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# 1 General Information

This user manual serves for ensuring proper handling and optimal functioning of the device. The user manual shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair. E+E Elektronik Ges.m.b.H. does not accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

All information, technical data and diagrams included in this document are based on the information available at the time of writing. It may contain technical inaccuracies and typographical errors. The contents will be revised on a regular basis and changes will be implemented in subsequent versions. The described product(s) and the contents of this document may be changed or improved at any time without prior notice.

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## PLEASE NOTE

Find this document and further product information on our website at [www.epluse.com/ee776](http://www.epluse.com/ee776).

## 1.1 Explanation of Warning Notices and Symbols

### Safety precautions

Precautionary statements warn of hazards in handling the device and provide information on their prevention. The safety instruction labeling is classified by hazard severity and is divided into the following groups:

### DANGER

**Danger** indicates hazards for persons. If the safety instruction marked in this way is not followed, the hazard will very likely result in severe injury or death.

### WARNING

**Warning** indicates hazards for persons. If the safety instruction marked in this way is not followed, there is a risk of injury or death.

### CAUTION

**Caution** indicates hazards for persons. If the safety instruction marked in this way is not followed, minor or moderate injuries may occur.

### NOTICE

**Notice** signals danger to objects or data. If the notice is not observed, damage to property or data may occur.

### Informational notes

Informational notes provide important information that stands out due to its relevance.

## INFO

The information symbol indicates tips on handling the device or provides additional information on it. The information is useful for reaching optimal performance of the device.

The title field can deviate from "INFO" depending on the context. For instance, it may also read "PLEASE NOTE".

## 1.2 Safety Instructions

### 1.2.1. General Safety Instructions

#### NOTICE

Improper handling of the device may result in its damage.

- The EE776 enclosure, the sensing probe and the sensing module shall not be exposed to unnecessary mechanical stress.
- Do not apply the supply voltage to the RS485 data lines.
- Use the EE776 only as intended and observe all technical specifications.

### 1.2.2. Intended Use

The flow sensor is intended to be used for the measurement of air, non-corrosive and other non-flammable gases in pipelines only. Please consult E+E Elektronik if the measurement is to be carried out in wet or filthy gases.

The EE776 flow sensor design allows for measurement in a pressurized system up to PN16 (16 bar / 230 psi).

#### WARNING

Non-compliance with the product documentation may cause safety risks for people and the entire measurement installation.

- Mounting, electrical installation, putting in operation and maintenance should only be done by qualified personnel. The plant operator should authorize qualified personnel to operate on the installation.
- The use of the flow sensor EE776 in any other way than described in this manual bears a safety risk for people and the entire measurement installation and is therefore not allowed.
- The manufacturer cannot be held responsible for damages as a result of incorrect handling, installation, and maintenance of the equipment.
- To avoid health risks or damage to the equipment, the installation should not be operated on with tools, which are not specifically mentioned or described in this manual.
- Excessive mechanical stress and inappropriate handling must be avoided.
- A short interruption of the flow using the measurement ball valve cannot be avoided when exchanging the sensing probe.
- The flow sensor can only be utilized in accordance with the conditions defined in the technical data. Otherwise, inaccuracies in the measurement will occur and equipment failures cannot be ruled out.
- For the safety of the user and for the functionality of the equipment the recommended steps by the manufacturer to put into operation, to test and to maintain should be taken and completed.

#### NOTICE

Failing to follow the instructions in this user manual may lead to measurement inaccuracy and device failures.

- The EE776 may only be operated under the conditions described in this user manual and within the specification included in chapter 9 Technical Data.
- Unauthorised product modifications result in the loss of all warranty claims. Modifications may only be made with the explicit authorisation of E+E Elektronik Ges.m.b.H.!

### 1.2.3. Mounting, Start-up and Operation

The EE776 has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory after fulfilling all safety criteria. The manufacturer has taken all precautions to ensure safe operation of the device. The user must ensure that the device is set up and installed in a way that does not impair its safe use. The user is responsible for observing all applicable local and international safety guidelines for safe installation and operation of the device. This user manual contains information and warnings that must be observed by the user in order to ensure safe operation.

**i PLEASE NOTE**

The manufacturer or his authorized agent can only be held liable in case of willful or gross negligence. In any case, the scope of liability is limited to the corresponding amount of the order issued to the manufacturer. The manufacturer assumes no liability for damages incurred due to failure to comply with the applicable regulations, operating instructions or the specified operating conditions. Consequential damages are excluded from the liability.

**⚠ WARNING**

Non-compliance with the product documentation may cause accidents, personal injury or property damage.

- Mounting, electrical installation, commissioning, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorized by the operator of the facility to carry out the mentioned activities.
- The qualified staff must have read and understood this user manual and must follow the instructions contained within.
- All process and electrical connections shall be thoroughly checked by authorized staff before putting the device into operation.
- Disconnect the device from power supply before opening or closing to avoid damages.
- Do not install or start-up a device supposed to be faulty. Ensure that such devices are not used accidentally by clearly marking them as faulty.
- A faulty device shall be removed from the process.
- Service operations other than described in this user manual may only be performed by the manufacturer.

## 1.3 Environmental Aspects

**i PLEASE NOTE**

Products from E+E Elektronik Ges.m.b.H. are developed and manufactured in compliance with all relevant environmental protection requirements. Please observe local regulations for the disposal of the device.



For disposal, the individual components of the device must be separated according to local recycling regulations. The electronics shall be disposed of correctly as electronics waste.

# 2 Scope of Supply

- EE776 Flow Sensor for Compressed Air and Gases DN50 - DN700 (2" - 28") according to the Ordering Guide
- Inspection certificate according to DIN EN 10204-3.1
- User Manual

# 3 Product Description

## 3.1 General

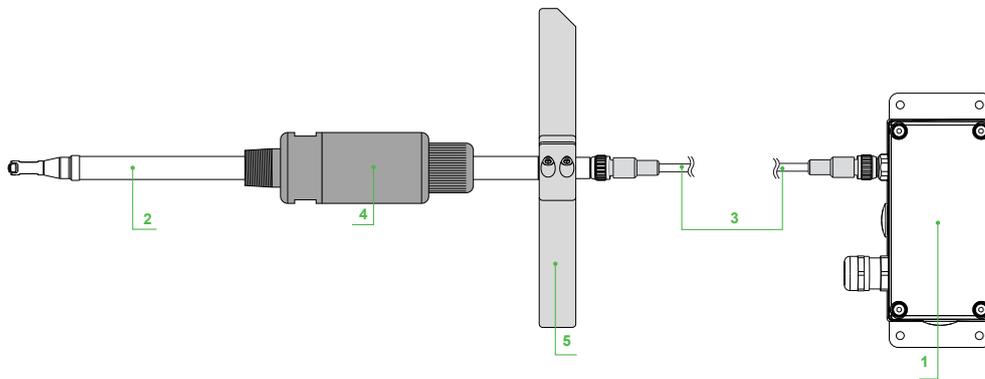
The EE776 flow sensor operates on the thermal mass flow measurement principle and is suitable for measuring the flow of air and gases in pipelines. Gases can be e.g. compressed air, nitrogen, helium, CO<sub>2</sub> or other non-corrosive and non-flammable gases.

The EE776 measures flow velocity and volume flow at standard conditions according to DIN 1343 (p<sub>n</sub> = 1013.25 mbar (14.7 psi); T<sub>n</sub> = 0 °C (32 °F)). Additionally to the standard volume flow, it measures mass flow, norm flow and temperature. The value of the integrated consumption meter is not lost after a power failure.

Two signal outputs are available. Depending on the ordered version, the outputs can be configured as analogue (current or voltage) output, as switch output or as pulse output for consumption metering and optionally with additional digital interface (Modbus RTU or M-Bus).

The freely available configuration software can be used to configure all outputs, to perform sensor adjustment, to change process parameters and standard conditions, to enter the current process pressure for compensation and to set the communication parameters of the digital interface.

### Associated Numbering with Description



#### 1. Signal conditioning with optional display

The enclosure with signal conditioning is remote with a pluggable sensor cable up to 10 meters (33 feet).

#### 2. Sensing probe with measurement electronics

The interchangeable sensing probe contains the sensing element and the measurement electronics, in which the data of the factory calibration is stored. The sensing probe is easily and quickly interchangeable in the field, independent of the electronics for the signal conditioning. After the exchange of the probe, the configuration of the outputs is unchanged.

#### 3. Sensor cable

The sensor cable allows remote installation (up to 10 meters (33 feet)), of the sensing probe from the enclosure with signal conditioning.

#### 4. Non-return protection for secure mounting

The patented non-return protection combines three functions in one device:

- **Non-return protection**

The sensor can only be pushed in one direction during installation. The sensor cannot return at all, even if it is released.

- **Seal**

An encapsulated O-ring ensures that no compressed air can escape under pressure during assembly.

- **Accurate positioning**

The precise positioning with respect to immersion depth and orientation is easy to perform, guaranteeing accurate measurement results.

#### 5. Mounting grip

With the mounting grip, the sensing probe is inserted and correctly positioned into the pipe line.

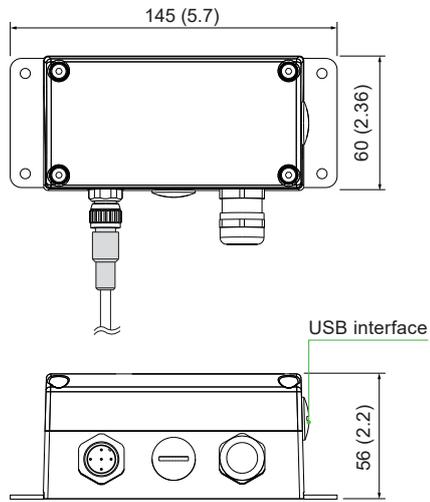
Fig. 1 Part description

### 3.2 Dimensions

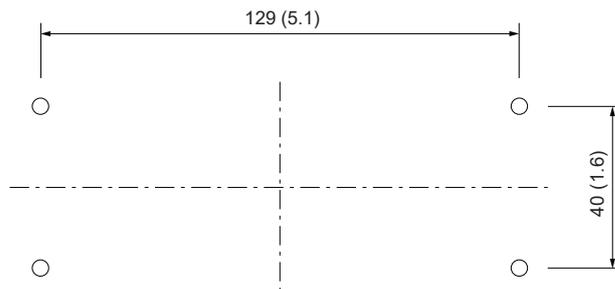
Values in mm (inch)

#### Enclosure

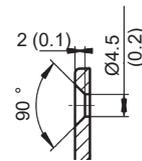
Signal conditioning unit



#### Drilling Plan



#### Cross-section bore hole



The bottom part of the enclosure is mounted with 4 screws (not in the scope of supply). Max. screw diameter: 4.5 mm (0.17 inch), e.g. 4.2 x 38 mm DIN 7938H screws

Sensor Probe

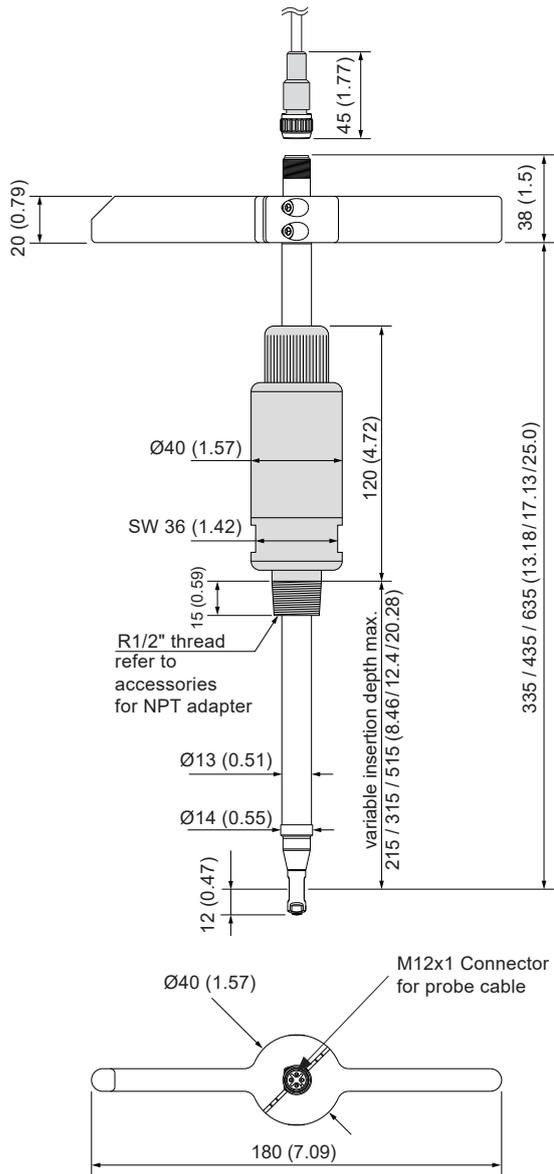


Fig. 2 Dimensions

### 3.3 Display

EE776 is available with an optional 2-line liquid crystal display and soft keys. Please find details on capabilities and operation in chapter 6.3 Display / Indicator with Keypad (Optional).

# 4 Mounting and Installation

## 4.1 Determining the Installation Site

- The installation site should be easy to access and free of vibrations and shocks.
- A clearance must be maintained above the enclosure with signal conditioning so that the sensor can be removed if necessary:
  - at least **500 mm** (19.7") for probe length 215 mm (8.46") DN50 (2") up to DN100 (4")
  - at least **600 mm** (23.6") for probe length 315 mm (12.4") DN125 (5") up to DN300 (12")
  - at least **800 mm** (31.5") for probe length 515 mm (20.28") DN350 (14") up to DN700 (28")
- The ambient temperature should not exceed the value stated in the specifications (please refer to chapter 9 Technical Data) – consider heating by radiation.
- The air purity must be on the installation site must be at least class 3.4.4 in accordance with ISO 8573-1:2010
- Fluids should not condense at the installation site. Condensation on the tip of the sensing probe must be avoided.
- In compressed air systems, the installation must be downstream of the dryer. In case of no dryer, there must at least be a steam trap and suitable filters.
- The direction of the flow by the installation must be observed (refer to chapter 4.2 Installation Position).
- The recommended straight pipe lengths up and downstream of the device must be observed to ensure the specified measurement accuracy.
- The flow sensor should be installed as far as possible from any flow disturbance. Valves or check-valves should be installed in a respective distance from the flow sensor.

