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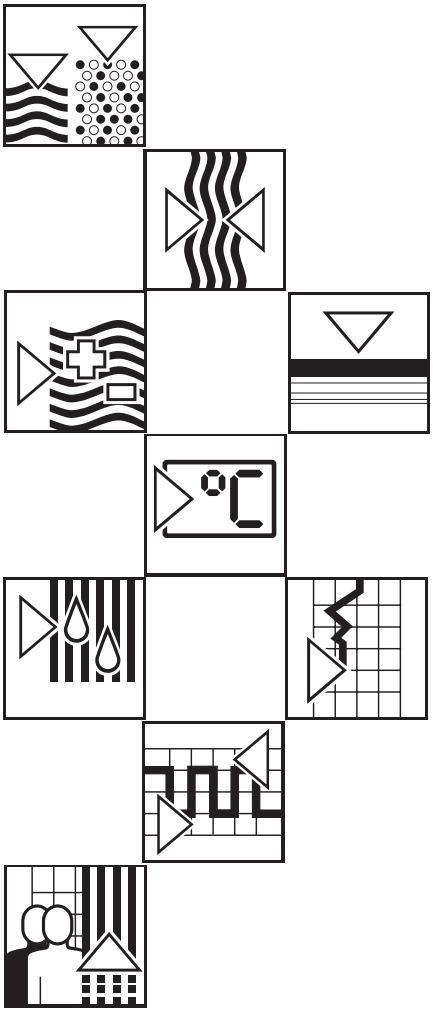
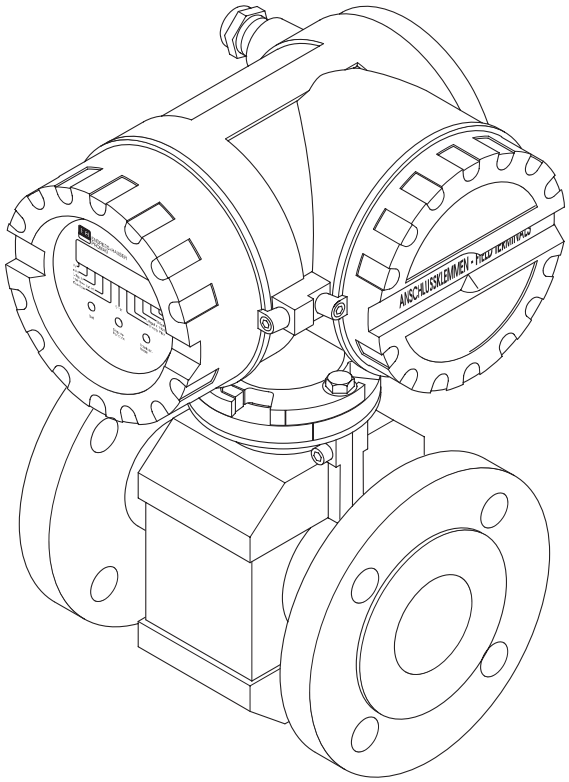
Nr. 50074675

valid from software version
V2.01.XX (measuring amplifier)

promag 31
Electromagnetic Flow Measuring System

Operating Manual





Endress+Hauser

Nothing beats know-how

Safety Instructions

Correct Usage

- The Promag 31 is only to be used for measuring the flow of conductive fluids.
- The Promag 31 flowmeter is designed and checked according to the regulations in force EN 61010 “Protection Measures for Electronic Measuring Equipment”). The flowmeter may be dangerous if it is not used for the purpose it was designed for or is used incorrectly.

  Please carefully note the information provided in this Operating Manual indicated by the pictograms:

- The manufacturer assumes no liability for damage caused by incorrect use of the instrument. Modifications and changes to the instrument may not be carried out.

Personnel for Installation, Start-up and Operation

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must absolutely and without fail read and understand this Operating Manual before carrying out its instructions.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this Manual are to be observed without fail.
- With special fluids incl. those used for cleaning, E+H will be pleased to supply information concerning the chemical resistance properties of wetted parts.
- The installer has to make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system is to be grounded.
- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.

Repairs, Dangerous Chemicals

The following procedures must be carried out before a Promag 31 flowmeter is sent to Endress+Hauser for repair:

- A note must always be enclosed with the instrument, containing a description of the fault, the application, and the chemical and physical properties of the product being measured.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- No instrument should be returned to us without all dangerous material being removed first, e.g. in scratches or diffused through plastic.

Incomplete cleaning fo the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the owner of the instrument.

Technical Improvements

The manufacturer reserves the right to modify technical data without prior notice. Your local E+H Sales Office will supply you with all current information and any updates to this Operating Manual.

Contents

1. System Description

1.1 Fields of application

For the exact calculation of the energy used in heating and cooling circulations heat counter do their work. Part of a heat counter is the hydraulic transmitter Promag 31. It registers the flow volume of the heat, resp. refrigerating transfer medium.
The thermic energy used ist taken from this measuring value and the temperature difference between backflow and inflow. Promag 31 can measure all heat or refrigerating media with a minimum conductivity of 5 μS/cm.
Major applications are:

- Calculation of heating costs in districts and buildings with central heating.
- Distributory stations of long distance energy nets.
- Definition of efficiency and supervision of energy transforming processes
- Control and regulation of refrigerators

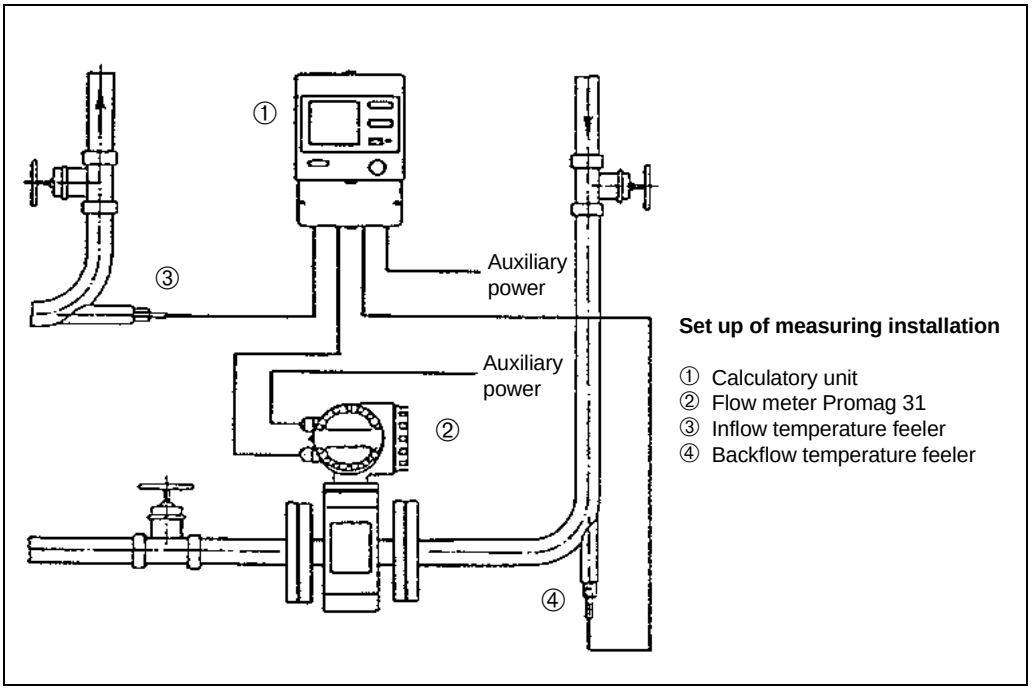


Fig. 1

1.2 Principle of measurement

$U_e = B \cdot L \cdot v$
$Q = v \cdot A$

U_e = induced voltage
B = magnetic induction
L = distance between electrodes
v = flow velocity
Q = volume flow
A = pipe cross-section

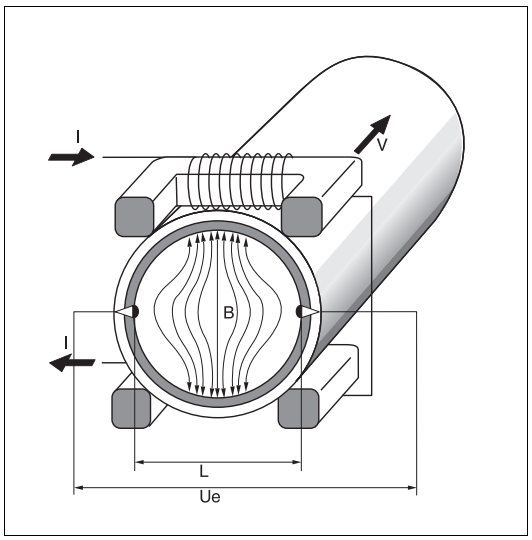


Fig. 2

In accordance with Faraday's law of induction, a voltage is induced in a conductor that is moved through a magnetic field. In the magneto-inductive principle of measurement the flowing medium represents the moving conductor. The induced voltage is proportional to the flow velocity and is fed to the measuring amplifier by a pair of electrodes. Across the cross-section of the pipe the flow volume is calculated.
The DC magnetic field is generated by a switched direct current of alternating polarity. Together with the patented "Integrated Autozero Circuit" this assures a stable zero point and makes the measurement independent of the medium and insensitive to entrained solid particles. In our works every unit is calibrated on modern calibrating facilities, referable to international standards. There is no need for it to be adapted to suit changing media.

1.3 The Promag 31 measuring system

The Promag measuring system is fully modular, both mechanically and electrically. The equipment can be extended by exchanging electronic boards. Thus the measuring point can be optimally equipped and extended.

The illustration below gives an overview of the complete Promag 31 measuring system.

