



OPERATING INSTRUCTIONS

Paddy

PARTICLE SIZE MONITORING



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2. Function

- Use in free fall after screening or grinding.
- The sensor uses the latest microwave technology. It is only used in metallic pipelines.
- The microwave radiation in the pipeline is reflected by the solid particles and received by the sensor. The frequency of the received signals is analysed.
- Due to the arrangement of two baffle plates in the drop, sedimentation causes differences in fall speed.
- The frequency-selected evaluation system ensures that only moving particles are measured and deposits are ignored.
- The frequency spectrum of the backscattered microwave signal contains information about the speed of the particles.

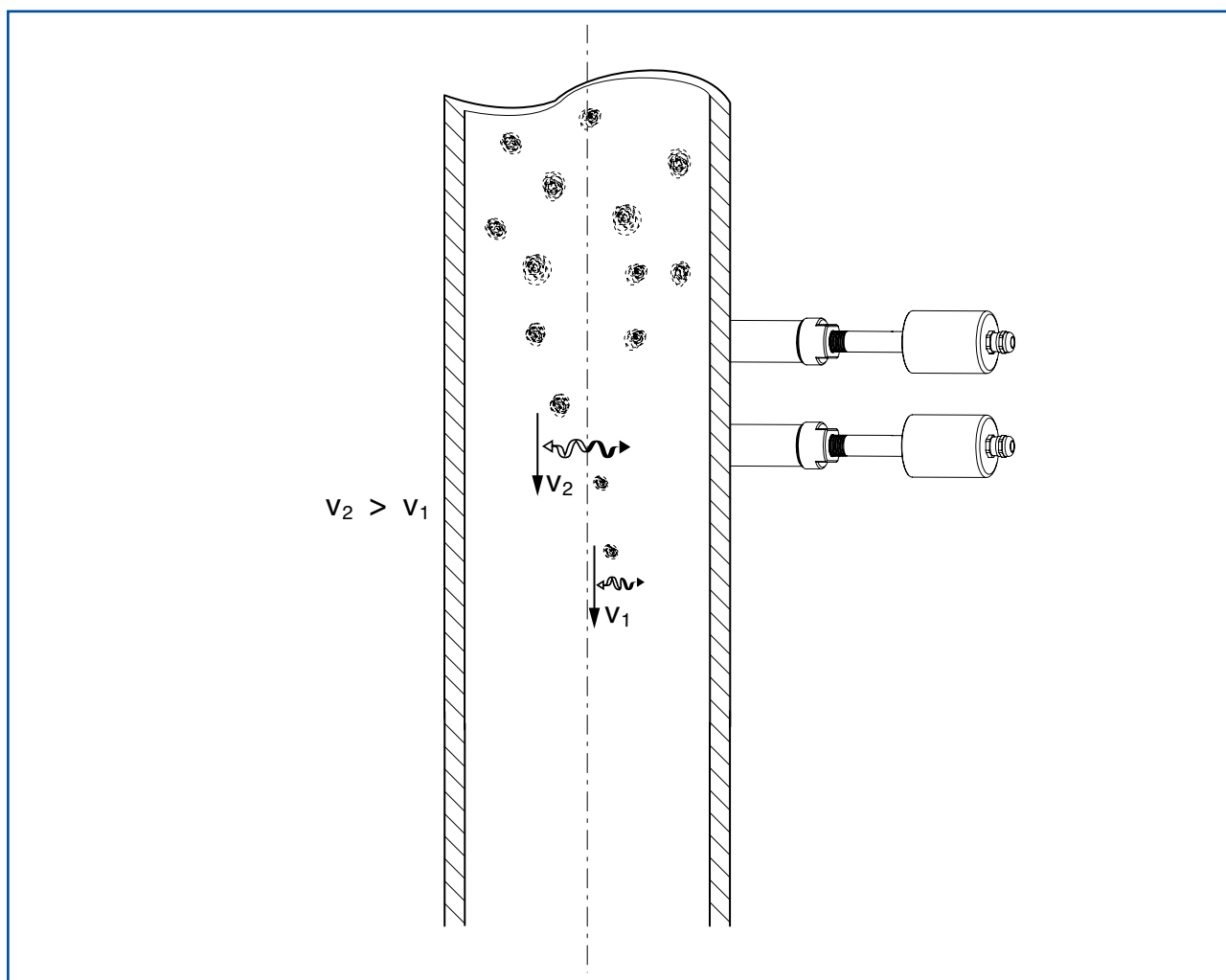


Fig. 3: Integration and reflection of microwaves

3. Safety

The Paddy measuring system has been designed, built and tested using state-of-the-art, reliable technology, and was found to be in a perfectly safe condition when it left 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 particle 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 dangers

- 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.



Important.

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

3.3 Safety at work and operational safety

- The measuring system may only be installed by trained, authorised personnel.
- During all maintenance, cleaning and inspection work on the pipelines or Paddy components, 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 Paddy's components. See the instructions in the section entitled Maintenance and care.
- 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 progress

- 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 relevant amendments.

3.5 Reliability

For any additional information concerning product reliability, please contact ENVEA Process.

4. Mounting and installation

4.1 Typical components of the measurement point:

- 1 x microwave particle sensor (reference sensor)
- 1 x microwave particle sensor (measuring sensor)
- 1 x C3-Box
- 1 x Evaluation unit (MSE 300) in the DIN Rail housing or field housing
- 2 x sensor mount for welding to the pipeline
- 1 x installation instructions

4.2 Required equipment

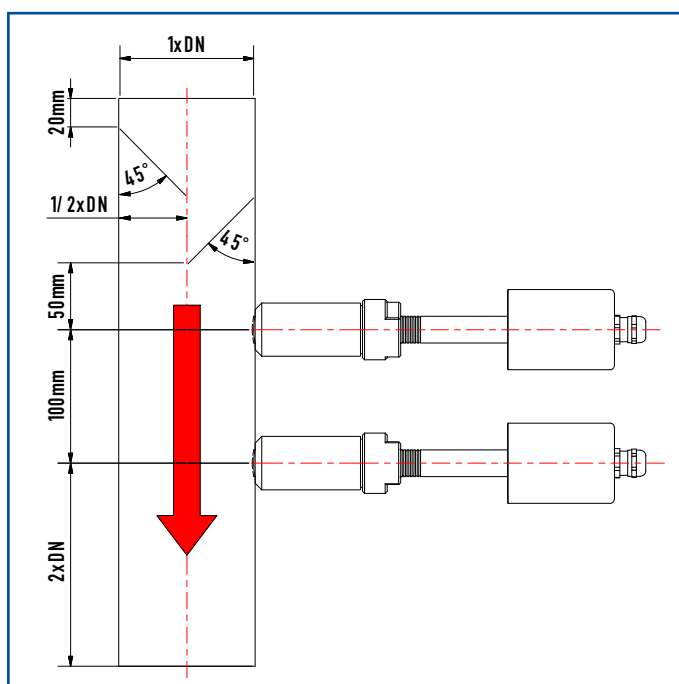
- Ø 20 mm twist drill bit
- 32 mm open-ended spanner for union nut
- Locking ring pliers (Ø 20 mm) to adjust the sensor to the wall thickness
- approved tools for the electric connection

4.3 Sensor installation

In pneumatic applications a venturi is mandatory. ENVEA Process designs the venturi and positions the sensors according to the application.

Proceed as follows to install the sensor:

- Decide on the installation position on the pipe.
- Ensure that the measurement point is at an adequate distance from valves, manifolds, blowers and rotary valve or other measurement ports such as those used for pressure and temperature sensors, etc.
- The minimum distance of 100 mm between the weld-on sockets must be adhered to.
- Unless otherwise specified by ENVEA Process, the baffle plates shall be provided with a distance of 100 mm, a length of 1/3 of the DN and in an angle of 45 °.



- The measuring and reference sensor must be installed in such a way that the material flow is detected from the rear.
- It is imperative that there are no mechanical or electrical interference sources below the measuring point.
- Weld the sensor mount to the pipe.
- Drill through the pipe through the sensor plug (Ø 20 mm). Ensure that the borehole is not angled so that the sensor can be installed precisely at a later stage.

Fig. 4: Assembly overview



Attention!

- After drilling, it is essential to check whether the drill bit has caused any burrs on the borehole edges. Any burrs on the pipe must be removed using a suitable tool. If the burrs are not removed they may affect the sensor's calibration.
- If the sensor is not installed immediately insert a plug until it is installed (see also Fig. 5). The plug must be inserted together with the seal, two sealing rings and the locking ring, and secured using the union nut.
Use a 32 mm open-ended spanner to tighten the union nut.

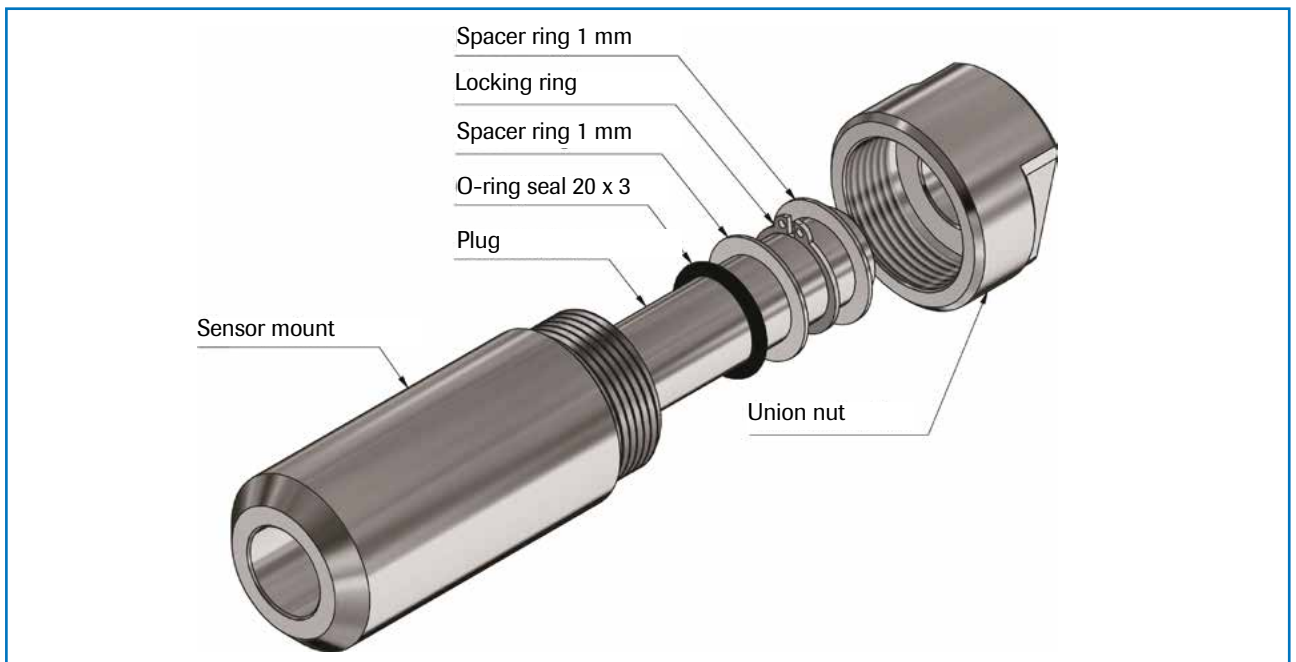


Fig. 5: Installing the sealing plug in the sensor holder

- Remove the sealing plug to insert the sensor.
- The union nut, spacer rings, seal and the locking ring for the sealing plug are required for installation of the sensor. The locking ring must be set so that the sensor is flush with the inner wall. If necessary, the wall thickness must be remeasured using a depth gauge. The weld-on socket is 93 mm long. It is important that the sensor does not project into the pipe. The sensor may be up to 1 mm inside the pipe wall without this causing a measurement error.

