



EE776 Series

**FLOW SENSOR for
COMPRESSED AIR and GASES**

Manual

Hardware and Software

YOUR PARTNER IN SENSOR TECHNOLOGY



ELEKTRONIK®
Ges.m.b.H.

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USA FCC notice:

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.

Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device.

CANADIAN ICES-003 notification:

This Device 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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1. GENERAL

This manual is a part of the scope of supply and serves to ensure optimal operation and functioning of the equipment.

For this reason, the manual must be read before start-up.

Therefore, it is necessary that this manual is read and understood by those responsible for the handling, installation, and maintenance of the equipment.

This manual may not be used for competitive purposes or passed on to third parties without the written consent of E+E Elektronik® Ges.m.b.H.

It is permitted to make copies for personal use.

All information, technical data and illustrations contained in these instructions are based on information available at the time of publication.

1.1. Symbol Clarification



This symbol indicates safety instructions.

The safety instructions have to be carried out unconditionally. If disregarded loss, injury, or damage may be inflicted on people and property. In any case E+E Elektronik® Ges.m.b.H. cannot be held responsible.



This symbol indicates attention.

The note should be observed to achieve an optimal functioning of the equipment.

1.2. Safety Instructions

1.2.1. Intended Use

The flow sensor is intended to be used for the measurement of air, non-corrosive and non-flammable gasses in pipelines only. Consult the factory first before the measurement of wet or filthy gasses.

The design of the flow sensor allows for the EE776 to be installed in a pressurized system up to PN16, i.e. 16 bar (230 psi).

Mounting, electrical installation, putting in operation and maintenance should only be done by qualified personnel.

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.

The flow sensor can only be utilized in accordance with the conditions defined in the technical data. Otherwise, inaccuracies of 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.

1.2.2. Installation, Start-up and Control

The flow sensor is designed and built in accordance with the latest state in technology, tested adequately and has been shipped from the factory in good order and condition.

As the user, you are responsible to comply with all applicable safety regulations amongst others:

- Instruction for the installation
- Local standards and codes

The manufacturer has taken all measures to assure safe operation. The user has to make sure that the equipment is positioned and installed in such a way that safe operation is not impaired. The equipment is tested in the factory and shipped in good order and condition. This manual contains information and notes of caution, which have to be adhered to by the user to assure a safe operation.

- Mounting, electrical installation, putting into operation and maintenance should only be done by qualified personnel. The plant operator should authorize qualified personnel to operate on the installation.
- It is necessary that this manual is read and understood by these professionals and that they follow the instructions as detailed in this manual.
- Check all connections of the entire installation thoroughly, before putting the system into operation.
- Disconnect the device from power supply before opening or closing to avoid damages.
- Do not put a damaged product into operation and make sure that that does not happen inadvertently.
- A malfunction of the equipment should only be handled and fixed by authorized and qualified personnel
- If it is not possible to repair the malfunction, put the equipment out of operation and make sure that it cannot be put back into operation again.
- Repairs not described in this manual may only be carried out by the manufacturer or by the respective service organization.


Disclaimer of Liability


The manufacturer or their delegated representative is only liable in case of intend or gross negligence. The accountability is limited to the value of the order issued at the time to the manufacturer.

The manufacturer is not liable for damages, originated from disregarding the safety instructions or violating the instructions of the manual or operating conditions.

Consequential damages are excluded from the any liability.

1.3. Environmental aspects

 The products from E+E Elektronik® are developed and designed in due consideration to the importance of the protection of the environment. Therefore, disposal of the product also should not lead to pollution of the environment.

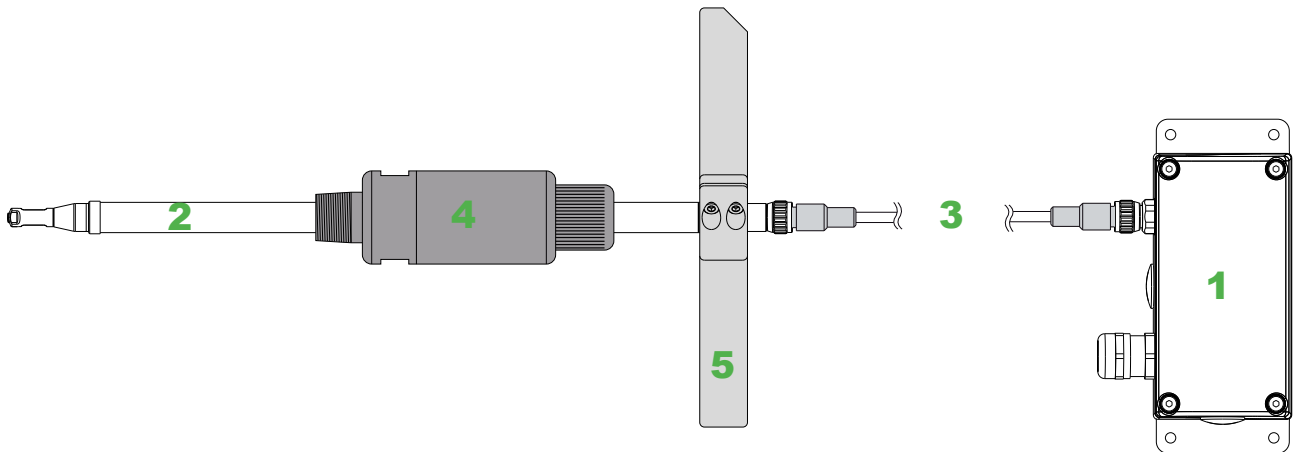
 The single-variety components must be separated before the sensor is disposed of. The electronic components must be collected and as electronic scrap properly be disposed of.

2. PRODUCT DESCRIPTION

The flow sensor of the series EE776, based on the measurement principle of thermal mass flow, is suited for the measurement of flow of air and gasses in pipelines. Measurement of for instance the consumption of compressed air, nitrogen, helium, CO2 or other non-corrosive and non-flammable gasses.

The EE776 measures the volume flow at standard conditions according to DIN 1343 ($P_0 = 1023.25$ mbar; $t_0 = 273.15$ K or 0 °C (32 °F)). In addition to the standard volume flow, the measurand mass flow, norm flow and temperature are available.

The EE776 has an integrated consumption counter. The consumption quantity is indicated in the display and is not lost after a power failure. Two signal outputs are available. Depending on the application, the outputs can be configured as analogue (current or voltage), switch output or as pulse output for the measurement of the consumption.



1 Signal conditioning with optional display

The enclosure with the signal conditioning is remote with a plugable sensor cable up to 10 meter (33 feet).

2 Sensing probe with measurement electronics

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

3 Sensor cable

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

4 Non-return protection for secure mounting

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

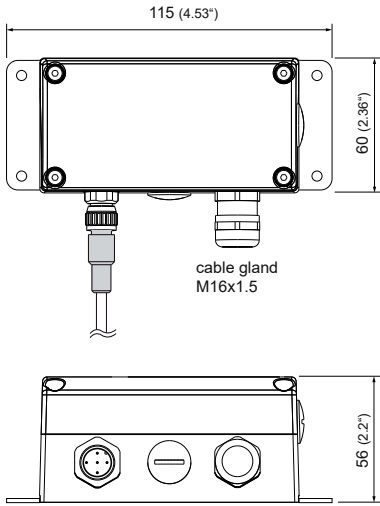
- **Non-return protection**
The sensor can only be pushed in one direction during installation. The sensor cannot return at all, even if it is released.
- **Seal**
By means of an encapsulated O-ring, no compressed air can escape under pressure during assembly.
- **Precise positioning**
The precise positioning with respect to immersion depth and orientation is easy to perform, guaranteeing accurate measurement results.

5 Mounting grip

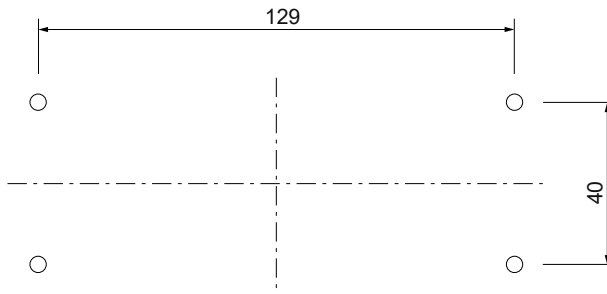
With the mounting grip, the sensing probe is inserted and correctly positioned into the pipe line.

3. INSTALLATION

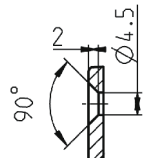
3.1. Mounting Dimensions



Drilling Plan:

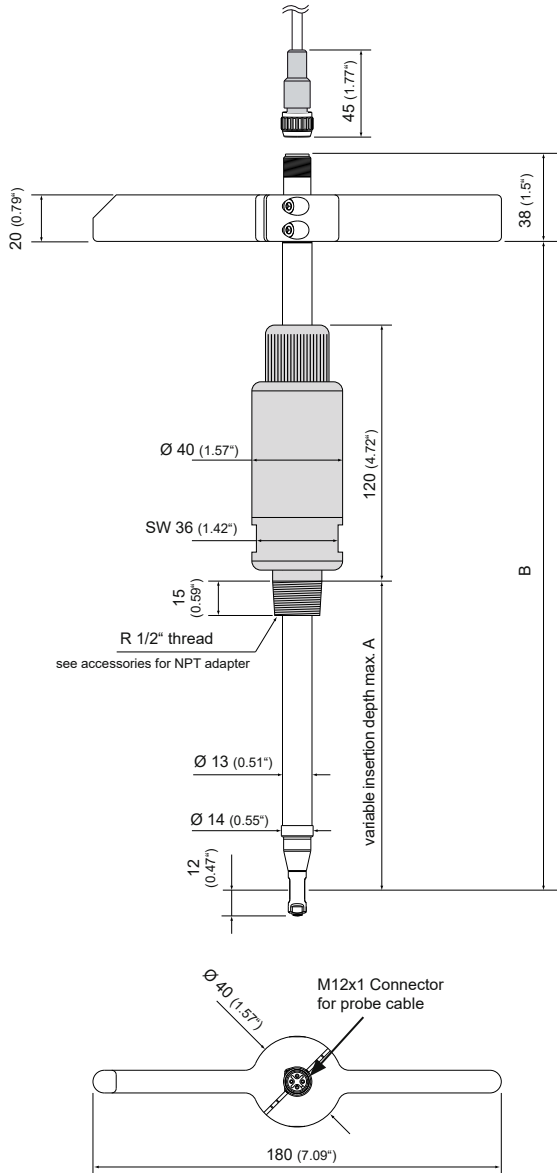


Cross-section bore hole:



The bottom part of the housing 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

EE776 - Enclosure - signal conditioning



Pipe Ø	A [mm]	B [mm]	A [inch]	B [inch]
DN50...DN100	165	285	6.5	11.22
DN125...DN300	315	435	12.4	17.13
DN350...DN700	465	585	18.3	23.03

EE776 - Sensor probe

3.2. Determining Installation Site

- The installation site should be easy accessible and free of vibrations and shocks
- Observe enough clearance above the mounting position, in order to be able to install and remove the sensing probe:
at least **450 mm** (17.7") for probe length 165 mm (6.5") 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 **750 mm** (30.0") for probe length 465 mm (18.3") DN350 (14") up to DN700 (28")
- The ambient temperature should not exceed the value as stated in the specifications (see page 24). Consider heating by radiation.
- Air purity on the installation site according to ISO 8573-1:2010: at least class 3.4.4
- The fluid 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. If there is no dryer, at least steam trap and suitable filter must be present.
- Observe the direction of the flow by the installation (see page 9).
- Observe the recommended straight pipe lengths up and downstream, in order to warrant 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.

3.2.1. Process Pressure

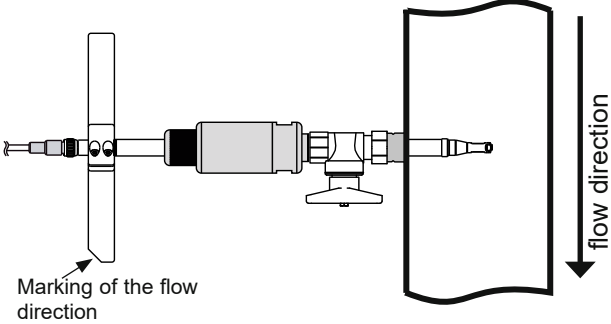
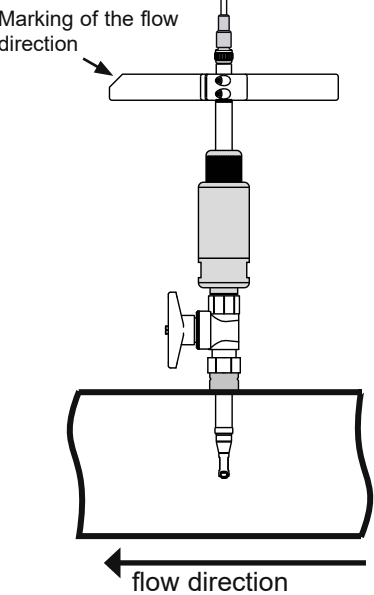
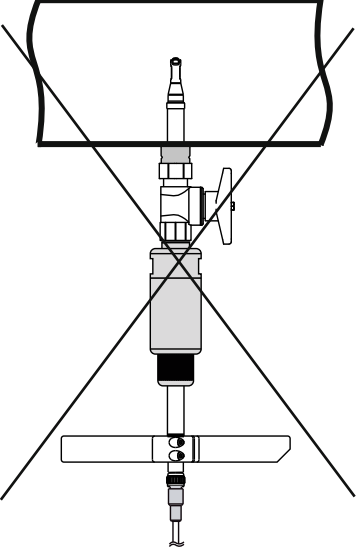
Because of the measuring principle the thermal mass flow sensor EE776 is largely independent of the process pressure and is factory calibrated at a pressure of 9 bar (130.5 psi).

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 (see page 34/35).
- in case of strong fluctuations of the process pressure (e.g. 3 to 10 bar (40 to 150 psi)) an external pressure sensor can be installed and connected to the pressure-compensation input (see page 35).

3.3. Installation Position

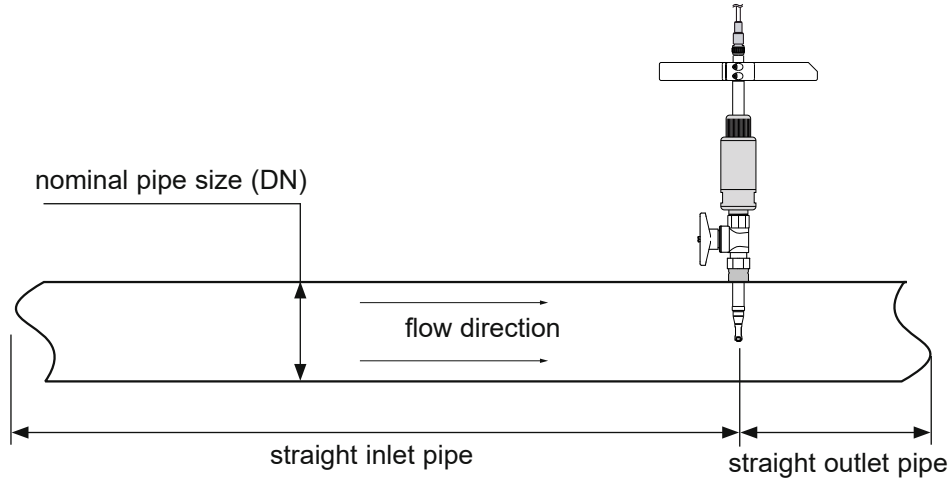
The flow sensor has a specified direction of flow. Make sure that the arrow on the tip of the sensing probe and the marking on the mounting grip is pointing in the direction of the flow.



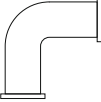
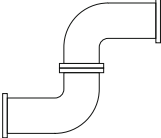
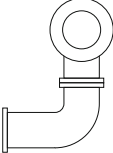
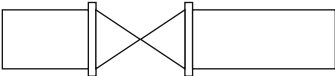
<p>Pipeline vertical; Sensor horizontal</p>	<p>recommended</p>
 <p>Marking of the flow direction</p> <p>flow direction</p>	<p>YES</p>
<p>Pipeline horizontal; Sensor vertical up or horizontal</p>	
 <p>Marking of the flow direction</p> <p>flow direction</p>	<p>YES</p>
<p>Pipeline horizontal, Sensor down</p>	
	<p>NO</p>

3.4. 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 as a minimum. If possible, allow for greater distances.
- Valves or gate valves should be installed downstream of the flow sensor.
- With lighter gasses the inlet straight pipe should be longer.



	Type	(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

3.5. Installation In The Pipeline

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

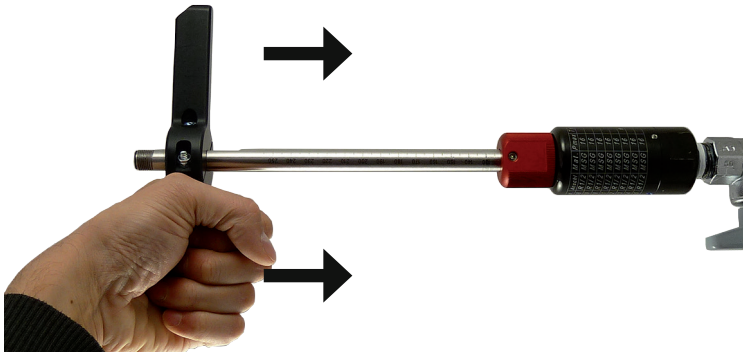
- **Non-return protection device**
The sensor can only be pushed in one direction during installation. The sensor will not move back at all, even when it is released.
- **Seal**
Thanks to an encapsulated O-ring, no compressed air can escape under pressure during assembly.
- **Precise positioning**
The precise positioning with respect to immersion depth and orientation is easy to perform, guaranteeing accurate measurement results.

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

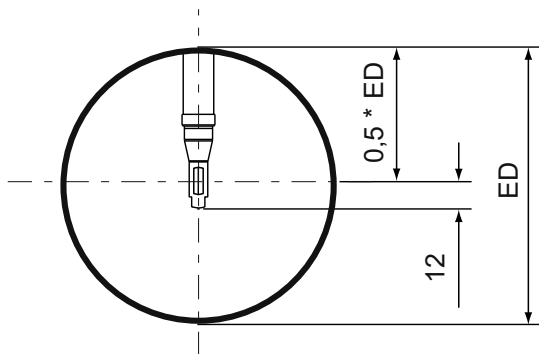
- Pull the measurement sensor back into the non-return protection device as far as it will go.
- Screw the non-return protection device into the ball valve using suitable sealants for a fully sealed connection.
- Screw knurled nut in by approx. one thread turn.



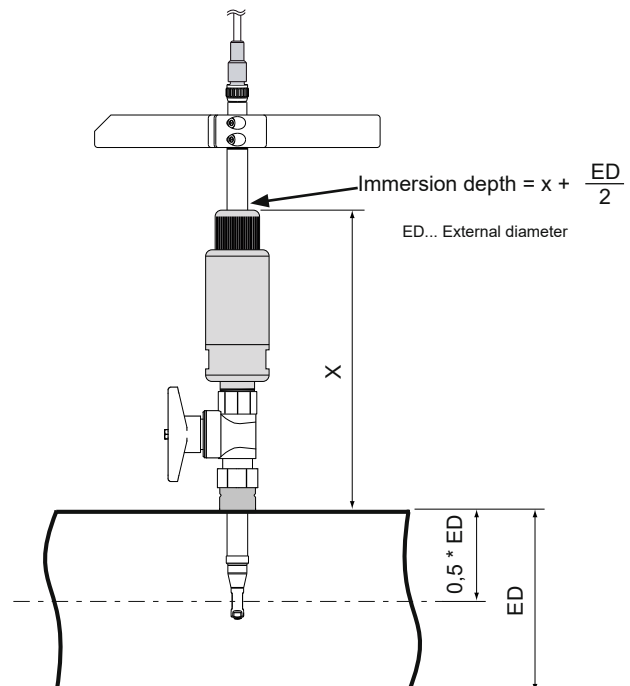
- Open the ball valve and dip the measurement sensor into the pipe line.