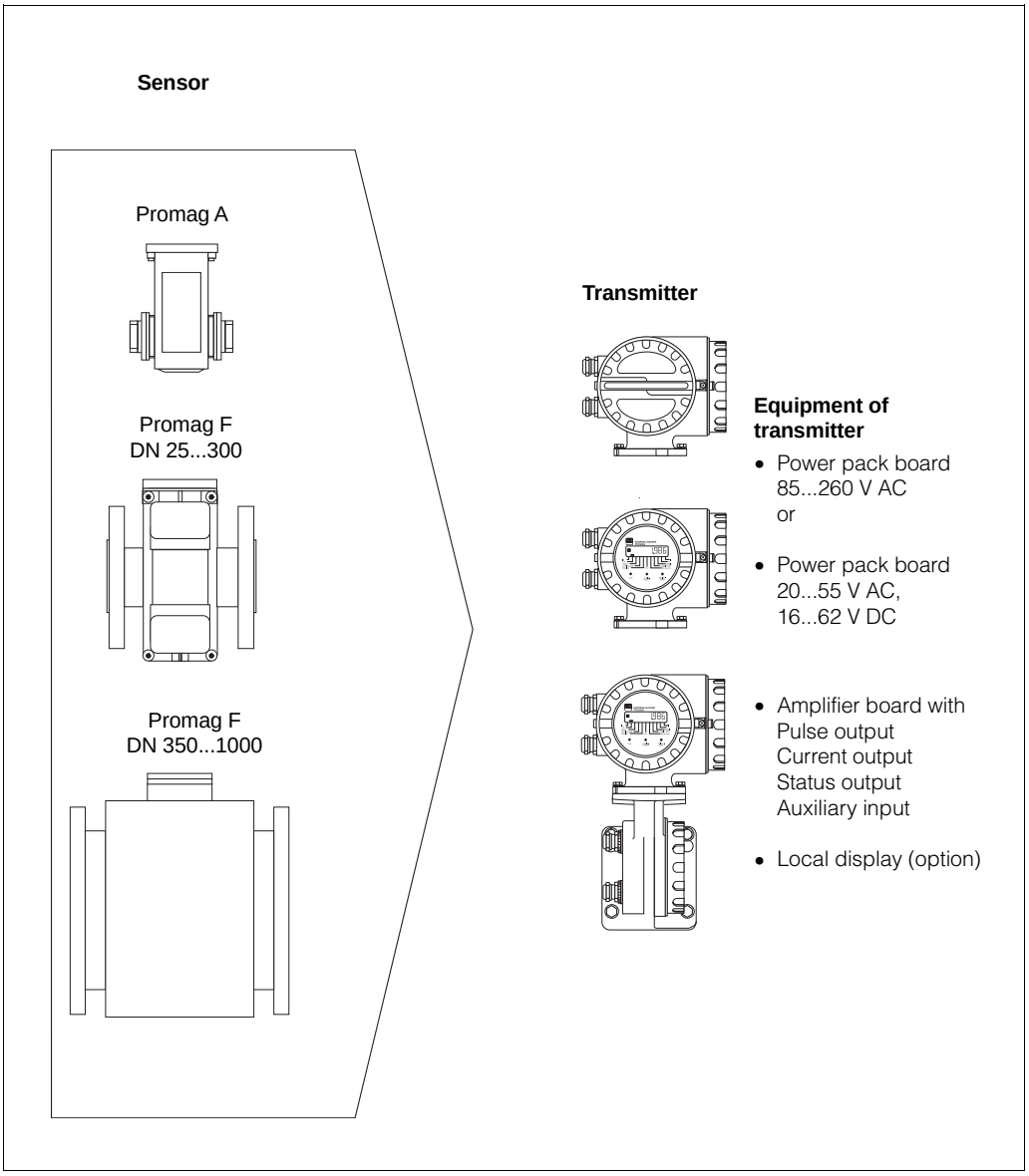


Fig. 3

1.4 Short description and design of the measuring system

Short description

The measuring equipment comprises:
- Transmitter Promag 31 and
- Sensor Promag A or F

Compact version:
The Promag 31 transmitter and the sensor together form a mechanical unit.

Remote-mounted version (FS or FL version):
The transmitter is mounted remote from the sensor:

FS version
- Up to 10 m distance — Medium conductivity min. 5 µS/cm
- From 10...200 m distance — Max. cable length in terms of the medium conductivity (5...200 µS/cm)

FL version
- Max. cable length 200 m, not dependent on conductivity.
- No EPD available.
- The electrical connection between transmitter and sensor is made in the connection housing (Exception: Promag A).
- The wall-mounting holder for the transmitter is supplied.

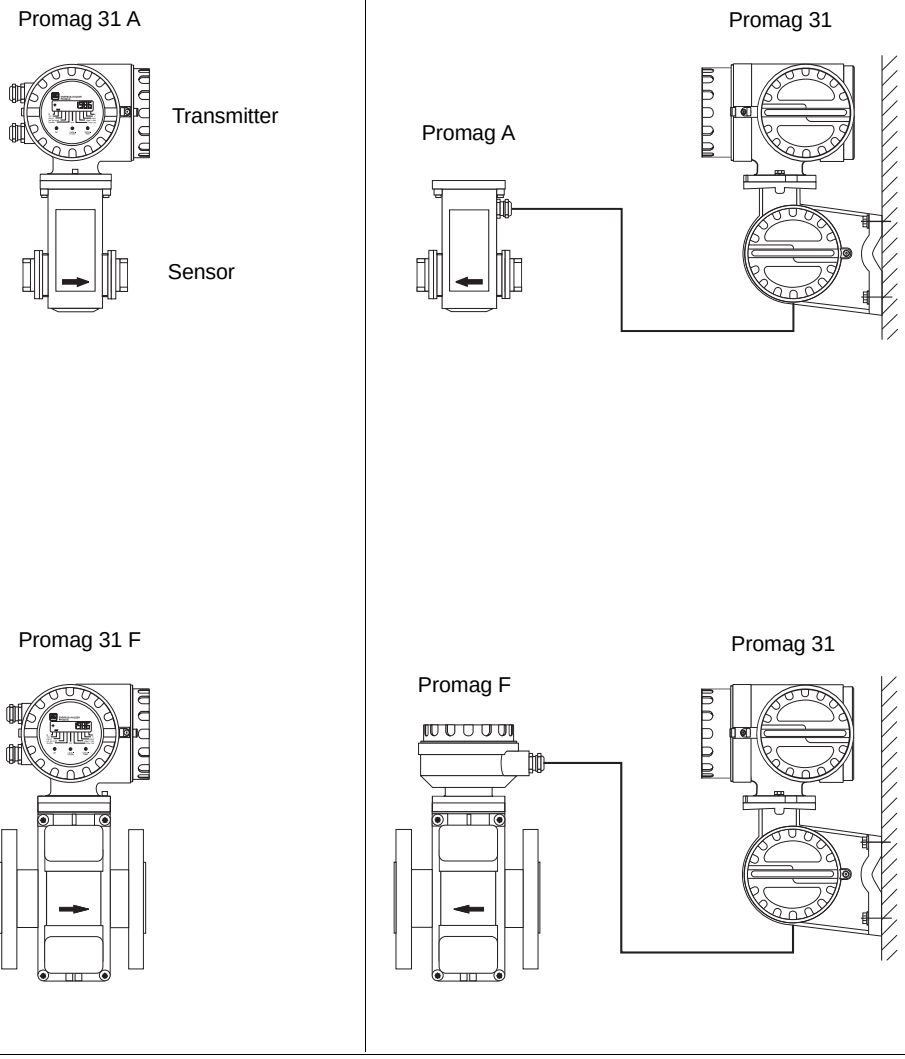
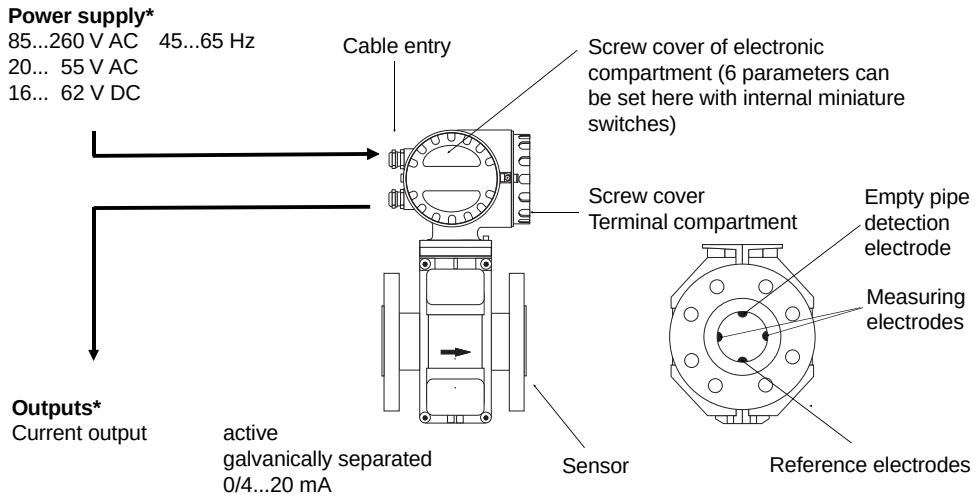


Fig. 4

Design of the measuring system (considering Promag 31 F as example)



Outputs*

Current output	active galvanically separated 0/4...20 mA $R_L \leq 700\ \Omega$
Pulse output	Open Collector, passive galvanically separated 0...400 Hz
Status output	Open Collector, passive galvanically separated configurable for: • output of system or process errors • detection of the direction of flow
Auxiliary input	The auxiliary voltage to be applied to activate the function is in the region of 3...30 V DC • Measured value suppression • Totalizer reset (with local display only)

* Technical data: see chapter 6

Fig. 5

Operation

Inside the housing of the transmitter there are miniature switches with which altogether six operating parameters can be set (see chapter 4).

- Current range 0/4...20 mA
- Full-scale value scaling (volume/time), 8 steps
- Pulse weighting in decadic steps (volume), 8 steps
- Engineering units
- Function of the status output
  Output of system/process errors
  Flow direction recognition
- Creep suppression (on/off)

Local display

Using the Promag 31 local display, important parameters can be read off and controlled at the measuring point directly:

- Flow rate and/or totaliser value
- Technical units (SI/US units)
- Process variables (e.g. creep rate, partial pipe filling)
- Error messages

Using the three operating keys, it is also possible to select and activate various functions. A small pin is used to press the keys down (keep pressed for approx. 0.5...0.8 s).

Turn down/Accuracy class
As a hydraulic transmitter appropriate for verification of thermic energy measurement Promag 31 has been tested according to the international recommendation for heat counters (OIML R72) and for warmwater countes and meets their technical requirements for measurements.
As a partial device of a heat counter it is approved for accuracy class 4, according to OIML R75 (+/-3% hydraulic transmitter), at a turn down $Q_i : Q_s = 1 : 100$ ($Q_i \sim Q_{min}$; $Q_s \sim Q_{max}$). This applies for a velocity of the medium between 100 mm/s and 10 m/s at specified measuring accuracy.

Memory (DAT)
DAT is an exchangeable memory module. Stored in it are all characteristic data of the sensor, such as calibrated quantities, nominal diameter, sensing rate, version, serial number. When the transmitter has been changed, the previous DAT memory is inserted in the new transmitter. When the measuring system is started, the measuring point continues to operate with the data stored in the DAT memory. Thus the DAT concept assures maximum safety and optimum ease of operation when components of the equipment are exchanged.