### 4.1.1. Process Pressure

Due to its measurement principle, the thermal mass flow sensor EE776 is largely independent of the process pressure and is factory calibrated at a pressure of 9 bar (130.5 psi).

In order to achieve the highest measurement accuracy, the slight dependence on process pressure can be compensated for in two ways:

- If the process pressure is stable, by programming the pressure value in the configuration software (refer to chapter 11.5.6 Setting up Process Parameters).
- In case of strong fluctuations of the process pressure (e.g. 3...10 bar (40...150 psi)), an external pressure sensor can be installed and connected to the pressure compensation input (refer to chapter 11.5.7 External Pressure Sensor for Pressure Compensation).

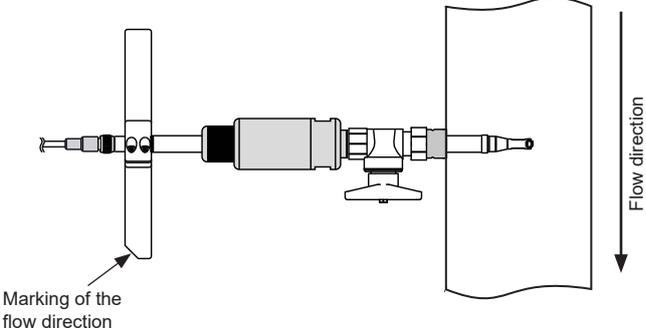
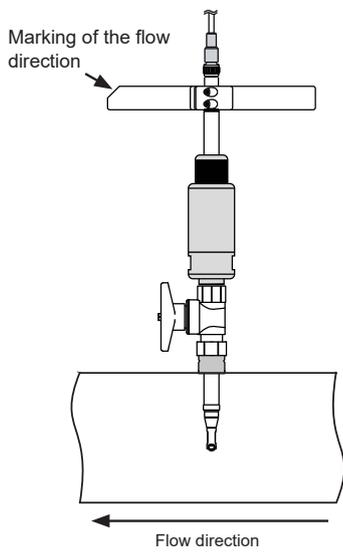
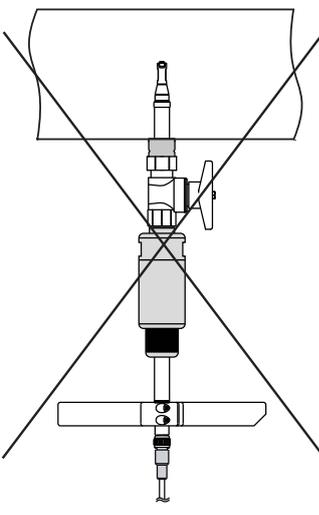
#### **WARNING**

Modifying the measuring system in a pressurised piping system may cause safety risks for people and the entire measurement installation.

In order to install, modify or remove the measurement section the pipeline system must be depressurized.

## 4.2 Installation Position

The flow sensor has a specified direction of flow. Make sure that the arrow on the tip of the sensing probe is pointing in the direction of the flow.

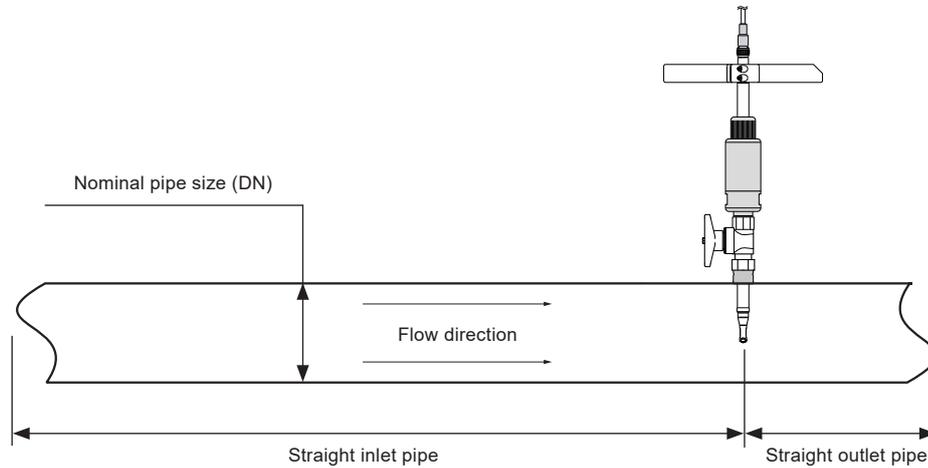
Mounting	Recommended
<p>Pipeline vertical, sensor horizontal</p> 	<p>Yes</p>
<p>Pipeline horizontal, sensor vertical upwards or horizontal</p> 	<p>Yes</p>
<p>Pipeline horizontal, sensor downwards</p> 	<p>No</p>

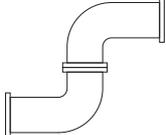
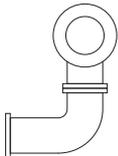
Tab. 1 Correct or incorrect sensor position

### 4.3 Required Length of Straight Pipe

The flow sensor should be installed as far as possible from disturbances of the flow. The causes for disturbance of the flow are for instance reducers, elbows, T-pieces, valves, gate valves, etc. The specified measurement accuracy can be achieved only when the following straight inlet and outlet pipe lengths are installed:

- The stated values are a minimum. If possible, larger distances should be planned.
- Valves or gate valves should be installed downstream of the flow sensor.
- When working with lighter gases the inlet straight pipe should be longer.



Types of pipes		DN = Nominal Pipe Size	
		Straight Inlet pipe	Straight Outlet pipe
	Extension	15 x DN	5 x DN
	Reduction	15 x DN	5 x DN
	90° - elbow	20 x DN	5 x DN
	Two 90° - elbows, in one level	25 x DN	5 x DN
	Two 90° - elbows, in two levels, T-piece	30 x DN	5 x DN
	Valve, gate valve	50 x DN	5 x DN

Tab. 2 Optimum conditions to achieve the specified measurement accuracy

## 4.4 Installation in the Pipeline

The patented non-return protection device for reliable installation combines three functions in one unit:

- **Non-return protection**

The sensor can only be pushed in one direction during installation. The sensor cannot return at all, even if it is released.

- **Seal**

An encapsulated O-ring ensures that no compressed air can escape under pressure during assembly.

- **Accurate positioning**

The precise positioning with respect to immersion depth and orientation is easy to perform, guaranteeing accurate measurement results.

An installation example with the weld-on nipple in combination with the 1/2" ball valve is described below. The same principles apply for installation with the tapping sleeve.

1. Pull the sensor back into the non-return protection device as far as it will go.
2. Screw the non-return protection device into the ball valve using suitable sealants for a fully sealed connection.
3. Screw knurled nut in by approximately one thread turn.



Fig. 3 Position of the knurled nut

4. Open the ball valve and dip the measurement sensor into the pipeline.

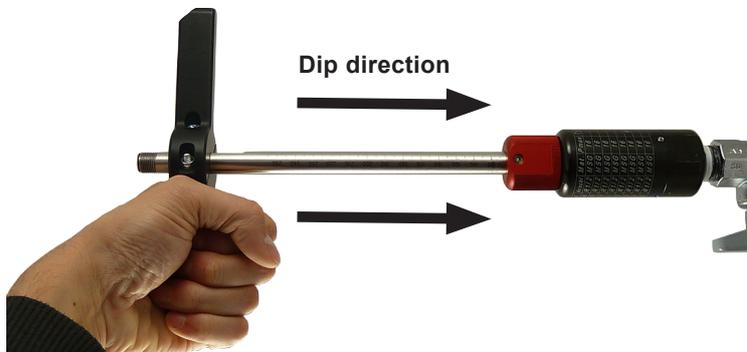


Fig. 4 Dip direction

5. Positioning in the pipeline

**NOTICE**

The sensor head must be positioned in the centre of the pipeline to ensure that the accuracy specified in the datasheet is maintained. The scale on the sensor pipe for the immersion depth refers to the centre of the sensor head.

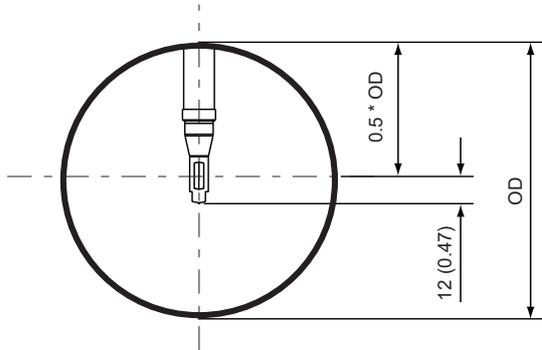


Fig. 5 Correct position in the pipeline

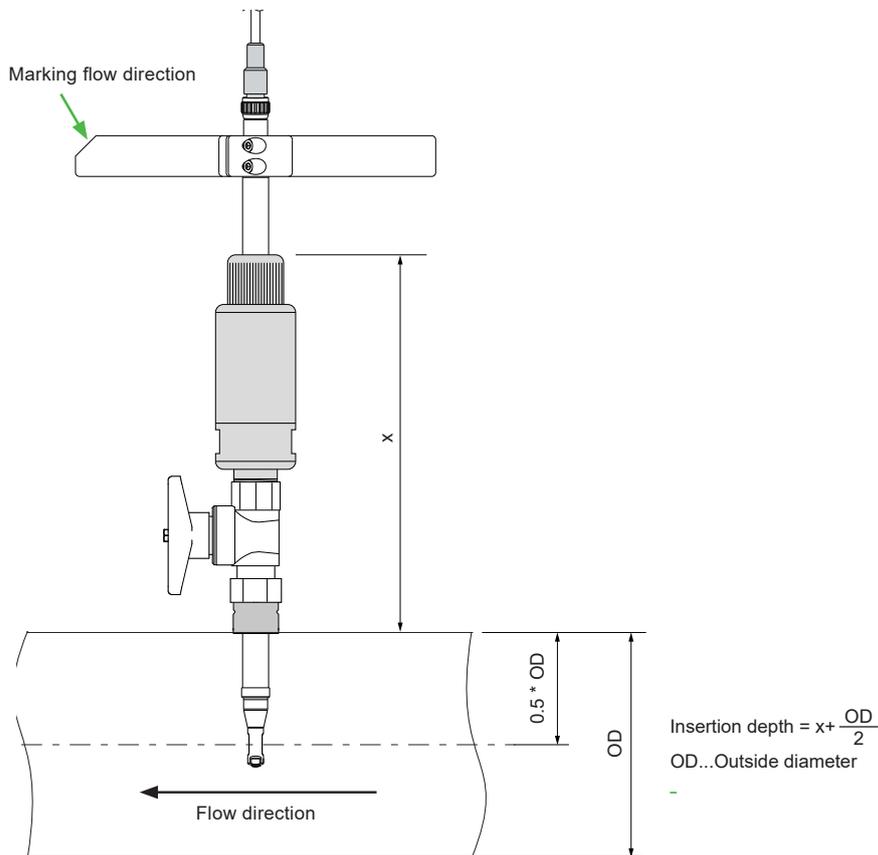


Fig. 6 Assembly, insertion depth

- If the sensor is immersed too far into the pipeline, it can be retracted again by unlocking the non-return protection device. To do this, the knurled nut is slowly pressed inwards. Similar to the pressure point in a car clutch, the immersion depth can be set to the desired millimetre value.



Fig. 7 Immersion depth adjustment

- Align the sensor with the flow direction.

**NOTICE**

The sensor has a set flow direction. The direction arrow on the sensor head or the marking and the mounting handle must point in the media flow direction.

The sensor is aligned accurately in the direction of flow using the mounting handle. An angular deviation from the ideal position must not be greater than  $\pm 5^\circ$ .

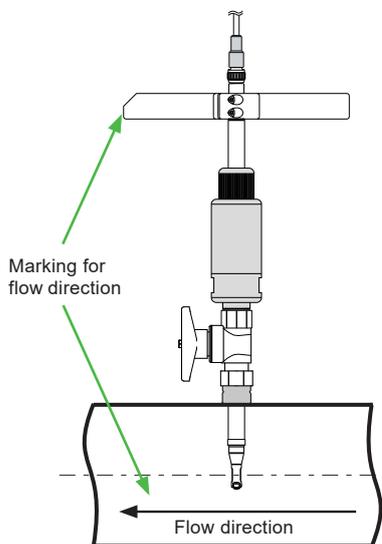


Fig. 8 Marking of the flow direction

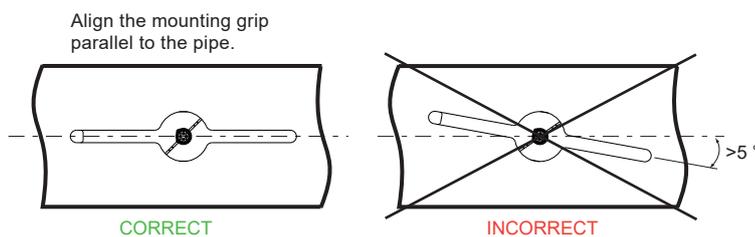


Fig. 9 Alignment of the mounting grip

8. When the measurement sensor is correctly positioned in terms of immersion depth and alignment, tighten the knurled nut with a screw wrench (AF 27).