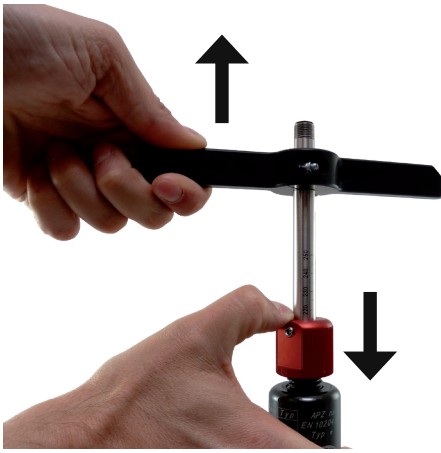


- **Positioning in the pipe line**
To ensure that the accuracy level specified on the data sheet is observed, the sensor head must be positioned in the centre of the pipe. The scale on the sensor pipe for the immersion depth relates to the centre of the sensor head.



Correct position in the pipe line

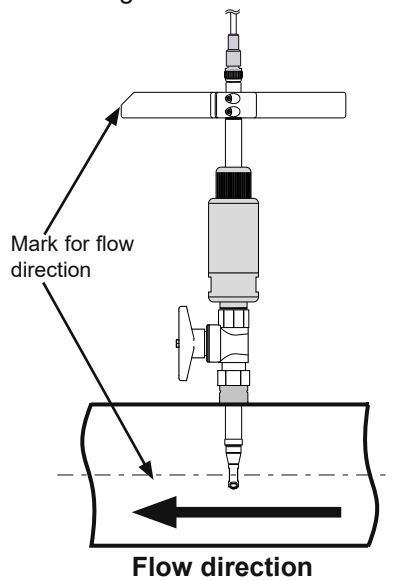




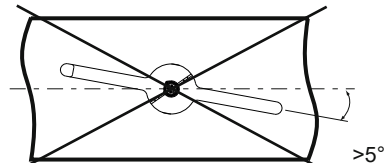
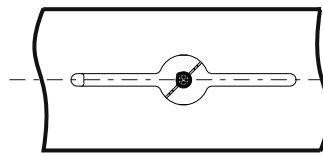
- If the measurement sensor is immersed too far into the pipe line, it can be retracted by unlocking the non-return protection device. To do this, slowly press the knurled nut inwards. As with a pressure point in a car clutch, this permits the immersion depth to be set to the precise millimetre.



- **Align the measurement sensor with the flow direction.**
The flow sensor has a set flow direction. Ensure that the direction arrow on the sensor head or the mark on the mounting handle is pointing in the media flow direction. The measurement sensor is aligned with precision in the flow direction using the mounting handle. An angle deviation must not be greater than $\pm 5^\circ$ from the ideal position.



Align the mounting grip parallel to the pipe.



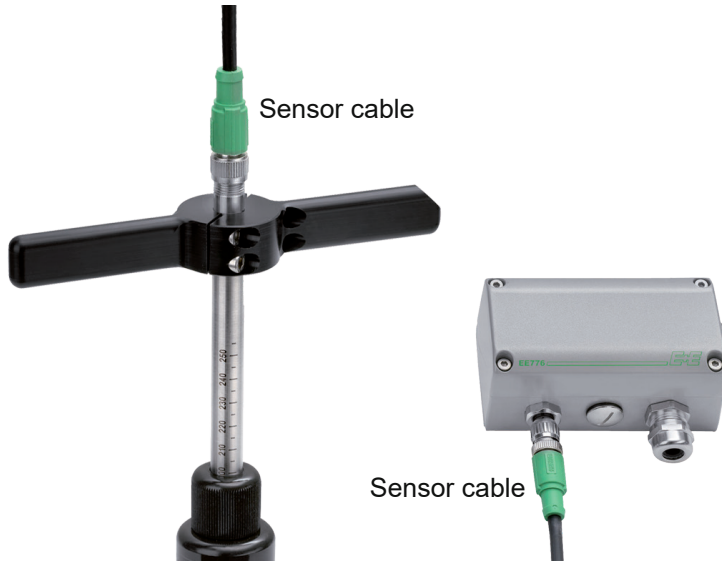
- When the measurement sensor is correctly positioned in terms of immersion depth and alignment, tighten the knurled nut with a screw-wrench (AF 27).



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



- Connect the measurement sensor and the evaluation unit to the sensor cable.




3.6. Setting the Pipe Diameter

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

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

- \dot{V}_0 ... Standardized volumetric flow [m³/h]
- v_0 ... Standardized flow [m/s]
- d_i ... Internal diameter of pipe [m]
- π ... 3,1415

 The internal diameter is factory-set to the value acc. table 1. Because the inner diameter of a pipe is not standardized and varies depending on wall thickness, the actual inner diameter of the pipe must be set with the Configurator Software! (see page 34)

Nominal diameter		External diameter	wall thickness	internal diameter
<i>DN</i>	<i>Inch</i>	<i>da (mm/inch)</i>	<i>s (mm/inch)</i>	<i>di (mm/inch)</i>
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

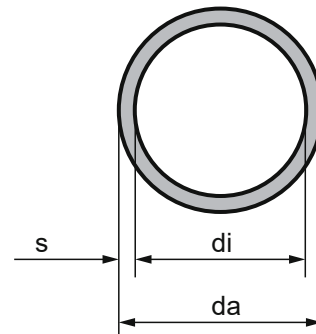


Table 1: Factory setting for pipe diameter


4. ELECTRICAL CONNECTIONS

Before electrical connections are made turn off the power supply first. If not observed the electronics can be damaged as a result.

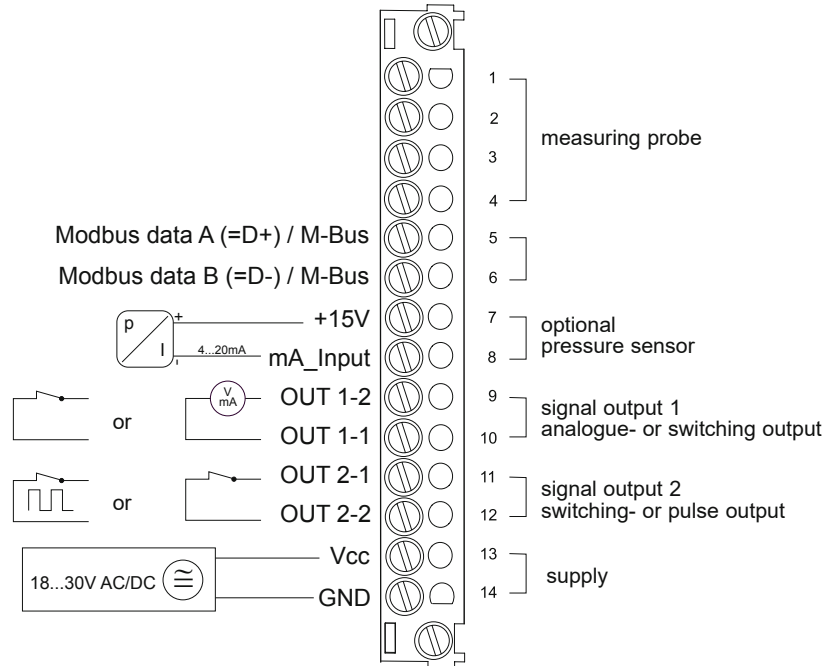
Only a qualified electrotechnical engineer may install the device.

- Unscrew the four screws and remove the cover of the housing.
- The screw terminals are located in the bottom part of the housing.
- For the electrical connection of the flow sensor a six-wire cable is needed (e.g. 6 x 1 mm² (AWG 17))

4.1. Connection Diagram



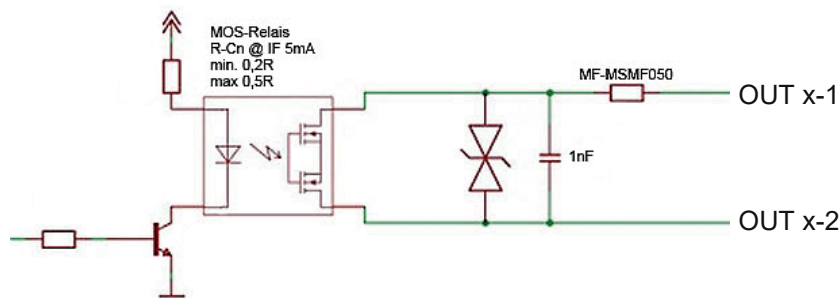
Important note:
The manufacturer cannot be held responsible for personal injuries or damage to property as a result of incorrect handling, installation, wiring, power supply and maintenance of the device.



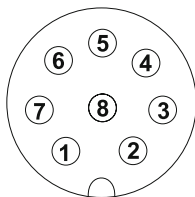
- Screw terminal OUT 1-1 for the analogue output is internally connected with GND.
- The housing should be grounded to achieve optimal electromagnetic compliance.

4.1.1. Relay and Pulse Output, Internal Switching

The relay switch and pulse outputs are both potential free.



4.1.2. Connection With Optional Plug for Power Supply and Outputs (Order Code Q)



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.

4.2. Bus Output (optional)

4.2.1. 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 two-wire line. The flow sensor as 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 metres is permitted per segment (primary addressed).

