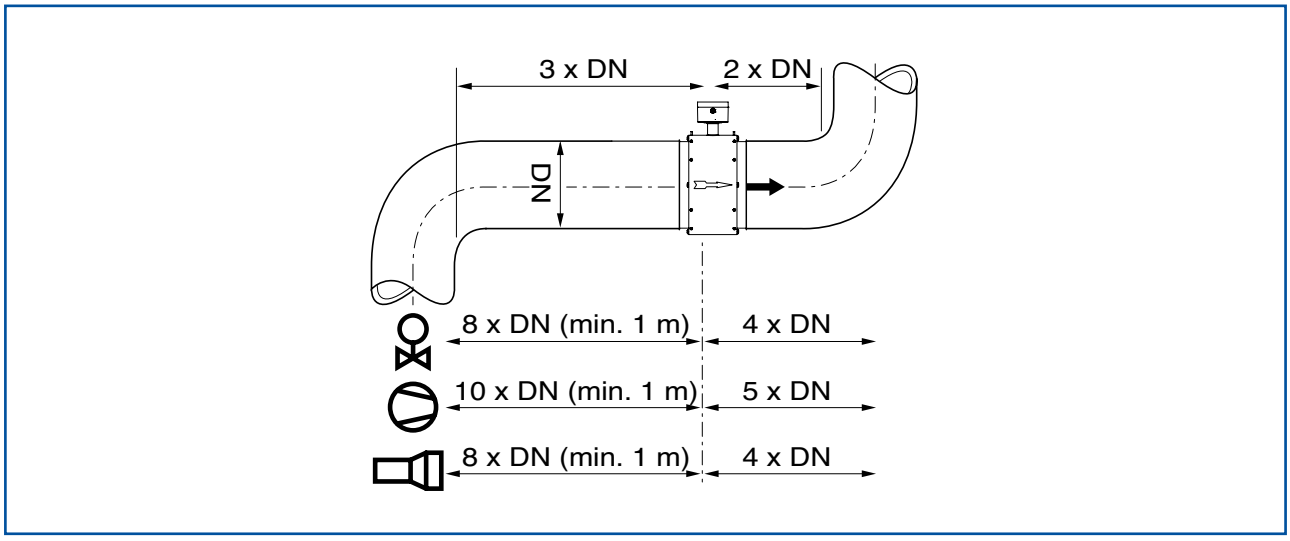


Fig. 4: Minimum distances of the measurement point from pipe geometries and fittings

- The standard connection to the existing line is made via a JACOBS flare connection. Various adapters can be procured from ENVEA Process.

4.4 Mounting of the Evaluation unit

The Evaluation unit can be installed at a maximum distance of 300 m from the sensor.

A cable of the type "Ölflex Classic 110 CY" is recommended. The cable should be four-core, twisted in pairs and shielded. A minimum cross section of 0.75 mm² should be maintained. For distances longer than 150 m, the cross-section should be adjusted.

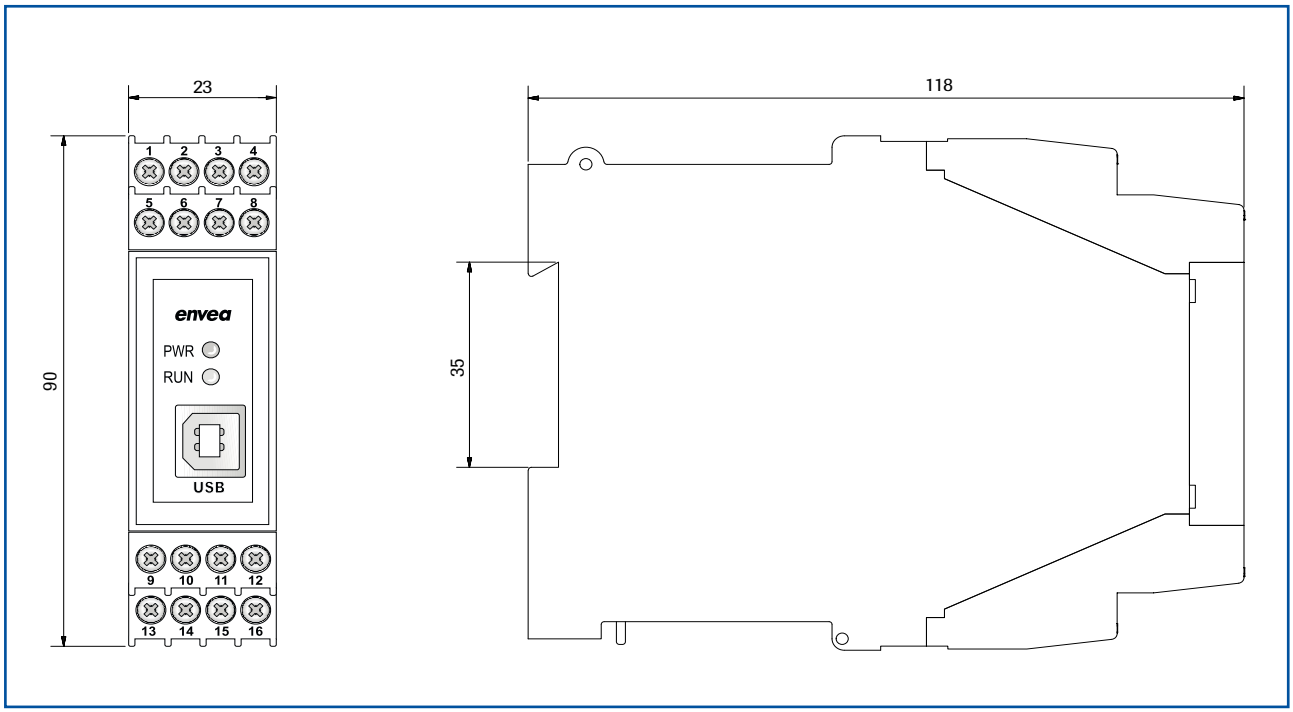


Fig. 5: Dimensions of the MSE 300 in the DIN Rail housing

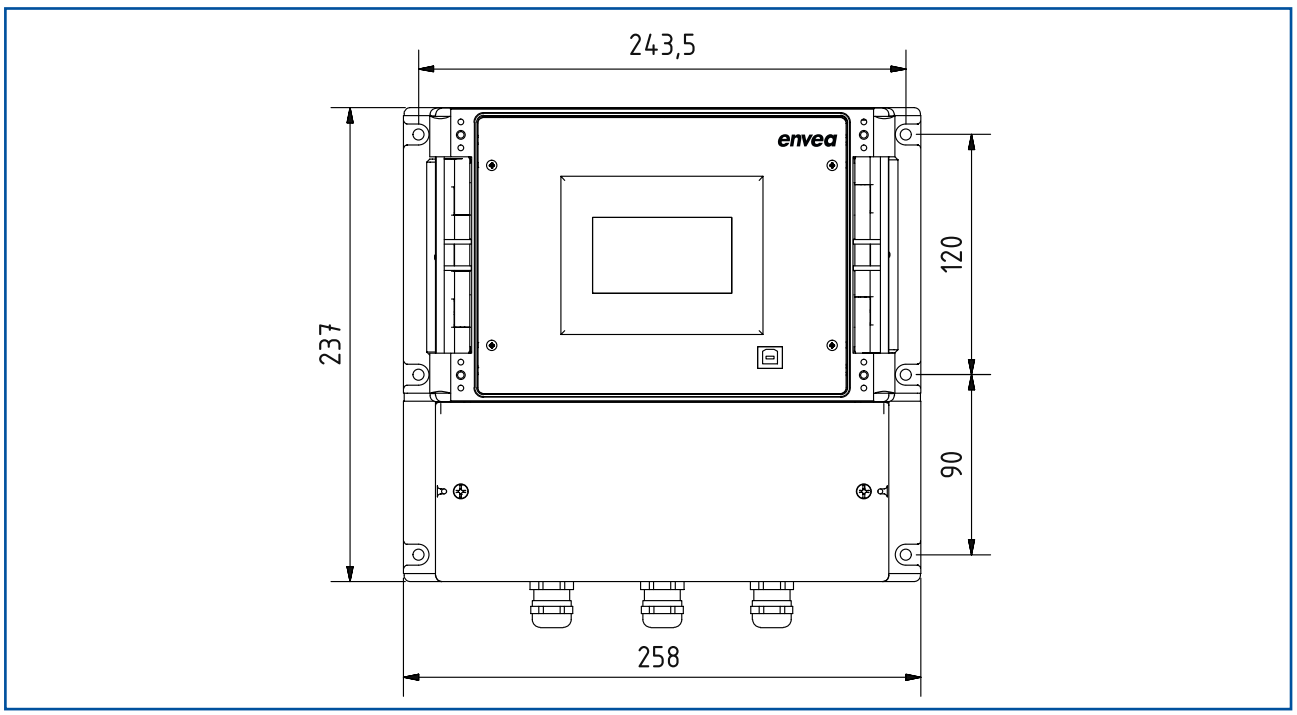


Fig. 6: Dimensions of the MSE 300 in the field housing (front view)

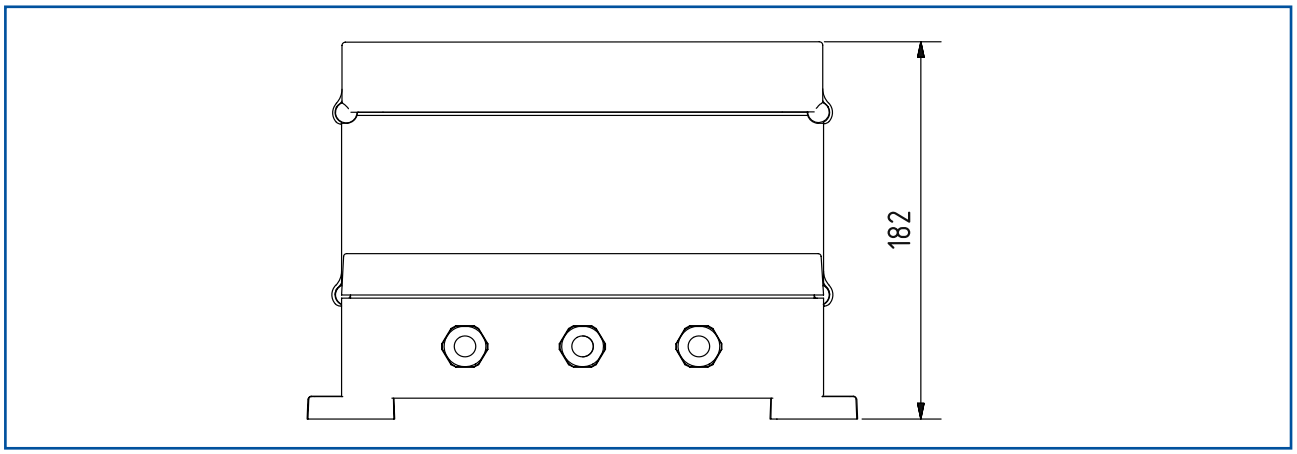


Fig. 7: Dimensions of the MSE 300 in the field housing (side view)