Fig. 10 Tighten the knurled nut

9. To prevent inadvertent twisting of the probe in use, tighten the grub screw.



Fig. 11 Tighten the grub screw

10. Connect the sensor and the evaluation unit to the sensor cable.

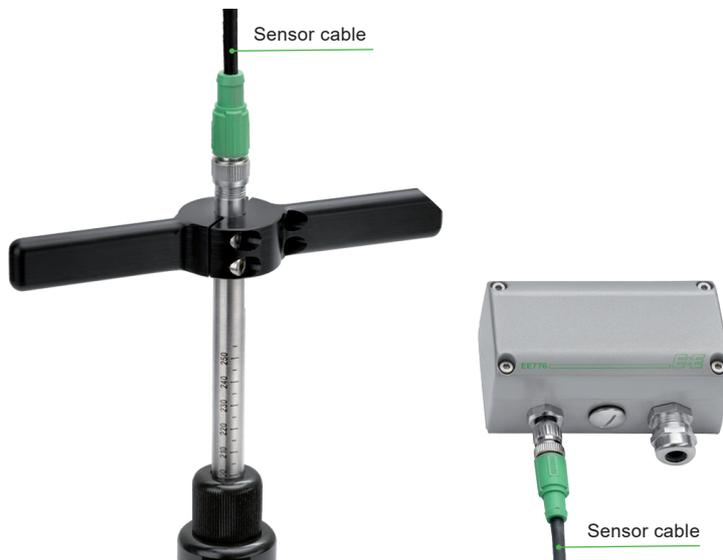


Fig. 12 Connection with the sensor cable

## 4.5 Setting the Pipe Diameter

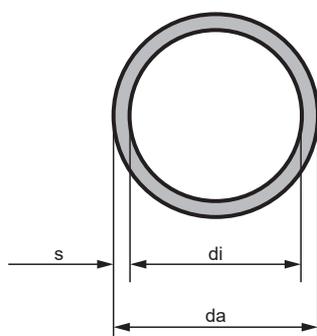
The flow sensor is factory-set so that the average corrected flow speed is measured in the pipe. The Standardized volume flow is calculated by the flow sensor as follows:

$$\dot{V}_0 = v_0 * d_i^2 * \pi/4 * 3600$$

Measurand	SI Unit	US/GB Unit	
$\dot{V}_0$	Standardized volume flow	m <sup>3</sup> /h	SCFM
$v_0$	Standardized flow	m/s	SFPM
$d_i$	Internal diameter of pipe	m	inch
$\pi$	3.1415		

### NOTICE

The internal diameter is always set to 54.5 mm (2.15") per factory-default. The inner diameter of a pipe is not standardized and varies depending on the pipe wall thickness (refer to Tab. 3 below), therefore the actual inner diameter of the pipe must be set using the configuration software! (refer to chapter 11.5.6 Setting up Process Parameters)



Nominal Diameter DN	Inch	External Diameter	Wall thickness	Internal Diameter
		da (mm/inch)	s (mm/inch)	di (mm/inch)
50	2	60.3 / 2.37	2.9 / 0.11	54.5 / 2.15
65	2 1/2	76.1 / 3.0	2.9 / 0.11	70.3 / 2.77
80	3	88.9 / 3.5	3.2 / 0.13	82.5 / 3.25
100	4	114.3 / 4.5	3.6 / 0.14	107.1 / 4.22
125	5	139.7 / 5.5	4.0 / 0.16	131.7 / 5.19
150	6	168.3 / 6.63	4.5 / 0.18	159.3 / 6.27
200	8	219.1 / 8.63	6.3 / 0.25	206.5 / 8.13
250	10	273.0 / 10.75	6.3 / 0.25	260.4 / 10.25
300	12	323.9 / 12.75	7.1 / 0.28	309.7 / 12.19
350	14	355.6 / 14.00	8 / 0.31	339.6 / 13.37
400	16	406.4 / 16.00	8.8 / 0.35	388.8 / 15.31
500	20	508 / 20.00	11 / 0.43	486 / 19.13
600	24	610 / 24.00	12.5 / 0.49	585 / 23.03
700	28	711 / 28.00	14.2 / 0.56	682.6 / 26.87

Tab. 3 Typical values for pipe diameter

# 5 Electrical Connection

## NOTICE

The power supply must be switched off before the electrical connection is made. Failure to do so may damage the electronics. Only a qualified electrical engineer may install the device.

- Unscrew the four screws and remove the cover of the housing.
- The screw terminals are located in the bottom part of the enclosure.
- For the electrical connection of the flow sensor a 6-wire cable is needed (e.g. 6x1 mm<sup>2</sup> (AWG 17)).

## 5.1 Connection Diagram

### ⚠ WARNING

Incorrect installation, wiring or power supply may cause overheating and therefore personal injuries or damage to property.

- For correct cabling of the device, always observe the presented wiring diagram for the product version used.
- The manufacturer cannot be held responsible for personal injuries or damage to property as a result of incorrect handling, installation, wiring, power supply or maintenance of the device.

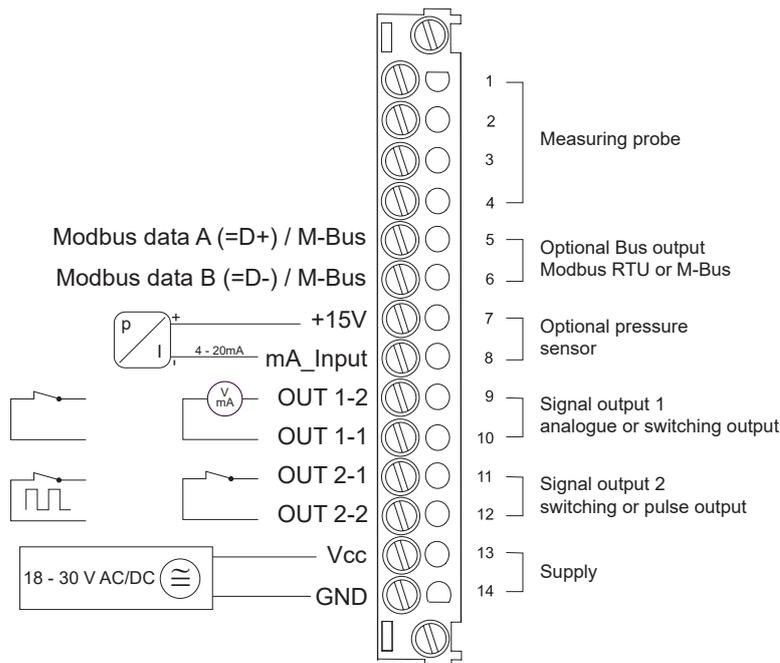
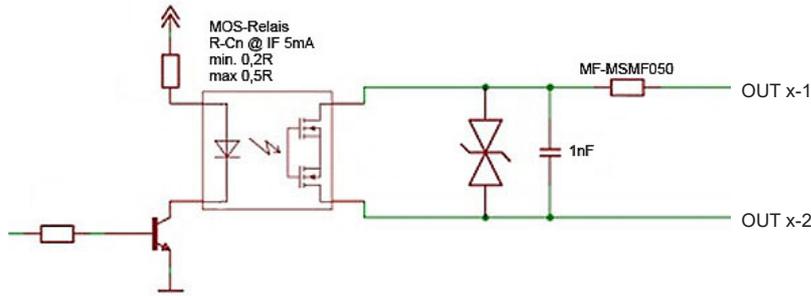


Fig. 13 EE776 connection options

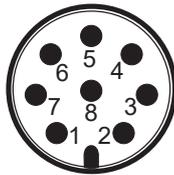
- Screw terminal OUT 1-1 for the analogue output is internally connected with GND.
- The enclosure should be grounded to achieve optimal electromagnetic compliance.

### 5.1.1. Relay and Pulse Output, Internal Switching



The relay switch and pulse outputs are potential free.

### 5.1.2. Connection with Optional Plug for Power Supply and Outputs (Order Code E4)



Connection plug for the power supply and analogue outputs (rear view of the terminals)

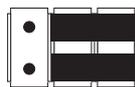
Pin	Assignment
1	OUT 2-2
2	OUT 1-2
3	OUT 1-1
4	GND
5	OUT 2-1
6	n.c.
7	Vcc
8	n.c.

## 6 Setup and Configuration

### 6.1 Jumpers for output configuration

If the signal output is altered from the relay to the analogue output or vice versa, jumper output 1 has to be relocated. If the analogue output is altered from a current to a voltage output or vice versa, jumper Out-1 has to be relocated.

Signal output 1 = switching output



Signal output 1 = analogue output



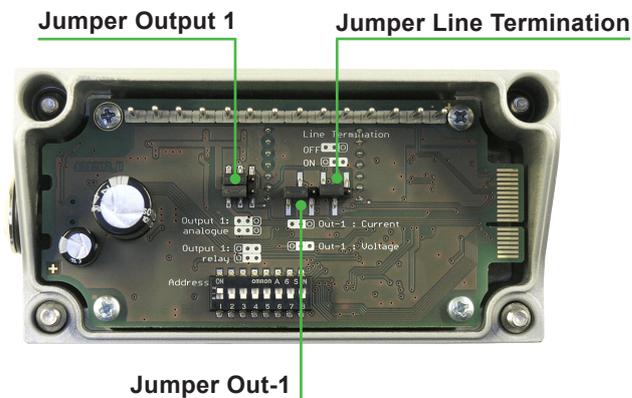
#### Modbus RTU only



Line termination = OFF



Line termination = ON  
150 Ω parallel to Bus output A and B



Analogue output = current signal (e.g. 4 - 20 mA)



Analogue output = voltage signal (e.g. 0 - 10 V)



Fig. 14 Jumper positions

## 6.2 USB Configuration Interface

The USB connector is located behind the blind screw cap, at the side of the enclosure.

1. Remove the blind screw cap with a screwdriver
2. Plug in the USB cable which connects the sensor to the PC.

### **i** PLEASE NOTE

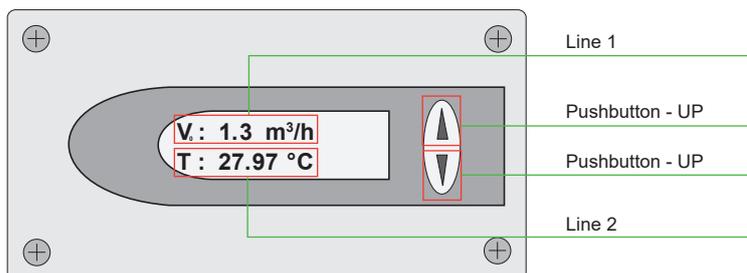
Install the configuration software that is included in the scope of supply. The configuration software can also be downloaded from our website [www.epluse.com/ee776](http://www.epluse.com/ee776).



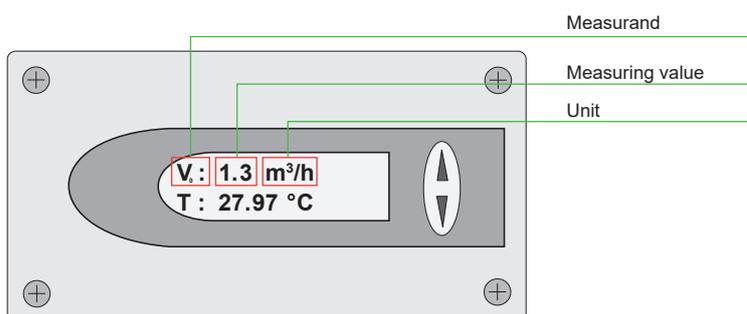
Fig. 15 USB interface connection

## 6.3 Display / Indicator with Keypad (Optional)

An optional 2-line display is available for the flow sensor EE776. The display is integrated into the enclosure cover and has two softkeys for controlling the display.



Depending on the configuration of the outputs either the measured values, the status of the relay or the consumption is indicated.



Measurand	SI Unit	US/GB Unit	
$v_0$	Standardized flow / velocity	m/s	SFPM
T	Temperature	°C	°F
$\dot{V}_0$	Standardized volume flow	m <sup>3</sup> /h, m <sup>3</sup> /min; l/min	SCFPM, SLPM
$\dot{m}$	Mass flow	kg/h, kg/min; kg/s	kg/h, kg/min; kg/s
Q	Consumption reading	m <sup>3</sup>	ft <sup>3</sup>
p	Pressure	bar	psi

### 6.3.1. Indication of the Analogue and Pulse Output

Line 1 always indicates the configured measurand at output 1. In line 2 the desired measurement value can be displayed using the UP and DOWN keys.

### 6.3.2. Indication of the Switch Output

Line 1 indicates the status of the switch output. In line 2 the desired measurement value can be indicated using the UP and DOWN keys.

The display shows an inverse image if the relay output is active (relay has switched).

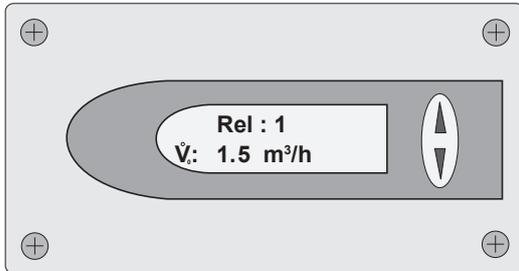


Fig. 16 Switch output inactive (relay has not switched)

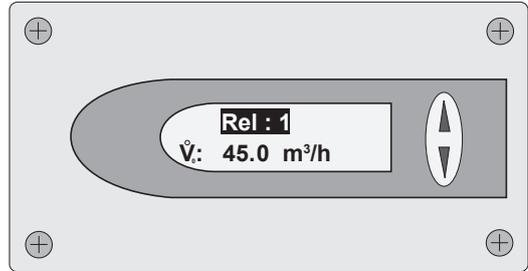
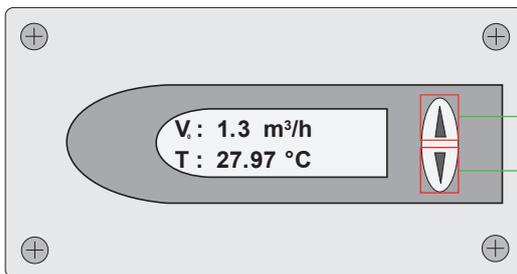


Fig. 17 Switch output active (relay has switched)

### 6.3.3. Indication of the MIN / MAX Values

Keep the DOWN key pressed for >3 seconds to indicate the MIN value.