Safety
A comprehensive self-monitoring facility for the measuring system assures maximum safety. Any error messages that do occur are emitted at the configured status output.

- Power supply failure
- Process error
- System error:
  Coil-current error
  Amplifier error
  DAT error
  EEPROM error
  ROM error
  RAM error

In the event of a power supply failure all data of the measuring system are securely stored in the EEPROM (without a backup battery).

The Promag 31 measuring system complies with the requirements for electromagnetic compatibility (EMC) as per IEC 801/VDE 0843 and the NAMUR recommendations.

IP 67 protection (EN 60529) is standard for the transmitter and sensor (remote or compact version).
The sensor is also optionally available in IP 68.

2. Mounting and Installation

Caution!
Pay consistent attention to the notes in this chapter regarding

- Type of protection
- Temperature ranges
- Mounting

to assure reliable measurement.

Caution!

2.1 General hints

Type of protection IP 67 (EN 60529)
The equipment fulfils all requirements of IP 67. In order to assure the type of protection IP 67 after installation in the field or servicing, it is essential to comply with the following points:

- The housing gaskets must be clean and undamaged when inserted in the sealing groove. If necessary, the gaskets must first be dried, cleaned or renewed.
- All screws in the housing and the screw cover must be screwed up tight.
- The cables used for connection must possess the stipulated outside diameter (see chapter 6.3).
- Tighten the cable entry (Fig. 6).
- Loop the cable before inserting. This prevents moisture from penetrating the cable entry (Fig. 6).
- Any cable entries not used must be stopped with a screw plug.
- The protective grommet must not be removed from the cable entry.

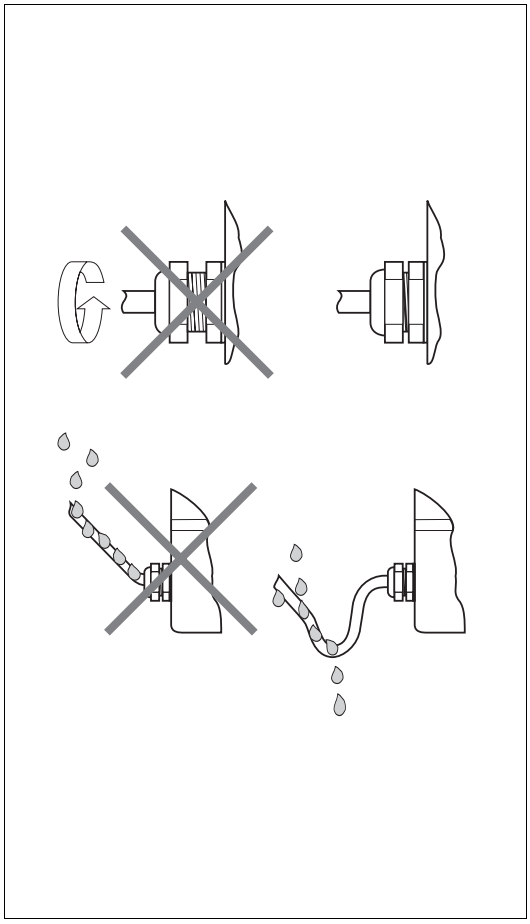


Fig. 6

Caution!
The screws of the Promag sensor housing must not be released, otherwise the guarantee for the type of protection expires.

Caution!

Note!
The sensors Promag A and F can optionally be supplied with the type of protection IP 68 (permanently under water to a depth of 3 m). In this case the transmitter (IP 67) has to be mounted remote from the sensor.

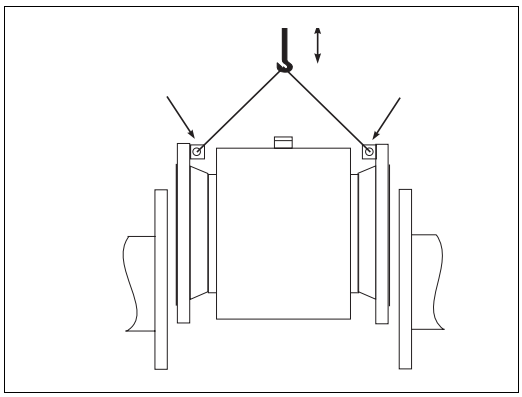
Note!

Temperature ranges
The maximum permissible ambient and medium temperatures must be adhered to (see chapter 6 “Technical Data“).

When installed outdoors, specially in countries with high ambient temperatures, a weatherproof hood should be provided as protection against direct solar radiation.

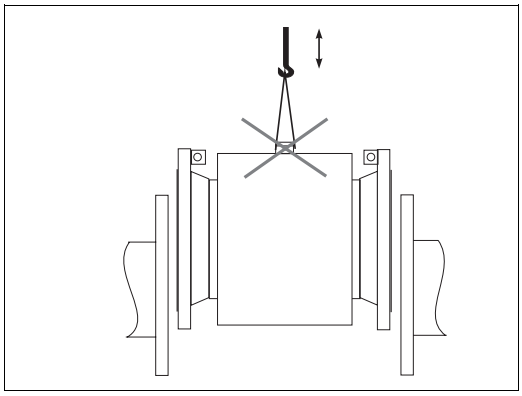
2.2 Transport instructions for Promag from > DN 350 / 14"

Transportation to the installation point
The pipe coating on the flanges is protected from damage by protective disks during transportation to the installation point. These are to be removed before installation. The instruments are to be transported in the containers in which they are delivered.



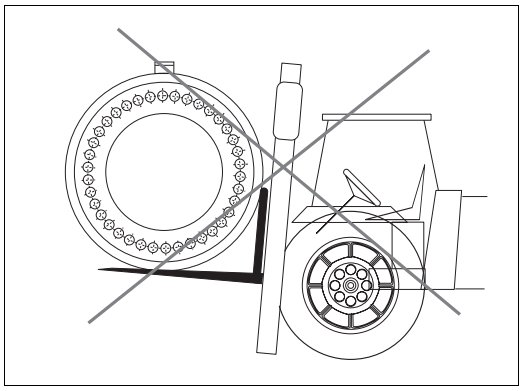
The eyelets on the flange should be used for lifting out and mounting the sensor in the piping!

Fig. 7



The sensor should not be lifted by the connection housing!

Fig. 8



The sensor should not be lifted by the sheet casing using a forklift truck! This can buckle the casing and damage the internal magnetic coils.

Fig. 9

Base of the sensor
The sensor should stand on a base which is sufficiently strong to withstand its weight.

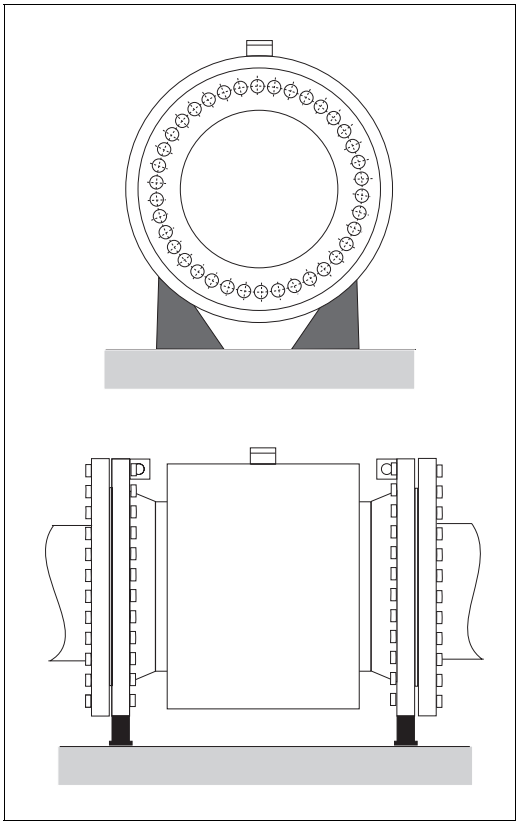
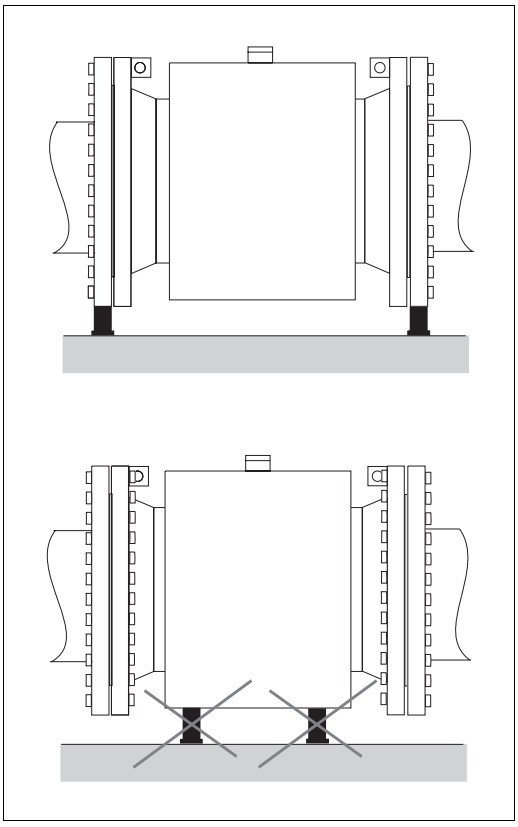


Fig. 10



Note!
The sensor must not be supported by the sheet casing!
This can buckle the casing and damage the internal magnetic coils.

Note!

Fig. 11

2.3 Hints for mounting

Please pay attention to the following hints, in order that you may measure correctly and avoid damage to the equipment.

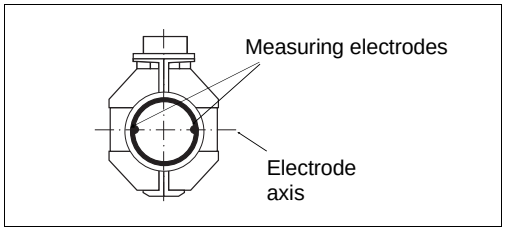


Fig. 12

Electrode axis
The plane in which the electrode axis lies with regard to the Promag 31 measuring transmitter is identical for the measuring sensors A and F.