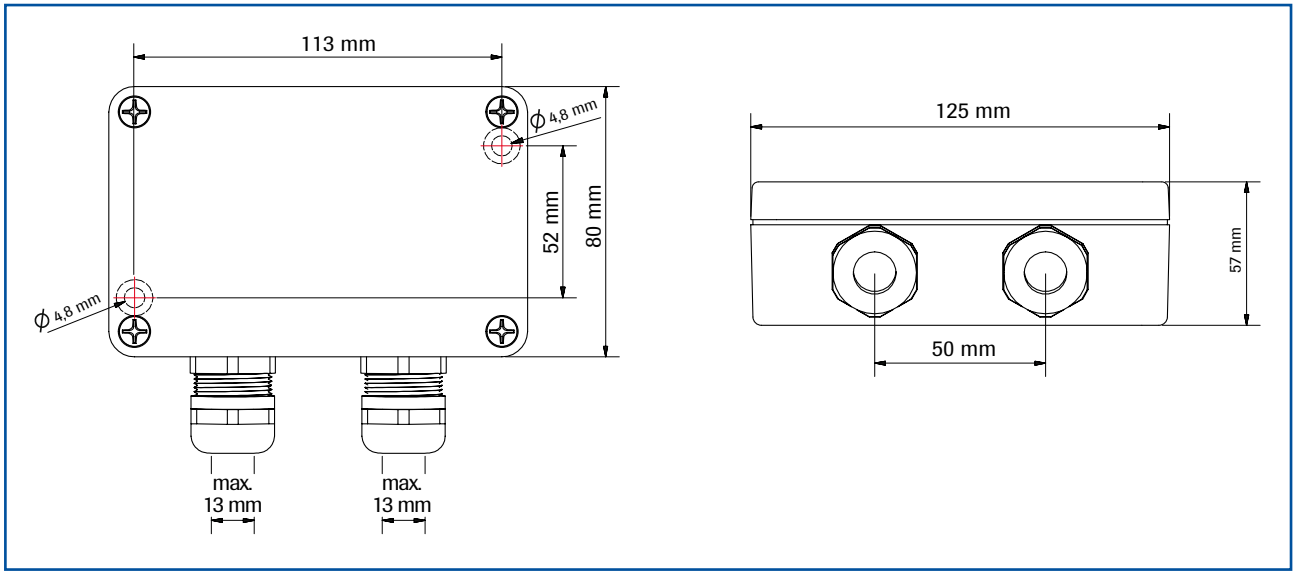


Fig. 8: C1-Box dimensions

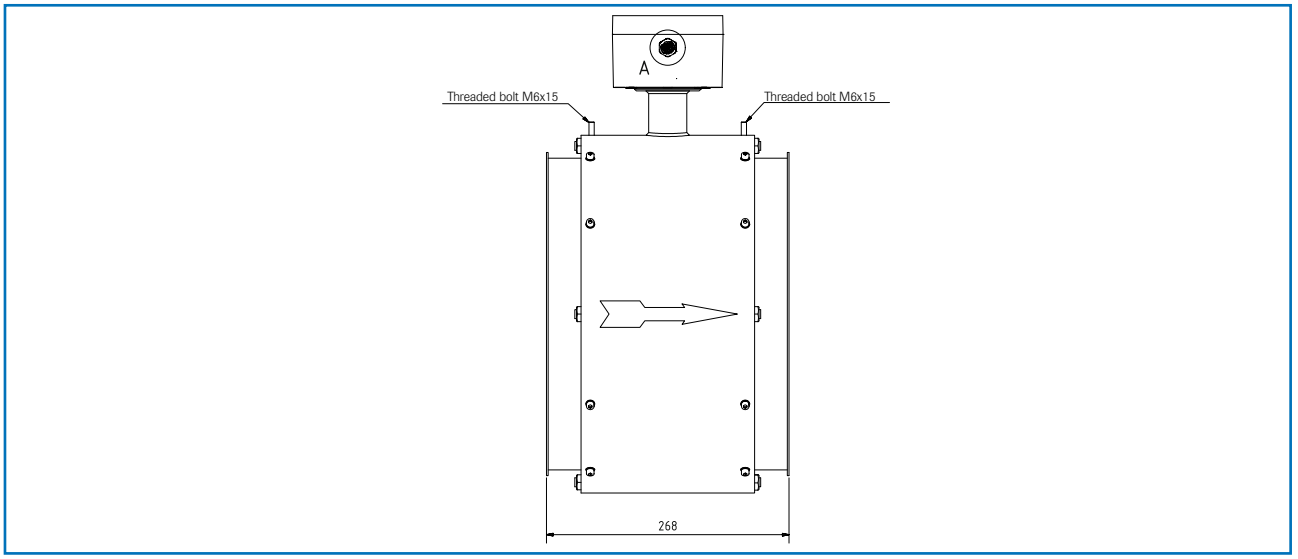


Fig. 9: Dimensions of the SpeedFlow 2.0-Pipe sensor

5. Electrical connection

5.1 DIN Rail terminal layout

1 Current output - 4 ... 20 mA	2 Current output + 4 ... 20 mA	3 Input Power supply 0 V DC	4 Input Power supply + 24 V DC
5 Not used	6 Alarm relay NC (break contact)	7 Alarm relay C	8 Alarm relay NO (make contact)

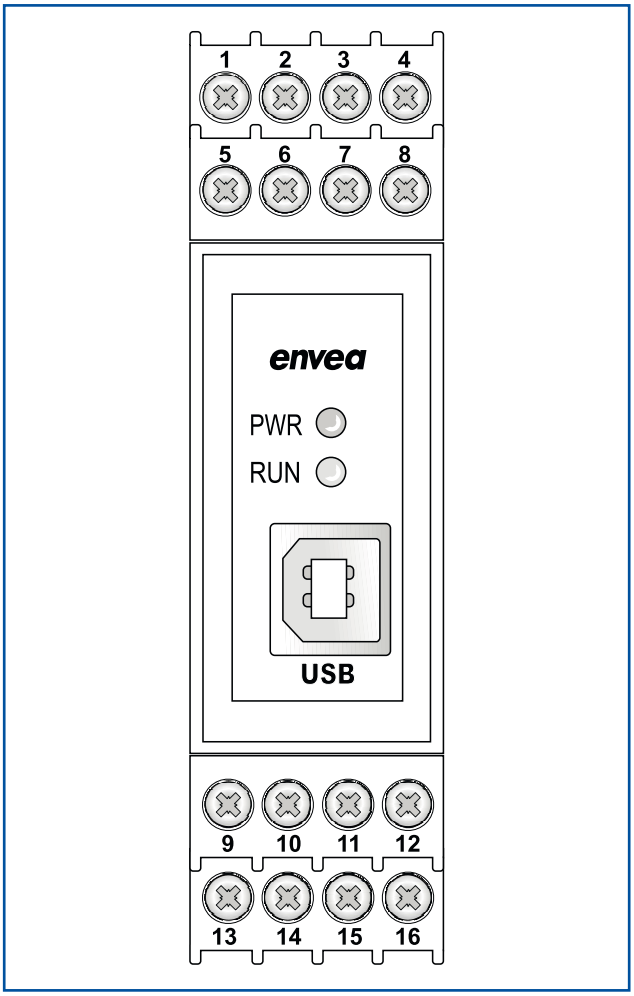


Fig. 10: Electrical connection for the MSE 300-DR

9 Digital pulse output (-)	10 Digital pulse output (+)	11 RS 485- Interface Data B	12 RS 485- Interface Data A
13 Sensor connection Cable 4 RS 485 Data B	14 Sensor connection Cable 3 RS 485 Data A	15 **Sensor connection** **Cable 2** **Power** **supply 0 V**	16 **Sensor connection** **Cable 1** **Power** **supply + 24 V**

5.2 Electrical connection of the sensor

The sensor can be delivered with a 4-pole plug connector or with an M12 plug.