Wall thickness (mm)	Position on the sensor neck	Number of spacer rings
3.0	1	2
4.0	1	1
5.5	2	2
6.5	2	1
8.0	3	2
9.0	3	1
10.5	4	2
11.5	4	1
13.0	5	2
14.0	5	1

- Now insert the sensor into the sensor hold as shown in the figure ...

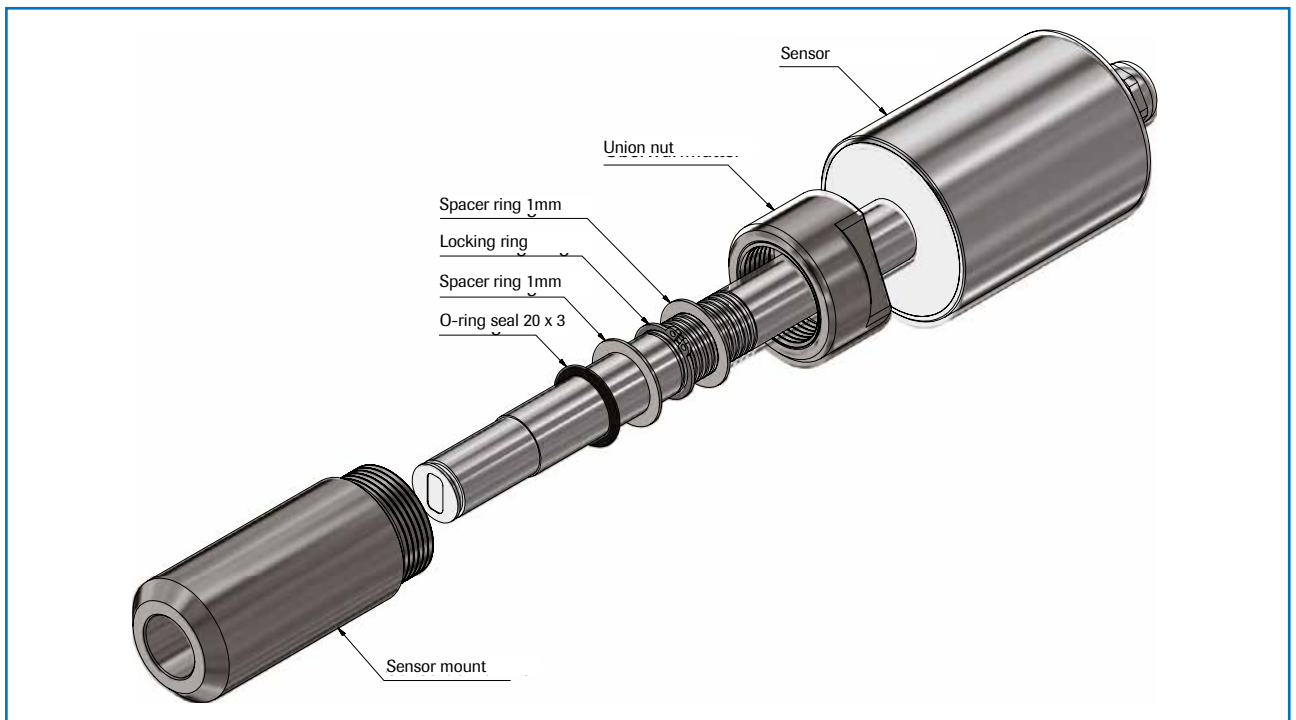


Fig. 6: Installing the sensor in the sensor holder

- ... and align it lengthwise to the pipe axis in accordance with the polarisation sticker (fig. 7). Then screw the measuring point tight with the union nut.

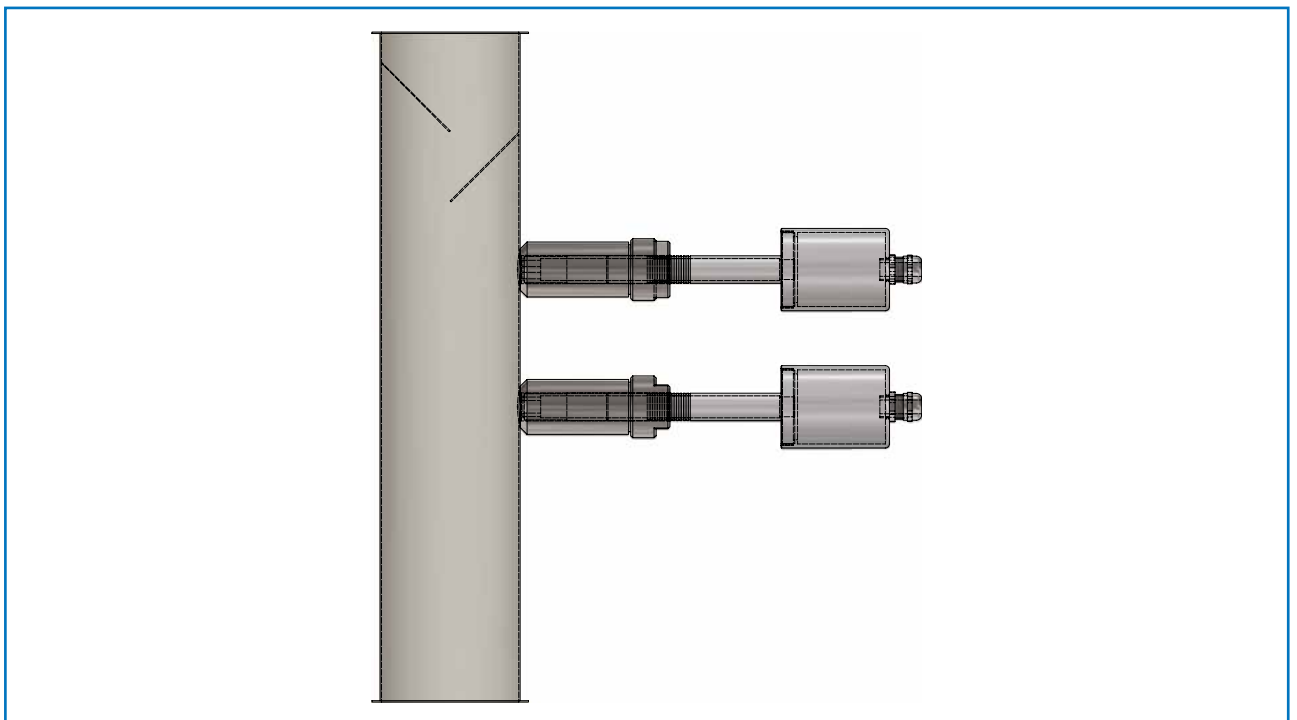


Fig. 7: Installing the sensor in the pipe

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 increased.

The housing is prepared for DIN Rail mounting according to DIN EN 60715 TH35.