Read-out of the current measurement/consumption data

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

- Standard volumetric flow (32 Bit Real)
- Temperature (32 Bit Real)
- Mass flow (32 Bit Real)
- Consumption meter status (32 Bit Real)
- Flow velocity (32 Bit Real)

- Standard volumetric 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 (Adresse)
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: Volumenstrom	
05	DIF (32 Bit Real)
3E	VIF (Volume flowmese in m ³ /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 ³)
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 ⁻³ m ³ /h)
XX XX XX XX	Act. measuring value
Data record 8: Temperatur	
04	DIF (32 Bit Integer)
59	VIF (Temperature in 10 ⁻² °C)
XX XX XX XX	Act. measuring value
Datenrecord 9: Mass flow	
04	DIF (32 Bit Integer)
51	VIF (Mass flow in 10 ⁻² kg/h)
XX XX XX XX	Act. measuring value
Datenrecord 10: Consumption meter reading	
07	DIF (64 Bit Integer)
13	VIF (Volume in 10 ⁻³ m ³)
XX XX XX XX XX XX XX XX	Akt. consumption data
Datenrecord 11: Flow rate	
04	DIF (32 Bit Integer)
7F	VIF (manufacturer specific in 10 ⁻² m/s)
XX XX XX XX	Act. measuring value
Data record 12: Pressure	
04	DIF (32 Bit Real)
68	VIF (Pressure in 10 ⁻³ bar)
XX XX XX XX	Act. measuring value
End of user data	
XX	Check sum
16	End of telegram

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>.

4.2.2. Modbus RTU

The measured values are stored as a 32 bit float value. Depending on the measurement unit selected, the 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 see Application Note AN0103 (www.epluse.com/EE776).

Modbus Map:

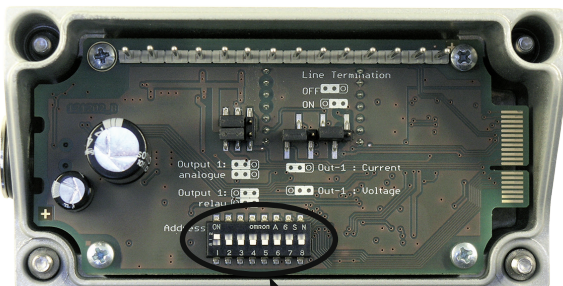
Register	Protocol-Address	Measuring Value	SI-Unit	US/GB-Unit
Read Registers (Function Code 0x03 / 0x04) / 32Bit float Value				
30026	19	Standardized Flow	m/s	SFPM
30028	1B	Standardized Volumetric Flow	m³/h	SCFPM
30030	1D	Temperature	°C	°F
30032	1F	Massflow	kg/h	kg/h
30034	21	Consumption reading	m³	ft³
30036	23	Pressure	bar	psi
30261	104	MIN-Value Standardized Flow	m/s	SFPM
30263	106	MAX-Value Standardized Flow	m/s	SFPM
30265	108	MIN-Value Standardized Volumetric Flow	m³/h	SCFPM
30267	10A	MAX-Value Standardized Volumetric Flow	m³/h	SCFPM
30269	10C	MIN-Value Temperature	°C	°F
30271	10E	MAX-Value Temperature	°C	°F
30273	110	MIN-Value Massflow	kg/h	kg/h
30275	112	MAX-Value Massflow	kg/h	kg/h
30277	114	MIN-Value Pressure	bar	psi
30279	116	MAX-Value Pressure	bar	psi
Write Registers (Function Code 0x06) / 16Bit integer Value				
60261	104	Reset MIN/MAX-Value Standardized Flow		
60262	105	Reset MIN/MAX-Value Standardized Volumetric Flow		
60263	106	Reset MIN/MAX-Value Temperature		
60264	107	Reset MIN/MAX-Value Massflow		
60265	108	Reset MIN/MAX-Value Pressure		

4.2.3. Data Transmission

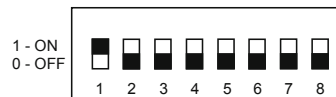
	Factory Setting M-Bus	Factory Setting Modbus	Adjustable Values	
			M-Bus	Modbus RTU
Baud Rate	2400	9600	600...9600	9600...57600
Data Bits	8	8	8	8
Parity	EVEN	EVEN	None, Odd, Even	None, Odd, Even
Stop Bits	1	1	1 or 2	1 or 2
Slave-Address	1	1	0...254	1...247

4.2.4. Addressing

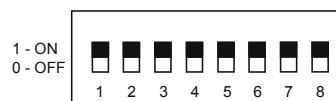
The flow sensors are factory-set to address 1. The slave address can be set via switches on the PCB.



DIP switch for setting address



Factory Setting:
Slave-Address = 1



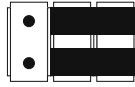
Slave-Address = 255
The address set using the configurator software is used.

5. CONTROL COMPONENTS

5.1. Jumper for Output

If the signal output is altered from relay to 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



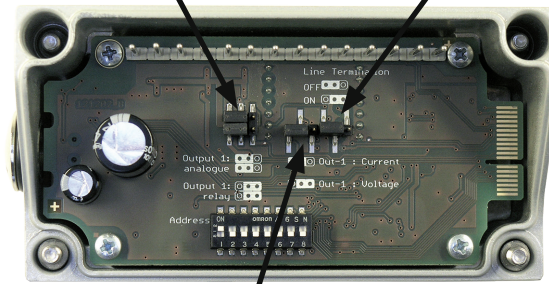
Line Termination = OFF



Line Termination = ON
150 Ohm parallel to
bus output A and B

Jumper Output 1

Jumper Line Termination



Jumper Out-1

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




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

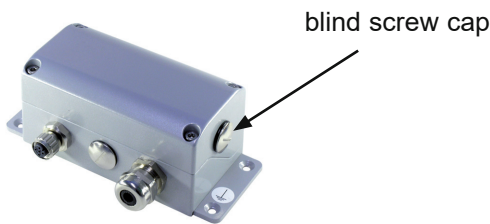


5.2. Digital Interface USB (For Configuration)

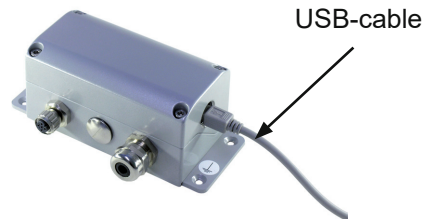
The USB connector is behind the blind screw cap, at the side of the housing.

- remove the blind screw cap with a screwdriver
- plug in the USB connector

 Install the configuration software, which is in the scope of supply. The configuration software is available for downloading as well from our website at www.epluse.com



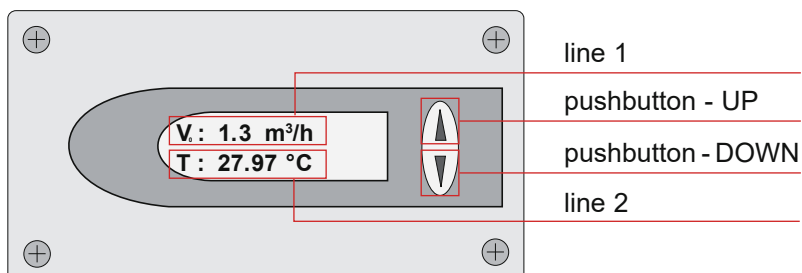
blind screw cap



USB-cable

5.3. Display / Indicator with Keypad (Optional)

An optional two-line display is available for the flow sensor EE771. The display is an integral part of the cover of the housing and has two soft-keys for the control of the indicator.



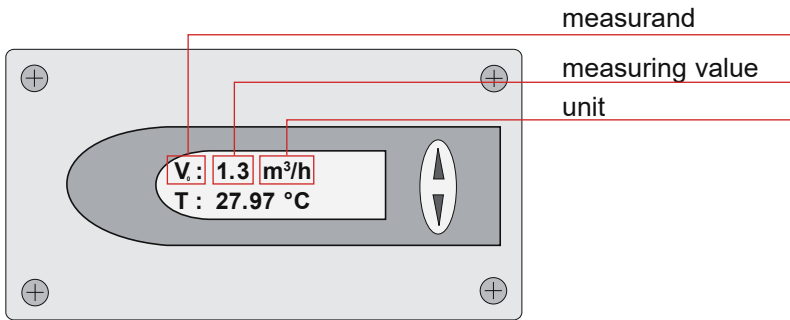
line 1

pushbutton - UP

pushbutton - DOWN

line 2

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 Unit
v_0	Standardized Flow	m/s	SFPM
T	Temperature	°C	°F
\dot{V}_0	Standardized Volumetric Flow	m ³ /h; m ³ /min; l/min	SCFM; SLPM
m	Massflow	kg/h; kg/min; kg/s	kg/h; kg/min; kg/s
Q	Consumption	m ³	ft ³
p	Pressure	bar	psi

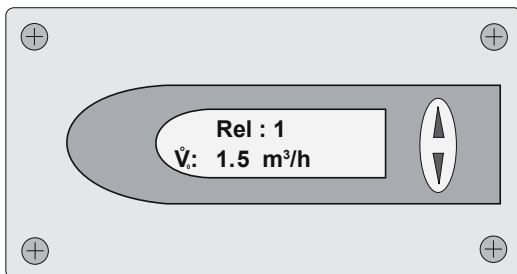
5.3.1. Indication of the Analogue and Pulse Output

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

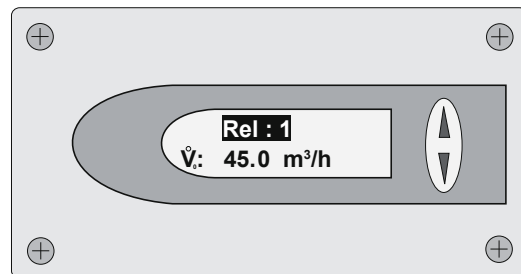
5.3.2. Indication of the Switch Output

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).