5.2.1 Electrical connection of the sensor plug contact

Pin 1: +24 V DC

Pin 2: GND

Pin 3: ModBus A

Pin 4: ModBus B

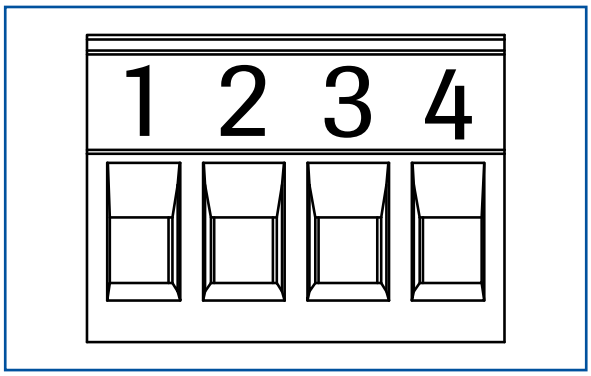


Fig. 11: Electrical connection of the plug connector

5.2.2 Electrical connection of the sensor M12 plug

Pin 1: +24 V DC

Pin 2: GND

Pin 3: ModBus A

Pin 4: ModBus B

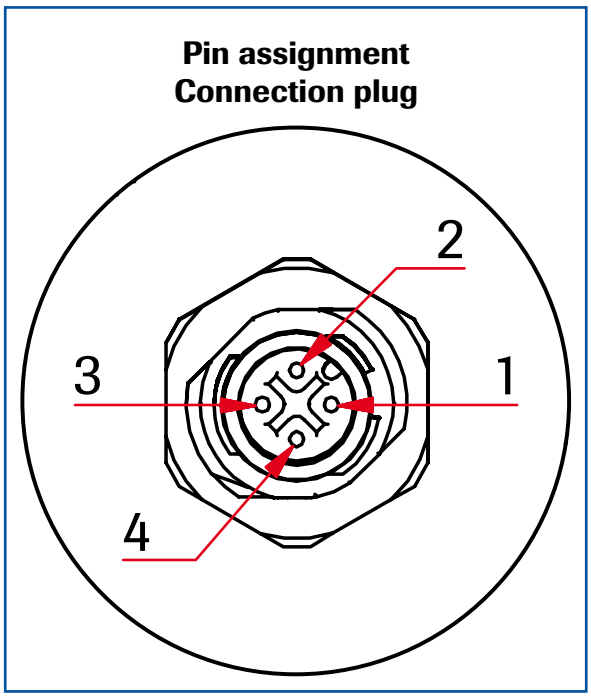


Fig. 12: Electrical connection of M12 plug

5.3 Field housing terminal layout

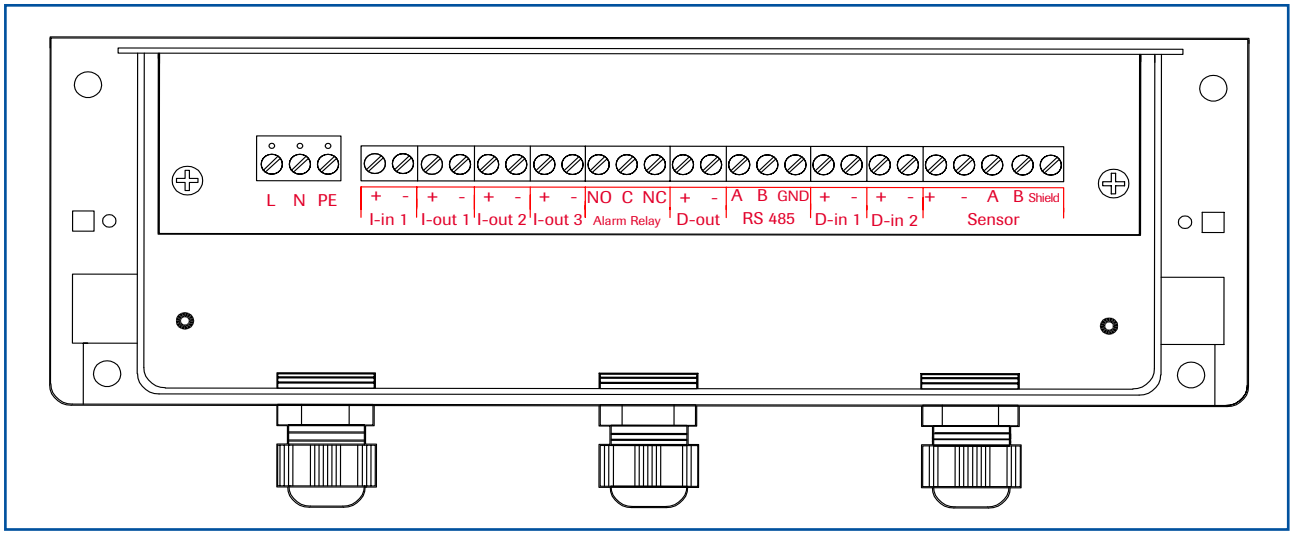


Fig. 13: Electrical connection for MSE 300 in the field housing

Evaluation unit			
Terminal No.		**Connection**	
Power supply connection			
L / +24 V		Input power supply 230 V / 50 Hz, 110 V / 60 Hz (optional 24 V DC)	
N / 0 V		Input power supply 230 V / 50 Hz, 110 V / 60 Hz (optional 24 V DC)	
PE		Protective Earth	
Connections			
I-in1	+	Current input +	
	-	Current input –	
I-out1	+	Current output +	
	-	Current output –	
	Na	Not used	
	Na	Not used	
	Na	Not used	
	Na	Not used	
Min. / Max. relay	NO	Floating change-over contact NO (make contact)	
	C	Floating change-over contact C (common contact)	
	NC	Floating change-over contact NC (break contact)	
D-out	+	Digital pulse output +	
	-	Digital pulse output –	
RS 485	A	RS 485 interface data A	
	B	RS 485 interface data B	
	GND	RS 485 interface ground	
D-in1	Na	Not used	
	Na	Not used	
D-in2	Na	Not used	
	Na	Not used	
Sensor	+	Power supply + 24 V	Cable no. 1
	GND	Power supply 0 V	Cable no. 2
	A	RS 485 data A	Cable no. 3
	B	RS 485 data B	Cable no. 4
	Shield	Shield	

5.4 C1-Box terminal layout

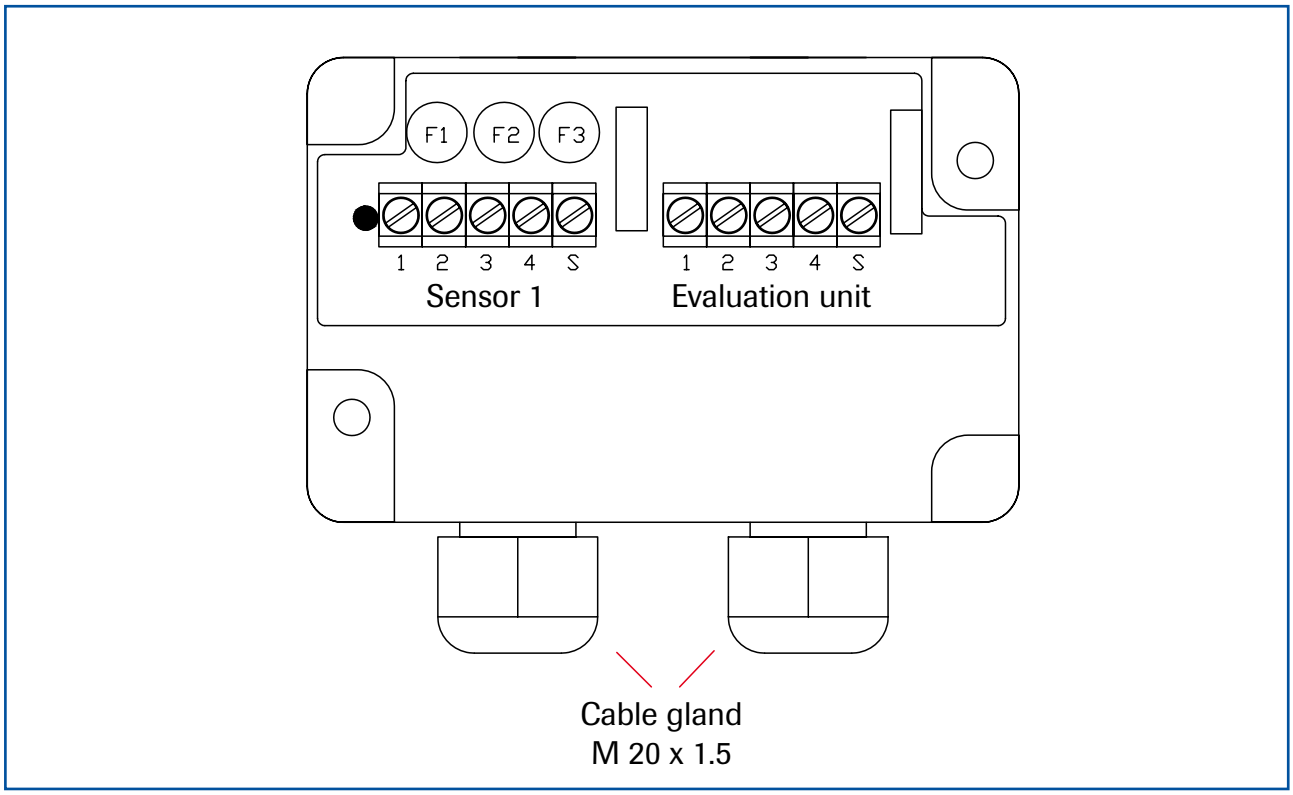


Fig. 14: Electrical connection of C1-Box

Sensor 1

1 **Power supply + 24 V**
2 **Power supply 0 V**
3 RS 485, Data A
4 RS 485, Data B
S Shield

Evaluation unit

1 **Power supply + 24 V**
2 **Power supply 0 V**
3 RS 485, Data A
4 RS 485, Data B
S Shield

6. Operator interface

The MSE 300 is a multi-sensor Evaluation unit. It is therefore strongly recommended to check whether the correct sensor is selected in the **System** menu item before commissioning.

The operator interface differs depending on the selected MSE 300:

- DIN Rail housing without display, operation via PC software
- Field housing with display, alternative operation via PC software

First of all, the different system versions are described below. Following that, the basic operation of the SpeedFlow 2.0-Pipe system as a one sensor system is then described without going back over the different versions.

6.1 Differences between DIN Rail and field housing MSE 300

The MSE 300 in the DIN Rail housing is only a part of the functions available in the field housing.
The following overview clarifies the differences between the two versions.

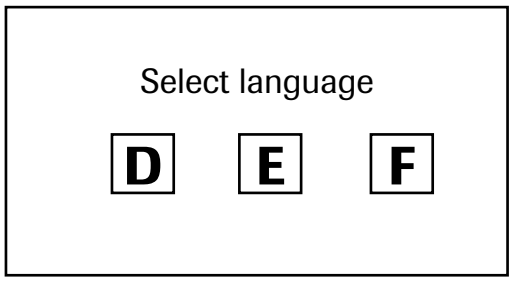
Function	Field housing	DIN Rail
Menu system		
• via PC software	yes	yes
• via display	yes	no
Measurement value display current output	yes	yes
Pulse output to control solenoid valves or output the measured value	yes	yes
Alarm system relay output	yes	yes
Autocorrect analogue input	yes	no
Error output		
• on current output	yes	yes
• at relay	yes	yes
• via PC software	yes	yes
• via display	yes	no
• At status LED	no	yes

The MSE 300 in the DIN Rail can only be configured via a USB connection and PC programme.
On the MSE 300 in the field housing, all functions can be configured by menu via the touch-sensitive display.
The field housing can also be configured by PC.