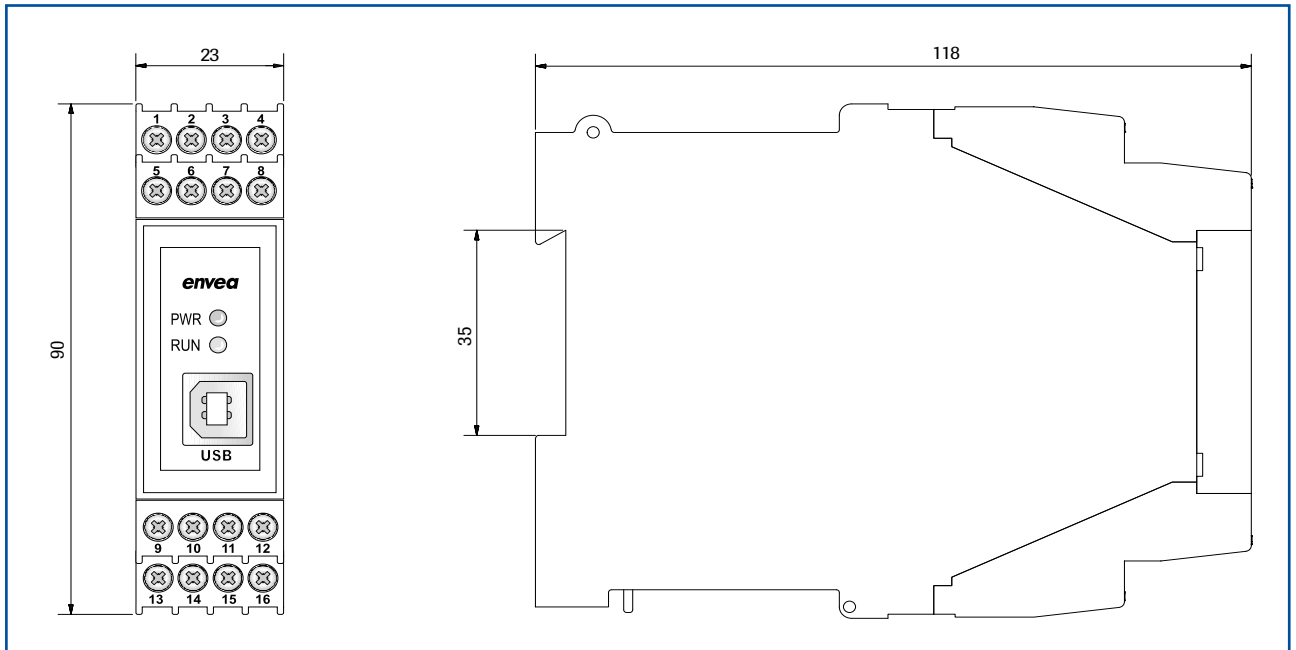


Fig. 8: Dimension of the MSE 300-DR

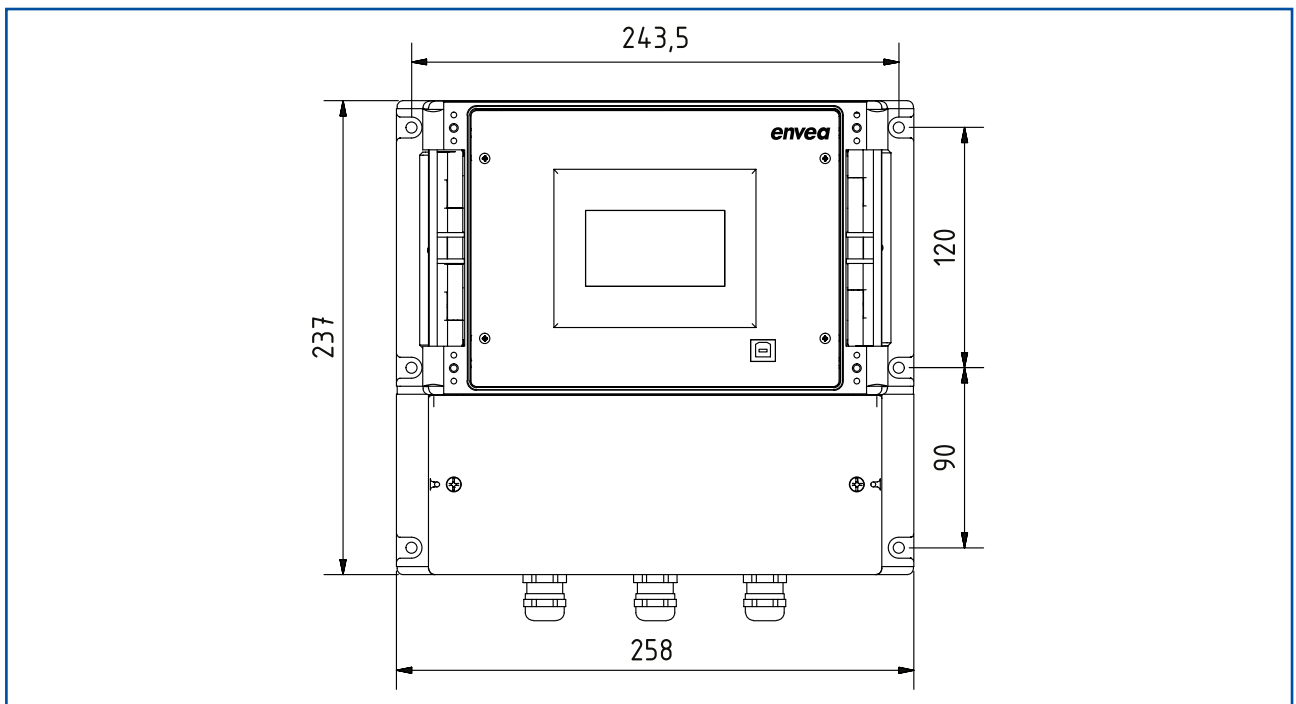


Fig. 9: Dimension of the MSE 300-FH (front view)

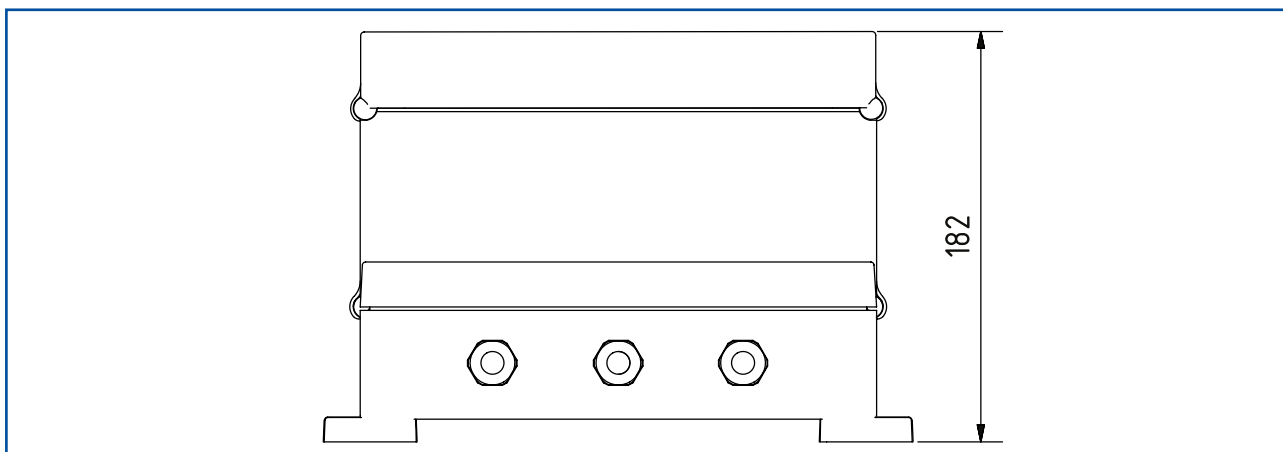


Fig. 10: Dimension of the MSE 300-FH (side view)

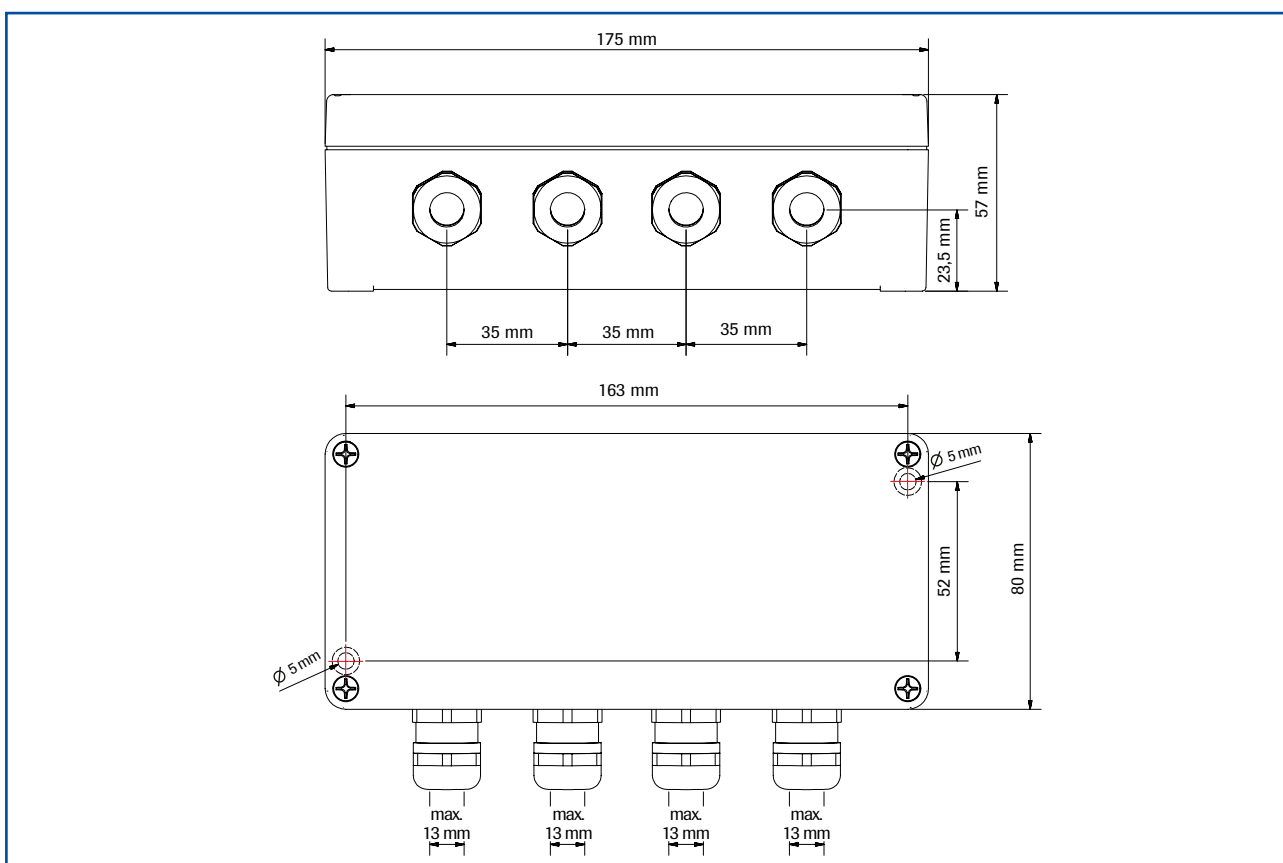


Fig. 11: Dimension of the C3-Box

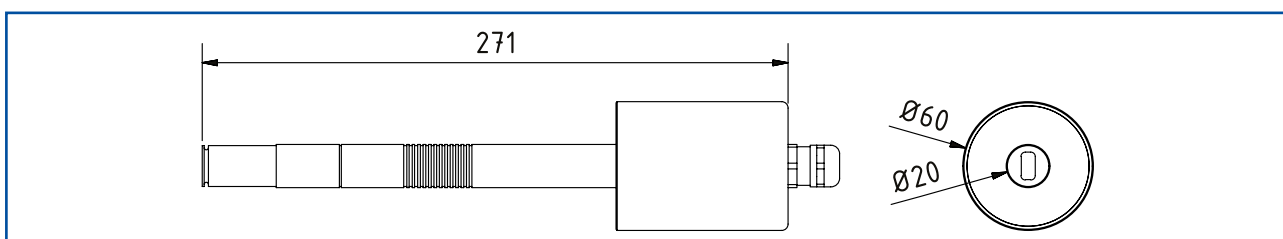


Fig. 12: Dimension of the Paddy sensor

4.5 Use in hazardous areas

Hazardous area identification:

II 1/2D Ex tD IP65 T84 °C

Zone 20: $0\text{ °C} \leq T_{\text{process}} \leq 80\text{ °C}$

Zone 21: $-1\text{ °C} \leq T_{\text{amb}} < 60\text{ °C}$

- Equipment group 2
- Equipment category: 1/2
- Waveguide window zone 20 / housing zone 21
- For explosive mixtures of air and combustible dust
- IP code 65
- Maximum surface temperature 84 °C at $T_a = 60\text{ °C}$

Gas explosion zone identification: II 1/2D Ex tD A20/21 IP65 T84 °C
II 2G Ex d IIC T5/T3

- Equipment group 2
- Equipment category: 2
- Zone 1
- For explosive mixtures of air and combustible gases
- IP code 65
- Permitted process temperature 0 to 150 °C
- Temperature class T3
- Maximum surface temperature 84 °C at $T_a = 60\text{ °C}$

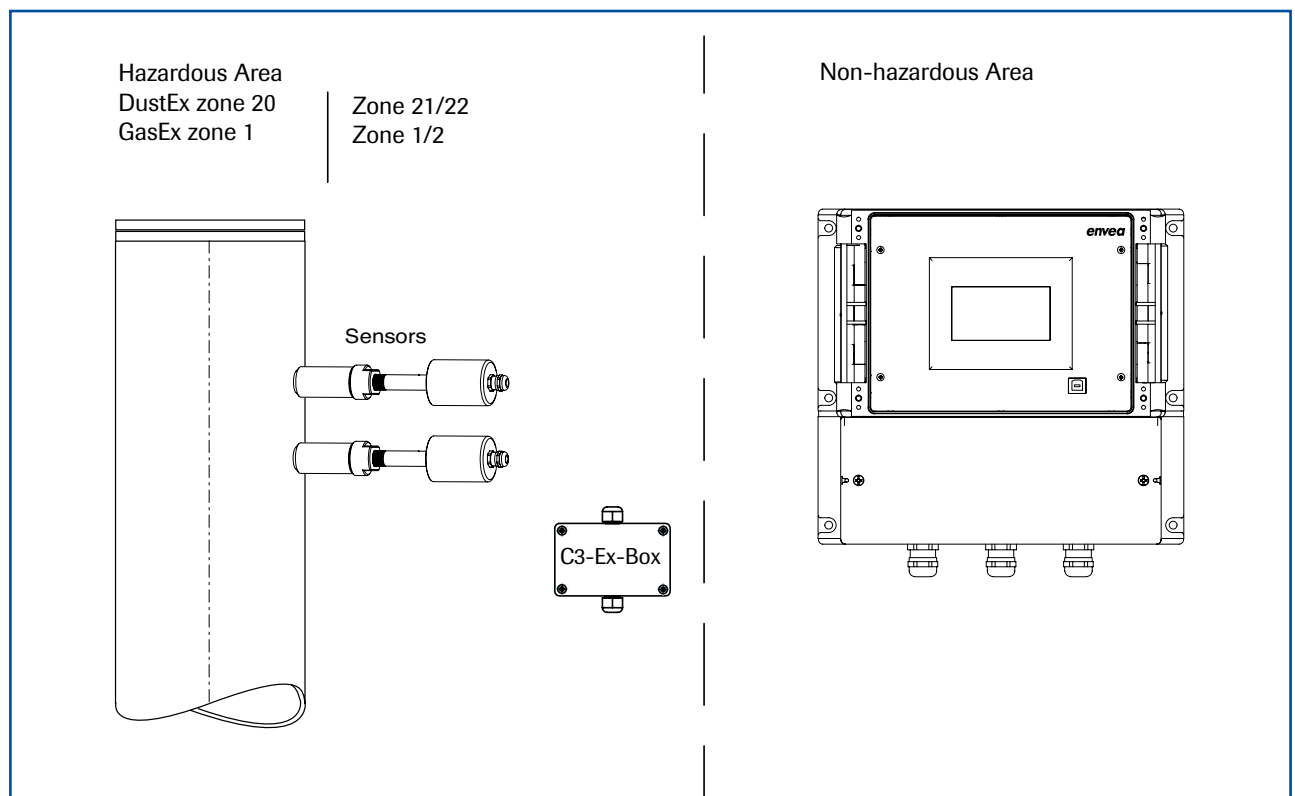


Fig. 13: Use of sensors in an ATEX zone

5. Electrical connection

5.1 Terminal layout MSE 300-DR

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)

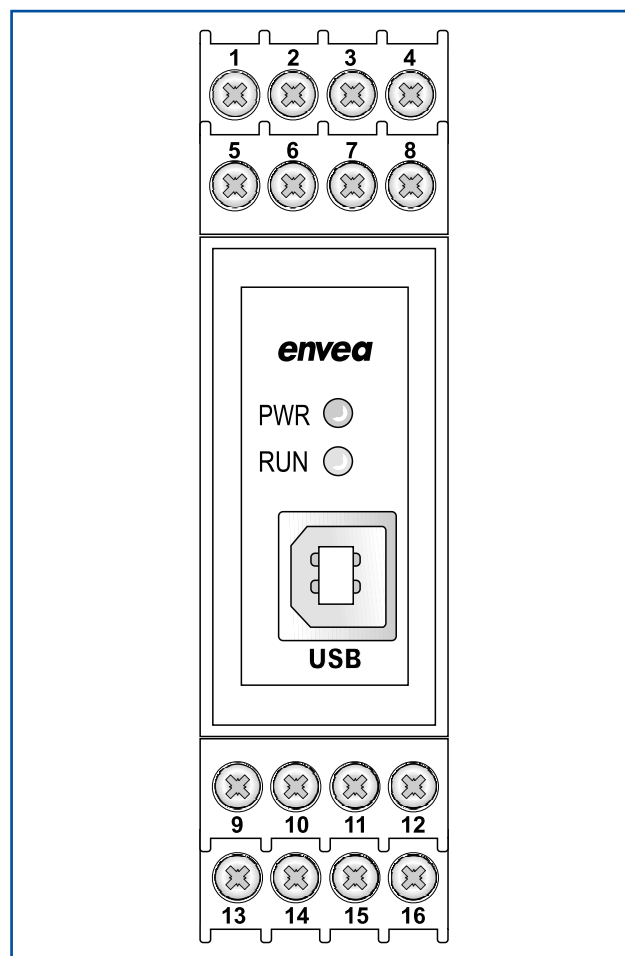


Fig. 14: Electrical connection of the MSE 300-DR

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 Terminal layout MSE 300-FH

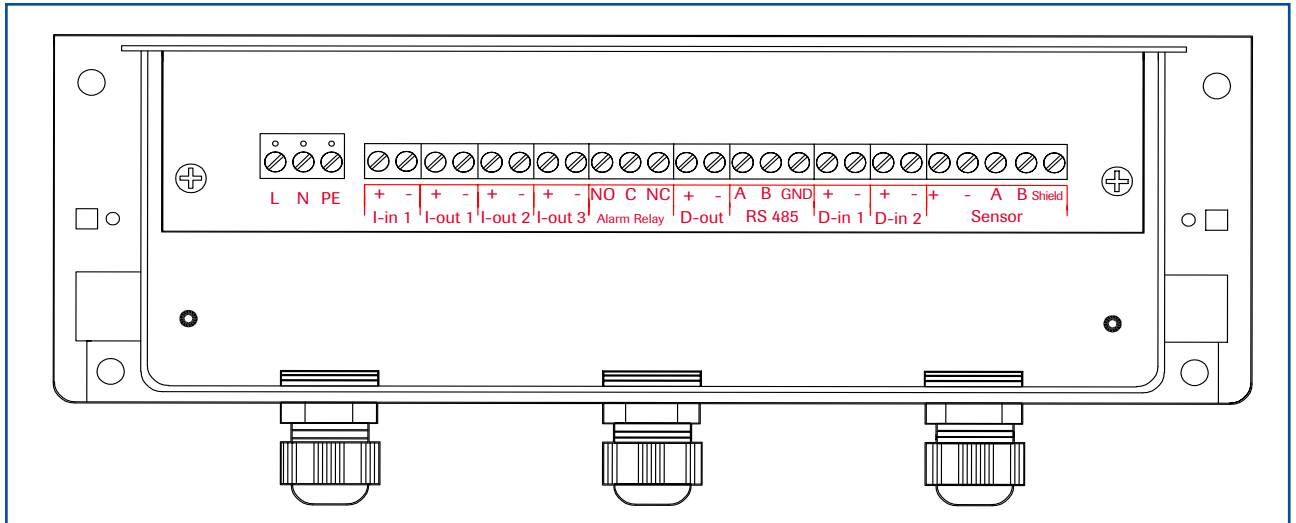


Fig. 15: Electrical connection of the MSE 300-FH

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		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 conductor)	
	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	+	Digital interface 1 (+)	
	-	Digital interface 1 (-)	
D-in2	+	Digital interface 2 (+)	
	-	Digital interface 2 (-)	
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	