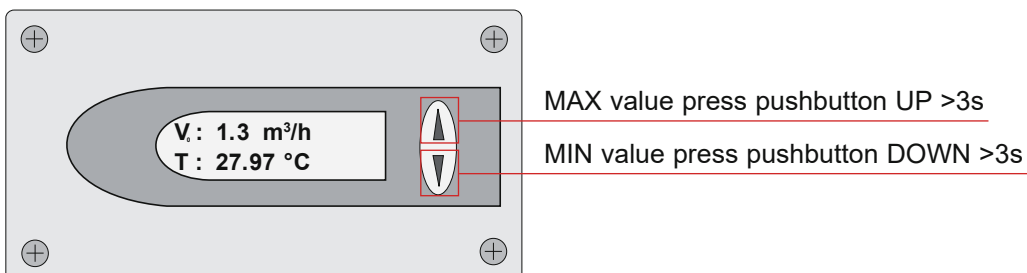
Switch output inactive (relay has not switched)



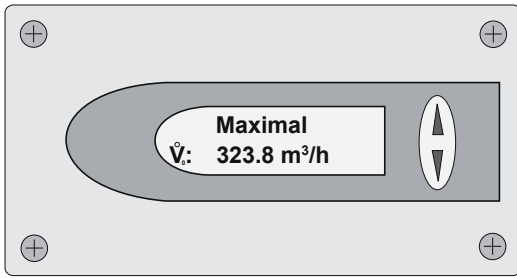
Switch output active (relay has switched)

5.3.3. Indication of the MIN / MAX Values

Keep the DOWN key pressed for > 3 sec to indicate the MIN value.
Keep the UP key pressed for > 3 sec to indicate the MAX value.



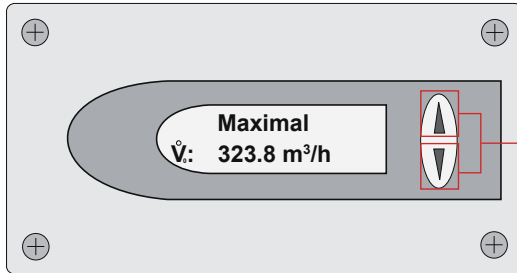
After that the several different measurement values can be indicated using the UP or DOWN keys.
Keep the DOWN or UP key pressed for > 3 sec to exit the MIN / MAX mode.



5.3.4. Reset of the Consumption Counter or the MIN / MAX Value

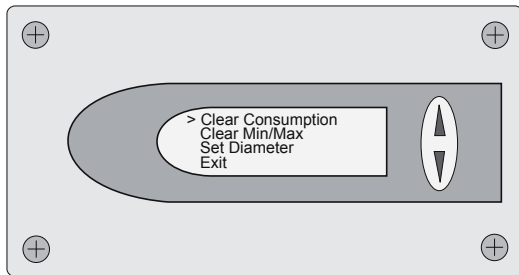
Keep both the UP and DOWN key pressed for > 3 sec to enter the menu for resetting the consumption counter or the MIN / MAX value.

Select the desired menu item by pressing the UP or DOWN key briefly.



Press pushbutton UP and DOWN at the same time for >3s

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



5.3.5. Maximum Consumption Counter

The maximum consumption counter readout on the display is 999,999,999.0 m³ or 99,999,999.0 ft³. Then it shows "LCD maximum". The internal memory continues counting. The maximum counter reading is 3.4 * 10³⁸ m³. It is possible to read-out the counter reading with the configuration software.

6. ERROR MESSAGES

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

ERROR 01: sensing probe is not detected

- Cause: the sensing probe is not connect or is defect
- Effect: the display indicates "0" for all measurand. The analogue output defaults to the lowest configured value.
- Action: 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.

ERROR 02: the EEPROM is defect


- Cause: the EEPROM for the storing of the consumption counter and MIN /MAX value is defect.
- Effect: the consumption counter and MIN / MAX values are no longer available. All measurement values though are still indicated. The analogue, relay and pulse output are still functional.
- Action: return the flow sensor to the manufacturer.

7. MAINTENANCE


Regular cleaning of the sensor is necessary is used in applications with wet or filthy gasses. Cleaning of the sensor is necessary prior to calibration or evaluation.

7.1. Cleaning of the Flow Sensor

Do not use an abrasive cleaning agent, an organic solvent containing halogen or acetone.

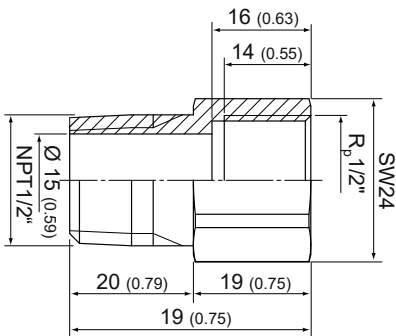
-  Clean the head of the sensor probe by carefully swirling in warm water or isopropyl alcohol. It is recommended to use isopropyl alcohol if the pollution is crease or oil.

The sensor should not be touch by fingers or solid objects like screwdrivers or brushes!

-  Leave the sensor to dry in ambient air.

8. ACCESSORIES

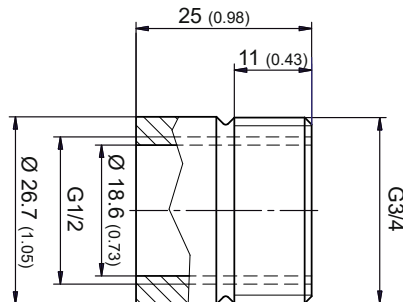
8.1. Adapter BSP - NPT



Material: Brass
Order code: HA074004

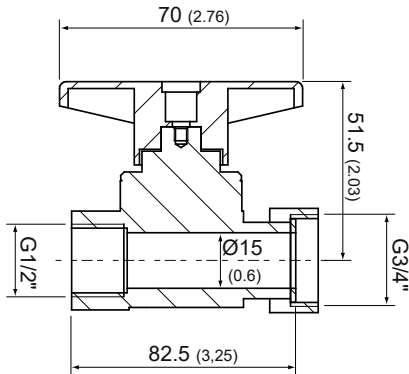
Dimensions mm (inch)

8.2. Welding Nipple



Material: Stainless steel 1.4301
Order code: HA074001

8.3. Ball Valve 1/2"

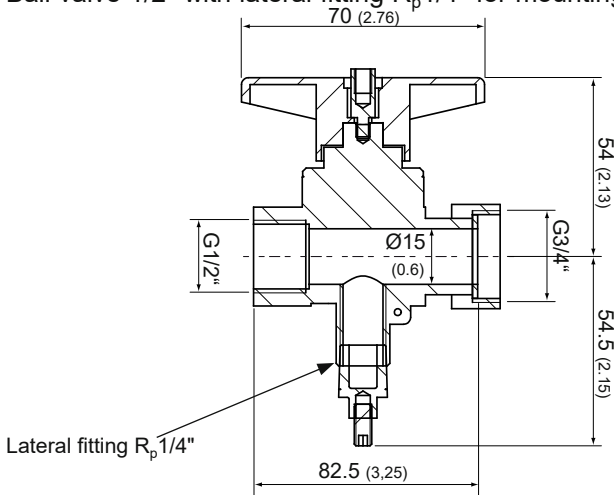


Material: Brass
Order code: HA074002

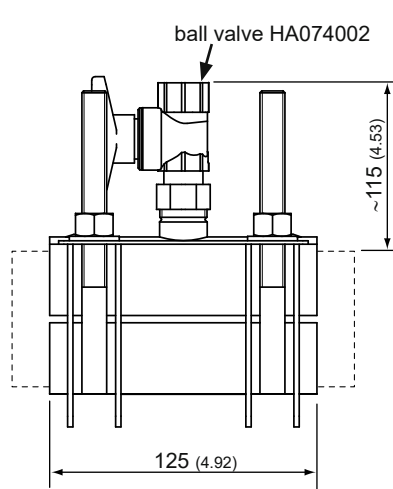
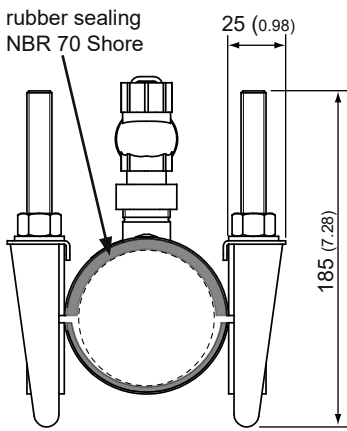
8.4. Ball Valve 1/2" for Parallel Measurement

Ball valve 1/2" with lateral fitting R_p 1/4" for mounting of pressure or dew point sensor.

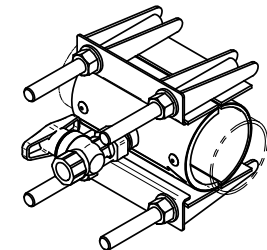
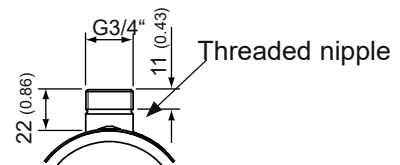
Material: Brass
Order code: HA074003



8.5. Tapping Sleeve (Delivery Without Ball Valve)

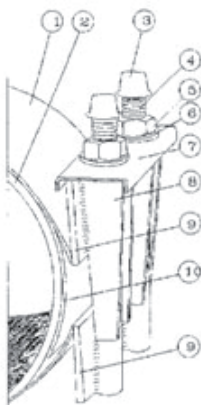


Material: stainless steel 1.4301



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

8.5.1. Mounting the Tapping Sleeve



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

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 mounting work at a height of max. 3.5 m above the floor (height of 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. Any grinding work required in the event of corroded pipes must be carefully carried out, ensuring that the roundness of the surface is maintained.

Recommendation for mounting work

- Compare pipe diameters and check the correct sleeve size.
- 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!
- Before mounting, mark the sleeve position to make it easier to check that the sleeve is positioned correctly.
- 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.
- Using the correct tools (long spanners and/or torque wrench) improves and simplifies the mounting process.
- It is essential that the pin thread is free of all dirt.
- 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.
- 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!

Remove the cap from the threaded pin and turn the nuts until they reach the end of the threaded pin - do not remove them!

Open out the pipe sleeve and place the top part on the sleeve around the pipe .



Position the retainer correctly over the bolt yoke on one side.

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.



When doing so, ensure that both retainer edges are moved evenly underneath the seals.

At this point, it must no longer be possible to move the sleeve radially!

Check that seals and retainer edges are positioned on the pipe and that the pointed ends are positioned evenly over the seal. Tighten the nuts on the retainer loosely positioned on the bolt yoke hand-tight, until the retainer is under tension.