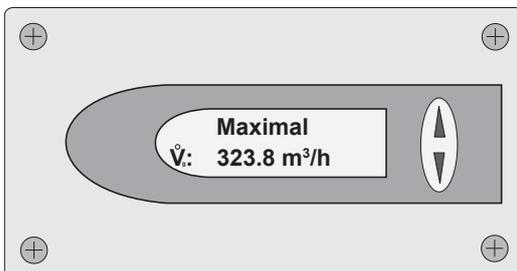
Keep the UP key pressed for >3 seconds to indicate the MAX value.



For the MAX value press the push-button UP for >3 s

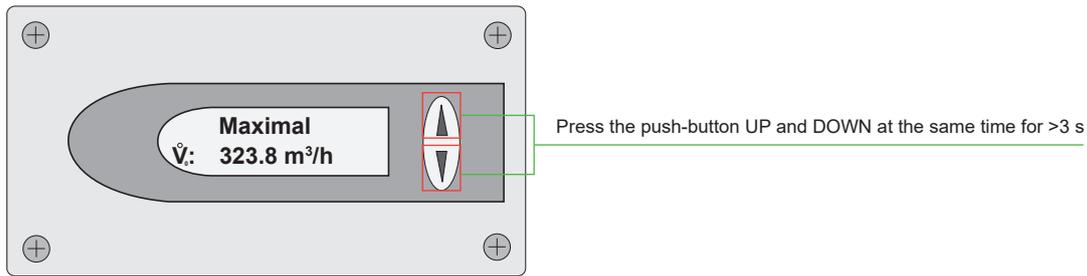
For the MIN value press the push-button DOWN for >3 s

After that, the several different measurement values can be indicated using the UP or DOWN keys. Keep the UP or DOWN key pressed for >3 seconds to exit the MIN / MAX mode.

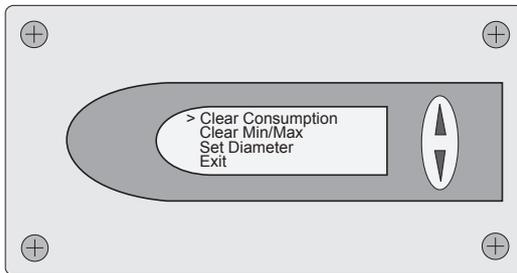


### 6.3.4. Reset of the Consumption Meter or the MIN / MAX Value

Keep both the UP and DOWN key pressed for >3 seconds to enter the menu for resetting the consumption meter or the MIN / MAX value. Select the desired menu item by pressing the UP or DOWN key briefly.



To confirm the selected choice of the menu keep the UP or DOWN key pressed for >3 seconds. Select menu item "NO" or "EXIT" to cancel without resetting.



### 6.3.5. Maximum Consumption Meter

The maximum consumption meter readout on the display is 999 999 999.0 m<sup>3</sup> or 99 999 999.0 ft<sup>3</sup>. Then it shows "LCD maximum". The internal memory continues counting. The maximum counter reading is 3.4\*10<sup>38</sup> m<sup>3</sup>. It is possible to read-out the counter reading with the configuration software.

## 6.4 Bus Output (Optional)

### 6.4.1. M-Bus (Meter-Bus)

The M-Bus (Meter Bus) is a field Bus for recording consumption data. Transmission is carried out serially on a reverse polarity protected 2-wire line. The flow sensor as an M-Bus slave requires a separate supply voltage. No specific topology (line or star) is prescribed for the cabling. Normal telephone cable of type J-Y(St)Y Nx2x0.8 mm can be used. A maximum of 250 meters is permitted per segment (primary address).

#### Read-out of the current measurement / consumption data

The following measurement/consumption values are transmitted during a standard query:

- Standardized volume flow (32 bit Real)
- Temperature (32 bit Real)
- Mass flow (32 bit Real)
- Consumption meter status (32 bit Real)
- Flow velocity (32 bit Real)
  
- Standardized volume flow (32 bit Integer)
- Temperature (32 bit Integer)
- Mass flow (32 bit Integer)
- Consumption meter status (64 bit Integer)
- Flow velocity (32 bit Integer)

The table below shows the package structure of the measurement/consumption data sent by the EE77x sensor:

Header	
68	Start of telegram
4F 4F	L-field (Length)
68	Second starting signal
08	C-field (RSP_UD)
XX	A-field (Address)
Start User Data	
72	CI-field (Variable data structure)
XX XX XX XX	Identification number
A5 16	Producer (0x16A5 ... EUE)
01	Version
09	Medium (9 ... compressed air)
XX	Access number (Continuous)
00	Status
00 00	Signature
Data Record 1: Volume Flow	
05	DIF (32 bit Real)
3E	VIF (Volume flow in m <sup>3</sup> /h)
XX XX XX XX	Act. measuring value
Data Record 2: Temperature	
05	DIF (32 bit Real)
5B	VIF (Temperature in °C)
XX XX XX XX	Act. measuring value
Data Record 3: Mass Flow	
05	DIF (32 bit Real)
53	VIF (Mass flow in kg/h)
XX XX XX XX	Act. measuring value
Data Record 4: Consumption Meter Reading	
05	DIF (32 bit Real)
16	VIF (Volume in m <sup>3</sup> )
XX XX XX XX	Act. measuring value
Data Record 5: Flow Rate	
05	DIF (32 bit Real)
7F	VIF (manufacturer specific in m/s)
XX XX XX XX	Act. measuring value
Data Record 6: Pressure	
05	DIF (32 bit Real)
6B	VIF (Pressure in bar)
XX XX XX XX	Act. measuring value
Data Record 7: Volume Flow	
04	DIF (32 bit Integer)
3B	VIF (Volume flow in 10 <sup>-3</sup> m <sup>3</sup> /h)
XX XX XX XX	Act. measuring value
Data Record 8: Temperature	
04	DIF (32 bit Integer)
59	VIF (Temperature in 10 <sup>-2</sup> °C)
XX XX XX XX	Act. measuring value
Data Record 9: Mass Flow	
04	DIF (32 bit Integer)
51	VIF (Mass flow in 10 <sup>-2</sup> kg/h)
XX XX XX XX	Act. measuring value
Data Record 10: Consumption Meter Reading	
07	DIF (64 bit Integer)
13	VIF (Volume in 10 <sup>-3</sup> m <sup>3</sup> )
XX XX XX XX XX XX XX XX	Act. consumption data
Data Record 11: Flow Rate	
04	DIF (32 bit Integer)
7F	VIF (manufacturer specific in 10 <sup>-2</sup> m/s)
XX XX XX XX	Act. measuring value
Data Record 12: Pressure	
04	DIF (32 bit real)
68	VIF (Pressure in 10 <sup>-3</sup> bar)
XX XX XX XX	Act. measuring value
End of User Data	
XX	Check sum
16	End of telegram

Tab. 4 Package structure of the measurement and consumption data

### Secondary Addressing

In addition to primary addressing, the EE77x sensor provides the option of secondary addressing. The fields of identification number, manufacturer, version and medium are used together as the secondary address. The exact sequence of the secondary addressing is described in detail in the M-Bus Standard: <https://m-bus.com/assets/downloads/MBDOC48.PDF>.

## 6.4.2. Modbus RTU Register Map

The measured data is saved as 32 bit floating point values (data type FLOAT32). Depending on the measurement unit selected, measurements are saved in SI or US/GB units. The measurement unit can be changed using the configuration software.

For resetting the MIN / MAX values, write 0 to the corresponding write register.

For Modbus protocol setting please refer to Application Note AN0103 available at [www.epluse.com/ee776](http://www.epluse.com/ee776).

### FLOAT32

Parameter	SI Unit	US/GB Unit	Register number <sup>1)</sup> [DEC]	Register address <sup>2)</sup> [HEX]
Read register: function code 0x03 / 0x04				
Standardized flow	m/s	SFPM	026	19
Standardized volume flow	m <sup>3</sup> /h	SCFPM	028	1B
Temperature	°C	°F	030	1D
Mass flow	kg/h	kg/h	032	1F
Consumption meter reading	m <sup>3</sup>	ft <sup>3</sup>	034	21
Pressure	bar	psi	036	23
MIN value standardized flow	m/s	SFPM	261	104
MAX value standardized flow	m/s	SFPM	263	106
MIN value standardized volume flow	m <sup>3</sup> /h	SCFPM	265	108
MAX value standardized volume flow	m <sup>3</sup> /h	SCFPM	267	10A
MIN value temperature	°C	°F	269	10C
MAX value temperature	°C	°F	271	10E
MIN value mass flow	kg/h	kg/h	273	110
MAX value mass flow	kg/h	kg/h	275	112
MIN value pressure	bar	psi	277	114
MAX value pressure	bar	psi	279	116

1) Register number (decimal) starts from 1.

2) Register address (hexadecimal) starts from 0.

Tab. 5 EE776 FLOAT32 measured data registers

### Write registers for resetting values (INT16)

Parameter	Register number <sup>1)</sup> [DEC]	Register address <sup>2)</sup> [HEX]
Write register: function code 0x06		
Reset MIN/MAX value standardized flow	261	104
Reset MIN/MAX value standardized volume flow	262	105
Reset MIN/MAX value temperature	263	106
Reset MIN/MAX value mass flow	264	107
Reset MIN/MAX value pressure	265	108

1) Register number (decimal) starts from 1.

2) Register address (hexadecimal) starts from 0.

Tab. 6 EE776 write registers for value resetting

## 6.4.3. Data Transmission

	Factory settings		Selectable values	
	M-Bus	Modbus RTU	M-Bus	Modbus RTU
Baud rate	2 400	9 600	600...9 600	9 600...57 600
Data bits	8	8	8	8
Parity	Even	Even	None, Odd, Even	None, Odd, Even
Stop bits	1	1	1 or 2	1 or 2
Address	1	1	0...254	1...247

Tab. 7 M-Bus and Modbus RTU protocol settings

### 6.4.4. Device Address

The DIP switches on the electronics board can be used to set the device address directly on-board or to switch to software configuration.

The flow sensors are factory-set to address 1.

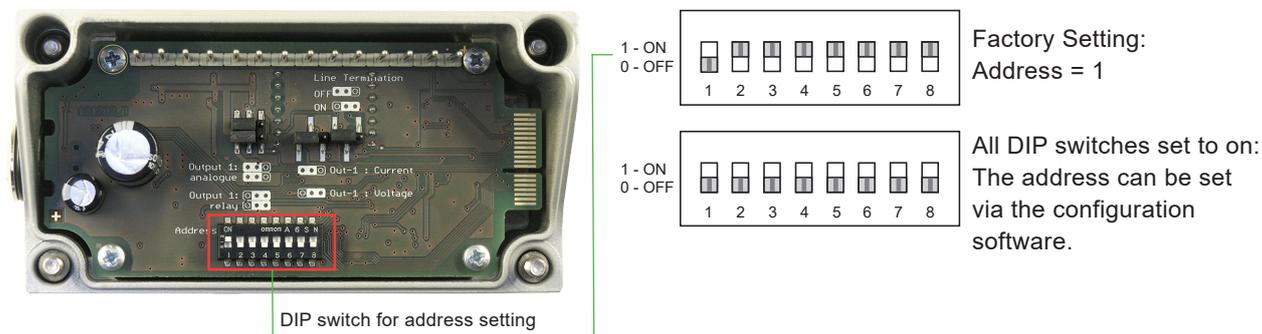


Fig. 18 Address setting

## 7 Maintenance and Service

### 7.1 Error Messages

In case the flow sensor is equipped with the optional display, the following error message can be indicated.

Error Category	Error Description	Recommended Action
01	Sensing probe is not detected or defect. The display indicates "0" for all measurands. The analogue output defaults to the lowest configured value.	Check the head of the sensing probe for visual damage. Check the sensor cable from the sensing probe to the electronics of the signal conditioning
02	The EEPROM for storing of the consumption meter and MIN / MAX value is defect. The consumption meter and MIN / MAX values are no longer available. All measurement values are still indicated. The analogue, relay and pulse output are still functional.	Return the faulty unit to E+E for service

Tab. 8 Explanation of the error category

### 7.2 Maintenance

Regular cleaning of the sensor is required for applications in wet or filthy gases. The sensor must be cleaned before calibration or evaluation.

### 7.3 Cleaning the Sensing Element of the Flow Sensor

Clean the head of the sensor probe by carefully swirling it in warm water or isopropyl alcohol. It is recommended to use isopropyl alcohol if the pollutant is grease or oil.

**i PLEASE NOTE**

- Do not use an abrasive cleaning agent, an organic solvent containing halogen or acetone.
- Do not touch the sensor with fingers or solid objects like screwdrivers or brushes.

Let the device dry in the ambient air.

## 7.4 Repairs

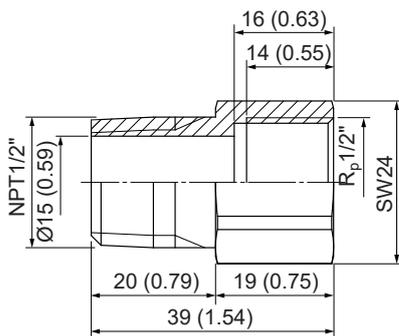
Repairs are to be carried out by the manufacturer only. The attempt of unauthorized repair invalidates any warranty claims.