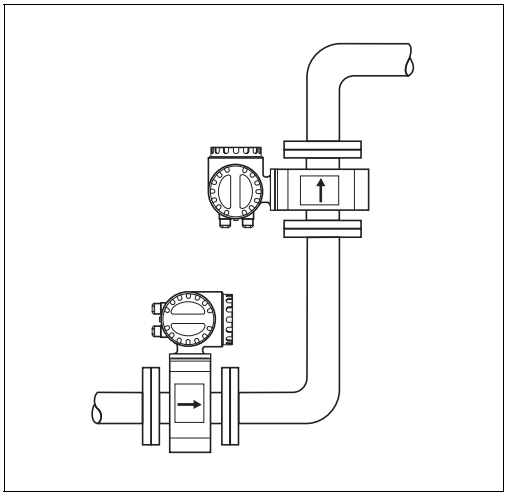


Fig. 13

Mounting position (any)

- Vertical mounting:
  Optimal, with the flow upwards. Entrained solid particles sink and lighter fatty elements in the stationary medium rise away from the electrodes.

- Horizontal mounting:
  The axis of the electrodes must be horizontal, thus preventing brief insulation of the electrodes by entrained air bubbles.

Caution!

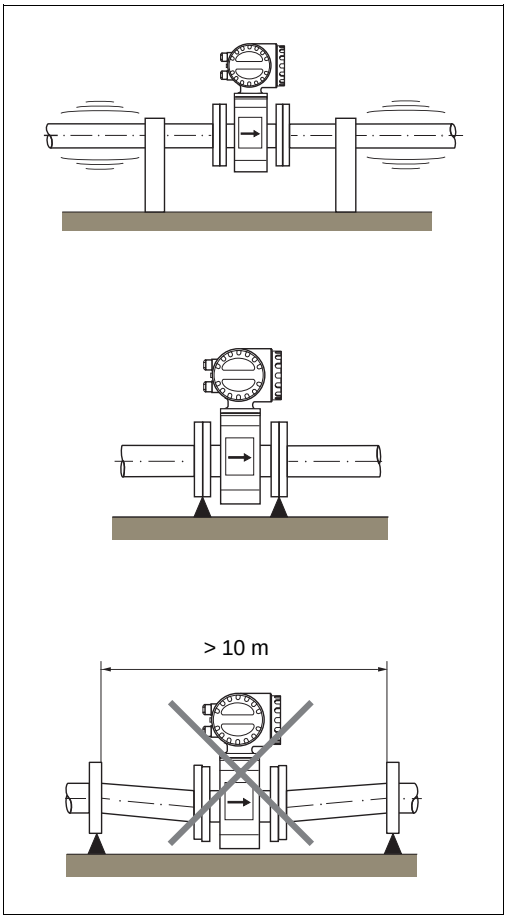


Fig. 14

Vibration
Fasten the piping before and after the sensor.

Caution!
Excessive vibration necessitates separate mounting of the sensor and transmitter (see chapter 2.6).

With free runs of piping over 10 m long, we recommend mechanical supports.

Inlet and outlet runs
The sensor should be mounted away from fittings liable to generate turbulence (e.g. valves, elbows, T-junctions).

Inlet run: > 3...5 x DN
Outlet run: > 2 x DN

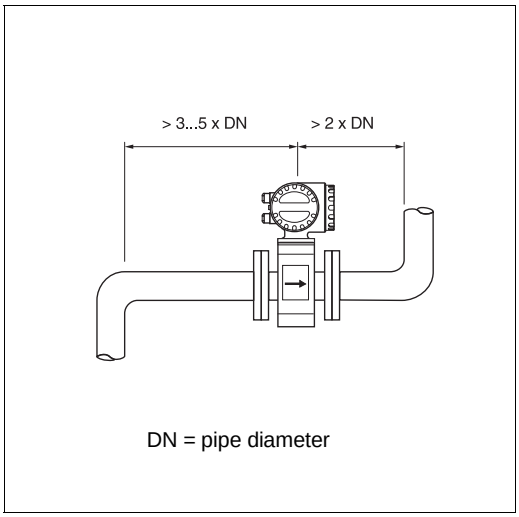


Fig. 15

Mounting location
Correct measurement is only possible when the pipe is full.
Consequently the following locations should be avoided:

- Installation at the highest point (air accumulation).
- Installation immediately before an open pipe outlet in a downward line. The alternative suggestion, however, permits such a location.

Promag 31 should preferably be installed in the cooler backflow for heat measurement, respectively in the foreflow for refrigerated measurement.

Promag 31 should be placed between 2 blockage and control units
(see installation scheme on page 5).

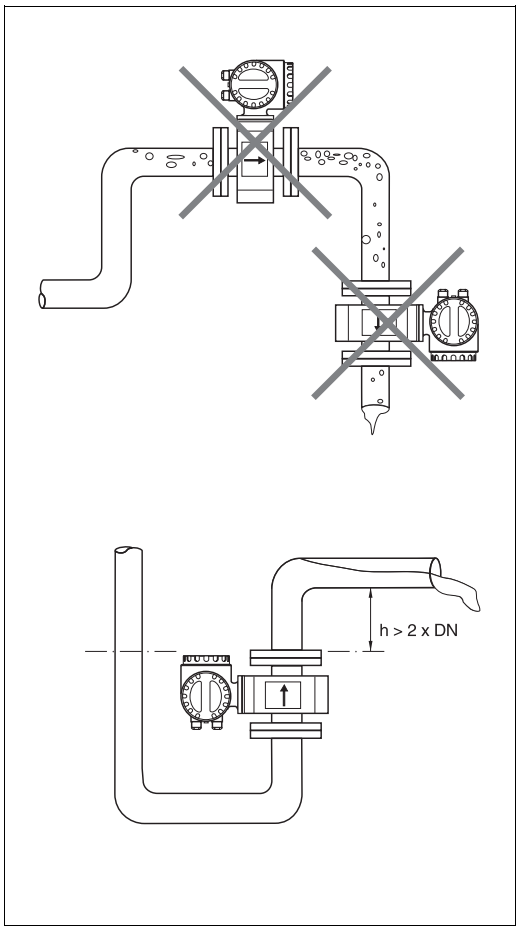


Fig. 16

Partly filled pipes
For inclines a mounting similar to a drain should be adopted.
Do not mount at the lowest point (risk of solids collecting).

Note!
Here, too, the inlet and outlet lengths should be maintained.

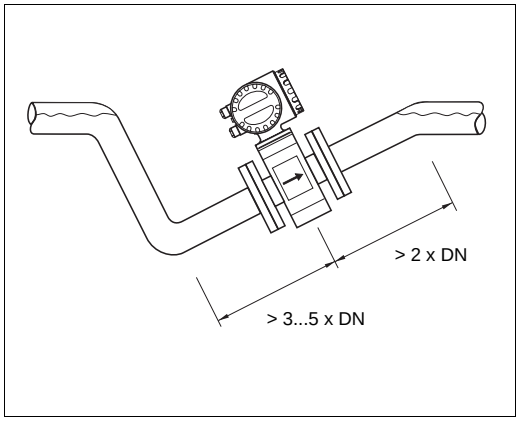


Fig. 17

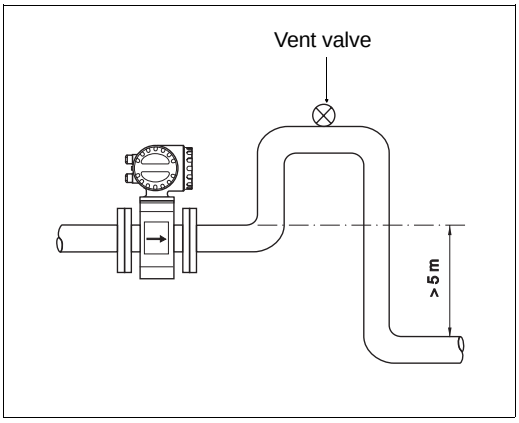


Fig. 18

Downward pipe (> 5 m)
With the suggested installation opposite no partial vacuum is created (siphon, vent valve after the sensor).

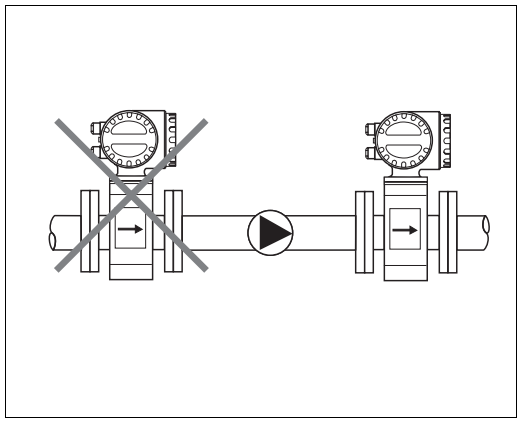


Fig. 19

Installation of pumps
If possible avoid mounting the sensor on the suction side of the pump (danger of vacuum!). Information on the resistance to vacuum of the measuring pipe lining can be found in section 6.2.

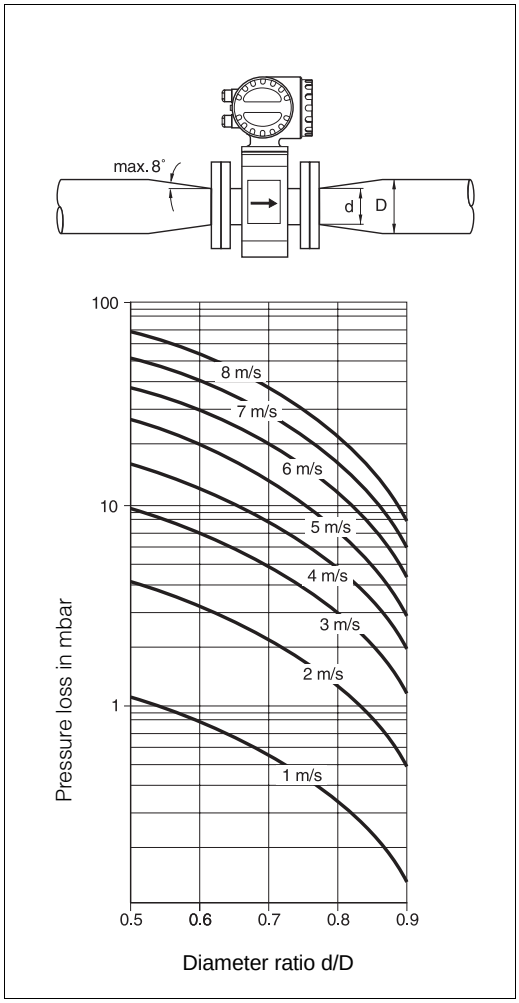


Fig. 20

Adaptor pieces
The sensor can also be mounted in a pipe with a larger nominal diameter when suitable adaptors (reducers and expanders) to DIN 28545 are fitted. The resultant increase in the rate of flow increases the accuracy of measurement with slowly flowing fluids.