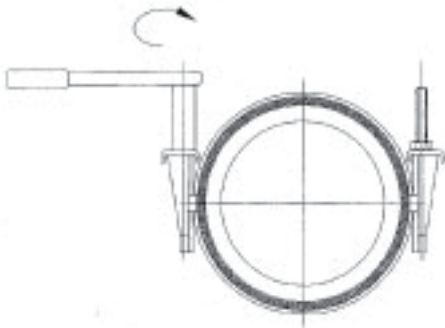
Turn further using a spanner until the retainer slides over the bolt yoke and engages into position.

Tighten the nuts evenly using a spanner (min. 300mm in length) until the delrin® washers curve very slightly around the nuts. The delrin® washers being slightly misshapen does not affect the function of the sleeve.

The following torques are set when using a torque wrench:

- M12 : 65 Nm
- M14 : 85 Nm
- M16 : 110 Nm

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



Check the torque after 20 minutes and adjust if necessary.



- Before the sleeve is put under pressure, the fitted sleeve should be checked to ensure that it is securely sealed!
- 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

Flow

Standardized conditions	According to DIN 1343 (configurable) $P_0 = 1013.25 \text{ mbar (14.7 psi); } t_0 = 0 \text{ }^\circ\text{C (32 }^\circ\text{F)}$
Measuring range	0.2...100 m/s (40...19685 SFPM) or 0.2...200 m/s (40...39370 SFPM)
Accuracy in air at 9 bar (130.5 psi) (abs) and 23 °C (73 °F) ¹⁾	± (1.5% of measuring value + 0.8% of full scale)
Temperature dependence	± (0.1% of measuring value/°C) ²⁾
Pressure dependence ³⁾	+ 0.5% of measuring value/bar
Response time t_{90}	< 1 s
Sample rate	0.5 s

Temperature

Measuring range	-20...80 °C (-4...176 °F)
Accuracy at 20 °C (68 °F)	±0.7 °C (1.26 °F)

Outputs


Signal range and measurands are freely configurable

Analogue output	Voltage	0 - 10 V	0 < IL < 1 mA
	Current (3-wire)	0 - 20 mA and 4 - 20 mA	RL < 500 Ohm
Switch output	Potential-free, max. 44 V DC, 500 mA switching capacity		
Pulse output	Totalizer, pulse length: 0.02...2 s		
Digital interface (optional)			
RS485	(EE776 = 1 unit load)		
Modbus RTU			
Default settings	Baud rate 9600 ⁴⁾ , parity even, stop bits 1, Modbus address 1		
M-Bus			
Default settings	Baud rate 2400 ⁵⁾ , parity even, stop bits 1, M-Bus address 1		

Input

Dynamic pressure compensation	4 - 20 mA (2-wire; 15 V) input for pressure sensor
-------------------------------	--

General

Supply voltage class III  (EU)/class 2 (NA)	18 - 30 V AC/DC
Current consumption, max.	200 mA
Temperature range	Ambient/Storage Medium -20...60 °C (-4...140 °F) -20...80 °C (-4...176 °F)
Humidity working range	0...99 %RH non-condensing
Max. working pressure	16 bar (232 psi)
Medium	Compressed air or non-corrosive gases
Electrical connection	Cable gland M16x1.5 (optional connector M12x1, 8 pole)
Electromagnetic compatibility	EN 61326-1 EN 61326-2-3 Industrial Environment
Material	Enclosure Probe Sensor head Non-return protection
	Metal (AlSi3Cu) Stainless steel Stainless steel/glass Brass
Protection rating enclosure	IP65/NEMA 4



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).

2) Deviating from 20 °C (68 °F)

3) The flow sensor is calibrated at 9 bar (130.5 psi) abs. If the working pressure is different from 9 bar (130.5 psi) you can compensate the error by setting the actual pressure with the configuration software.

4) Supported baud rates: 9600, 19200, 38400 and 57600; find more details about communication setting in the Modbus Application Note at www.epluse.com/EE776.

5) Supported baud rates: 600, 1200, 2400, 4800 and 9600.

Flow measuring range in dependence on pipe diameter

Pipe	Inner Ø	Measuring range	
		0.2...100 m/s (40...19685 SFPM)	0.2...200 m/s (40...39370 SFPM)
DN50 / 2"	54.5 (2.15)	1.7...839 m ³ /h 1.0...493.8 SCFM	1.7...1679 m ³ /h 1.0...987.6 SCFM
DN65 / 2 1/2"	70.3 (2.77)	2.8...1397 m ³ /h 1.6...821.6 SCFM	2.8...2793 m ³ /h 1.6...1643.2 SCFM
DN80 / 3"	82.5 (3.25)	3.8...1923 m ³ /h 2.3...1131.5 SCFM	3.8...3847 m ³ /h 2.3...2263.0 SCFM
DN100 / 4"	107.1 (4.22)	6.5...3242 m ³ /h 3.8...1906.9 SCFM	6.5...6483 m ³ /h 3.8...3813.8 SCFM
DN125 / 5"	131.7 (5.19)	9.8...4902 m ³ /h 5.8...2883.5 SCFM	9.8...9803 m ³ /h 5.8...5766.9 SCFM
DN150 / 6"	159.3 (6.27)	14.3...7171 m ³ /h 8.4...4218.7 SCFM	14.3...14343 m ³ /h 8.4...8437.3 SCFM
DN200 / 8"	206.5 (8.13)	24.1...12051 m ³ /h 14.2...7089.0 SCFM	24.1...24101 m ³ /h 14.2...14178.0 SCFM
DN250 / 10"	260.4 (10.25)	38.3...19163 m ³ /h 22.5...11272.6 SCFM	38.3...38325 m ³ /h 22.5...22545.3 SCFM
DN300 / 12"	309.7 (12.19)	54.2...27105 m ³ /h 31.9...15945.1 SCFM	54.2...54211 m ³ /h 31.9...31890.1 SCFM
DN350 / 14"	339.6 (13.37)	65.2...32591 m ³ /h 38.3...19172.5 SCFM	65.2...65183 m ³ /h 38.3...38345.0 SCFM
DN400 / 16"	388.8 (15.31)	85.4...42719 m ³ /h 50.3...25130.2 SCFM	85.4...85438 m ³ /h 50.3...50260.0 SCFM
DN500 / 20"	486 (19.13)	133.5...66749 m ³ /h 78.5...39266.0 SCFM	133.5...133498 m ³ /h 78.5...78531.9 SCFM
DN600 / 24"	585 (23.03)	193.4...96712 m ³ /h 113.8...56892.6 SCFM	193.4...193425 m ³ /h 113.8...113785.1 SCFM
DN700 / 28"	682.6 (26.87)	263.4...131675 m ³ /h 154.9...77459.8 SCFM	263.4...263350 m ³ /h 154.9...154919.6 SCFM

9.1. Factory Setting Analogue Output

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

Pipe			Standardized Volumetric Flow			Standardized Volumetric Flow			Mass Flow			
DN	Zoll	Inner Ø	From	Up to		Unit	Up to		Unit	Up to		Unit
		di (mm)		low (L1)	high (H2)		low (L1)	high (H2)		low (L1)	high (H2)	
50	2"	54,5	0	800	1600	m³/h	450	900	SCFM	1035	2070	kg/h
65	2 1/2"	70,3	0	1300	2600	m³/h	800	1600	SCFM	1682	3364	kg/h
80	3"	82,5	0	1900	3800	m³/h	1100	2200	SCFM	2458	4916	kg/h
100	4"	107,1	0	3200	6400	m³/h	1900	3800	SCFM	4140	8280	kg/h
125	5"	131,7	0	4900	9800	m³/h	2800	5600	SCFM	6339	12678	kg/h
150	6"	159,3	0	7100	14200	m³/h	4200	8400	SCFM	9185	18371	kg/h
200	8"	206,5	0	12000	24000	m³/h	7000	14000	SCFM	15524	31049	kg/h
250	10"	260,4	0	19000	38000	m³/h	11000	22000	SCFM	24580	49161	kg/h
300	12"	309,7	0	27000	54000	m³/h	15000	30000	SCFM	34930	69860	kg/h
350	14"	339,6	0	32000	64000	m³/h	19000	38000	SCFM	41398	82797	kg/h
400	16"	388,8	0	42000	84000	m³/h	25000	50000	SCFM	54335	108671	kg/h
500	20"	486	0	66000	132000	m³/h	39000	78000	SCFM	85384	170768	kg/h
600	24"	585	0	96000	192000	m³/h	56000	112000	SCFM	124195	248390	kg/h
700	28"	682,6	0	130000	260000	m³/h	77000	154000	SCFM	168181	336362	kg/h

9.2. Order Code Replacement Sensor

Replacement Sensor		PE776-
Type	Remote probe	T3
Measuring range	Low	HV31
	High	HV33
Maximum pipe diameter / probe length	DN100 / 165 mm	N100
	DN300 / 315 mm	N300
	DN700 / 465 mm	N700
Pipe diameter pre-setting	DN50 (2")	DN50
	DN65 (2 1/2")	DN65
	DN80 (3")	DN80
	DN100 (4")	DN100
	DN125 (5")	DN125
	DN150 (6")	DN150
	DN200 (8")	DN200
	DN250 (10")	DN250
	DN300 (12")	DN300
	DN350 (14")	DN350
	DN400 (16")	DN400
	DN500 (20")	DN500
	DN600 (24")	DN600
	DN700 (28")	DN700



Replacement sensor order example:

PE776-T3HV31N100DN100

Type: Remote probe
 Measuring range: Low
 Maximum pipe diameter / probe length: DN100 / 165 mm
 Pipe diameter pre-setting: DN100 (4")

CONFIGURATION SOFTWARE

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.

1. General

The configuration software can be downloaded free of charge at www.epluse.com/ee776
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 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 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.

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.

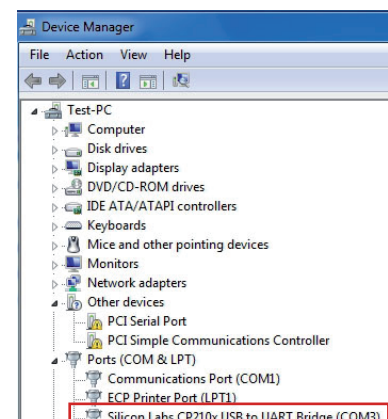
- During installation of the software the EE776 should NOT be connected with the USB cable to the computer.
- With Setup.exe the InstallShield-Wizard for the EE776 configurator will be started.
- Follow the instructions on the screen to install the software.