# 8 Accessories

## 8.1 Adapter BSP - NPT

**HA074004** Material: brass

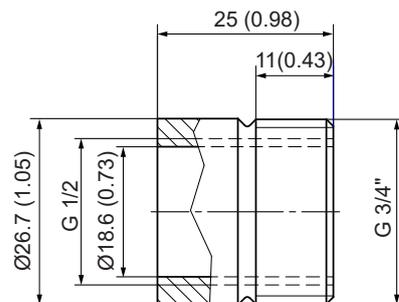
Values in mm (inch)



## 8.2 Welding nipple

**HA074001** Material: stainless steel 1.4301

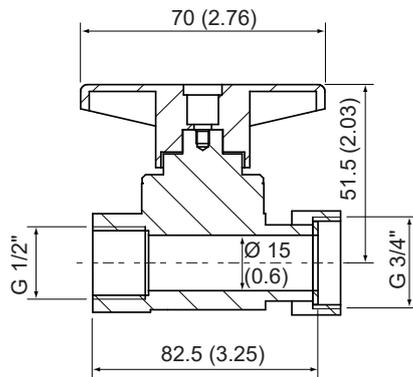
Values in mm (inch)



### 8.3 Ball valve 1/2"

HA074002 Material: brass

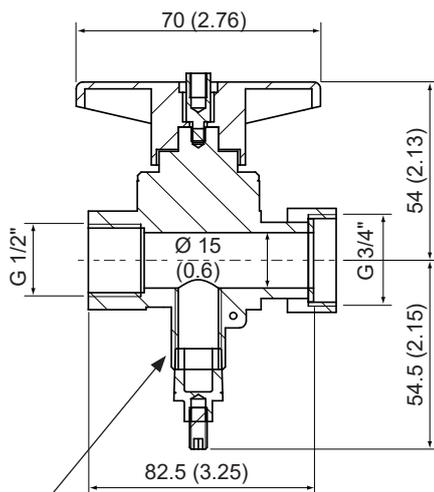
Values in mm (inch)



### 8.4 Ball valve 1/2" for Bypass Measurement

HA074003 Material: brass

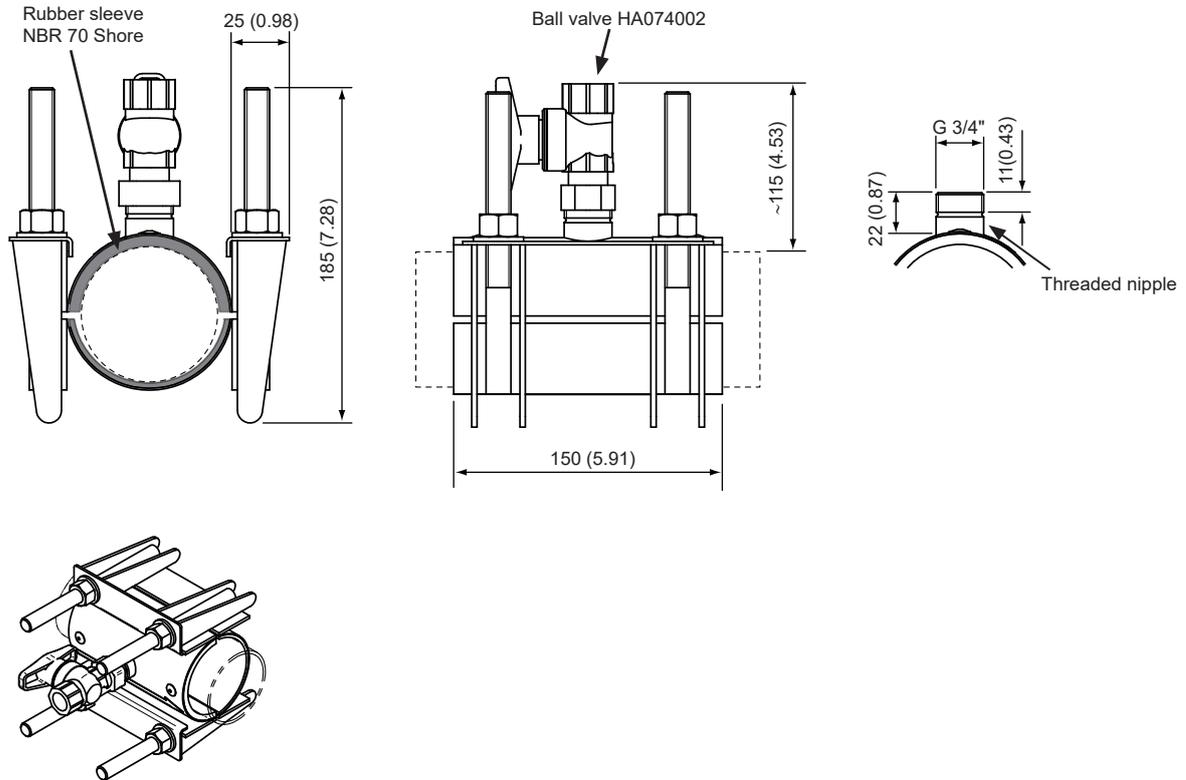
Values in mm (inch)



Lateral fitting Rp1/4" for mounting of pressure or dew point sensor

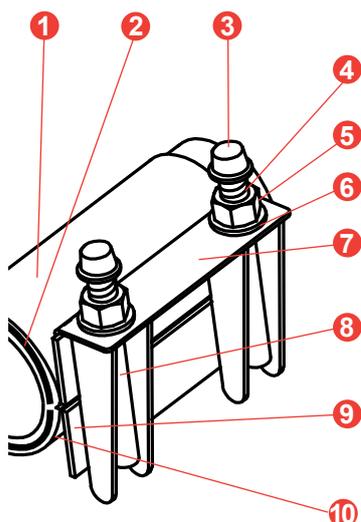
## 8.5 Tapping Sleeve (Delivery without Ball Valve)

**HA074xxx** Material: stainless steel 1.4301  
 Values in mm (inch)



Pipe	Clamping range [mm (inch)]	Max. working pressure	Order code
DN50 (2")	47 - 67 (1.85 - 2.64)	16 bar (232 psi)	HA074050
DN65 (2 1/2")	73 - 93 (2.87 - 3.66)	16 bar (232 psi)	HA074065
DN80 (3")	86 - 106 (3.39 - 4.17)	16 bar (232 psi)	HA074080
DN100 (4")	107 - 127 (4.21 - 5.00)	16 bar (232 psi)	HA074100
DN125 (5")	128 - 148 (5.04 - 5.83)	16 bar (232 psi)	HA074125
DN150 (6")	149 - 171 (5.87 - 6.73)	16 bar (232 psi)	HA074150
DN200 (8")	216 - 236 (8.50 - 9.29)	16 bar (232 psi)	HA074200
DN250 (10")	260 - 280 (10.24 - 11.02)	10 bar (145 psi)	HA074250
DN300 (12")	315 - 335 (12.40 - 13.19)	10 bar (145 psi)	HA074300

Fig. 19 Pipe diameter with the appropriate order code



No.	Description
1	Sleeve
2	Seal
3	Cap
4	Threaded pin
5	Nut
6	Delrin® washer
7	Retainer
8	Bolt yoke
9	Side bracket
10	Sliding plate

Fig. 20 Tapping sleeve components

### Site preparation work

The mounting area must be freely accessible, and there must be sufficient working space available in the area around the pipe.

A stable ladder is required for carrying out mounting work at a height up to 3.5 m (11.5 ft) above the floor (height of the pipe). At greater heights, a working platform must be provided. If the measuring point area is not accessible using a platform, a stable working platform using scaffolding or similar must be provided.

Any cladding or insulation covering the pipe must be removed in the measuring point area to a minimum length of 0.6 m (1.97 ft). Any necessary grinding work on corroded pipes must be carried out carefully, ensuring that the roundness of the surface is maintained.

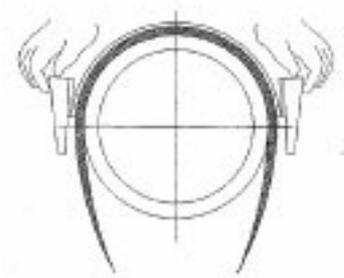
### Recommendation for mounting work

1. Compare pipe diameters and check the correct sleeve size.
2. Completely clear all dirt, rust or grease from the sleeve area to ensure that the surface is smooth and clean. Seals and a sliding plate should be moistened for improved adhesion. Seal material, pins and nuts must not be lubricated under any circumstances!
3. Before mounting, mark the sleeve position to make it easier to check that the sleeve is positioned correctly.
4. During the mounting operation, ensure that seals and retainer edges are free of dirt and that there is no foreign matter between the seal and pipe.
5. Using the correct tools (long spanners and/or torque wrench) improves and simplifies the mounting process.
6. It is essential that the pin thread is free of all dirt.
7. If a torque wrench is not used, it is essential to ensure that the nuts are not tightened too far. It is essential to observe the shaping of the Delrin® washers.
8. Always perform a pressure test before the sleeve is sealed. If not completely tight, adjust the torque and check again after 20 minutes.

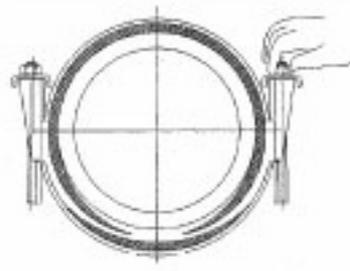
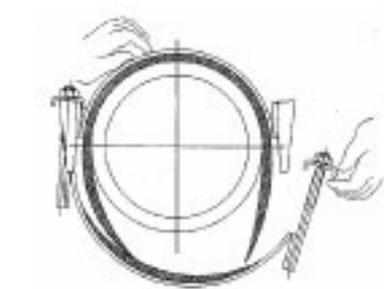
### Mounting the sleeve

The pipe on the sleeve must be completely free of dirt, rust and grease. The preferred option for cleaning is using a soap solution - this also improves the function of the sleeve. Seal material, pins and nuts must not be lubricated under any circumstances!

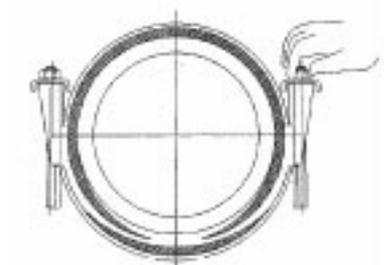
1. Remove the cap from the threaded pin and turn the nuts until they reach the end of the threaded pin - do not remove them!
2. Open out the pipe sleeve and place the top part on the sleeve around the pipe.



3. Position the retainer correctly over the bolt yoke on one side.
4. Lift and insert the loosely positioned lower part of the sleeve underneath the sleeve and place loosely onto the other bolt yoke with the free retainer.



5. Make sure that both retaining edges are moved evenly under the seals. At this point, it must no longer be possible to move the sleeve radially!
6. Check that seals and retainer edges are positioned on the pipe and that the pointed ends are positioned evenly over the seal. Hand-tighten the nuts of the retainer lying loosely on the bolt yoke until the retainer is under tension.



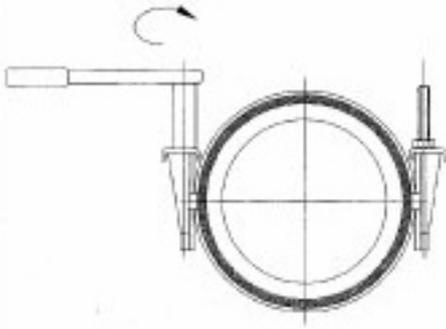
7. Turn further using a spanner until the retainer slides over the bolt yoke and engages into position.
8. Tighten the nuts evenly using a spanner (min. 300 mm (11.8") in length) until the Delrin® washers curve very slightly around the nuts. Slight deformation of the Delrin® washers does not affect the function of the sleeve.

The following torques are set when using a torque wrench:

Thread size	Tightening torque
M12	65 Nm
M14	85 Nm
M16	110 Nm

Tab. 9 Tightening torque for standard thread in [Nm]

Using this method, the Delrin® washers should curve slightly around the nuts.



9. Check the torque after 20 minutes and adjust if necessary.

#### **⚠ WARNING**

- Before the sleeve is pressurized, the assembled sleeve must be checked for leaks.
- To achieve this, exert a test pressure from outside via the ball valve/mounting valve and check for correct sealing using leak.

## 9 Technical Data

### Measurands

#### Volume Flow (V'n)

<b>Standard conditions</b>	Factory setting according to DIN 1343 pn = 1 013.25 mbar (14.7 psi), Tn = 0 °C (32 °F), configurable
<b>Measuring range</b>	0.2...100 m/s (40...19 685 SFPM) or 0.2...200 m/s (40...39 370 SFPM)
<b>Accuracy</b> <sup>1)</sup> in air at 9 bar (130.5 psi) (abs.) and 23 °C (73 °F)	±(1.5 % of measured value + 0.8 % of full scale)
<b>Temperature dependency</b>	±(0.1 % of measured value / °C deviating from 20 °C) ±(0.18 % of measured value / °F deviating from 68 °F)
<b>Response time t<sub>90</sub></b>	<1 s
<b>Sampling interval</b>	0.5 s

1) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement). The accuracy specifications apply when using inlet and outlet sections of suitable length, refer to chapter 4.3 Required Length of Straight Pipe.