5.3 Terminal layout C3-Box

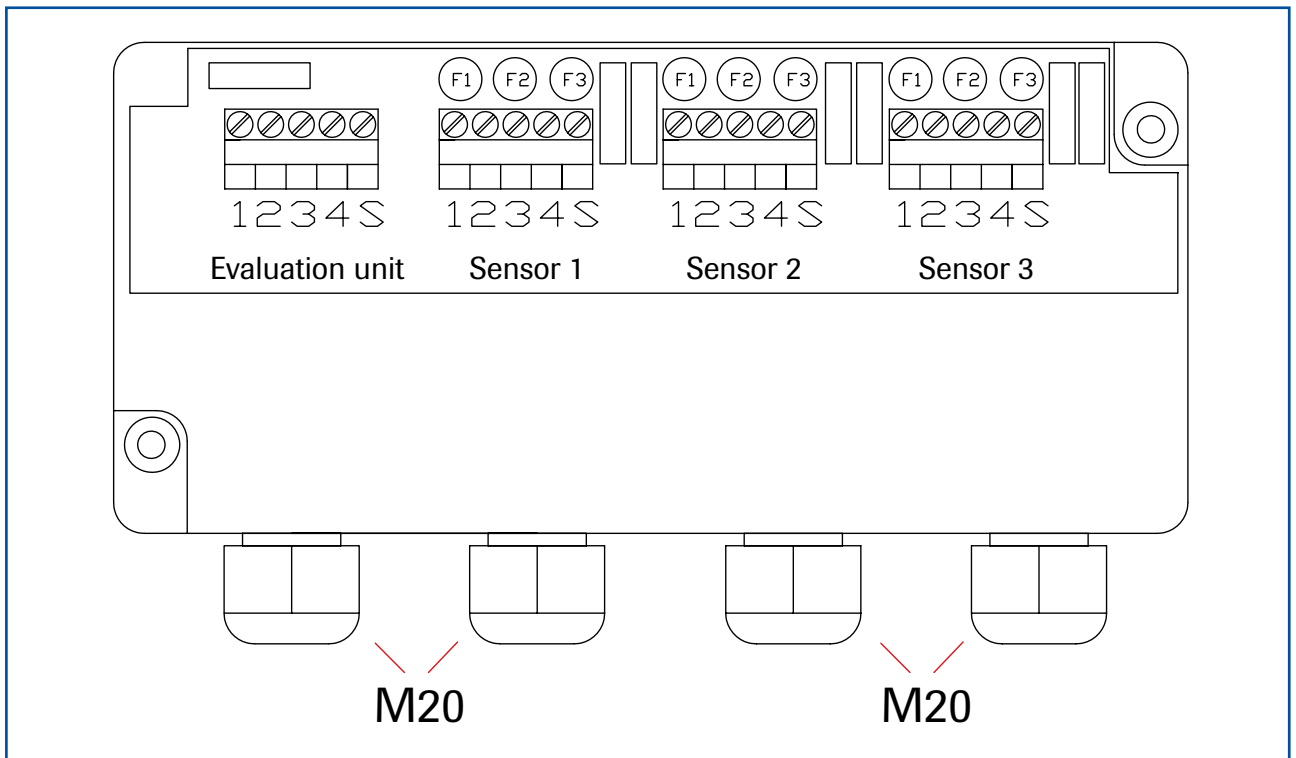


Fig. 16: Electrical connection for the C3-Box

Sensor 1 / 2 / 3

- 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 system design:

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

First of all, the different system versions are described below. In the following, the basic operation of the Paddy measurement system is described without repeating details about the differences between the various versions.

6.1 Differences between the DIN Rail and field housing analysis units

The Evaluation unit 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
Remote control digital input	yes	no
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

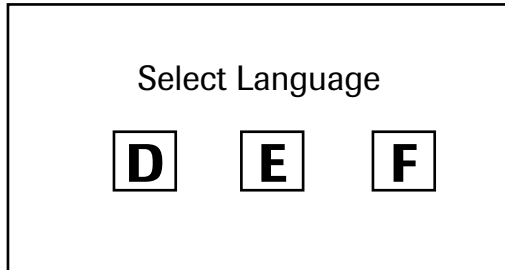
The Evaluation unit in the DIN Rail housing can only be configured via a USB connection and PC software program. On the Evaluation unit in the field housing, all functions can be configured by menu via the touch-sensitive display.

The Evaluation unit in 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

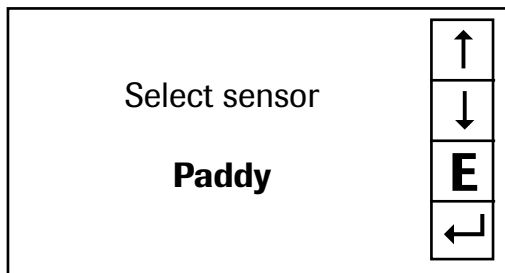
The display is touch-sensitive. Available keys are displayed directly in context. When the measuring system is first started, a query is initiated to select the language and sensor. If no selection is made, the initialization disappears and the German language with a Paddy sensor is selected.



Initialization screen when the Evaluation unit in the field housing started first time.

Selection of the menu language:

Deutsch, **E**nglish, **F**rançais

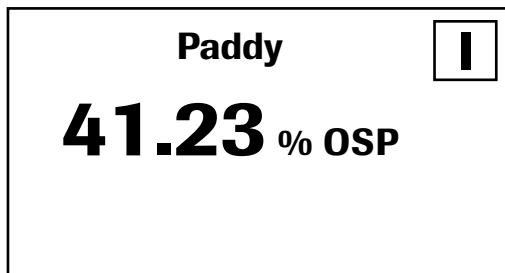


If a language has been selected, the sensor to be used must be selected.

To be 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.

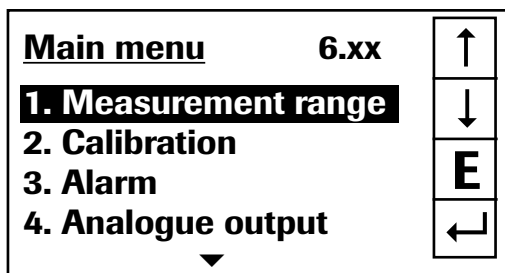
Afterwards the start page appears.



The start page display the following values:

- Name "Paddy", freely selectable text which describes the material or the measuring point
- Measured value, here in % Over Size Particle [% OSP]
- [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:

- [Arrow]: 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.

Sensor status			
	Temp	Raw value	Stat
S1	63.0	0.000123	OK
S2	63.0	0.000213	OK

With the key [I] you can choose between different information windows. The first window shows the raw values, temperature and the status of the sensor.
The second window displays the error memory. Recent error codes always come first. If an error code is repeated, it will appear first, but will not be listed multiple times.

Save changes?

Y

N

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** in **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 Evaluation unit in the field housing at the ModBus A (+) and ModBus B (-) terminals. On the DIN Rail version, these connections are nos. 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.

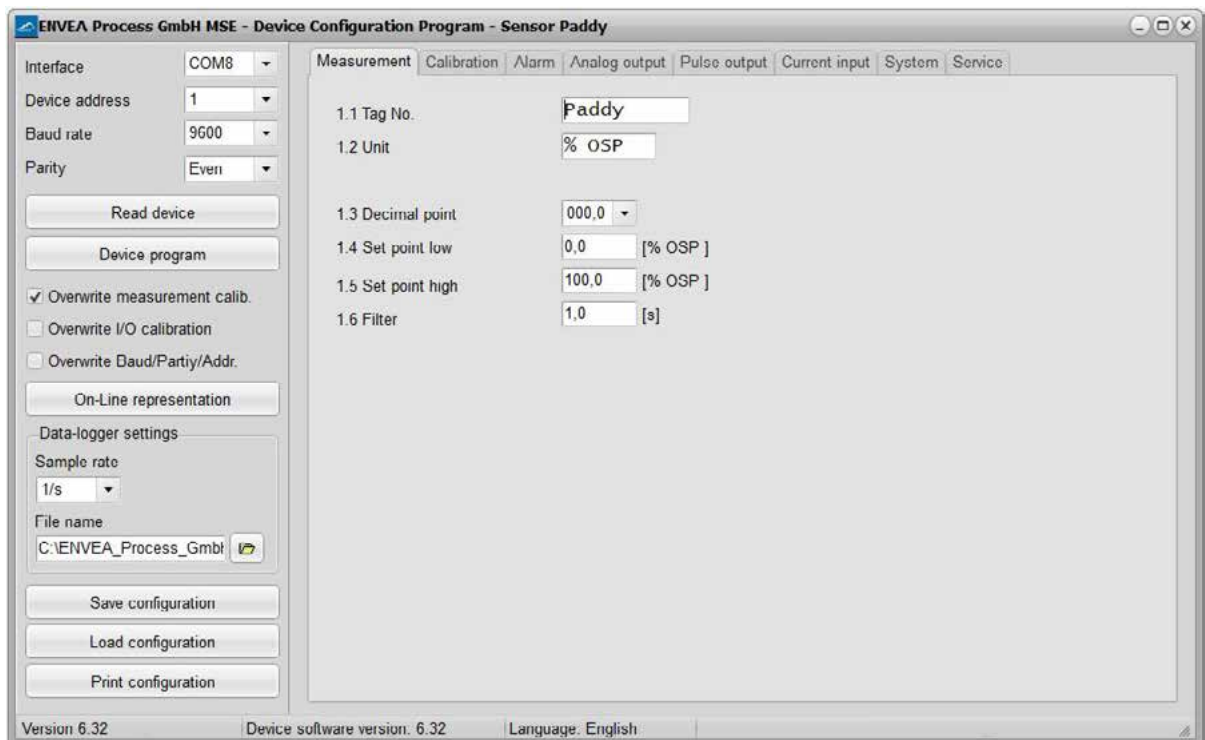
- ✓ A standard USB-A-B cable is supplied for the USB connection to the DIN Rail version. The USB connection is a point-to-point connection that is BUS-enabled. The ModBus address and baud rate for the front connections cannot be changed and are always:

- 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 parameter 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 “German/English/French”.

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. The password to operate the display can be read and changed in menu

7. System under **7.6 Password**.

6.4 Menu structure

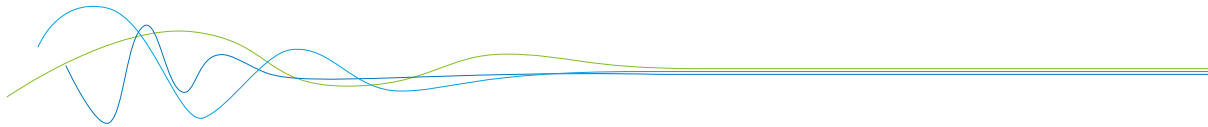
The menu structure supports the user when adjusting the measuring range, the calibration, the measurement values and the choice of additional functions. In this connection, the numbering both on the display and in the PC interface is identical:

1. Measurement

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	Input: Unit text, e. g. % OSP	Desired display unit.
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	Throughput rates under this value will not be displayed at the current output. The display is not affected.
1.5 Set point high	Input: 0 ... 9999	Throughput rates above this value will not be displayed at the current output. The display is not affected.
1.6 Filter s	Input: 0.0 ... 999.9	Filtering of measurement for the indicator and the output values.



2. Calibration

Deposit a calibration table.

ENVEA Process GmbH MSE - Device Configuration Program - Sensor Paddy

Interface: COM8
 Device address: 1
 Baud rate: 9600
 Parity: Even

Read device
 Device program

☒ Overwrite measurement calib
☐ Overwrite I/O calibration
☐ Overwrite Baud/Parity/Addr.