The menu items on the display and in the PC software are numbered in a uniform manner so that they can be referred to later on.

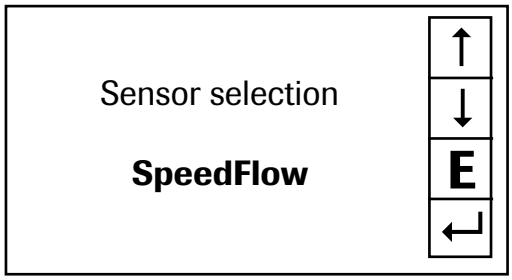
6.2 Display

The display is touch-sensitive. Available keys are shown directly in context.
When the measurement system is started for the first time, a query is initiated to select the language and sensor. If no selection is made, the initialisation disappears and the German language is selected with a SpeedFlow 2.0 sensor.



Initialisation screen the first time the MSE 300 in the field housing is switched on.

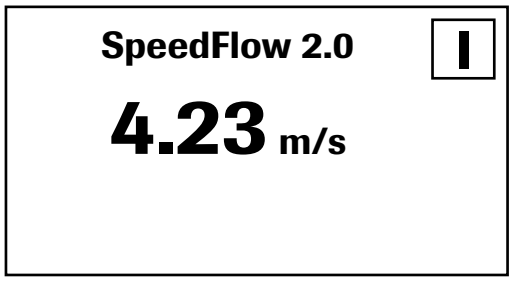
Selection of the menu language:
Deutsch, **E**nglish, **F**rançais



Once a language has been selected, the sensor to be used must be selected.

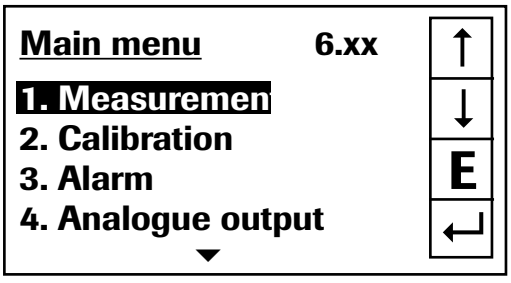
The following are available:
SolidFlow 2.0, Paddy, PicoFlow, MaxxFlow HTC, DensFlow, SpeedFlow 2.0, SlideControl 2.0, ProSens, M-Sens 2, M-Sens 3, M-Sens WR, M-Sens WR2.

Then the start page appears.



The start page display the following values:

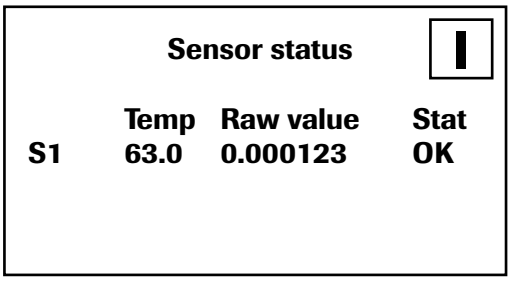
- Name “SpeedFlow 2.0”, freely selectable text which describes the material or the measuring point
- Measurement value, here in [m/s]
- [I] key for info



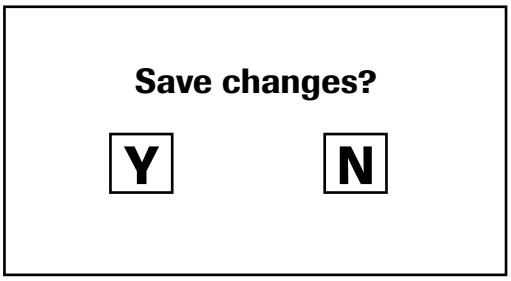
To access the main menu, press and hold any area of the display for several seconds. The sub-menu selection appears.

In the menus and input fields, the displayed keys can be used to browse, select, edit or reject:

- [Arrows]: Scroll down the page, Select an option, Select a position in the input text
- [E] for ESC: Interrupt the function without making any changes
- [↵]: Select the function or confirm the input
- [C] for Clear: Delete a symbol or number



The key [I] is used to choose between different information windows.
The raw values, temperature and status of the sensor are shown in the first window.
The error memory is displayed in the second window.
The most recent error codes are always shown first. If an error code is repeated, it is shown first, but it is not listed several times.



If any data has been changed, the change will only be taken into account when you exit the complete menu structure and answer [Yes] when asked if you wish to save the changes.

For reasons of simplicity, a further display menu screen has been dispensed with.
The display screens are directly derived from the menu structure in section 6.4.

Protection against unauthorised use:

If, a password has been entered in menu **7. System** under **7.6 Password**, which is different to the “0000” default setting, you will be asked to enter a password when attempting to access the menus.
After the password has been successfully entered, the menus will be unlocked for approx. 5 minutes (from the last menu entry).

6.3 PC interface

With both the DIN Rail and field housing version, communication with a laptop or PC is optionally performed either at the terminals via an RS 485 or at the front via a USB interface.

✔ The **RS 485 connection** is attached to the MSE 300 in the field housing at the ModBus A (+) and ModBus B (-) terminals. On the DIN Rail version, these connections are no. 12 and 11, accordingly. RS 485 is a bus connection; the ModBus address and the baud rate can be set on the device. Upon delivery, the communication parameters are set to:

- ModBus address 1
- Baud rate 9600, 8, E,1
- Parity: even

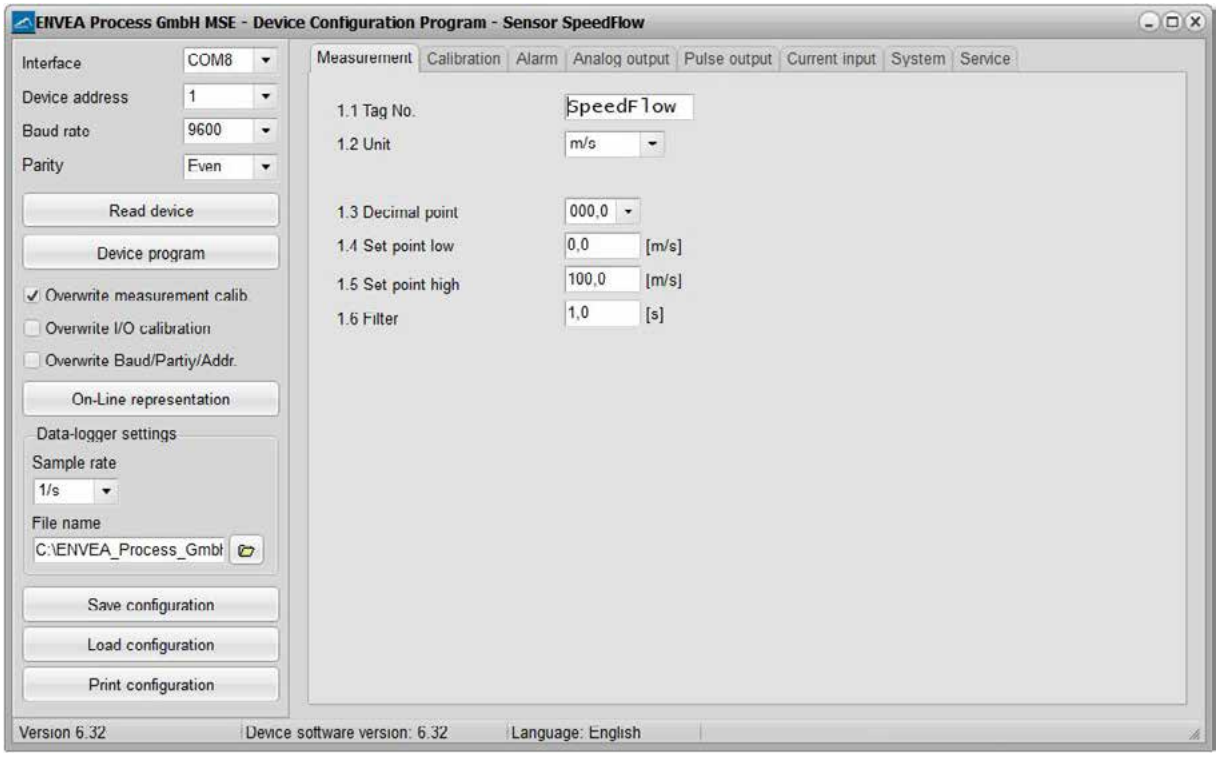
An RS 485 to USB adapter can be purchased from ENVEA Process.

✔ A standard USB-A-B cable is supplied for the USB connection to the DIN Rail version. The USB connection is a point-to-point connection that is BUS-enabled. The ModBus address and baud rate for the front connections cannot be changed and are always:

- ModBus address 1 (or the device answers to all addresses)
- Baud rate 9600, 8, E,1
- Parity: even (parity can not be changed on the USB connection)

When connected to the PC for the first time, any interface drivers enclosed with the Evaluation unit must be installed.

After starting the software, the communication parameters must first be entered accordingly. These can be found in the top left of the program window. The COM port to be configured is displayed in the device manager.



Communication is established by clicking on “Read device”. The acknowledgement message “Parameter read in” is displayed. If an error message is displayed instead, check the communication parameters and cable connections between the PC and the Evaluation unit.

The edited data is transmitted to the Evaluation unit via “Program device”.
Critical data concerning the ModBus communication and the calibration must be confirmed before the parameters are transmitted to the Evaluation unit:

✔ If, when saving the parameters in the Evaluation unit, the system calibration data is changed, this action must be confirmed by checking “Overwrite calibration”.

✔ If, when saving the parameters in the Evaluation unit, the system interface parameters are changed, this must be confirmed by checking the selection “Overwrite baud r./address”.

In addition, with the PC software,

- the parameters of the Evaluation unit can be saved in a file (Save configuration)
- the parameters of the Evaluation unit can be loaded from a file (Load configuration)
- the parameters of the Evaluation unit can be printed via the set Windows standard printer (Print configuration)
- the measured values can be logged in a data logger file (enter the file name and storage rate, and activate the data logger on the online display)

The software language can be set by right-clicking the “Sprache/Language/Langue” field in the bottom program line on “Deutsch/English/Français”.