The adjacent nomogram can be used to determine the pressure loss caused.

Procedure:
1. Determine the ratio of the diameters d/D.

2. From the nomogram read off the pressure loss at the flow velocity and d/D ratio.

Note!
Note!
The nomogram applies to fluids with a viscosity similar to that of water.

2.4 Mounting the sensor

Mounting Promag 31 A

Length and dimensions
See chapter 6.1 “Dimensions and weights”.

Mounting
The inserted parts are
- screwed on to the 1" stub with a skirted nut.
- screwed on to the 1" stub direct
- mounted instead of the 1" threaded stub.

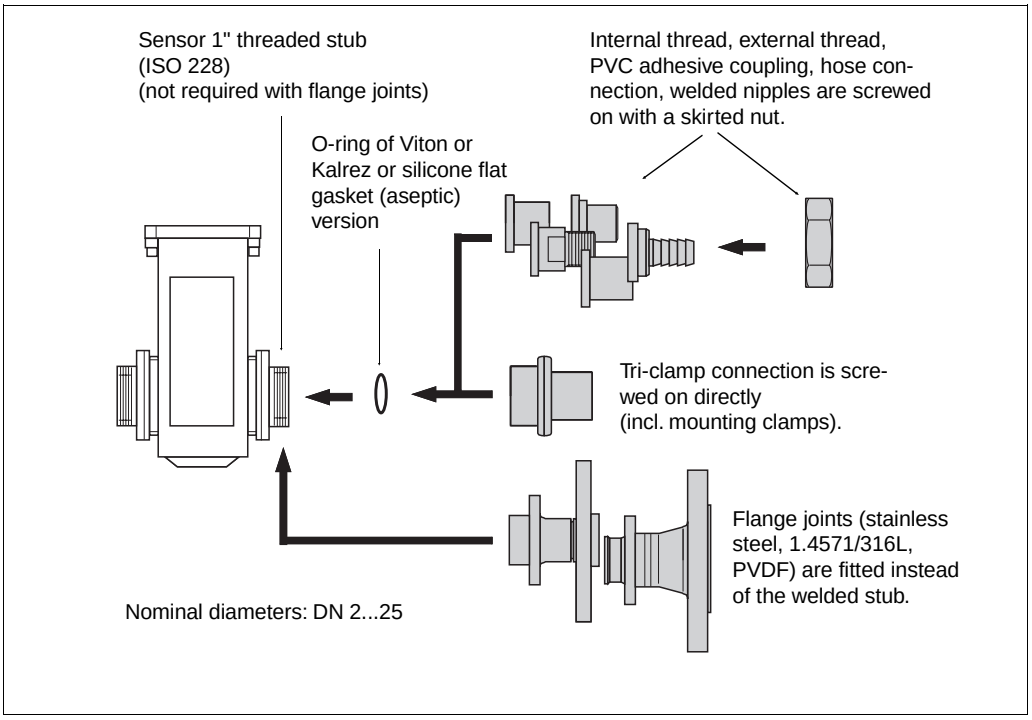


Fig. 21

Screw tightening torques and gaskets
When screwing on the inserted parts the O-ring or the flat gasket is pressed completely into the sealing groove of the stub. The skirted nut thereby experiences a fixed stop.

Mounting Promag 31 F

Lengths and dimensions
See chapter 6.1 “Dimensions and weights”

Mounting
The sensor is mounted between the flanges of the pipe (Fig. 22). Since the lining of the measuring pipe is drawn on over the sensor flange, it performs the sealing function at the same time.

Caution!
The Teflon (PTFE)-lined measuring pipe of the Promag F is fitted with protective discs to guard the liner which is turned over the flanges. These discs may only be removed just before mounting the sensor, thereby making sure that the liner is not damaged at the flange or removed (during storage these discs must remain in position).

Caution!

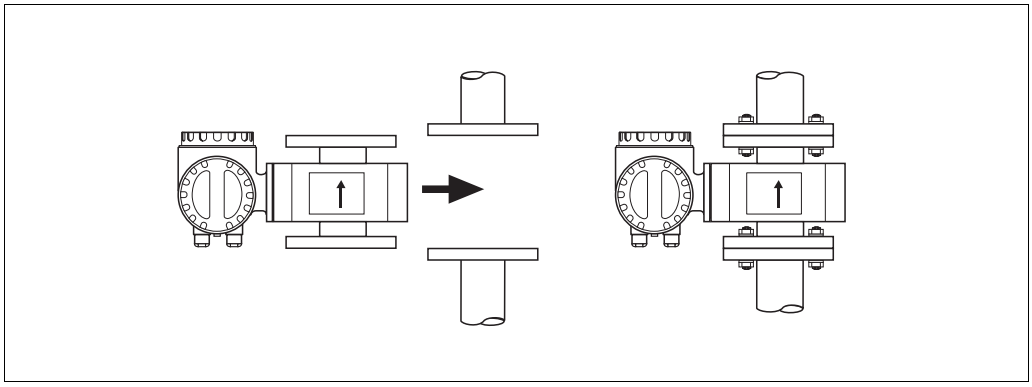


Fig. 22

DN [mm]	PN [mm]	Screws	Max. tightening torque [Nm]	
			Hard rubber	Teflon (PTFE)
25	40	4 x M 12	25	33
32		4 x M 16	40	53
40		4 x M 16	50	67
50		4 x M 16	64	84
65	16	4 x M 16	87	114
80		8 x M 16	53	70
100		8 x M 16	65	85
125		8 x M 16	80	103
150		8 x M 20	110	140
200		8 x M 20	108	137
250	10	12 x M 20	104	139
300		12 x M 20	119	159
350	10/16	16 x M 20	141/193	188/258
400		16 x M 24	191/245	255/326
450		20 x M 24	170/251	227/335
500		20 x M 24	197/347	262/463
600		20 x M 27	261/529	348/706
700		24 x M 27	312/355	-
800		24 x M 30	417/471	-
900		28 x M 30	399/451	-
1000		28 x M 33	513/644	-

Screw tightening torques
- The listed tightening torques apply to greased threads.
- Screws tightened up too tightly deform the sealing surface.

Gaskets
- With Teflon (PTFE) linings a flange gasket is dispensable.
- With soft rubber linings the mating flange should have a thin film of sealing grease applied.
- Use a gasket according to DIN 2690.

Caution!
Do not use sealing media that is electrically conductive (e.g. graphite). On the inside of the measuring pipe this could result in an electrically conductive layer forming which would short-circuit the measuring signal.

Caution!

Replacement measuring electrodes

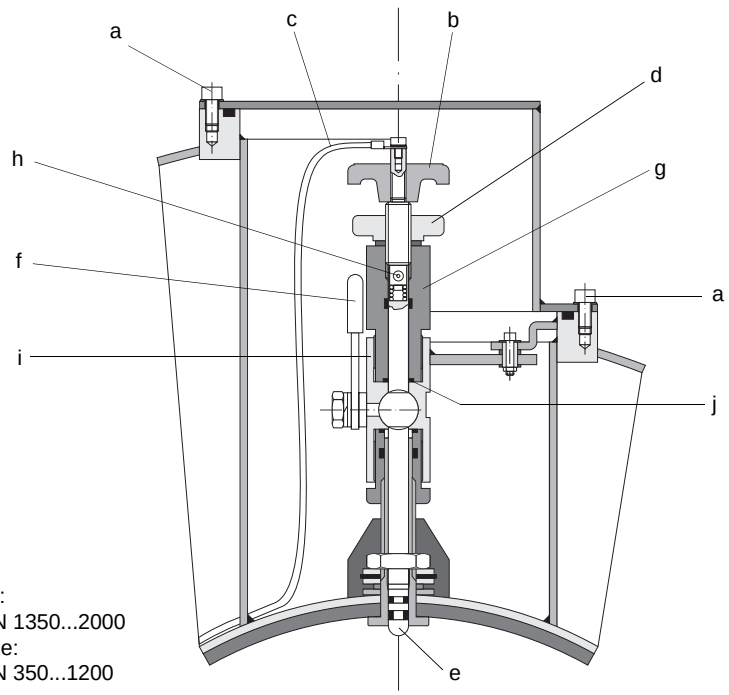


Fig. 23

The Promag F Type DN 350...DN 2000 is available with replacement electrodes.
This version enables the measuring electrodes to be cleaned or replaced under process conditions.
Replacing an electrodes is carried out as follows:

Dismantling the electrode:

1. Loosen the Allen screws (a) of the cap/cover.
2. Unscrew the electrode cable (c) attached to the rotary arm (b).
3. Undo the knurled nut (d) by hand. This nut is used as a counter nut.
4. Remove the electrode (e) using the rotary arm (b). This can now be taken out from the holder (g) as far as the stop allows.

   Warning!
   The electrode can spring back to the stop. Keep pressing against it while loosening.

5. Close the shut-off valve (f) after the electrode has been taken out as far as the stop.

   Warning!
   Do not attempt to open the shut-off valve. Keeping it shut prevents medium from escaping.

6. Unscrew the entire electrode along with the holding cylinder (g).
7. Remove the pins (h) below the rotary arm.
8. Replace electrode with a new one.
   A set of new electrodes can be ordered from E+H.

Assembling the electrode:

1. Slide the new electrode (e) through the holding cylinder (g) from below.
   Gaskets at the tip of the electrode must be in place and clean.
2. Connect the rotary arm (b) and electrodes together using the pins (h). Ensure that the small coil spring is in place.
3. Pull back the electrode as far as possible so that the tip does not protrude out from the holding cylinder (g).
4. Screw the holding cylinder onto the shut-off unit (I) and tighten by hand.

   Note!
   Gasket (j) on the holding cylinder must be in place and clean.

5. Open the shut-off value (f) and screw in the electrode using the rotary arm (b). Pull the electrode on by hand.
6. Screw the knurled nut (d) onto the holding cylinder in order to clamp the electrode tight.
7. Secure the electrode cable (c) to the rotary arm using the Allen screw.

   Caution!
   Ensure that the Allen screw of the electrode cable is tight. A close electrical contact cannot otherwise be guaranteed and this can lead to measurement errors.

2.5 Turning the transmitter housing (compact version)

In the compact version the transmitter housing can be rotated in steps of 90° relative to the sensor. This enables the unit to be adapted to suit the various mounting positions in the pipe.