On-Line representation

Data-logger settings
 Sample rate: 1/s
 File name: C:\ENVEA_Process_GmbH

Save configuration
 Load configuration
 Print configuration

Version 6.32 | Device software version: 6.32 | Language: English

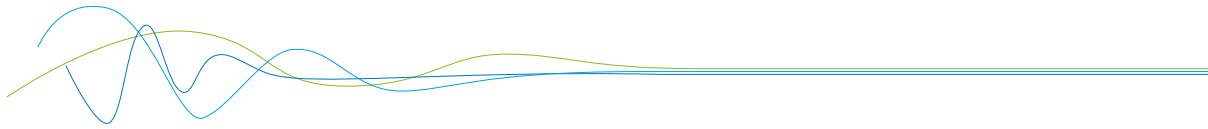
Calibration settings:

2.1 Calibration factor: 1.00
 2.2 Calibration filter [s]: 100
 2.3 Calibration points: 5

2.4 Calibration

Point	Calibration point	Raw value
2.4.1	1. Calibration point: 0.0 [% OSP]	0.000000
2.4.3	2. Calibration point: 10.0 [% OSP]	0.001000
2.4.5	3. Calibration point: 20.0 [% OSP]	0.002000
2.4.7	4. Calibration point: 30.0 [% OSP]	0.003000
2.4.9	5. Calibration point: 40.0 [% OSP]	0.004000

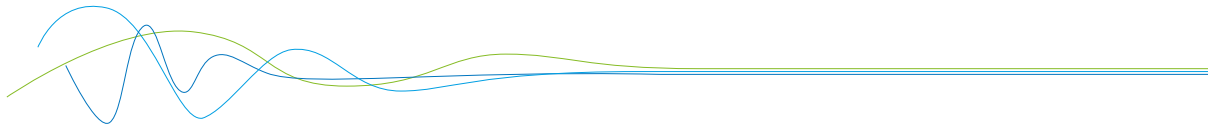
2.1	Calibration factor	Input: 0.01 ... 9.99	Factor for the subsequent adjustment of the actual measurement. All measurements are measured with this factor.
2.2	Calibration filter s	Input: 1 ... 9999	Filter time for recording the raw value during calibration. The raw values already measured over the set time period are combined into an average value.
2.3	Calibration points	Input: 2 ... 5	Number of support points for a linearisation above the operating range.
2.4	Calibration	Calibration submenu	
2.4.1	1. Calibration point	Input:	Output measurement value in the selected measurement value to be shown mass /time unit.
(2.4.2)	P1 calibration	Transfer: Raw value	Transfer the current raw value (filtered) from the mass flow with the key [←]. The value can also be entered manually.
	... (depending on the number of support points)		For additional support points (depending on [2.3]), additional value pairs can be set.
2.4.n	Pn value	Input: Measurement to be displayed	
2.4.n	Pn calibration	Transfer: Current raw value	



3. Alarm

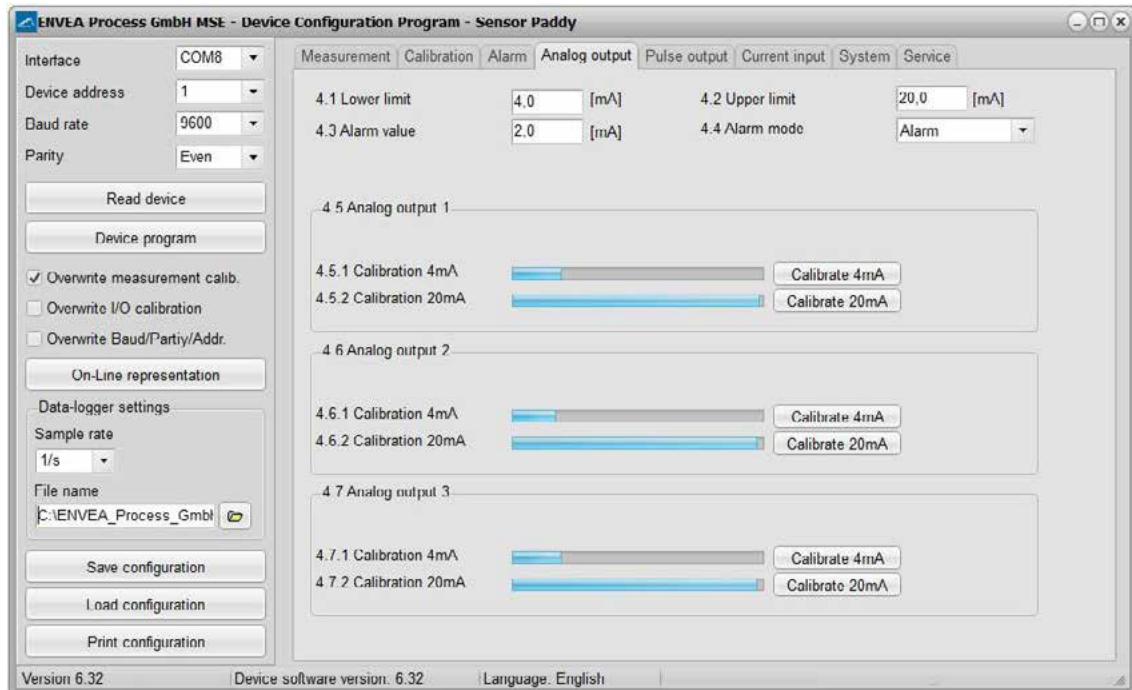
Setting for the alarm via the relay contacts.

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: NC / NO	NC: the relay is closed, current principle 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 section entitled Troubleshooting.



4. Analog 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: Alarm / Hold 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	Analogue 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

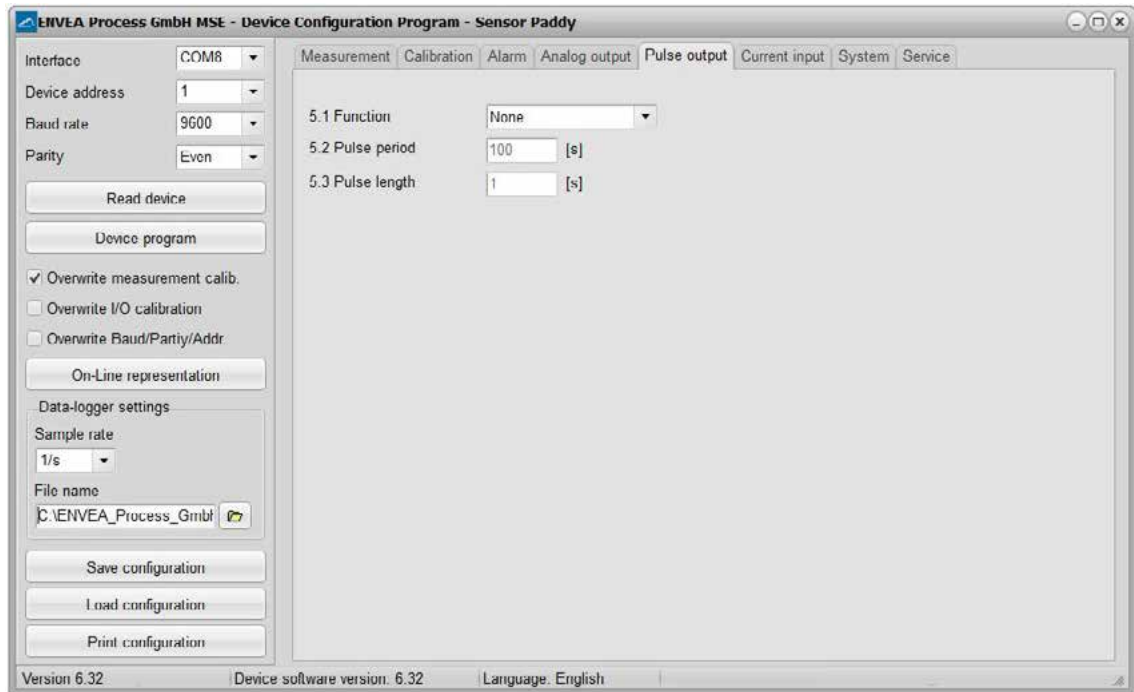
The current output can be calibrated so that the zero point (output of 4 mA) is set to the background noise of the measuring point. If the background noise decreases due to process changes, sensor wear or other ageing effects, a signal of less than 4 mA can be output at the analogue output. In this way, 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, the checkbox **Overwrite I/O calibration** must be set. If the checkbox is set the changed parameters can be sent to the Evaluation unit by clicking on **Device program**.

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 valve for pneumatic air flushing.

5.2 Pulse period

Input: 1 s ... 600 s

Duration between two pulses

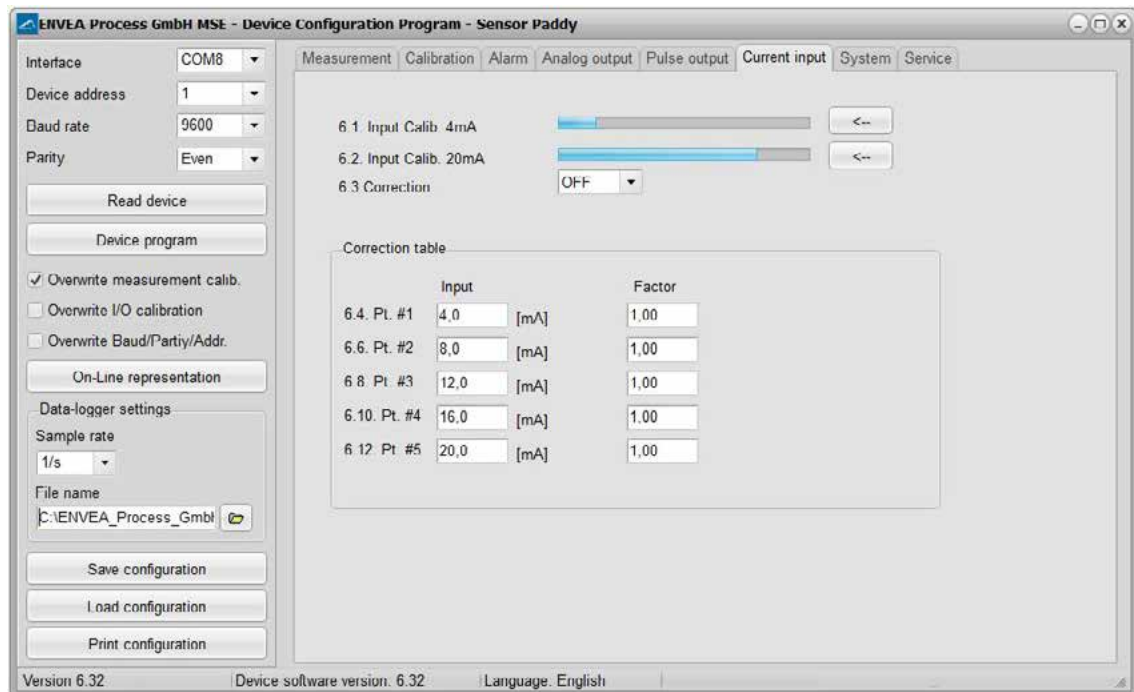
5.3 Pulse length

Input: 1 s ... 60 s

Length of the pulse

6. Current input

Option for auto-correction by external current signal.