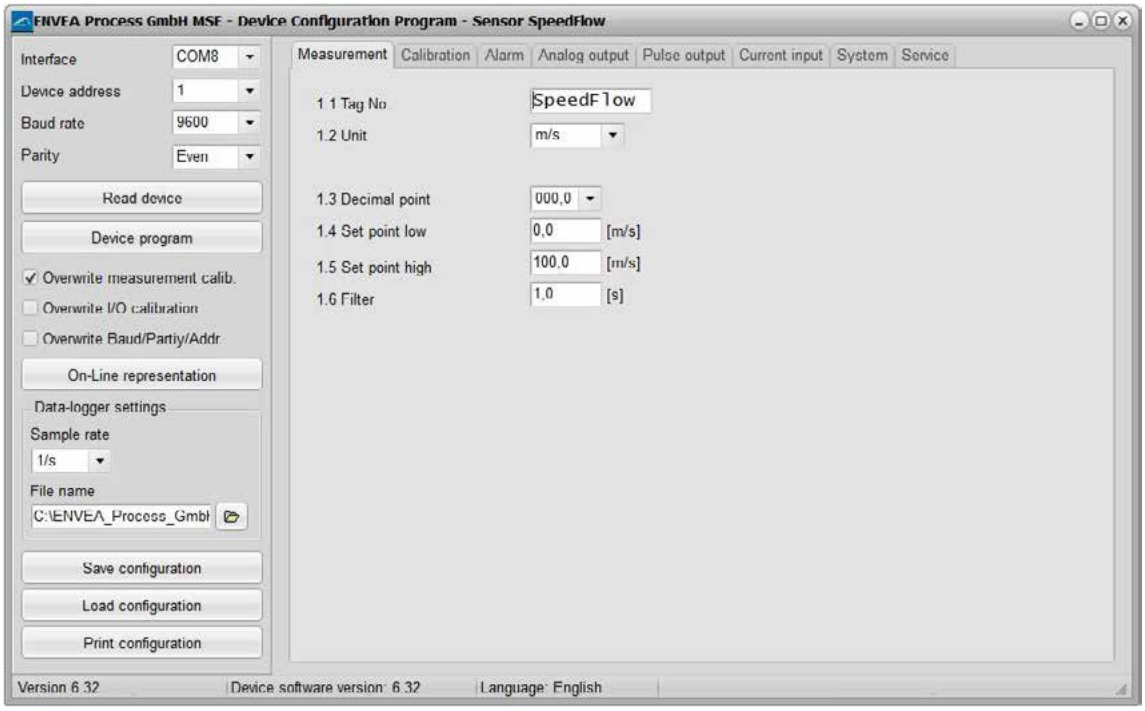
Protection against unauthorised use:
The PC interface does not have a password prompt as it is assumed that only authorised personnel will have access to the PC and the software. However, the password to operate the display can be read and changed in menu **7. System** under **7.6 Password**.

6.4 Menu structure

The menu structure supports the user when adjusting the measuring range, the calibration, the measurement values and the choice of additional functions. In this connection, the numbering both on the display and in the PC interface is identical:

1. Measurement range

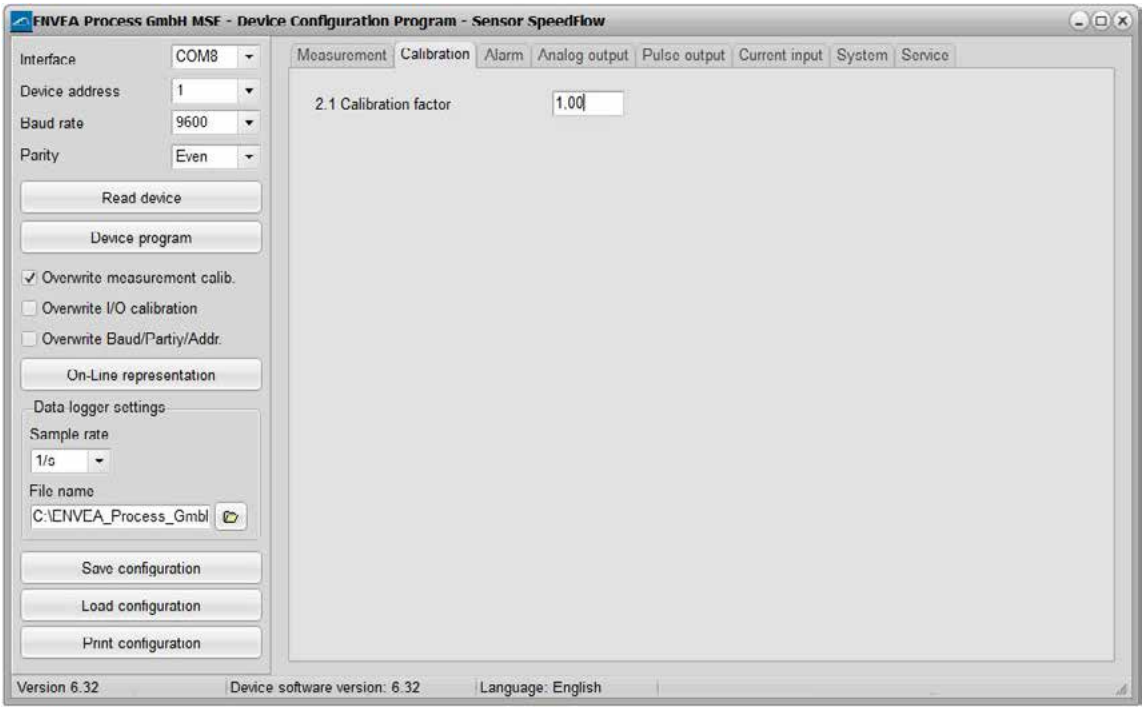
Setting all relevant measuring range settings



1.1 Tag No.	**Input:** Free text (10 characters)	Name of the measurement point or product.
1.2 Unit	**Selection:** m/s, mm/s, ft/s	Desired unit of speed.
1.3 Decimal point	**Selection:** 0000, 0.000, 00.00, 000.0	Number representation and decimal point-accuracy in the measurement menu.
1.4 Set point low	**Input:** 0 … 9999	Speeds under this value will not be displayed at the current output. The display is not affected by this.
1.5 Set point high	**Input:** 0 … 9999	Speeds under this value will not be displayed at the current output. The display is not affected by this.
1.6 Filter	**Input:** 0.0 s … 999.9 s	Filtering of measurement for the indicator and the output values.