At first, the configuration software will be installed and then the installation of the USB driver activated – except if the user has defined that USB setup is disabled.

i The USB driver will be automatically installed the moment the first connection is made with the EE776. The appearing dialog boxes can be dealt 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 via the USB interface with the personal computer, a connection “Silicon Labs CP210x USB to UART Bridge” should have been created in the device manager.

See: Start => Settings => Control Panel => System => Hardware => Device Manager

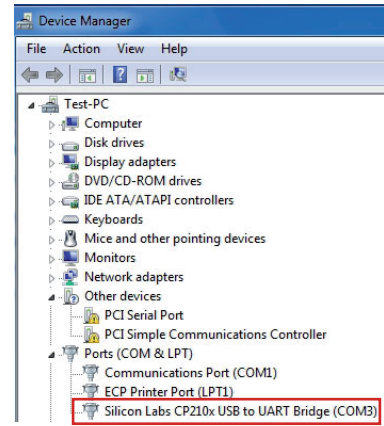


2.1. Configuration of the USB Interface (VirtualCOM)

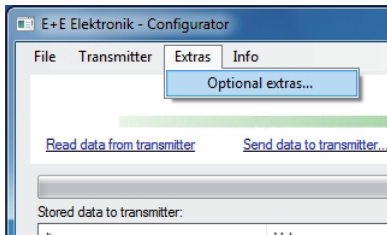
After the startup of the software, the correct VirtualCOM interface for the USB driver must be configured

The number for the used USB interface can be found under:

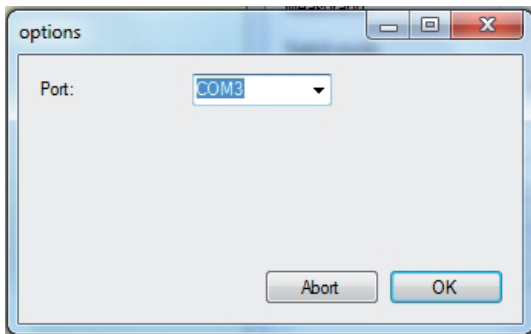
Start => Settings => Control Panel => System => Hardware => Device Manager



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

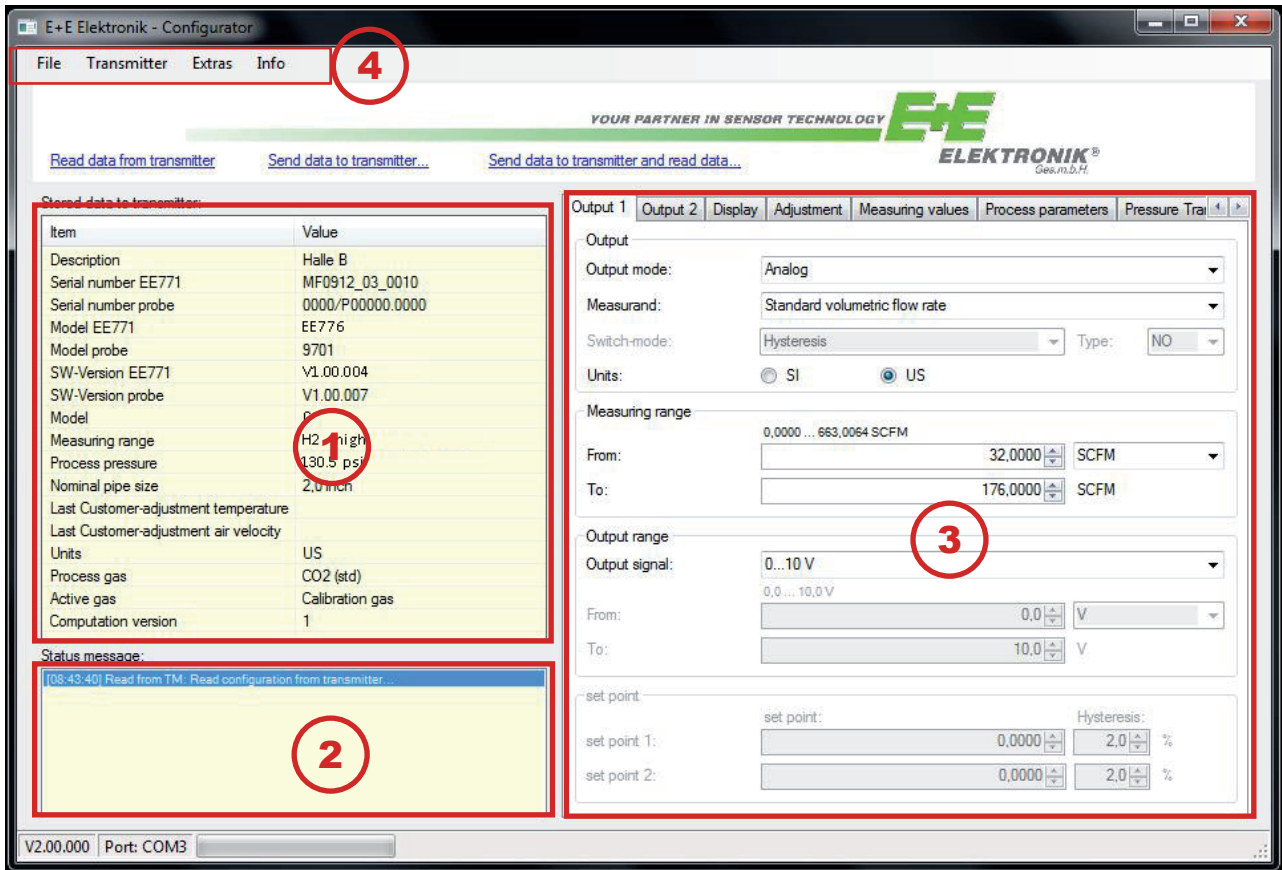


Select the COM-port number as shown in the device manager.



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

3. User Interface



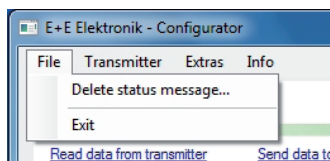
NOTE:

In the following chapters, the term “transmitter” is used synonymously with the term “sensor”.

- 1** Basic information:
After retrieving the data from the transmitter, the basic information of the device is shown here.
- 2** Status message:
Here are the messages shown about the status and other information.
- 3** Input screen:
Input screen for the configuration or adjustment of the flow sensor.
- 4** Menu tool bar:
Selection of menu items.

4. Menu Toolbar

4.1. File



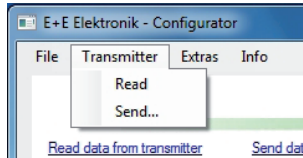
Delete status message

deletes the status messages.

Exit

closes the configuration software.

4.2. Transmitter



Read reads the actual configuration of the transmitter.

Send uploads the 'new' configuration to the transmitter. The following settings are uploaded to the transmitter

- Units
- Output 1
- Output 2
- Display mode
- Pressure transmitter

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.

4.3. Extras

Configurations of the VirtualCOM- interface (see page 27).

5. Input Screen

5.1. Output 1, Output 2

In this screen the actual settings of the transmitter for the output 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.

5.1.1. 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 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 (see page 29)

5.1.2. Measurand

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

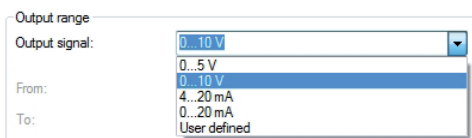
5.1.3. Units

Choice of the engineering units of the selected measurand in either SI- (m/s; °C; m³/h) or US-units (SFPM; °F; SCFM).

i 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.

5.1.4. Output Mode – Analogue

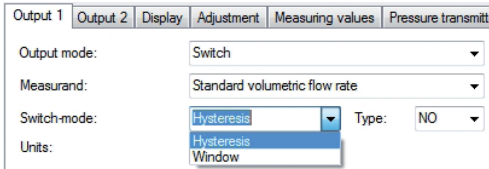
Within the limits of measurement range and the scaling of the output, the analogue output can be freely configured and scaled. Either a standard output signal (0 – 5 V, 0 – 10 V, 0 – 20 mA, 4 – 20 mA) can be selected or a user defined range for the current / voltage output (e.g. 1 – 9 V).



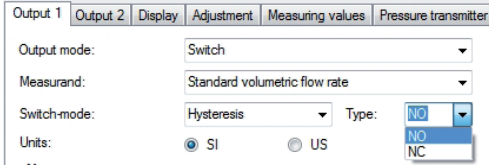
i NOTE:
In case the analogue output is changed (from current to voltage or vice versa), the Jumper J2 on the board of the signal conditioning electronics has to be relocated as well (see page 29).

5.1.5. Output Mode – Switch (Relay)

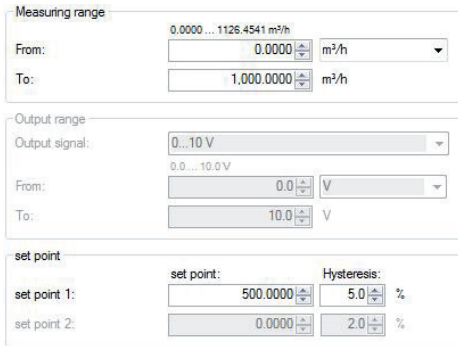
In the field for the “Switch-mode”, one can select “Hysteresis” or “Window”.



The field for “Type” is to determine the switch action of the relay, NO = Normally Open (activate to close), NC = Normally Close (activate to open).



Under “Measuring range” in the field “From” the low value of the measuring range can be entered and in the field “To” the high value.