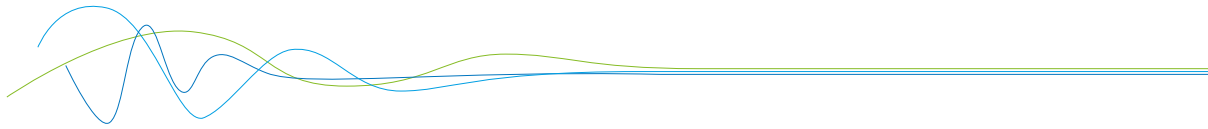


The signal is not electrically isolated.

If the connection is incorrect, the CPU of the Evaluation unit may be destroyed.

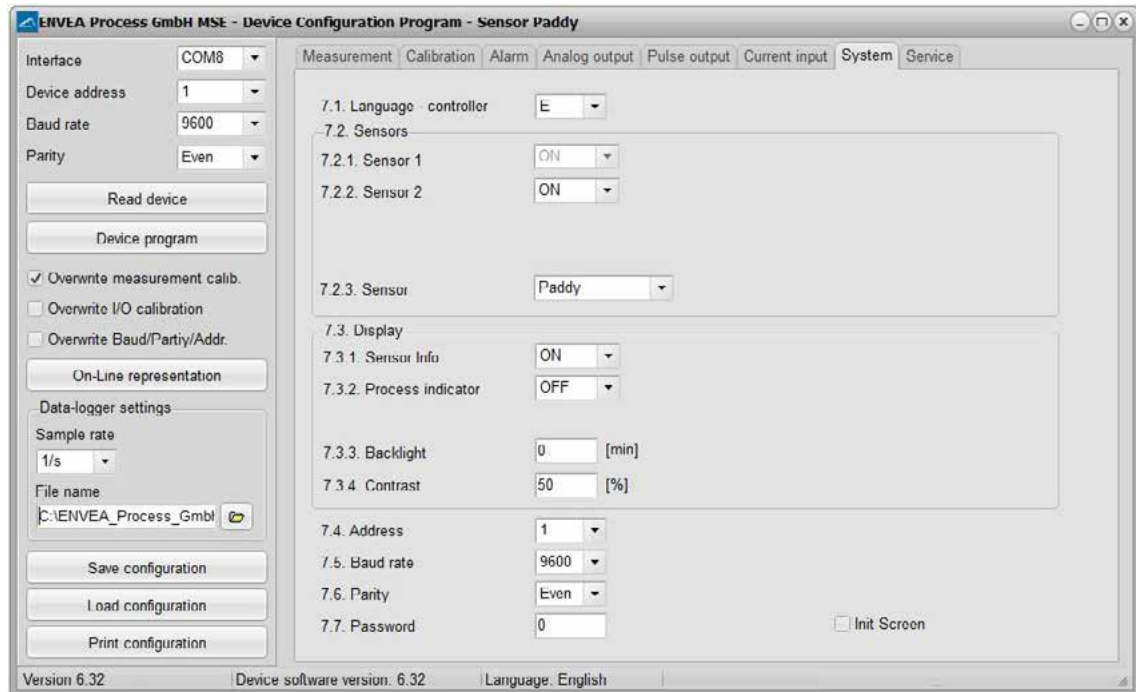
An external, galvanic isolation by means of a current disconnecter or similar must be provided.

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	Input 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 mA ... 20 mA	Option for further entry of current value and correction factors.
6.n	Pn factor	Input: 0.01 ... 10	

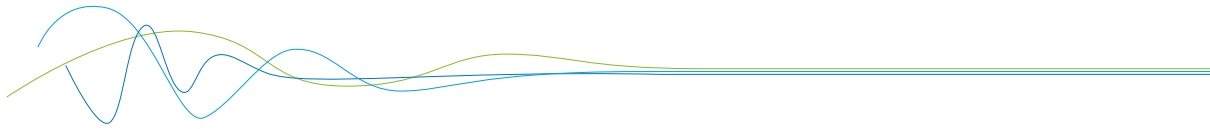


7. System

Basic adjustment of the system and Evaluation unit.



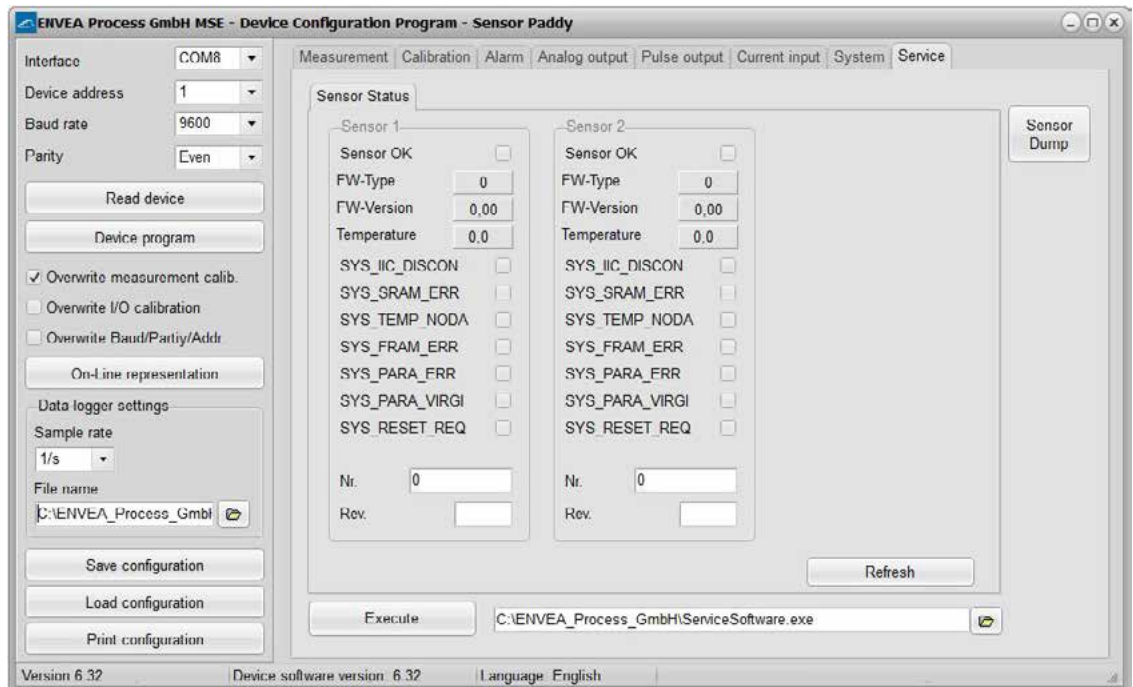
7.1	Language	Selection: D / E / F	Selection of the language on the display of the Evaluation unit
7.2	Sensors	Submenu	
7.2.1	Sensor 1	Selection: ON	Sensor 1 cannot be switched off, since at least one sensor is required for a measurement.
7.2.2	Sensor 2	Selection: ON / OFF	ON: Sensor is evaluated OFF: Sensor is ignored
7.2.3	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 connected sensor corresponds to the set sensor. The measurement values are calculated and potential errors are displayed based on the set sensor. 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 (RS 485 connection).
7.5	Baud rate	Selection: 4800 / 9600 / 19200 / 38400	Communication speed of the Evaluation unit if 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 after instruction by 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.

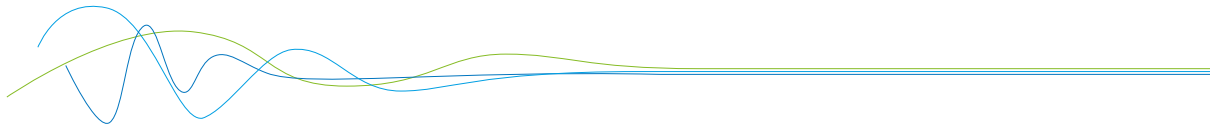
7. Start-up procedure

7.1 Basic start-up

Upon delivery, the sensor is not calibrated to the product to be measured and must be parametrised when started up. During the process, the raw values measured by the sensor are assigned the display values and output quantities required by the user.

The following points must be checked before commissioning:

- Correct installation of the baffle plates in the transport pipeline as per the information provided by ENVEA Process.
- The correct flush-mounting of the sensor on the internal wall of the transport pipe.
- The correct electrical connection between the sensor, C3-Box and Evaluation unit.
- After switching on the supply voltage, a warm-up phase of at least 5 minutes must be observed.



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. Measurement range**.

The **1.2 Unit** is a free text unit, for which 10 characters are available. For the Paddy, we recommend using the unit: **% OSP** (% Over Size Particle), since the measuring point is calibrated to a defined oversize allowance.

The system is then calibrated via at least two calibration points in **2. Calibration**.

For the calibration it is absolutely necessary to add coarse material to the fine flow. It is recommended to use the first calibration point for the good condition and the additional calibration points for the addition of coarse material.

Good condition	When the process is running and the material flow is stable, the first calibration point is read in. To do this, in 2.4.1 - 1. Calibration point a value of "0" is entered and then assigned to the corresponding raw value (2.4.2 Raw value). The raw value is entered either by direct read-in or is manually determined via the data logger function in the PC software.
Calibration point 1	When the process is running, a mass of coarse material of at least 10 % is added as evenly as possible to the "clean" material flow. Subsequently, in 2.4.n - 2. Calibration point , the added percentage of oversize material is entered and assigned to the associated raw value. The raw value is entered either by direct read-in or is manually determined via the data logger function in the PC software.

Once the calibration points have been saved, the transfer of the calibration parameters must be confirmed. On the Evaluation unit in the field housing, this is done by a security query when exiting the menu structure. In the software, a tick must be set next to **Overwrite calibration**.

If the tick is set, the parameters can be sent to the Evaluation unit by clicking on **Device program**.

The configuration of the device's basic functions is thus complete and an alarm can be set and output.

Additional calibration points	If it is possible to calibrate for different levels of coarse material up to 5 support points can be selected in 2.3 Number of calibration points . Each additional support point is calibrated in the same way as for <i>Calibration point 1</i> .
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7.2 Data logger function in the software

To determine the raw values via the data logger function in the PC software, a file path must first be stored. The file path and file name can be selected after clicking on the folder icon (next to file name). Once the file path has been stored, it is still possible to change the storage rate. This is recommended for long-term logging. To determine the raw values for a calibration point, the default setting of 1 (raw value) per second is recommended.