2. Calibration

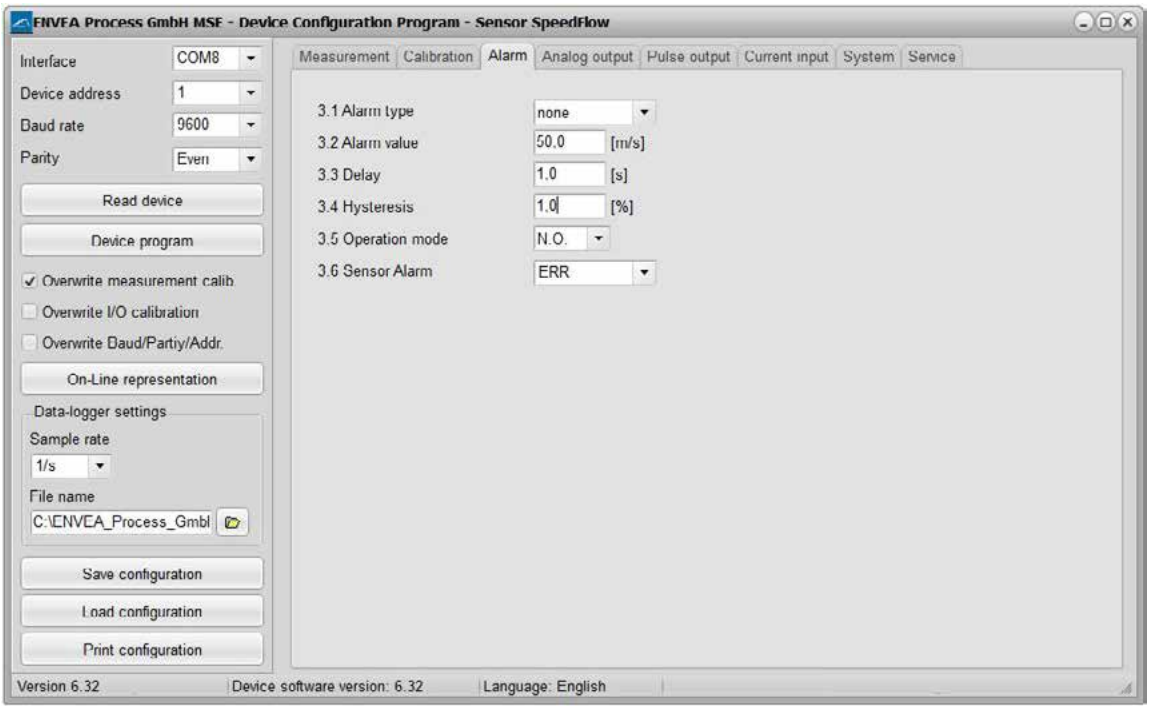
Storing a correction factor



2.1 Calibration factor **Input:** 0.01 … 9.99 Value for adjusting the measured speed.

3. Alarm

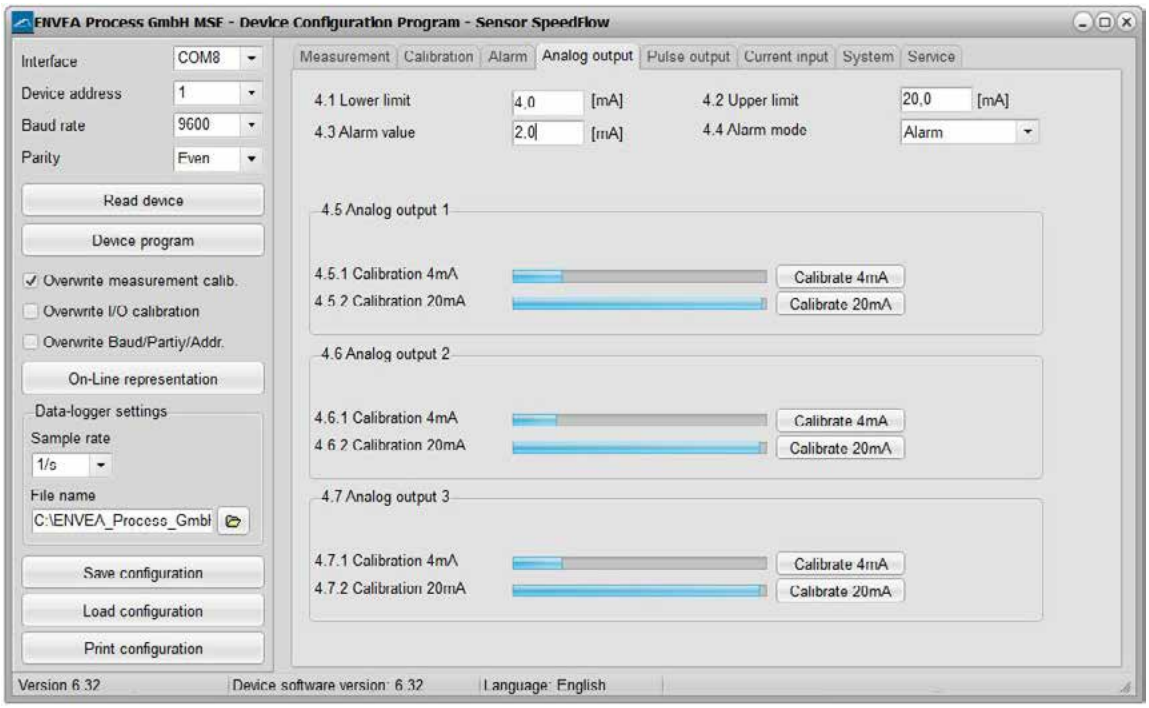
Settings for the alarm via the relay contacts



3.1	Alarm type	**Selection:** Min / Max / None	The relay is activated when the measured value exceeds the Max. limit or undershoots the Min. limit.
3.2	Alarm value	**Input:** 0 … 999.9	Limit value for monitoring Min. or Max.
3.3	Delay	**Input:** 0.1 … 99.9 s	The value must permanently exceed or fall below the set limit during this time.
3.4	Hysteresis	**Input:** 0.1 … 99.9 %	The alarm continues for as long as the measurement is not smaller or larger than the limit value plus or minus hysteresis.
3.5	Operation mode	**Selection:** Working / closed current principle	**NC:** the relay is closed, as long as no alarm is active. **NO:** the relay is closed, if there is an alarm.
3.6	Sensor alarm	**Selection:** OFF /ERR / PROC	**Off:** Sensor or process indicators are not displayed at the relay. **ERR:** Serious internal sensor errors trigger an alarm at the relay. **PROC:** Serious internal sensor errors and process indicators trigger an alarm at the relay. Further information on the signalling levels ERR or PROC can in chapter Fault clearance.

4. Analogue output

Setting and calibrating the analogue output



4.1	Lower limit	**Input:** 0 … 22 mA	Standard setting: 4 mA
4.2	Upper limit	**Input:** 0 … 22 mA	Standard setting: 20 mA
4.3	Alarm value	**Input:** 0 … 22 mA	Value to be output at pending alarm (Standard setting 2 mA)
4.4	Alarm mode	**Selection:** Hold alarm / output	**Alarm:** Alarm is output Measurement value drops to 0, or current measurement value. **Hold output:** Last measurement value remains pending until fault rectification at the output signal.
4.5	Analog output 1	**Submenu**	
4.5.1	Calibration 4 mA	**Selection:** Setting the output current	Key functions can be used to set the current and equalise it to the receiver side.
4.5.2	Calibration 20 mA	**Selection:** Setting the output current	Key functions can be used to set the current and equalise it to the receiver side.
4.6	Analog output 2	**Submenu**	
4.6.1	Calibration 4 mA	**Selection:** Setting the output current	Key functions can be used to set the current and equalise it to the receiver side.
4.6.2	Calibration 20 mA	**Selection:** Setting the output current	Key functions can be used to set the current and equalise it to the receiver side.

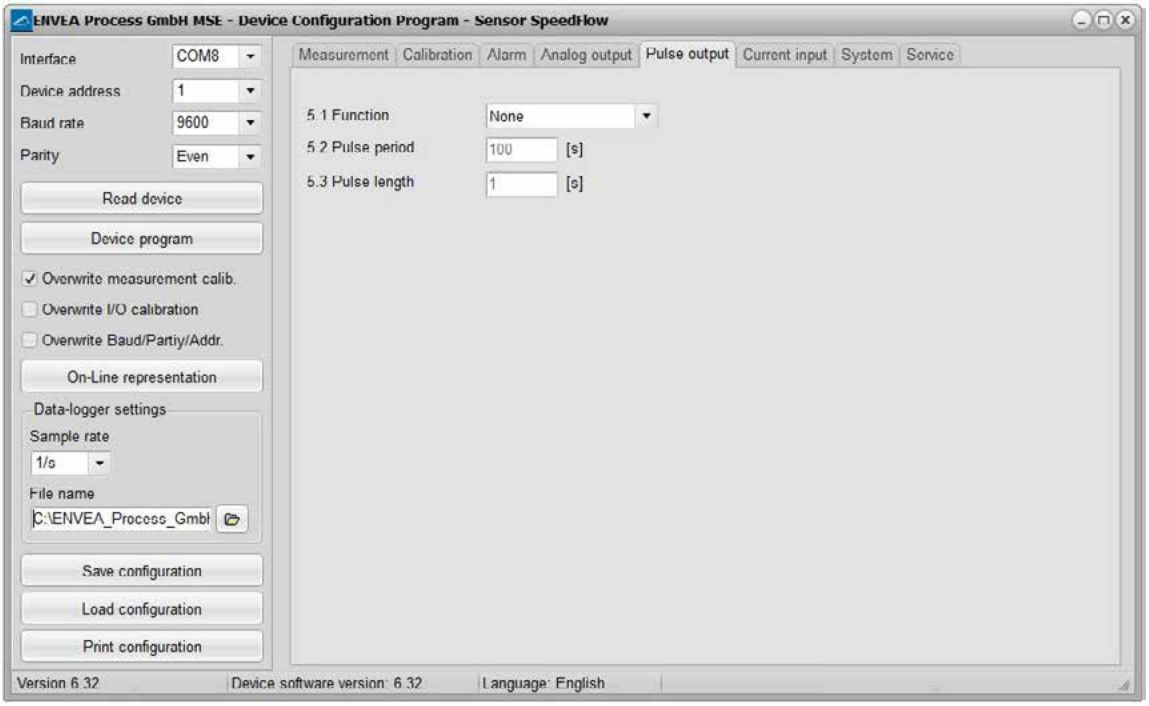
4.7	Analog output 3	**Submenu**	
4.7.1	Calibration 4 mA	**Selection:** Setting the output current	Key functions can be used to set the current and equalise it to the receiver side.
4.7.2	Calibration 20 mA	**Selection:** Setting the output current	Key functions can be used to set the current and equalise it to the receiver side.

The current output can be calibrated so that the zero point (output of 4 mA) is set to the background noise of the measuring point. If the background noise decreases due to process changes, sensor wear or other ageing effects, a signal of less than 4 mA can be output at the analogue output. In this way, a zero offset can be detected (zero point drift).
If this function is not desired for process engineering reasons, the zero point must be specified for the calibration to a raw value of zero and/or the **4.1 MIN limit** set to 4 mA.

If the settings of the 4 mA or 20 mA signal are changed, a check mark must be placed by **Overwrite I/O calibration**.

5. Pulse output

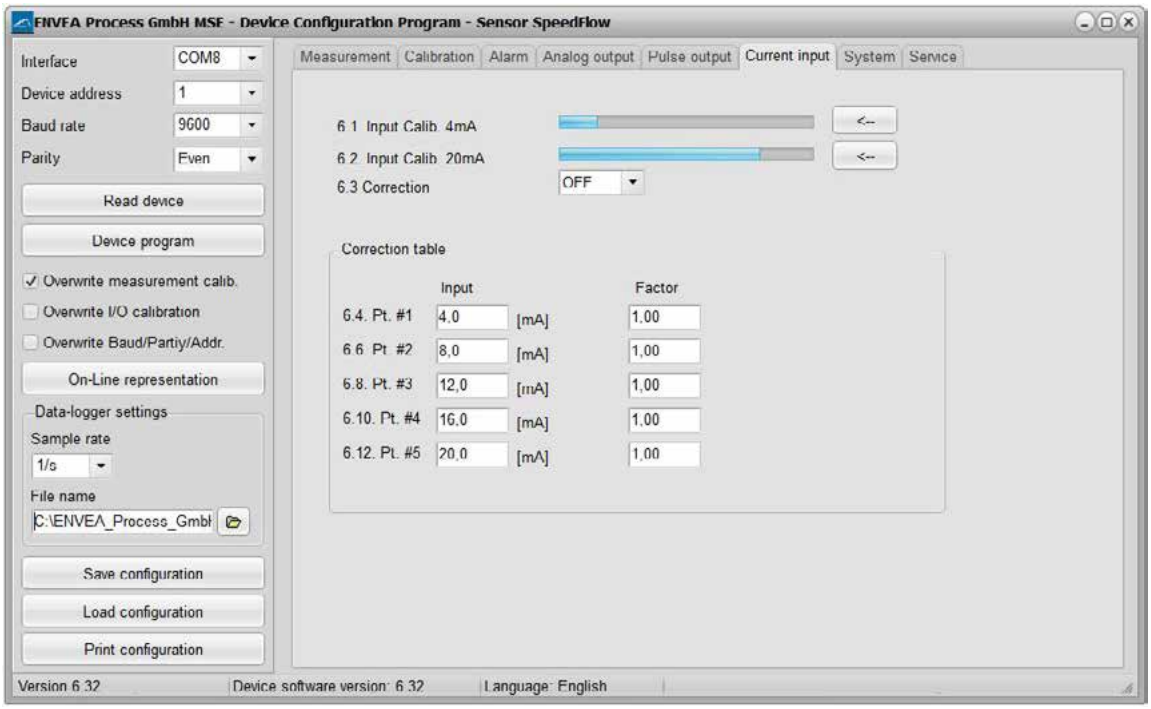
Passive signal for pulse cleaning.