#### Temperature (T)

<b>Measuring range</b>	-20...+80 °C (-4...+176 °F)
<b>Accuracy</b> @ 20 °C (68 °F)	±0.7 °C (±1.26 °F)

## Outputs

### Analogue

Signal range and measurands are freely configurable				
Analogue output	Voltage Current	0 - 10 V	max. $\pm 1$ mA	$R_L$ = load resistance
		4 - 20 mA 3-wire	$R_L < 500 \Omega$	
		0 - 20 mA 3-wire	$R_L < 500 \Omega$	
<hr/>				
Relay (switch output)		Potential free		
Switching capacity		Max. 44 V DC, 500 mA		
Pulse output		Totalizer (consumption meter)		
Pulse length		0.02...2 s		

### Digital (optional)

Digital interface	RS485 (EE776 = 1 unit load)
Protocol <sup>1)</sup>	Modbus RTU
Factory settings	9 600 Baud, parity even, 1 stop bit, Modbus address 1
Supported Baud rates	9 600, 19 200, 38 400 and 57 600
Measured data types	FLOAT32 and INT16
Protocol <sup>2)</sup>	M-Bus
Factory settings	2 400 Baud, parity even, 1 stop bit, M-Bus address 1
Supported Baud rates	600, 1 200, 2 400, 4 800 and 9 600

1) Find more details about communication setting in chapter and the Modbus Application Note at [www.epluse.com/ee776](http://www.epluse.com/ee776).

2) Find more details about communication setting in the User Manual.

## Input

### External Dynamic Pressure Compensation

Dynamic pressure compensation	4 - 20 mA (2-wire; 15 V) for pressure sensor (relevant for gases other than air and nitrogen)
-------------------------------	---

## General

Power supply class III  USA & Canada: Class 2 supply necessary, max. voltage 30 V DC	18 - 30 V AC/DC
Current consumption, max.	200 mA
Electrical connection	Cable gland M16 and screw terminals max. 1.5 mm <sup>2</sup> (AWG 16), optional with connector M12x1, 8 poles
Nominal pressure	16 bar (232 psi)
Medium	Compressed air or non-corrosive gases
Humidity working range	0...99 %RH, non-condensing
Temperature range	Ambient, Storage Medium -20...+60 °C (-4...+140 °F) -20...+80 °C (-4...+176 °F)
Material	Enclosure Probe Probe head Measurement valve AlSi9Cu3 (Die-cast aluminium) Stainless steel Stainless steel / glass Brass
Protection rating	Enclosure IP65 / NEMA 4
Electromagnetic compatibility	EN 61326-1      EN 61326-2-3      Industrial environment FCC Part15 Class B      ICES-003 Class B
Conformity	 

## Flow Measuring Range in Dependence on Pipe Diameter

Pipe		Measuring range in m <sup>3</sup> /h	
	Inch	0.2...100 m/s (40...19 685 SFCM)	0.2...200 m/s (40...39 370 SFCM)
DN50	2	1.7...839 m <sup>3</sup> /h (0...493.8 SCFM)	1.7...1 679 m <sup>3</sup> /h (1.0...987.6 SCFM)
DN65	2 1/2	2.8...1 397 m <sup>3</sup> /h (1.6...821.6 SCFM)	2.8...2 793 m <sup>3</sup> /h (1.6...1 643.2 SCFM)
DN80	3	3.8...1 923 m <sup>3</sup> /h (2.3...1 131.5 SCFM)	3.8...3 847 m <sup>3</sup> /h (2.3...2 263.0 SCFM)
DN100	4	6.5...3 242 m <sup>3</sup> /h (3.8...1 906.9 SCFM)	6.5...6 483 m <sup>3</sup> /h (3.8...3 813.8 SCFM)
DN125	5	9.8...4 902 m <sup>3</sup> /h (5.8...2 883.5 SCFM)	9.8...9 803 m <sup>3</sup> /h (5.8...5 766.9 SCFM)
DN150	6	14.3...7 171 m <sup>3</sup> /h (8.4...4 218.7 SCFM)	14.3...14 343 m <sup>3</sup> /h (8.4...8 437.3 SCFM)
DN200	8	24.1...12 051 m <sup>3</sup> /h (14.2...7 089.0 SCFM)	24.1...24 101 m <sup>3</sup> /h (14.2...14 178.0 SCFM)
DN250	10	38.3...19 163 m <sup>3</sup> /h (22.5...11 272.6 SCFM)	38.3...38 325 m <sup>3</sup> /h (22.5...22 545.3 SCFM)
DN300	12	54.2...27 105 m <sup>3</sup> /h (31.9...15 945.1 SCFM)	54.2...54 211 m <sup>3</sup> /h (31.9...31 890.1 SCFM)
DN350	14	65.2...32 591 m <sup>3</sup> /h (38.3...19 172.5 SCFM)	65.2...65 183 m <sup>3</sup> /h (38.3...38 345.0 SCFM)
DN400	16	85.4...42 719 m <sup>3</sup> /h (50.3...25 130.2 SCFM)	85.4...85 438 m <sup>3</sup> /h (50.3...50 260.0 SCFM)
DN500	20	133.5...66 749 m <sup>3</sup> /h (78.5...39 266.0 SCFM)	133.5...133 498 m <sup>3</sup> /h (78.5...78 531.9 SCFM)
DN600	24	193.4...96 712 m <sup>3</sup> /h (113.8...56 892.6 SCFM)	193.4...193 425 m <sup>3</sup> /h (113.8...11 3785.1 SCFM)
DN700	28	263.4...131 675 m <sup>3</sup> /h (154.9...77 459.8 SCFM)	263.4...263 350 m <sup>3</sup> /h (154.9...154 919.6 SCFM)

## 9.1 Factory Setting Analogue Output

Analogue output [0 - 10 V / 0 (4) - 20 mA]

			Standardized Volume Flow			Standardized Volume Flow			Mass Flow		
Pipe		From	Up to		Unit	Up to		Unit	Up to		Unit
DN	Inch		Low (L1)	High (L2)		Low (L1)	High (L2)		Low (L1)	High (L2)	
50	2	0	800	1 600	m <sup>3</sup> /h	450	900	SCFM	1 035	2 070	kg/h
65	2 1/2	0	1 300	2 600	m <sup>3</sup> /h	800	1 600	SCFM	1 682	3 364	kg/h
80	3	0	1 900	3 800	m <sup>3</sup> /h	1 100	2 200	SCFM	2 458	4 916	kg/h
100	4	0	3 200	6 400	m <sup>3</sup> /h	1 900	3 800	SCFM	4 140	8 280	kg/h
125	5	0	4 900	9 800	m <sup>3</sup> /h	2 800	5 600	SCFM	6 339	12 678	kg/h
150	6	0	7 100	14 200	m <sup>3</sup> /h	4 200	8 400	SCFM	9 185	18 371	kg/h
200	8	0	12 000	24 000	m <sup>3</sup> /h	7 000	14 000	SCFM	15 524	31 049	kg/h
250	10	0	19 000	38 000	m <sup>3</sup> /h	11 000	22 000	SCFM	24 580	49 161	kg/h
300	12	0	27 000	54 000	m <sup>3</sup> /h	15 000	30 000	SCFM	34 930	69 860	kg/h
350	14	0	32 000	64 000	m <sup>3</sup> /h	19 000	38 000	SCFM	41 398	82 797	kg/h
400	16	0	42 000	84 000	m <sup>3</sup> /h	25 000	50 000	SCFM	54 335	108 671	kg/h
500	20	0	66 000	132 000	m <sup>3</sup> /h	39 000	78 000	SCFM	85 384	170 768	kg/h
600	24	0	96 000	192 000	m <sup>3</sup> /h	56 000	112 000	SCFM	124 195	248 390	kg/h
700	28	0	130 000	260 000	m <sup>3</sup> /h	77 000	154 000	SCFM	168 181	336 362	kg/h

# 10 Replacement Parts / Accessories

## 10.1 Order Code Replacement Sensor

Feature	Description	Code	
Hardware Configuration		<b>PE776-</b>	
	Type	Remote probe	<b>T3</b>
	Measuring range	Low	<b>HV31</b>
		High	<b>HV33</b>
	Maximum pipe diameter / probe length	DN100 (4")/215 mm (8.46")	<b>N100</b>
		DN300 (12")/315 mm (12.4")	<b>N300</b>
		DN700 (28")/515 mm (20.28")	<b>N700</b>
	Pipe diameter presetting	DN50 (2")	<b>DN50</b>
		DN65 (2 1/2")	<b>DN65</b>
		DN80 (3")	<b>DN80</b>
		DN100 (4")	<b>DN100</b>
		DN125 (5")	<b>DN125</b>
		DN150 (6")	<b>DN150</b>
		DN200 (8")	<b>DN200</b>
		DN250 (10")	<b>DN250</b>
		DN300 (12")	<b>DN300</b>
DN350 (14")		<b>DN350</b>	
DN400 (16")		<b>DN400</b>	
DN500 (20")		<b>DN500</b>	
DN600 (24")		<b>DN600</b>	
DN700 (28")	<b>DN700</b>		

### Order Examples

**PE776-T3HV31N100DN100**

Feature	Code	Description
Type	<b>T3</b>	Remote probe
Measuring range	<b>HV31</b>	Low
Maximum pipe diameter / probe length	<b>N100</b>	DN100 (4")/215 mm (8.46")
Pipe diameter presetting	<b>DN100</b>	DN100 (4")

# 11 Configuration Software

## 11.1 Introduction

The configuration software allows for a user-friendly adaptation of the flow sensor to the application. In addition, the measurement values for flow and temperature can be calibrated / adjusted.

The configuration software can be downloaded free of charge at [www.epluse.com/ee776](http://www.epluse.com/ee776).

### **i** LIMITED LIABILITY

E+E Elektronik shall not be held liable for any damages or consequential damages (for example, but not restricted to, loss of earnings, interruption of business, loss of information and data or any other financial losses) resulting from the installation, use or impossibility of use of an E+E Elektronik software product and any associated support services or non-performance of support services.

The system requirements for the installation and execution of the software are:

- Windows XP with SP3, Windows Vista or Windows 7
- .NET framework 3.5 with SP1
- USB 2.0 interface

### **i** PLEASE NOTE

During setup there will be no installation of .NET Framework 3.5 SP1 – if the required version is not already installed on the computer, the following error message will appear at the start of the configuration software. .NET Framework 3.5 SP1 can be installed using Windows Update.



## 11.2 Installation

In order to set up a smooth installation of the configuration software of the EE776, admin authorization for the personal computer is required.

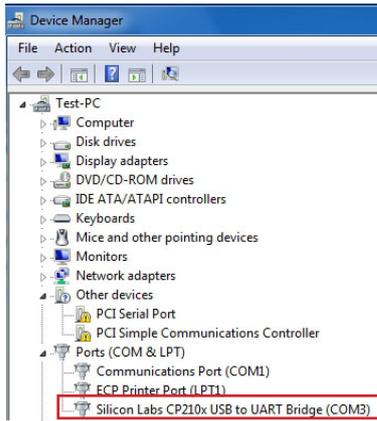
- During installation of the software the EE776 should NOT be connected to the computer via the USB cable.
- With Setup.exe the InstallShield-Wizard for the EE776 configurator will be started.
- Follow the instructions on the screen to install the software.

### **i** PLEASE NOTE

- First, the configuration software is installed, then the installation of the USB driver is activated - unless the user has specified that the USB setup is disabled.
- The USB driver will be installed automatically the moment the first connection is made with the EE776.
- The dialogue boxes that appear can be handled with the settings "No. Do not download driver from the Internet" and "Install the hardware automatically".

If the EE776 configuration software and the USB driver are installed correctly, and the EE776 is connected to the personal computer via the USB interface, a connection "Silicon Labs C210x USB to UART Bridge" should have been created in the device manager.

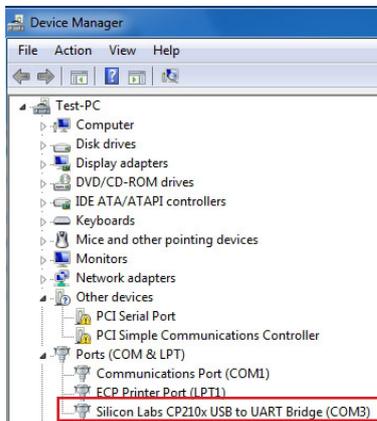
See: Start → Settings → Control Panel → System → Hardware → Device Manager



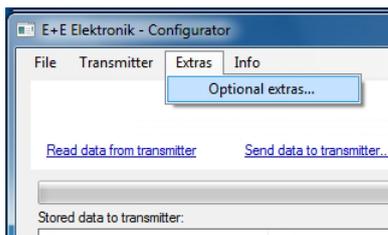
### Configuration of the USB Interface (VirtualCOM)

After the startup of the software, the correct VirtualCOM interface for the USB driver must be configured. The number for the used USB interface can be found under:

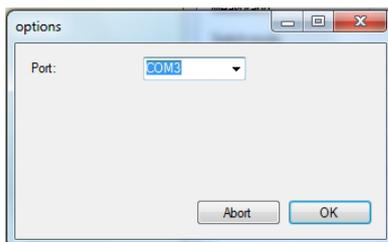
Start → Settings → Control Panel → System → Hardware → Device Manager



The setting is done under menu “Extras” and menu item “Optional extras ...”