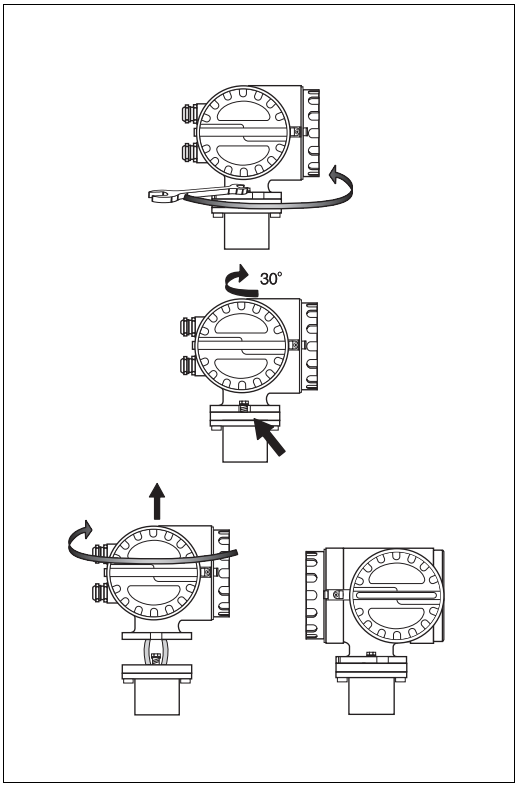


Fig. 24

Procedure:

1. Loosen the two fixing screws of the transmitter bayonet catch (appr. 2 turns).
2. Turn the bayonet catch of the transmitter as far as the screw slits.
3. Lift the transmitter housing to the stop.

   Note!
   During servicing (and only then) the transmitter housing can be separated from the sensor. To do this the corresponding marking notches on the side of the bayonet flanges should be brought into alignment. Do not damage the cable to the sensor when lifting the transmitter housing.

4. Turn the transmitter housing into the desired position. Engage the bayonet catch and re-tighten the two screws.

Note!

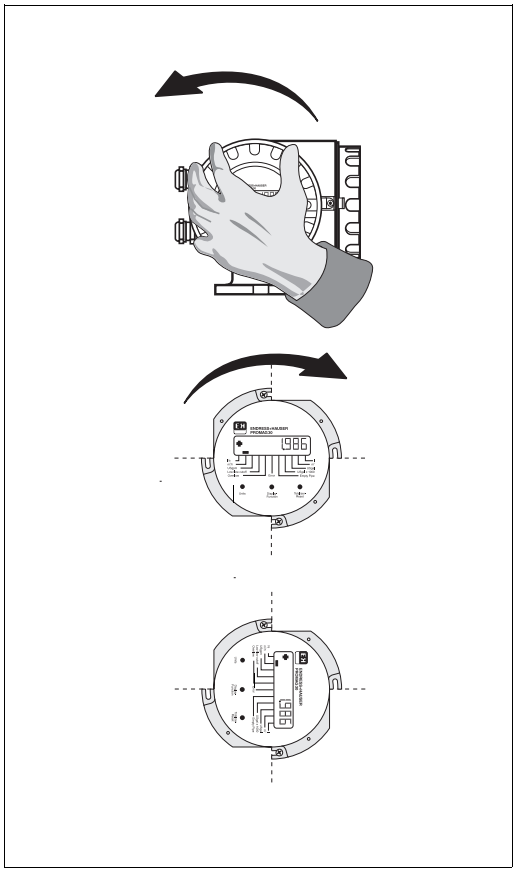


Fig. 25

Warning!

Turning the local display

1. Warning! Danger from electric shock. Switch off the power supply.
2. Loosen the safety grip of the cover of the electronics area. Loosen the screw with a 3 mm Allen key.
3. Unscrew the cover of the electronics area of the transmitter housing.
4. Unscrew the two Phillips screws which fasten the display module.
5. Rotate the display module to the required position.
6. Securely tighten the Phillips screws.
7. Replace and screw down securely the cover of the electronics area of the transmitter housing.
8. Replace and tighten the safety grip.

2.6 Mounting the transmitter (remote-mounted version)

It is necessary to mount the transmitter remote from the sensor when:
- Accessibility is difficult
- Space is restricted
- Extreme medium and ambient temperatures prevail (for temperature ranges see chapter 6 “Technical Data”)
- Severe vibration (>2 g/2 h per day; 10...100 Hz)

Caution!
- The permissible length of cable between the sensor and the transmitter at a distance of >10 m is governed by the conductivity of the medium (Fig. 26).
- Fix the cable run or lay it in conduit. When the conductivity of the medium is low, cable movements can cause serious changes in capacitance and thereby falsify the measuring signal.
- Do not lay cable in the vicinity of electrical machines or switching elements.
- Pay attention to potential equalization between the transmitter and the sensor (see page 25).

Length of cable for the remote-mounted version (FS and FL)

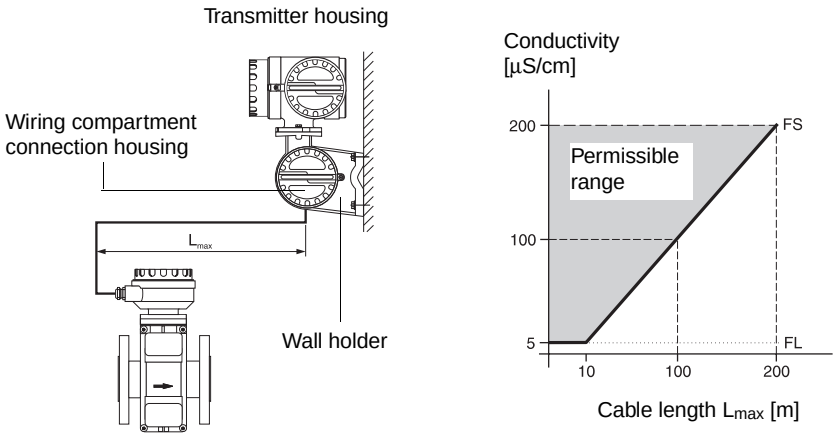
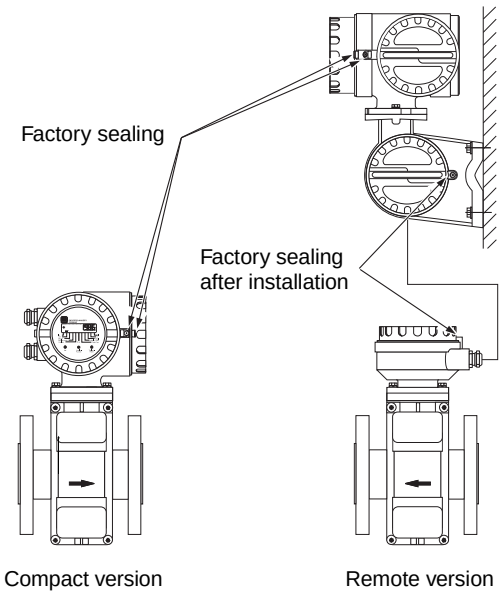


Fig. 26

Fixing the wall holder/Stamped lead seal



Stamped lead seal for compact version
(Promag 31 F for example)
The lids of the electronics housing, e.g. connection housing of Promag 31 F (blind and display version) are leaded separately. Instead of the conventional cylindric screw a leading screw is used and the seal wire is drawn through it and fixed under the clutch.

Stamped lead seal for remote version
(Promag 31 F for example)
In addition to the above mentioned and described seal the connection housing in both the sensor and the electronics will be lead sealed after installation by the service man with a user protection (sealed from works).

Fig. 27

2.7 Potential equalisation

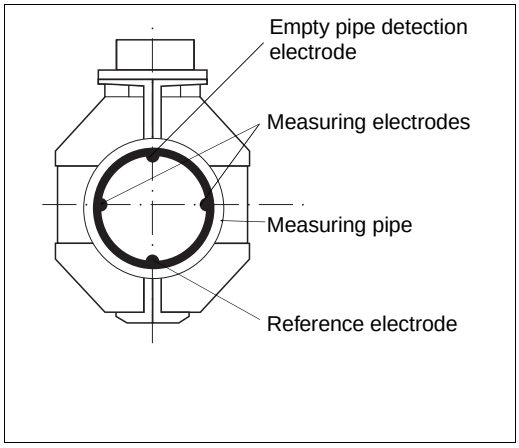


Fig. 28

The sensor and the medium must have roughly the same electrical potential to ensure that measurement is accurate and no galvanic corrosion takes place at the electrodes. Normally the reference electrode in the sensor or the metal pipe ensures that the potentials are equalised. With an existing reference electrode and for media carried in earthed metal piping it is therefore sufficient to connect the earthing terminal of the Promag 31 transmitter housing to the potential equalising line.

With the remote-mounted version this connection is made at the earth terminal of the connection housing (transmitter). Sensor Promag A is always fitted with a reference electrode, in Promag F it is optional. Fig. 28 shows the reference electrode in the sensor Promag F.

Potential equalisation for some special cases is described below:

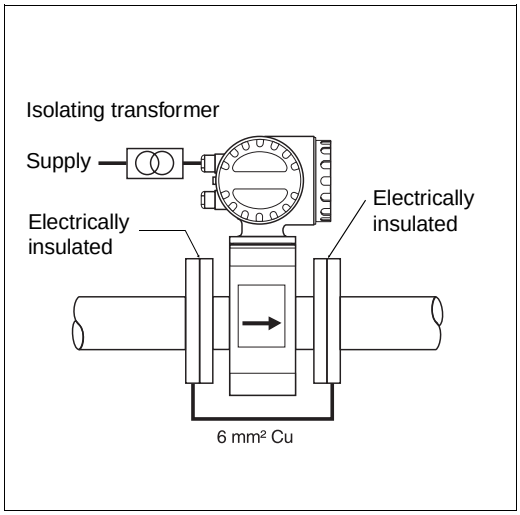
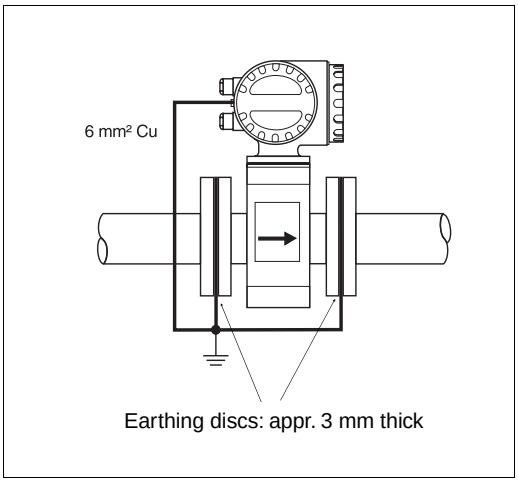


Fig. 29

Potential equalisation for lined pipes with cathodic protection
When the medium cannot be earthed for operational reasons, the measuring unit must be installed that it is potential-free (Fig. 29).