5.1	Function	**Selection:** OFF / Cleaning	**OFF:** No pulse output **Cleaning:** Option for actuation of a solenoid value for pneumatic air flushing.
5.2	Pulse period	**Input:** 1 s … 600 s	Duration between two pulses
5.3	Pulse length	**Input:** 1 s … 60 s	Length of the pulse

6. Current input

Option for auto-correction by external current signal.

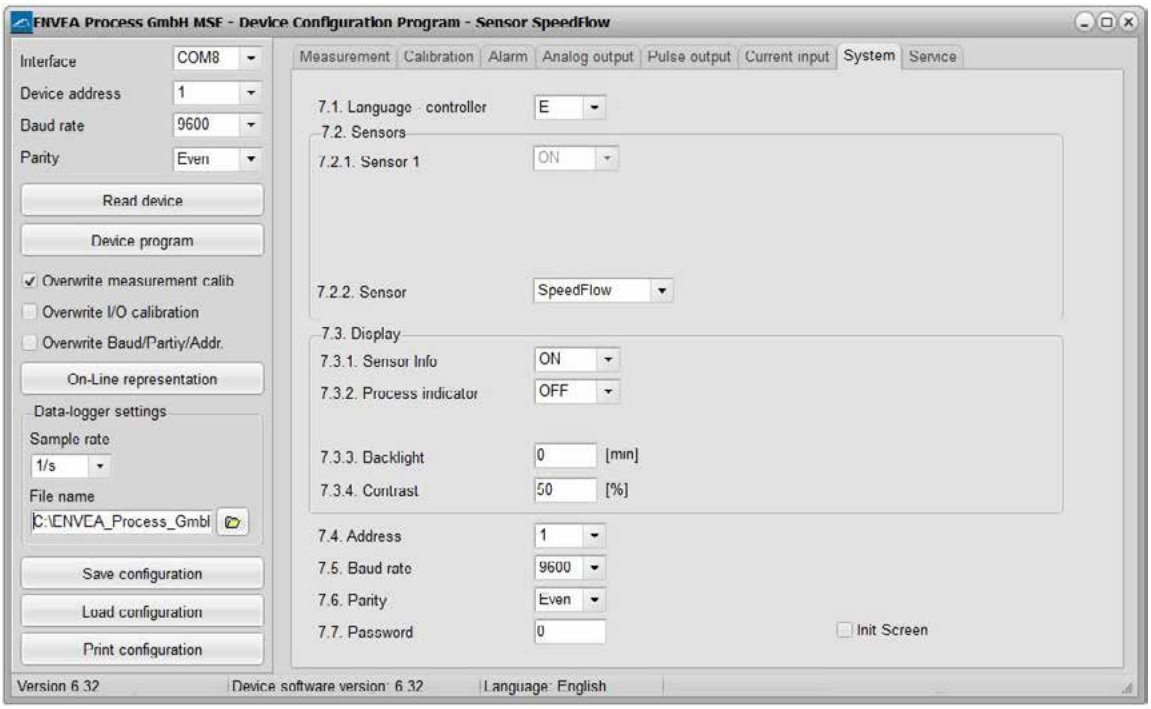


The signal is not electrically isolated.
If the connection is incorrect, the CPU of the Evaluation unit may be destroyed.
An external, galvanic isolation by means of a current disconnector or similar must be provided.

6.1	Input calib. 4 mA	**Selection:** Set input current	The 4 mA signal must be read in via key functions.
6.2	Input calib. 20 mA	**Selection:** Set input current	The 20 mA signal must be read in via key functions.
6.3	Correction	**Selection:** ON / OFF	**ON:** Activation of the correction. **OFF:** Deactivation of the correction.
6.4	P1 input	**Input:** 4 mA … 20 mA	Entry of the current that is to be used for the correction.
6.5	P1 factor	**Input:** 0.01 … 10	Factor for subsequent adjustment of the actual measurement value.
6.n	Pn input	**Input:** 4 m A … 20 mA	Option for further entry of current value and correction factors.
6.n	Pn factor	**Input:** 0.01 … 10	

7. System

Basic settings of the system and the Evaluation unit

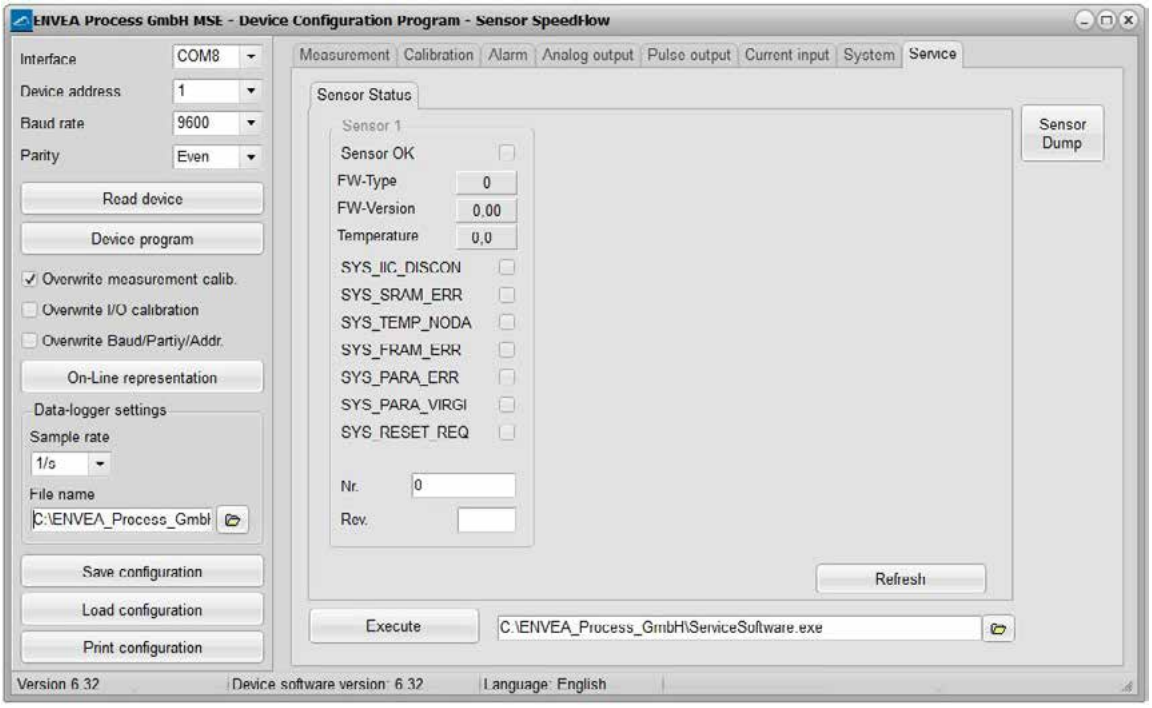


7.1	Language-controller	**Selection:** G / E / F	Selection of the language on the display of the Evaluation unit
7.2	Sensors	**Submenu**	
7.2.1	Sensor 1	**Selection:** ON	Sensor 1 is always active and cannot be switched off.
7.2.2	Sensor	**Selection:** SolidFlow 2.0 / Paddy / PicoFlow / MaxxFlow HTC / DensFlow / SpeedFlow 2.0 / SlideControl 2.0 / ProSens / M-Sens 2 / M-Sens 3 / M-Sens WR	The Evaluation unit checks whether the sensor connected to the matches with the sensor set for based on the set sensor the measured values are calculated and possible errors are displayed. Incorrect sensor selection leads to communication denial.
7.3	Display	**Submenu**	
7.3.1	Sensor info	**Selection:** ON /OFF	**ON:** The key for querying sensor information is shown on the display. **OFF:** The key for querying sensor information is hidden on the display.

7.3.2	Process indicator	**Selection:** ON /OFF	**ON:** Process indicators are shown on the display and indicated on the DIN Rail by flashing twice. **OFF:** Process indicators are not output.
7.3.3	Backlight	**Input:** 0 min … 99 min	Display lighting in minutes 0 = Permanent lighting 99 = Time selection for lighting
7.3.4	Contrast	**Input:** 0 … 100 %	In the event of an inadequate display, the contrast can be changed via the PC software, if necessary.
7.4	Address	**Input:** 1 … 255	ModBus address of Evaluation unit, if this is operated on a PLC or PC as a ModBus slave (RS485 connection).
7.5	Baud rate	**Selection:**	Communication speed of the Evaluation unit if 4800 / 9600 / 19200 / 38400 operated on a PLC or PC as a ModBus slave.
7.6	Parity	**Selection:** Even/Odd/None	The parity is set to even by default. The parity is important for further communication. A change of the parity is only valid after a restart of the power supply.
7.7	Password	**Input:** 0 … 9999	0 = No password protection XXXX = Four digit password that is queried when calling up the menu on the display. Automatic locking for five minutes after the last display input.
7.8	Init Screen	**Selection:**	If Init Screen is selected, the Evaluation unit is reset to factory settings after the next voltage reset.

8. Service

Display of the sensor status



In menu **8. Service** the status of each connected sensor is displayed. FW type, FW version, temperature, serial number and possible hardware errors are automatically read in and displayed. In the case of a change of display, the PC software can be used to adjust the contrast, if necessary.

Only by instruction of trained personnel from ENVEA Process:

If a detailed error analysis is necessary, you can use the PC software by clicking on **Sensor Dump** to save a copy of all ModBus registers as a text file in the installation folder of the software. This is possible only with the PC software. In addition, a service program with deeper access to the sensors can be launched via the PC software.

Only the information on the status of the individual sensors is output on the field housing display.

7. Start-up procedure

7.1 Basic start-up procedure

The sensor is an absolute measuring device and must be parametrised during the commissioning procedure. The following points must be checked before parametrisation:

- The correct flush-mounting of the sensor in the transport pipe.
- The correct connection between the sensor and the Evaluation unit.
- A warm-up time of approx. 5 minutes before starting parametrisation and after switching on the sensor's power supply.

At the beginning of the calibration, it is necessary to check whether the correct sensor is selected via the System menu item. If the correct sensor has been selected, the desired measuring range and the physical unit are entered in **1. Measuring range**.

Once all parameters are correctly stored, the sensor transmits a measured value. No extensive calibration is required beyond the defined distance of both measurement antennas and the internal correlation of the measured values. Should the measured speed nevertheless deviate from a reference speed, the value can be adjusted via **2.1 Calibration factor**.