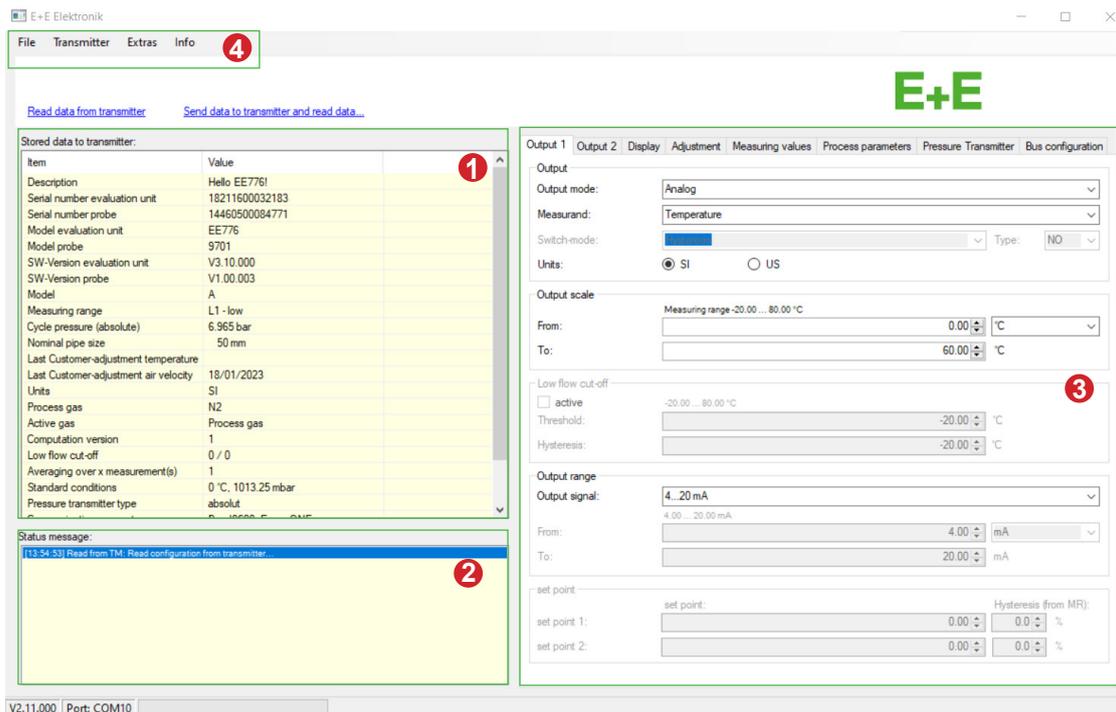
Select the COM-port number as shown in the device manager.



### **i** PLEASE NOTE

These settings are done only once and at the first start of the configuration software. The settings are stored for future use.

## 11.3 User Interface



No.	Function
1	<b>Basic information:</b> After retrieving the data from the sensor, the basic information of the device is shown here.
2	<b>Status message:</b> Here the status messages and other information are displayed.
3	<b>Input screen:</b> Input screen for the configuration or adjustment of the flow sensor.
4	<b>Menu toolbar:</b> Selection of menu items.

## 11.4 Menu Toolbar

### 11.4.1. File

Menu	Item	Description
	Delete status message	Deletes the status messages.
	Exit	Closes the configuration software.

### 11.4.2. Transmitter

**i PLEASE NOTE**

The term “Transmitter” is used synonymously with “Sensor” in this user manual.

Menu	Item	Description
	Read	Reads the actual configuration of the transmitter.
	Send	Uploads the “new” configuration to the transmitter. The following settings are uploaded to the transmitter. <ul style="list-style-type: none"> <li>▪ Units</li> <li>▪ Output 1</li> <li>▪ Output 2</li> <li>▪ Display mode</li> <li>▪ Pressure transmitter</li> </ul>

Prior to uploading the “new” configuration to the transmitter, a dialog box will show a summary of the changes. Click on the button “OK” and the configuration will be uploaded to the transmitter, click “Cancel” to cancel the operation.

### 11.4.3. Extras

Configurations of the VirtualCOM interface are described in more detail in chapter 11.2 Installation under "Configuration of the USB Interface (VirtualCOM)".

## 11.5 Input Screen

### 11.5.1. Output 1, Output 2

In this screen the actual settings of the transmitter for the outputs 1 and 2, resp. relay 1 and 2 are shown. The user can alter and upload these settings to the transmitter, together with other changes of the configuration.

#### Output Mode

Here the mode of signal output can be determined.

- Output 1: Analogue or switch (relay) output
- Output 2: Switch (relay) or pulse output

**i PLEASE NOTE**

In case the mode of output 1 is changed, the jumper J1 on the board of the signal conditioning electronics has to be relocated as well (refer to chapter 6.1 Jumpers for output configuration).

#### Measurand

Here it is determined which measurand will be represented at the particular output.

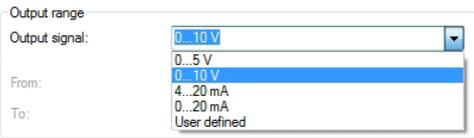
#### Units

Choice of the engineering units of the selected measurand in either SI- (m/s; °C; m<sup>3</sup>/h) or US-units (SFPM; °F; SCFM).

**i PLEASE NOTE**

The setting “Units” on the tabs for Output 1 and Output 2 are in sync with each other. If the units are changed on one of the output tabs, automatically the units on the other output tab are changed accordingly.

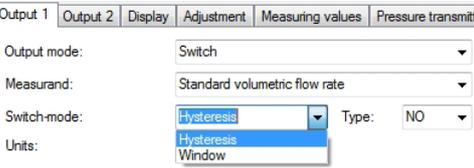
### Output Mode – Analogue

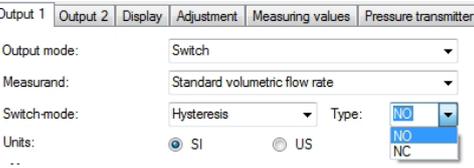
Menu	Description
	<p>Within the limits of measurement range and the scaling of the output, the analogue output can be freely configured and scaled. Either a standard output signal (0 - 5 V, 0 - 10 V, 0 - 20 mA, 4 - 20 mA) can be selected or a user defined range for the current / voltage output (e.g. 1 - 9 V).</p>

#### **i** PLEASE NOTE

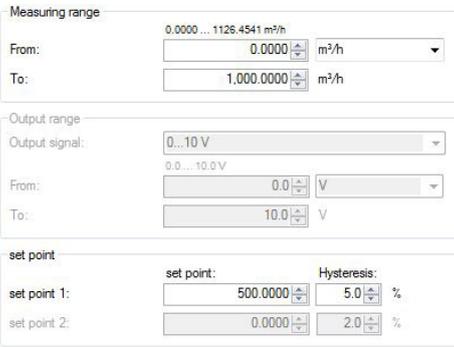
In case the analogue output is changed (from current to voltage or vice versa), the jumper J2 on the board of the signal conditioning electronics has to be relocated as well (refer to chapter 6.1 Jumpers for output configuration).

### Output Mode – Switch (Relay)

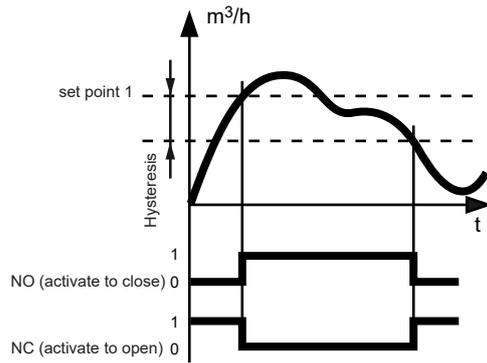
Menu	Description
	<p>In the field for the “Switch-mode”, one can select “Hysteresis” or “Window”.</p>

Menu	Description
	<p>The field “Type” is to determine the switch action of the relay, NO = Normally Open (activate to close), NC = Normally Close (activate to open).</p>

In the section “Measuring range” the range can be defined, using “From” to set the low value “To” to set the high value.

Menu	Description
	<p>The high value depends on the setting of pipe diameter. Make the setting of the pipe diameter first! (refer to chapter 11.5.6 Setting up Process Parameters - Setting the Inner Pipe Diameter).</p> <p>The hysteresis of the set point is entered as a percentage of the measuring range.</p> <p>[Measuring range] = high measuring value - low measuring value e.g. hysteresis Set point = 500 m<sup>3</sup>/h and reset point is 450 m<sup>3</sup>/h Hysteresis = 50 m<sup>3</sup>/h = 0.5 % of measuring range</p>

## Hysteresis



When the measurement value reaches set point 1, the relay will be activated. The value at the reset point is the value at set point 1 minus the hysteresis.

e.g. set point 1 = 100 m<sup>3</sup>/h and the hysteresis 5 m<sup>3</sup>/h. The relay switches at 100 m<sup>3</sup>/h.  
The reset point is at 96 m<sup>3</sup>/h.

set point

set point 1:   %

set point 2:   %

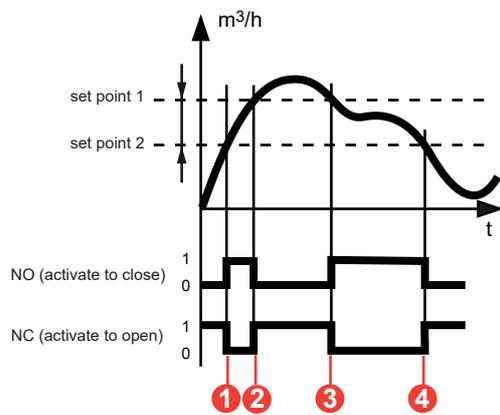
Measuring range

From:  m<sup>3</sup>/h

To:  m<sup>3</sup>/h

Hysteresis = 5 m<sup>3</sup>/h = 5 % of the measuring range

## Window



No.	Data
1	80 m <sup>3</sup> /h = set point 2
2	100 m <sup>3</sup> /h = set point 1
3	99 m <sup>3</sup> /h = set point 1 - hysteresis
4	79 m <sup>3</sup> /h = set point 2 - hysteresis

The relay is activated as long as the measuring value is between the values of set point 1 and set point 2. The hysteresis of each set point is fixed at 0.2 % of the measuring range.

e.g. set point 1 = 100 m<sup>3</sup>/h; set point 2 = 80 m<sup>3</sup>/h.

set point

set point 1:   %

set point 2:   %

Measuring range

From:  m<sup>3</sup>/h

To:  m<sup>3</sup>/h

Hysteresis of each point is 1 m<sup>3</sup>/h = 0.2 % of the measuring range 500 m<sup>3</sup>/h.

### Output Mode – Pulse

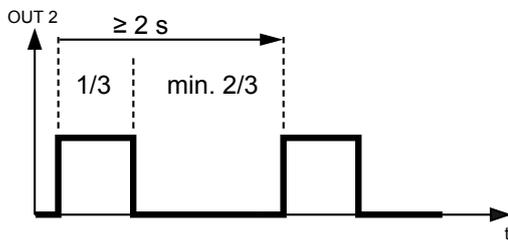
If output 2 is configured for pulse, the measurand can only be consumption. The duration of the pulse and the pulse value (significance level of the pulse) can be freely configured under “Pulse”.

$$\frac{\text{Volume Flow [m}^3\text{/h]}}{\text{Pulse Value [m}^3\text{/Pulse]}} = \frac{\text{Number of Pulses}}{\text{Hour}}$$

The duration of the pulse can be set between 0.02 and 2 seconds.

Menu	Description
	e.g. duration of pulse = 100 ms; one pulse for each m <sup>3</sup> consumed

The pulse/interval ratio must be at least 1:2, meaning that the duration of the pulse interval must be at least twice the duration of the pulse itself.



### Calculation of the minimum “pulse value” or the maximum “pulse duration”.

$$\text{IMPW\_MIN} = \text{NORMV\_MAX [m}^3\text{/h]} * \text{IMPL [s]} / 1200$$

$$\text{IMPL\_MAX} = \text{IMPW [m}^3\text{]} * 1200 / \text{NORMV\_MAX [m}^3\text{/h]}$$

Short Form	Description
IMPW	Pulse value [m <sup>3</sup> ]
IMPL	Pulse length (duration) [s]
IMPW_MIN	Minimum pulse value [m <sup>3</sup> ]
IMPL_MAX	Maximum pulse length (duration)
NORMV_MAX	Expected maximum volume flow (m <sup>3</sup> /h)

### 11.5.2. Minimum Flow Shutdown

The minimum flow shutdown is switched on and off using the “active” checkbox.

If the output signal is ≤ than the set “Shutdown value”, the flow sensor issues 0 on the analogue output.



### 11.5.3. Display

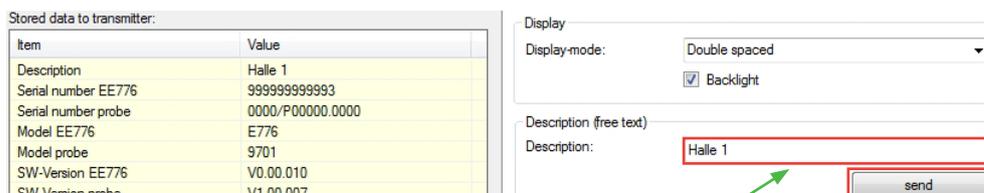
If an optional display is installed, at the tab Display the following items can be entered:

Drop-down input field "Display-Mode"

- Single spaced
- Double spaced (default)

Checkbox "Backlight"

- Checked = ON
- Unchecked = OFF



In the input field "Description (free text)", a user specific name (max. 16 characters) for the transmitter can be entered. E.g.: HALL 1

With the button "send" only the description will be uploaded to the transmitter.

### 11.5.4. Adjustment

The user can perform an adjustment for the measurands normflow and temperature in air.

The configuration software automatically distinguishes between a 1-point and a 2-point adjustment, depending on how many reference points for adjustments are entered.

The values entered for the customer's adjustment are stored in the electronics of the sensing probe and are therefore not lost if the electronics of the signal conditioning are replaced (refer to chapter 3 Product Description).

If the checkbox "Performing customer-adjustment" is checked, the adjustment mode will be activated and the actual measuring value in the set interval automatically retrieved from the flow sensor (transmitter).

**i PLEASE NOTE**

- At first change to "Calibration gas" in the tab "Process parameters".
- While the customer-adjustment is active all other pages, functions and commands are deactivated.

Menu	Item	Description
	Adjustment	The measurand to be adjusted is selected
	Measuring value	The actual measurement value of the transmitter is indicated. The update-interval can be set.
	Reference value	The measurement value of the standard is entered.

After clicking the "send" button, a control dialog box appears in which the values can be corrected if necessary. The reference value is then loaded into the flow sensor (transmitter) and the adjustment process is complete.

The reference point of the customer-adjustment must be within the determined measuring range.