Please pay attention to national regulations regarding potential-free installation (e.g. VDE 0100).

It is also important to ensure that the mounting material used does not result in a conductive bond with the measuring unit and that the material can withstand the tightening torque used.



Caution!

Fig. 30

Plastic or lined piping
This arrangement (Fig. 30) is needed if there is no reference electrode present or the medium has to be earthed on account of equalising currents.

Caution!
Make sure the earthing discs are corrosion-resistant.

Equalizing currents in unearthed metal pipes
The medium may be earthed.
Make the electrical connection from flange to flange and to the measuring unit (Fig. 31).

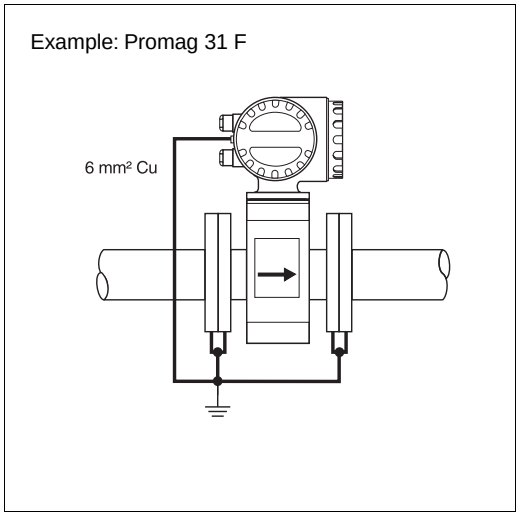


Fig. 31

2.8 Earthing in an area with severe interference

In order to make the most of the electromagnetic compatibility (EMC) of the Promag 31, it is advisable to provide two flange-to-flange links and to connect them jointly with the transmitter housing to earth potential.

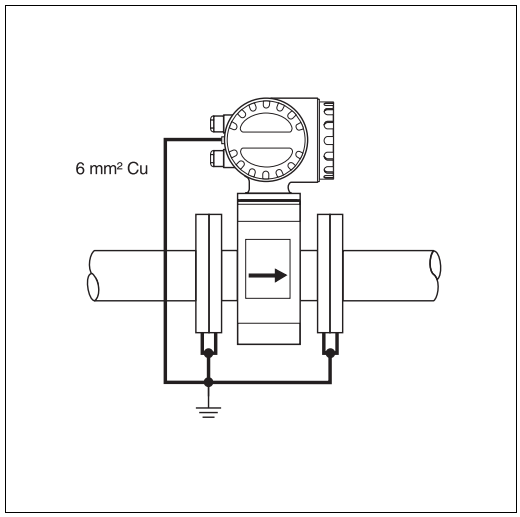


Fig. 32

3. Electrical Connection

3.1 General information

Please note the information in section 2.1 on maintenance of the type of protection IP 67.

3.2 Connection to the transmitter

Warning!
- Risk of electric shock. Install or wire the unit when it is not live. Failure to comply can also result in damage to electronic components.
- Join the protective conductor to the earth terminal of the housing before the supply voltage is switched on.
- Compare the data on the nameplate with the local mains voltage and frequency. Also pay attention to the national rules for installation (e.g. VDE 0100).

Procedure:

1. Switch off the supply voltage.

2. Release the safety grip of the screw cover of the terminal compartment using a 3-mm Allen key. Then unscrew the cover from the terminal compartment of the transmitter.

3. Push the supply cable and signal cable in through the appropriate cable entries.

4. Make the connection in accordance with the wiring diagrams (see also wiring diagram in the screw cover):
   - The supply voltage is connected to terminals 1 (L1 oder L+), and 2 (N oder L-) and the earthing terminal (⏚).
   - Fine-wire leads: max. 4 mm^2; put sleeves on the end of the cores. Single-core lead: max. 6 mm^2.

5. Having made the connection, screw the cover up tight again on the transmitter housing. Tighten the Allen screw of the safety grip thoroughly.

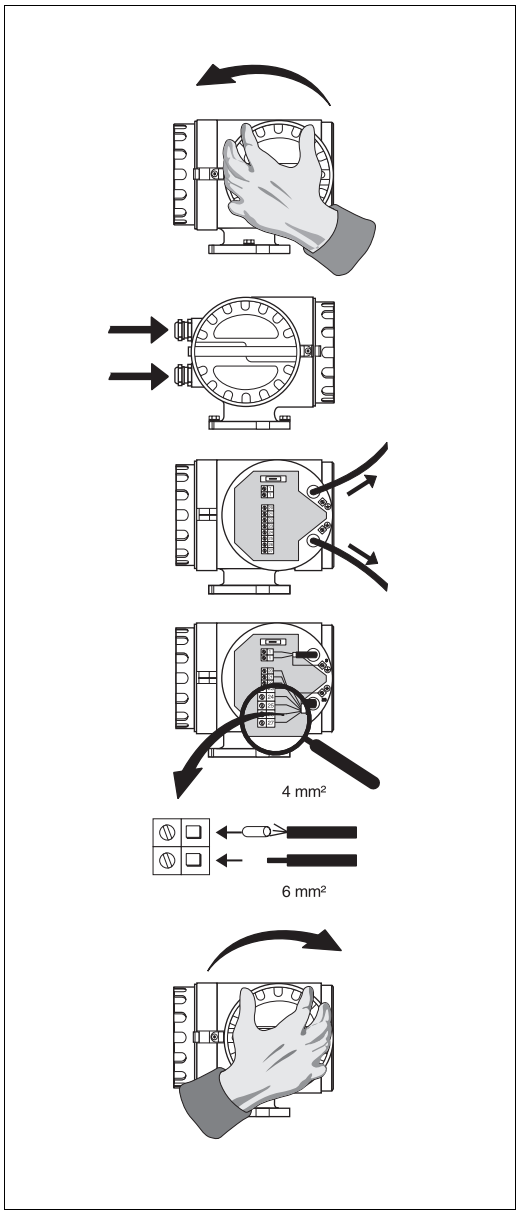


Fig. 33

3.3 Connection of the remote-mounted version (FS)

Procedure:

Caution!

Caution!
Only connect or disconnect the coil-current cable when the supply is switched off.

1. The connection to the terminal compartment is made as described for the compact version (see section 3.2).

2. Open the covers of the connection housing of the sensor and transmitter by unscrewing the four Phillips screws.

Note!

Note!
The terminals of Promag A are situated inside its housing.