7.2 Datalogger function in the software

To determine the raw values via the Datalogger function of the PC software, a file path first must be stored. The file path and file name can be selected by clicking on the folder icon next to File name. If the file path is stored, the sample rate could still be changed, this is recommended for long recordings. For determining the raw values for a calibration point, the default setting of 1 (raw value) / second is recommended.

To start the datalogger, the **On-line representation** must be started. As soon as the checkbox on **Datalogger activated** is set in the on-line display, the recording starts and the log file is created in the background.

The data logger is only activated as long as the on-line representation is open. If the window of the on-line display or the entire software is closed, the data recording is aborted. If the data logger is activated, a message window also appears before the on-line representation is closed.

For an evaluation of the recorded log file, it must be opened with Excel or a similar program.

7.3 Adjusting the measurement values

The system's additional functions can be set in the following menus:

Alarms	Throughput upper/lower limit values can be set in **3. Alarm**. A sensor monitoring alarm can also be activated here.
Analogue output	The analogue output values are assigned in **4. Analogue output**. Upper and lower limits of the permitted power and fault current are set here. The analogue output is an active signal. In the field housing design, analogue output 2 + 3 are provided for the MaxxFlow HTC. All other sensors output their 4 ... 20 mA signal to analogue output 1.
Pulse output	In **5. Pulse output** there is an option to use different pulses. A cleaning pulse can be used for a possible pneumatic cleaning on the sensor.
Current input	In **6. Current input** different input currents can be stored. When the current is applied, the corresponding correction factor is applied to the measured value. The input current can also be equalised here.
System	In **7. System** functions such as selection of the menu language, the number of connected sensors and their average, the display screen or ModBus addressing and speed are summarised.

8. Error signalling

To monitor availability, comprehensive system diagnostic functions have been integrated to signal various errors:

1. **Serious errors (ERR):**
   Serious errors (ERR) always set the current output to the configured alarm value. Technical problems affecting the sensor or the entire system that require replacement or repair of a component are displayed:
   - Failure of the communication to a sensor (sensor failure)
   - Failure of a subcomponent of a sensor (temperature monitoring, heater control, memory, data consistency, etc. on the sensor)
   - Inconsistent signal paths in the sensor (amplifier stages, DC offsets)
2. **Process indicators (PROC):**
   Process indicators (PROC) merely report a violation of set parameters and should be viewed as information to improve the measurement process.
   Process indicators are not output at the current output, however they can be shown on the display (field housing) or the RUN LED (DIN Rail) and optionally on the relay:
   - Temperature instability in the sensor due to external thermal stress (overtemperature, low temperature)
   - Overload of the sensor due to material flow (too much, too little)

Process indicators may also only show temporary abnormalities in the process, which can be prevented by optimising the sensor or delivery parameters.
Process indicators are not sensor errors, but rather provide information about optimisation potential at the measuring point.

Display	Display (field housing)	Run LED (DIN Rail)	Relay (optional)	Current output
No error	Sensor status OK in the information display ([I] key)	Single flashing every second	Normal status	4 ... 20 mA
PROC (Process indicators)	Display with indicator code in the bottom display line, extended information via [I] key	Double flashing every second	Enabled if relay alarm option PROC is selected	4 ... 20 mA
ERR (Hardware error)	Display with error code in the bottom display line, extended information via [I] key	Triple flashing every second	Enabled if relay alarm option PROC or ERR is selected	2 mA (or alarm value set for the current output)

Error codes: Error and indicator codes are composed of the letter E (ERR = error) or P (PROC = process indicator) and a three-digit hexadecimal value from “000” to “FFF”. The cause can be determined via the displayed code.

Error timeout: In order not to complicate the start-up of a processing plant due to process and heating status errors, non-serious errors are only signalled at the outputs after approx. 5 minutes have elapsed following a reset of the measuring system. The timeout delay is indicated by a small "t" in the upper-left corner of the display (field housing only).

9. Maintenance

Warning!

- Switch the power supply off before performing any maintenance or repair work on the measuring system. The transport pipe must not be operational when replacing the sensor.
- Repair and maintenance work may only be carried out by electricians.
- The system requires no maintenance.

10. Warranty

On condition that the operating conditions are maintained and no intervention has been made on the device and the components of the system are not damaged or worn, the manufacturer provides a warranty of 1 year from the date of delivery.

In the event of a defect during the warranty period, defective components will be replaced or repaired at ENVEA Process plant free of charge at the discretion of ENVEA Process. Replaced parts will become the property of ENVEA Process. If the customer requests that parts be repaired or replaced at its plant, the customer must pay the travel expenses for ENVEA Process service personnel.

ENVEA Process cannot accept any liability for damage not suffered by the goods themselves and in particular ENVEA Process cannot accept liability for loss of profit or other financial damages suffered by the customer.

11. Fault clearance

- **Warning!**
  The electrical installation may only be inspected by trained personnel.

Error	Cause	Action
Measuring system does not work. POW LED does not light up. RUN LED does not light up.	Power supply interrupted.	Check the power supply.
	Cable break.	Check the connection cables for a possible cable break.
	Defective fuse.	Replace fuse.
	Defective device.	Notify ENVEA Process and rectify the error as instructed on the telephone.
Measuring system does not work. POW LED does not light up. RUN LED does not light up.	Microprocessor does not start.	Switch the power supply off and on again. Remove programming cable.
Measuring system works. POW LED does not light up. RUN LED flashes twice or three times per cycle.	No sensor communication.	Sensor defective. Cable break between sensor and measuring system.
	Sensor connected incorrectly.	Check connection cable.
	Sensor defective.	Replace sensor.
	Sensor not receiving 24 V supply.	Make sure the power supply is connected.
	Excessive voltage drop in the supply cable to the sensor.	Check cable lengths.
	Error code available on the display.	Additional error diagnosis by error code.
Measuring system outputs incorrect values.	Calibration incorrect.	Perform a recalibration.
	Calibration shifted by abrasion on the sensor head.	Perform a recalibration.
Switch output relay chatters.	Hysteresis too low.	Increase hysteresis. Check for fault caused by external consumer.
Do not open sensor electronics. To do so will make the warranty void!		

11.1 Error codes

Type	Error code	DR flashing	Current	Description	Remedy
ERR	E0001	3	2 mA	Internal amplifier defective (DC offset)	Switch off power supply for at least 10 s, if not helpful: replace, check parameters
PROC	P0002	2	4…20 mA	Signal too small	Process stopped? Check parameters
ERR	E0004	3	2 mA	Defective speed electrode	Check parameters, set fixed speed or replace sensor
ERR	E0008	3	2 mA	Defective speed electrode	Check parameters, set fixed speed or replace sensor
ERR	E0010	3	2 mA	Asymmetrical speed signal	Check parameters, set fixed speed or replace sensor
PROC	P0020	2	4…20 mA	Inverted input signal on a channel	Check parameters, set fixed speed, replace sensor
PROC	P0040	2	4…20 mA	Measurement range exceeded	Set parameters, check process
PROC	P0080	2	4…20 mA	Measurement range exceeded	Set parameters, check process
PROC	P0100	2	4…20 mA	Poor result of individual measurement	Set parameters, set fixed speed, check process
PROC	P0200	2	4…20 mA	Periodic speed signal	Set parameters, set fixed speed, check process
PROC	P0400	2	4…20 mA	Speed too high, signal cannot be measured	Set parameters, set fixed speed, check process
PROC	P1000	2	4…20 mA	Negative speed measurement	Set parameters, configuration flags, set fixed speed, check process
PROC	P2000	2	4…20 mA	Empty calculation buffer	Wait, reset if necessary if not gone after some time

A detailed error analysis and subsequent troubleshooting can be carried out by trained ENVEA Process personnel.

12. Technical data

Sensor	
Inner diameter	DN: 80, 100, 120, 150, 200, 250, 350, other sizes in request.
Inner pipe material	PMMA
Mechanical connection	Flare connection
Protection type	IP54
Max. pressure	100 mbar
Range of speed	1 ... 35 m/s
Temperature inside the pipe	0 ... +50 °C
Temperature outside the pipe	0 ... +45 °C
Power supply	24 V DC
Weight	Depends on the diameter
Measuring accuracy	± 1% (in the calibrated measuring range)

MSE 300 Field housing	
Power supply	110/230 V, 50 Hz (optional 24 V DC)
Power consumption	20 W / 24 VA
Protection type	IP65 to EN 60 529/10.91
Ambient operating temperature	-10 ... +45 °C
Dimensions	258 x 237 x 174 mm (W x H x D)
Weight	Approx. 2.5 kg
Interface	RS 485 (ModBus RTU) / USB
Cable glands	3 x M20 (4.5 - 13 mm diameter)
Screw terminals	0.2 – 2.5 mm² [AWG 24-14]
Current output signal	3 x 4 ... 20 mA (0 ... 20 mA), load < 500 Ω (Active)
Relay contact	Max. switching capacity: 250 V AC Max. start up current: 6 A Max. breaking capacity 230 V AC: 250 VA Max. switching current DC1: 3/110/220 V: 3/0.35/0.2 A Min. breaking capacity: 500 mW (10 V/5 mA)
Data storage	Flash
Pulse output	Open collector – max. 30 V, 20 mA

MSE 300 DIN Rail	
Power supply	24 V DC ± 10 %
Power consumption	20 W / 24 VA
Protection type	IP40 to EN 60 529
Ambient operating temperature	-10 ... +45 °C
Dimensions	23 x 90 x 118 mm (W x H x D)
Weight	Approx. 172 g
Interface	RS 485 (ModBus RTU) / USB
DIN Rail fastening	DIN 60715 TH35
Connection terminals cable cross-section	0.2 – 2.5 mm² [AWG 24-14]
Current output	1 x 4 ... 20 mA (0 ... 20 mA), load < 500 Ω (Active)
Relay contact	Max. switching capacity: 250 V AC Max. start up current: 6 A Max. breaking capacity 230 V AC: 250 VA Max. switching current DC1: 3/110/220 V: 3/0.35/0.2 A Min. breaking capacity: 500 mW (10 V/5 mA)
Data backup	Flash memory
Pulse output	Open collector – max. 30 V, 20 mA

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