To start the data logger, the **On-Line representation** must be opened. As soon as the tick is set by **Data logger activated** in the On-Line representation, 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.

To evaluate the recorded log file, it must be opened with Excel or a similar program.

The content of each column of the log file is named in the first line.

In order to determine the appropriate raw value for a calibration point, the mean value must be determined from the time period of the coarse material addition, or from the stable "clean" material flow. The mean value can be calculated by Excel using the function **=AVERAGE()**. The calculated mean value of the raw value is then entered in the box next to **Raw value** in the configuration software.

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 assignment of the analogue output values takes place in 4. analogue output . Upper and lower limit of the permitted current and the fault current are set here. The analogue output is an active signal. In the field housing version, analogue outputs 2 + 3 are provided for the MaxxFlow HTC. All other sensors provide their 4 ... 20 mA signal to analogue output 1.
Pulse output	In 5. Pulse output there is an option to use a cleaning pulse. This impulse may be for pneumatic cleaning of the sensor (if available).
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 <u>or</u> 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).

8.1 Compatibility

For the Paddy system, the software version 6.xx or higher is available for the Evaluation unit and the associated PC software.

Technical innovations may include the addition of new functions, so that only corresponding variants of the Evaluation unit and PC software can be operated together.

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, ENVEA Process will replace or repair defective components at its factory free of charge at its discretion. Replaced parts will become the property of ENVEA Process. If the customer requests that parts be repaired or replaced at its site, the customer must pay the travel expenses for ENVEA Process service personnel.

ENVEA Process cannot accept any liability for damage not caused to 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.	Power supply interrupted.	Check the power supply.
POW LED does not light up.	Cable break.	Check the connection cables for a possible cable break.
	Defective fuse.	Replace fuse.
RUN LED does not light up.	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.
The warranty will be rendered void if you open the device.		

11.1 Error codes

Type	Error code	Flashing RUN LED	Current output	Cause	Action
ERR	DISC	3	2 mA	Sensor not detected or wrong sensor detected	Check supply, communication lines, shielding and software settings
ERR	ID	3	2 mA	Sensor responds with wrong ID	Check whether selected sensor type matches with connected sensor
ERR	E002	3	2 mA	Internal data bus defective	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E020	3	2 mA	Internal data memory defective	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E040	3	2 mA	Internal temperature measurement defective	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E080	3	2 mA	Internal parameter memory defective	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E100	3	2 mA	Parameter table not readable	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E200	3	2 mA	Parameter table not described	Switch off power supply for at least 10 s, reprogram parameters, if not helpful: replace
ERR	E400	3	2 mA	Reset request not executable	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E001	3	2 mA	Internal amplifier defective (DC offset)	Switch off power supply for at least 10 s, if not helpful: replace
ERR	E200	3	2 mA	Internal amplifier defective (channels)	Switch off power supply for at least 10 s, if not helpful: replace
ERR	UT-K	3	2 mA	Critical low temperature, measurement value output not possible	Check heater, observe heating time, insulate cooling sources
ERR	OT-K	3	2 mA	Critical overtemperature, measurement value output not possible	Insulate heat sources in the vicinity
PROC	UT	2	4 ... 20 mA	Low temperature, warning: unreliable measurement value	Check heater, observe heating time, insulate cooling sources
PROC	OT	2	4 ... 20 mA	Overtemperature, warning: unreliable measurement value	Insulate heat sources in the vicinity
PROC	P010	2	4 ... 20 mA	Low measurement signal	Adjust limit value, increase test flow of material
PROC	P040	2	4 ... 20 mA	Measurement signal too high	Adjust limit value, decrease test flow of material
PROC	P000	2	4 ... 20 mA	Measuring signal indicates Quality 0	Check installation situation and material flow

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

12. Connection examples

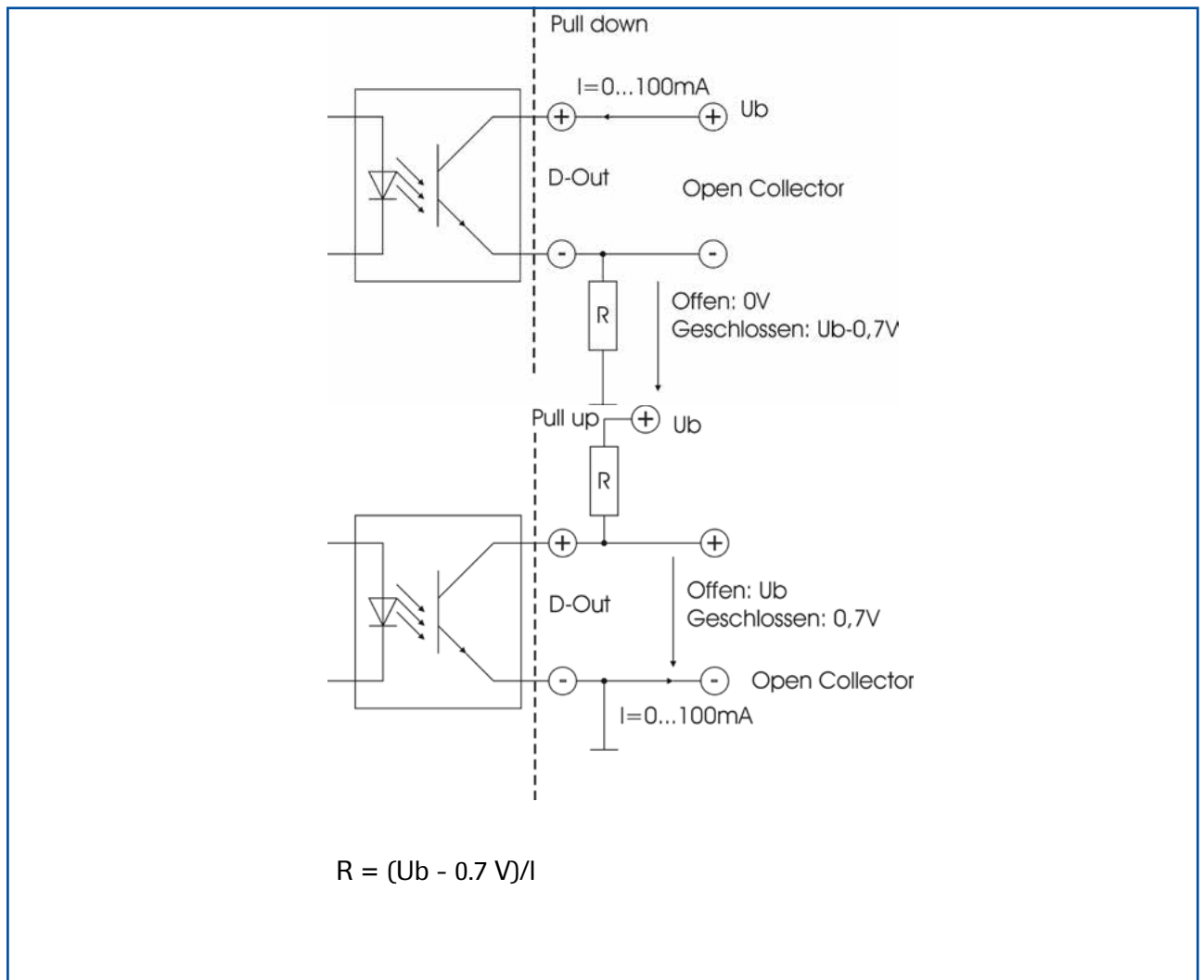
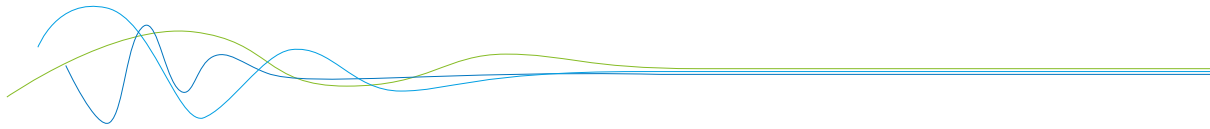


Fig. 17: Pulse output



13. Technical data

Sensor	
Housing material	Stainless steel 1.4571
Protection category	IP65, dust explosion zone 20 or gas explosion zone 1 (optional)
Process temperature	Sensor tip: -20 ... + 80 °C Optional: -20 ... + 200 °C Sensor element: 0 ... + 60 °C
Max. operating pressure	1 bar, optional 10 bar
Operating frequency	K-Band 24.125 GHz, \pm 100 MHz
Transmission power	Max. 5 mW
Weight	1.3 kg
Dimensions	Ø 60, Ø 20, L 271 mm
Evaluation unit MSE 300-FH	
Power supply	110/230 V, 50 Hz (optional 24 V DC)
Power consumption	20 W / 24 VA
Protection category	IP65 to EN 60 529/10.91
Ambient operating temperature	-10 ... +45 °C
Dimensions	258 x 237 x 174 (W x H x D)
Weight	Approx. 2.5 kg
Interface	RS 485 (ModBus RTU) / USB
Cable screw connectors	3 x M20 (4.5 – 13 mm Ø)
Connection terminals cable cross-section	0.2 – 2.5 mm ² [AWG 24-14]
Current output	3 x 4 ... 20 mA (0 ... 20 mA, load < 500 Ω (Active)
Relay contact	Max. rated load: 250 V AC Max. peak current: 6 A Max. rated load 230 V AC: 250 VA Max. breaking capacity DC1: 3/110/220 V: 3/0.35/0.2 A Min. switching load: 500 mW (10 V/5 mA)
Data backup	Flash memory
Pulse output	Open collector – max. 30 V, 20 mA
Evaluation unit MSE 300-DR	
Power supply	24 V DC \pm 10 %
Power consumption	20 W / 24 VA
Protection category	IP40 to EN 60 529
Ambient operating temperature	-10 ... +45°C
Dimensions	23 x 90 x 118 (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 mm ² [AWG 24-14]
Current output	1 x 4 ... 20 mA (0 ... 20 mA, load < 500 Ω (Active)
Relay contact	Max. rated load: 250 V AC Max. peak current: 6 A Max. rated load 230 V AC: 250 VA Max. breaking capacity DC1: 3/110/220 V: 3/0.35/0.2 A Min. switching load: 500 mW (10 V/5 mA)
Data backup	Flash memory
Pulse output	Open Collector – Max. 30 V, 20 mA