The customer-adjustment results in a slight rotation of the characteristic line, in such a way that the measurement deviation at the upper and lower adjustment points equals zero.

Depending on the position, the configuration software determines whether it is an upper or lower adjustment point.

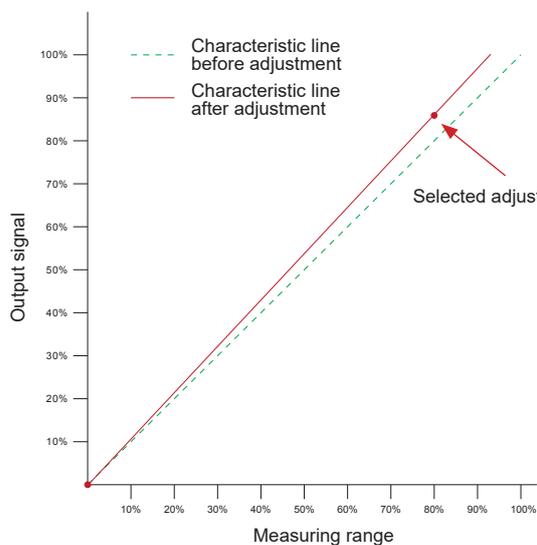
### 1-point Adjustment

Possibility	Lower adjustment point	Upper adjustment point
1	0 ... 50 % of m.r.	100 % of m.r.
2	0 % of m.r.	>50 ... 100 % of m.r.

m.r. = measuring range

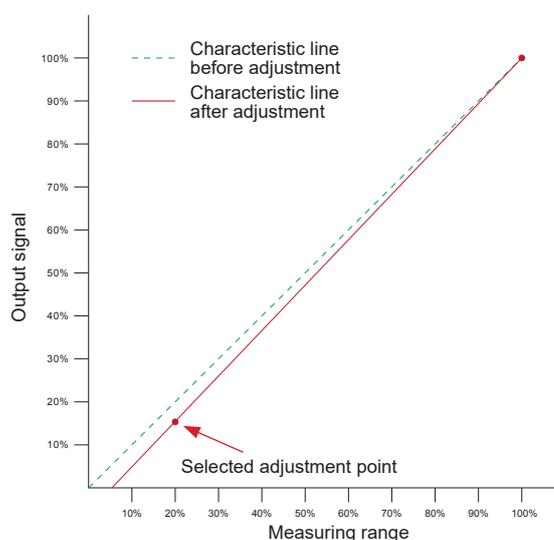
#### Upper adjustment point at 80% of measuring range

Lower adjustment point automatically at 0% of m.r.



#### Lower adjustment point at 20% of measuring range

Upper adjustment point automatically at 100% of m.r.



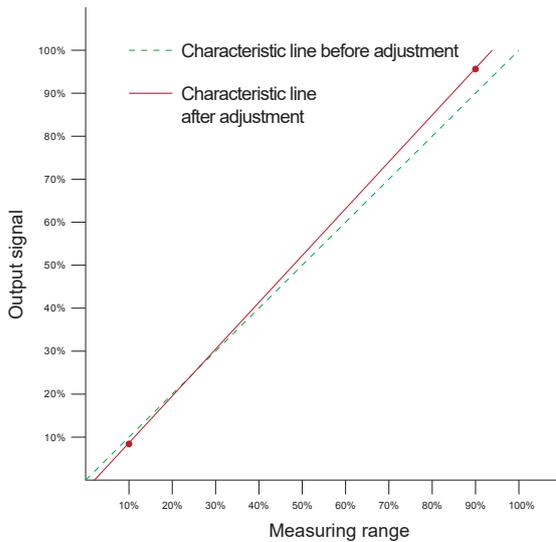
### 2-point Adjustment

With a 2-point adjustment procedure the lower adjustment point must be between 0 and 40% of the measuring range and the upper adjustment point between 60 and 100% of the measuring range. If the adjustment point is between 40 and 60% of the measuring range, automatically a 1-point adjustment procedure will be executed instead.

Possibility	Lower adjustment point	Upper adjustment point
1	0 ... <40 % of m.r.	60...100 % of m.r.
2	40 ... <50 % of m.r.	100 % of m.r.
3	0 % of m.r.	50 ... <60 % of m.r.

m.r. = measuring range

**Lower adjustment point at 10% of measuring range  
Upper adjustment point at 90% of measuring range**



**Reset to Factory Settings**

Customer-adjustment can be reset to the factory settings by checking the appropriate checkbox and subsequently clicking the “reset” button.

Reset to factory adjustment

Temperature customer-adjustment

Air velocity customer-adjustment

reset

**11.5.5. Measuring Values Overview**

The tab “measuring values” provides an overview of the retrieved actual measurement values of the flow sensor (transmitter).

Menu	Description																														
<table border="1"> <thead> <tr> <th>Measurand</th> <th>Actual</th> <th>Min</th> <th>Max</th> <th>Unit</th> </tr> </thead> <tbody> <tr> <td>Air velocity</td> <td>1,279</td> <td>0.500</td> <td>1,412</td> <td>m/sec</td> </tr> <tr> <td>Volumetric flow rate</td> <td>9,006</td> <td>0,247</td> <td>9,939</td> <td>m³/h</td> </tr> <tr> <td>Temperature</td> <td>23,58</td> <td>16,05</td> <td>26,66</td> <td>°C</td> </tr> <tr> <td>Mass flow</td> <td>11,483</td> <td>0,315</td> <td>12,672</td> <td>kg/h</td> </tr> <tr> <td>Pressure</td> <td>2,029</td> <td>0,000</td> <td>2,047</td> <td>bar</td> </tr> </tbody> </table>	Measurand	Actual	Min	Max	Unit	Air velocity	1,279	0.500	1,412	m/sec	Volumetric flow rate	9,006	0,247	9,939	m³/h	Temperature	23,58	16,05	26,66	°C	Mass flow	11,483	0,315	12,672	kg/h	Pressure	2,029	0,000	2,047	bar	<p>Clicking on “Fetch values” will retrieve the actual measurement and MIN / MAX values for flow, volume flow, temperature, mass flow and pressure (only if a pressure transmitter is connected) from the transmitter – additionally, the reading of the consumption meter is retrieved as well.</p> <p>Checking the “Polling” checkbox will retrieve the measuring data from the transmitter at the selected interval.</p>
Measurand	Actual	Min	Max	Unit																											
Air velocity	1,279	0.500	1,412	m/sec																											
Volumetric flow rate	9,006	0,247	9,939	m³/h																											
Temperature	23,58	16,05	26,66	°C																											
Mass flow	11,483	0,315	12,672	kg/h																											
Pressure	2,029	0,000	2,047	bar																											

**Reset of the MIN / MAX Values**

The MIN / MAX values of each measurand, as stored in the flow sensor (transmitter). They can be reset by checking the appropriate checkbox and subsequently clicking the “Clear MIN / MAX” button.

Clear min-/max values

Air velocity

Volumetric flow rate

Temperature

Mass flow

Pressure

Clear min/max

**Reset of the Consumption Meter (Totalizer)**

The reading of the consumption meter can be reset by clicking the “Reset meter” button.

Standard consumption meter

399,07 m³

Reset meter

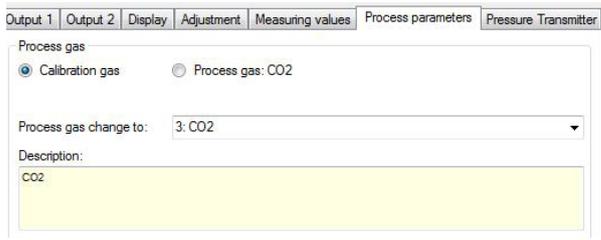
### 11.5.6. Setting up Process Parameters

In the tab “Process Parameters” the Process gas (medium) can be changed and the pressure compensation can be set.

#### Change the Process Gas

**i PLEASE NOTE**

This function is only active if the flow sensor has been ordered for a medium other than air (refer to order code “Medium” in the datasheet).

Menu	Item	Description
	Calibration gas	The gas (medium) in which the flow sensor was calibrated in the factory. Unless otherwise specified, the flow sensor is always factory calibrated in air.
	Process gas	The gas (medium) in the measured process. The adjustable process gases are set at the factory and can be selected from a list.

The flow sensor is factory set to the ordered gas (medium). If the setting for the process gas is modified or changed between calibration and process gas, the changed setting has to be sent to the transmitter. Use “send data to the transmitter and read ...” button. The “active gas” to which the flow sensor is set can be seen in the basic information field.

Units	US
Process gas	CO2
Active gas	Calibration gas
Computation version	1

#### Changing the Standard Conditions

The flow sensor is factory-set to standard conditions conforming to DIN 1343.

**Factory setting: pn = 1013.25 mbar, Tn = 0 °C (32 °F).**

The corrected volume flow value is calculated in line with the standard conditions set.

System values

Standard conditions:  °C

mbar

#### Pressure Compensation

The flow sensor is factory-adjusted to 7 bar (abs). At an operating pressure other than 7 bar (abs), the error can be corrected via the pressure coefficient of +0.5% of the measured value per bar by entering the actual system pressure.

The “Send” button is used only to send the process pressure to the transmitter.

Cycle pressure (absolute)  bar

## Setting the Inner Pipe Diameter

### **i** PLEASE NOTE

The actual inner diameter of the pipe must be set here. The “Send” button is only used to send the pipe diameter to the transmitter.

Nominal pipe size:   mm

### 11.5.7. External Pressure Sensor for Pressure Compensation

In order to achieve the highest accuracy in case of strongly fluctuating pressure (e.g. 3 to 10 bar (45 to 150 psi)), the input from an external pressure transmitter will be very useful. An absolute pressure transmitter with a 2-wire loop, powered 4 - 20 mA output, should be used.

On the tab “Pressure transmitter” the measuring range can be entered.

Measuring range

Transmitter type:

From:   bar

To:

Output range

Output signal:

### 11.5.8. Bus Configuration

If the flow sensor is equipped with an optional bus module, the data transfer rate and the network address can be set on the “Bus configuration” tab.

The network address set is only used when the DIP switches on the flow sensor PCB are set to 255 (refer to 6.4.1 M-Bus (Meter-Bus)).

Communication parameter

Baud rate:

Parity:

Stop bits:

Bus protocol:

Network address:

# 12 Conformity

## 12.1 Declarations of Conformity

E+E Elektronik Ges.m.b.H. hereby declares that the product complies with the respective regulations listed below:



European directives and standards

and



UK statutory instruments and designated standards

Please refer to the product page at [www.epluse.com/ee776](http://www.epluse.com/ee776) for the Declarations of Conformity.

## 12.2 FCC Part 15 Compliance Statement

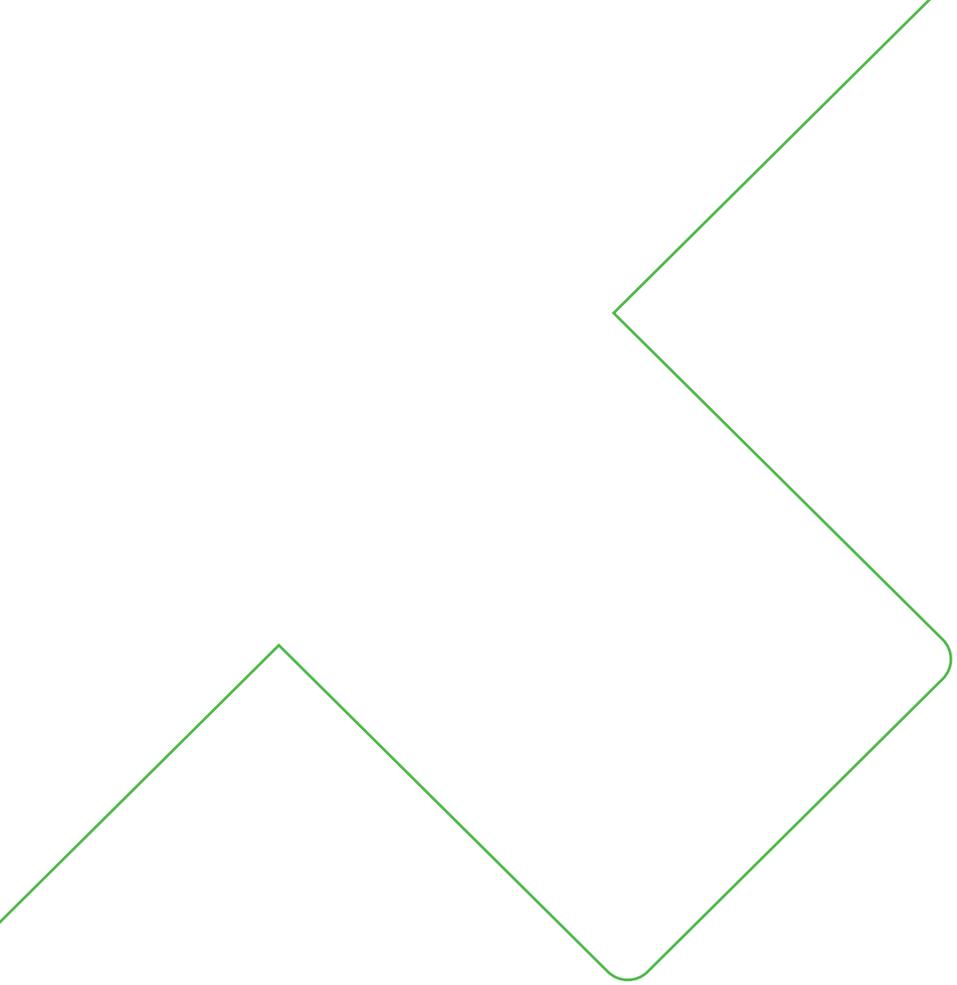
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the installation manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## 12.3 ICES-003 Compliance Statement

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.



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