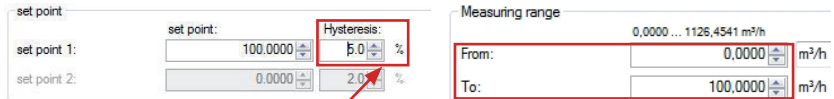
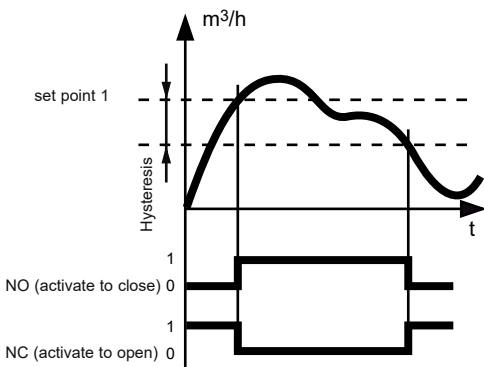
The high value depends on the setting of pipe diameter. Make the setting of the pipe diameter first! (see page 34)

The hysteresis of the set point is entered as a percentage of the measuring range.
[measuring range] = high measuring value – low measuring value

e.g. hysteresis
set point = 500 m³/h and reset point is 450 m³/h
Hysteresis = 50 m³/h = 0.5 % of measuring range

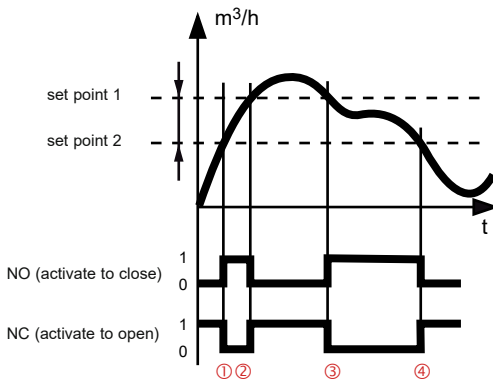
Hysteresis

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 m³/h and the hysteresis 5 m³/h.
the relay switches at 100 m³/h. The reset point is at 96 m³/h.
Hysteresis = 5 m³/h = 5% of the measuring range

Window



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 m³/h; set point 2 = 80 m³/h;



- ① 80 m³/h = set point 2
- ② 100 m³/h = set point 1
- ③ 99 m³/h = set point 1 - hysteresis
- ④ 79 m³/h = set point 2 - hysteresis

hysteresis of each set point is 1 m³/h (0.2% of 500 m³/h)

5.1.6. Output Mode – Pulse

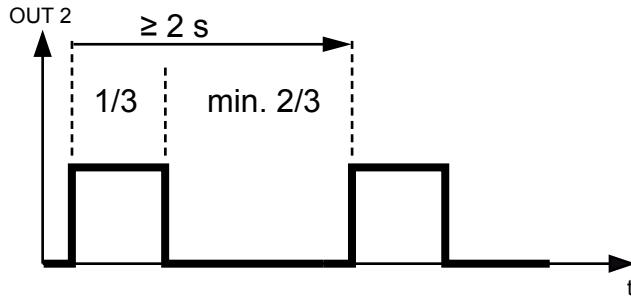
If output 2 is configured for pulse, the measurand can be consumption only. Under “Pulse”, the duration of the pulse and the pulse value (Significance level of pulse) can be freely configured.

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

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

e.g. Duration of pulse = 100ms; one pulse for each m³ 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”.

$$\text{IMPW_MIN} = \text{NORMV_MAX [m}^3\text{/h]} * \text{IMPL [s]} / 1200$$

$$\text{IMPL_MAX} = \text{IMPW [m}^3\text{]} * 1200 / \text{NORMV_MAX [m}^3\text{/h]}$$

IMPW	pulse value [m ³]
IMPL	pulse length (duration) [s]
IMPW_MIN	minimum pulse value [m ³]
IMPL_MAX	maximum pulse length (duration)
NORMV_MAX	expected maximum volume flow (m ³ /h)

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.

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

Item	Value
Description	Halle 1
Serial number EE771	999999999993
Serial number probe	0000/P00000.0000
Model EE771	E771
Model probe	9701
SW-Version EE771	V0.00.010
SW-Version probe	V1.00.007

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.

5.4. Adjustment

The user can perform an adjustment for the measurands **normflow** and **temperature** in air. The configuration software distinguishes between a 1-point and a 2-point adjustment automatically, 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 (see page 6)

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.

i 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.

In the field "Adjustment" the measurand to be adjusted is selected.
In the field "Measuring value" the actual measurement value of the transmitter is indicated.
The update-interval can be set.

In the field "Reference value" the measurement value of the standard is entered. After clicking the button "send" a control dialog box appears in which the values can be corrected if needed. Then the reference value will be uploaded to the flow sensor and is the adjustment procedure complete. The reference point of the customer-adjustment must be within the determined measuring range.

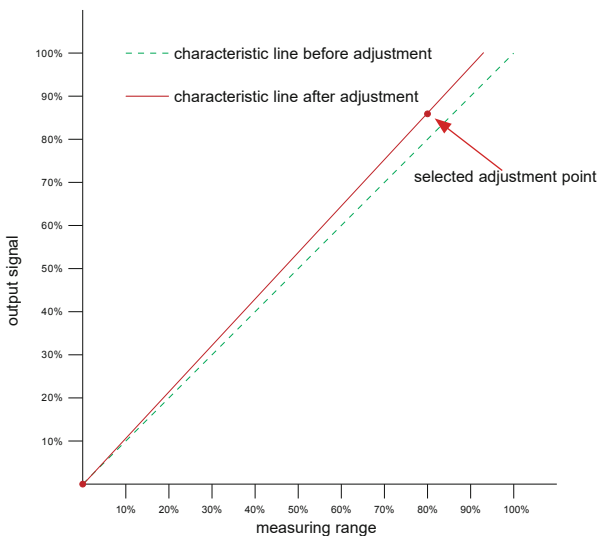
The customer-adjustment results in a slight rotation of the characteristic line, in such a way that the measurement deviation at the upper and lower adjustment points equals zero. The configuration software determines, depending on its position, if it is an upper or lower adjustment point.

5.4.1. 1-Point Adjustment

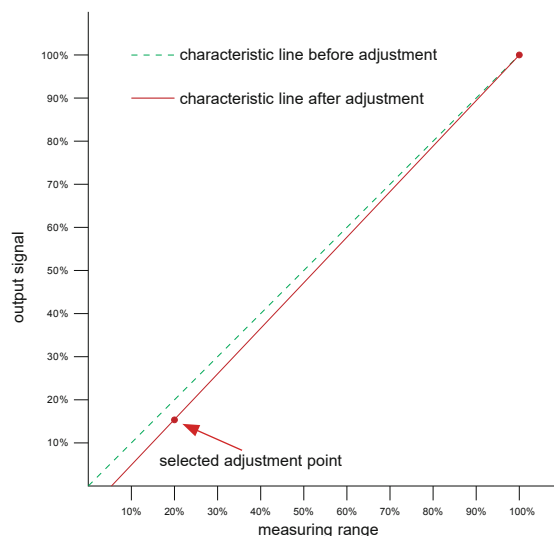
	lower adjustment point	upper adjustment point
possibility 1	0 - 50% of measuring range	100% of measuring range
possibility 2	0% of measuring range	>50 - 100% of m.r.

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.

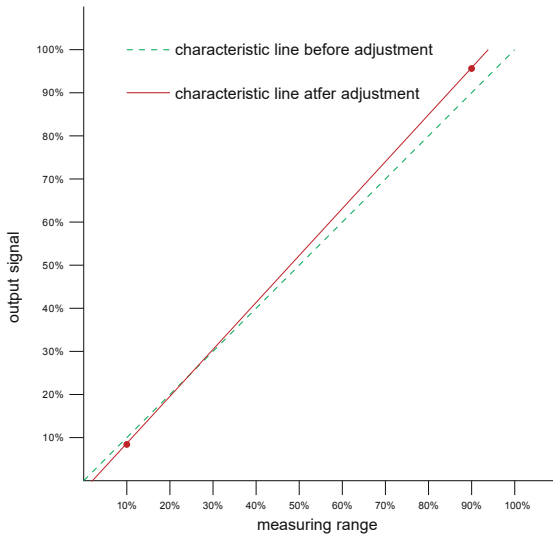


5.4.2. 2-Point Adjustment

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.

	lower adjustment point	upper adjustment point
possibility 1	0 - <40% of m.r.	60 - 100% of m.r.
possibility 2	40 - <50% of m.r.	100% of m.r.
possibility 3	0% of m.r.	50 - <60% of m.r.

**lower adjustment point at 10% of measuring range
upper adjustment point at 90% of measuring range**



5.4.3. 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

5.5. Measuring Values Overview

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

Checking the “Polling” checkbox will retrieve the measuring data from the transmitter at the selected interval.

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

5.5.1. Reset of the MIN / MAX Values

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

5.5.2. Reset of the consumption counter (totalizer)

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

5.6. Setting up Process Parameters

In the tab **Process Parameters** you can change the Process gas (medium) and set the pressure compensation

5.6.1. Change the Process Gas

i **NOTE:** This function is only active if the flow sensor for a medium different from air has been ordered (see order code Medium in the data sheet)

Calibration-Gas: Is the gas (medium) in which the flow sensor was calibrated in the factory. Unless otherwise specified, the flow sensor is calibrated at the factory always in air.

Process-Gas: Is 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 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, you can see in the field basic information.

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

5.6.2. Changing the Standard Conditions

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

Factory setting: $P_0 = 1013.25 \text{ mbar}$, $t_0 = 0^\circ\text{C}$ (273.15 K)

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



System values

Standard conditions: °C

mbar

5.6.3. Pressure Compensation

The flow sensor is factory-adjusted to 9 bar (abs). At an operating pressure other than 9 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

5.6.4. Setting the Inner Pipe Diameter

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



Nominal pipe size: mm

5.7. External Pressure Sensor for Pressure Compensation

In order to achieve the highest accuracy, the input from an external pressure transmitter will be very useful if the pressure fluctuates strongly (e.g. 3 to 10 bar (45 to 150 psi)). 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:

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 (see page 15).



Communication parameter

Baud rate:

Parity:

Stop bits:

Bus protocol:

Network address:



HEADQUARTERS

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