3. Push both cables (signal and coil-current cable) in through the appropriate cable entries.

4. Make the connection between the sensor and transmitter in accordance with the wiring diagrams.

5. Tighten the cover of the connection housing securely.

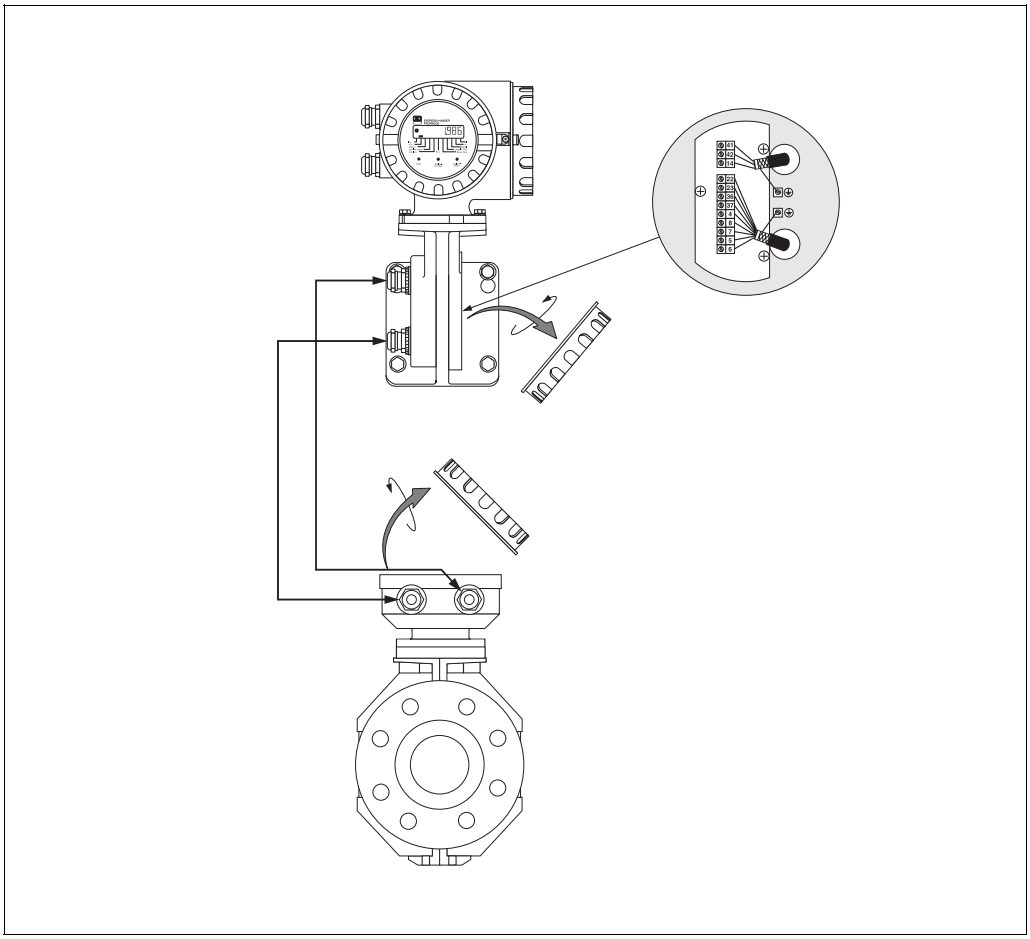


Fig. 34

3.4 Wiring diagrams

Electrical connection: supply, inputs and outputs

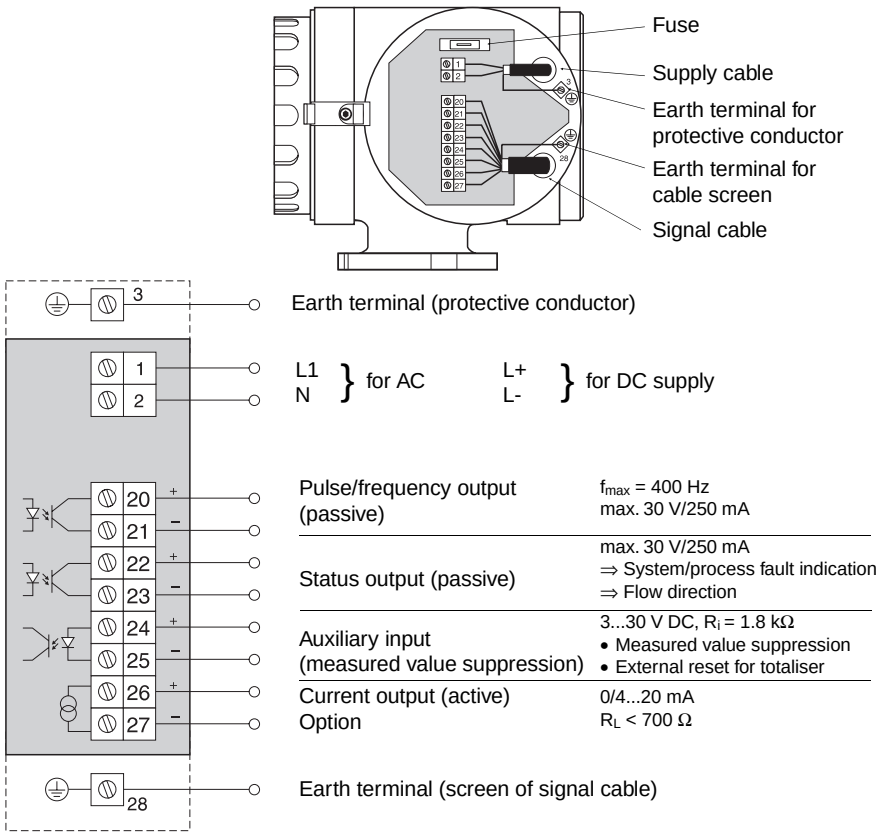


Fig. 35

Remote-mounted version (FS/FL): Connection between sensor and transmitter

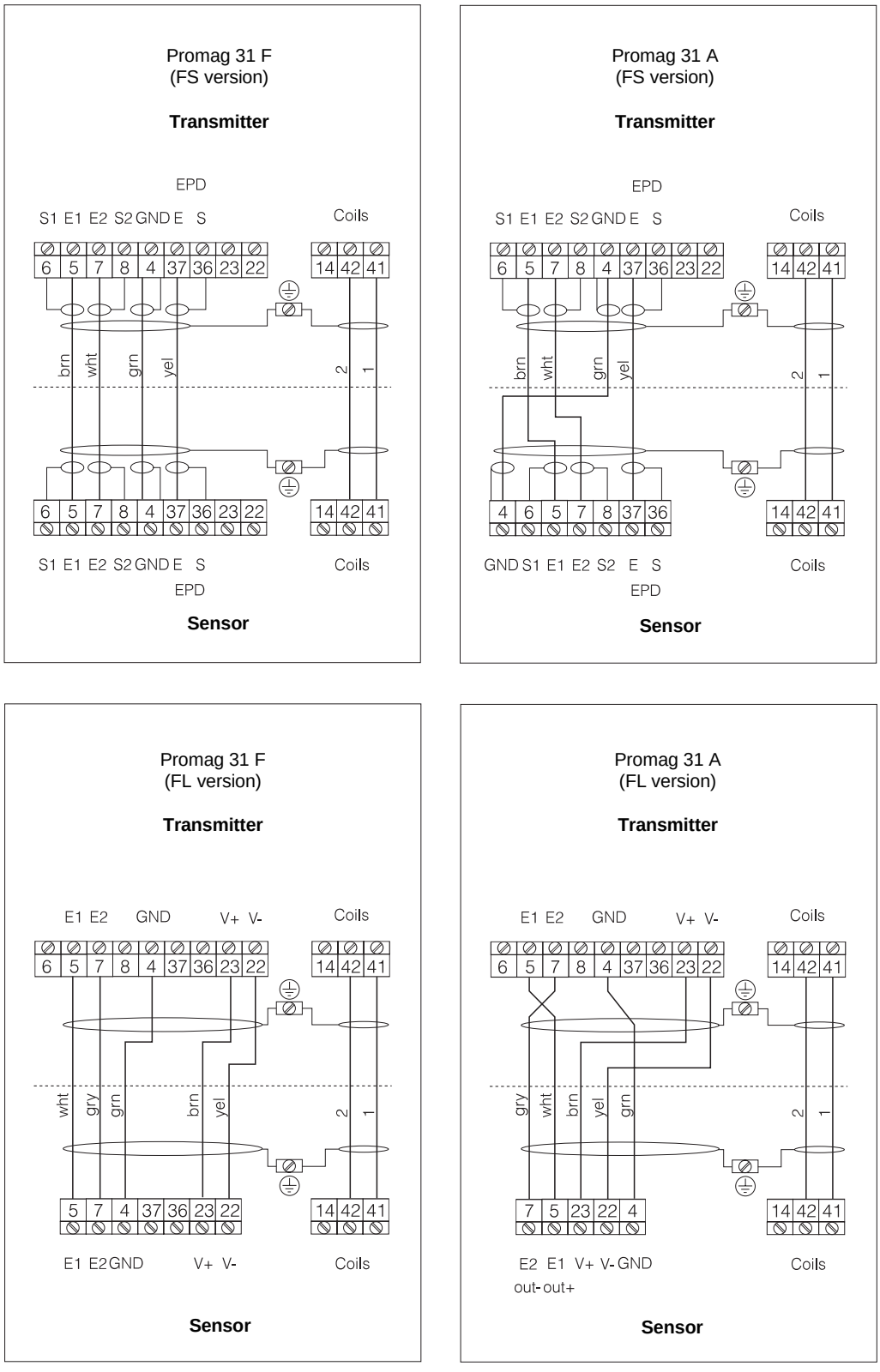


Fig. 36

3.5 Cable specifications

Cable specification for remote-mounted version (FS)

Coil cable: 2 x 0.5 mm^2 PVC cable with common screen
Conductor resistance: ≤37 Ω/km
Capacitance: core/core, screen earthed ≤120 pF/m

Signal cable: 3 x 0.38 mm^2 PVC cable with common screen and separately screened cores.
Conductor resistance: ≤50 Ω/km
Capacitance: core/screen ≤420 pF/m

Cable specification for remote-mounted version (FL)

Coil cable: 2 x 0.5 mm^2 PVC cable with common screen
Conductor resistance: ≤37 Ω/km
Capacitance: core/core, screen earthed ≤120 pF/m

Signal cable: 5 x 0.5 mm^2 PVC cable with common screen
Conductor resistance: ≤37 Ω/km
Capacitance: core/screen ≤120 pF/m

Cable specifications for use in areas with severe electrical interference

The Promag 31 measuring equipment fulfils all general requirements for electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 when installed in accordance with the NAMUR recommendations.

Note!
With the remote-mounted version (FS and FL) the signal and coil cables between sensor and transmitter must always be screened and earthed at both ends.
This is done at the earth terminals inside the connection housing of sensor and transmitter (see chapter 3.4).


Note!

4. Operation and Commissioning

4.1 Functions of the equipment and works settings

The six unit parameters are set inside the housing with the aid of miniature switches.

➤ Creep suppression

Works setting: Switched on
Switch No. 1: ON

Creep suppression prevents "false flow" in the lower part of the measuring range from being detected (e.g. varying liquid head at standstill). This enables flows to be suppressed which should not be measured or totalled.

Closing point:
When the velocity of the medium is less than 0.02 m/s creep suppression is activated and all output signals (pulse and analogue signals) are set to the fall back value (0/4 mA, logical "0").

Opening point:
When the velocity of the medium again exceeds v = 0.04 m/s, creep suppression is deactivated.

DN [mm]	Closing point at v = 0.02 m/s in [m^3/h]	Opening point at v = 0.04 m/s in [m^3/h]
2	0.0002	0.0005
4	0.0009	0.0018
8	0.004	0.007
15	0.013	0.025
25	0.035	0.071
32	0.058	0.116
40	0.090	0.181
50	0.141	0.283
65	0.239	0.478
80	0.362	0.724
100	0.565	1.131
125	0.884	1.767
150	1.272	2.545
200	2.262	4.524
250	3.534	7.069
300	5.089	10.179
350	6.927	13.854
400	9.048	18.096
450	11.451	22.902
500	14.137	28.274
600	20.358	40.715
700	27.709	55.418
750	31.809	63.617
800	36.191	72.382
900	45.804	91.609
1000	56.549	113.097

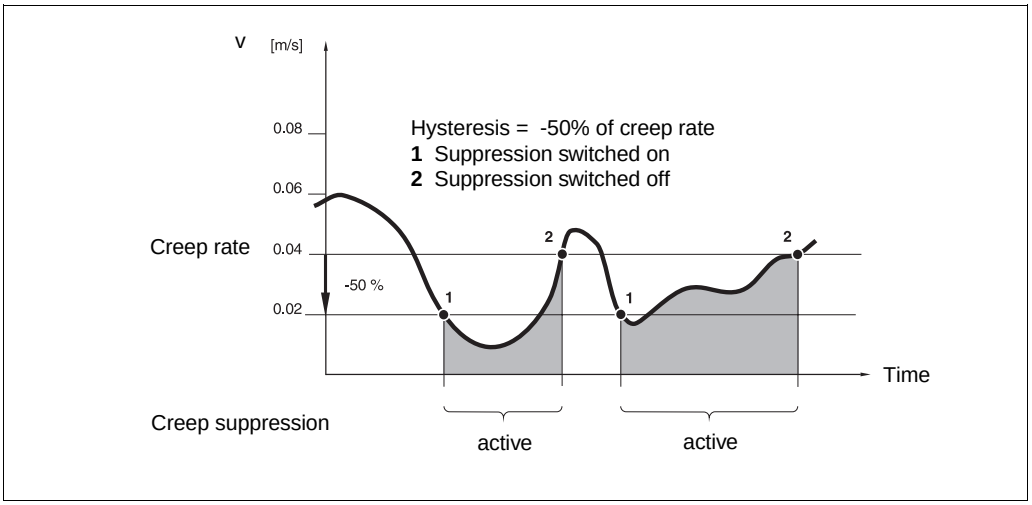


Fig. 37

➤ Status output

Works setting: Error messages
Switch No. 2: OFF

This switched output can optionally be configured for:

- Signalling the direction of flow
- Error messages: Fault (System error: coil current error, amplifier error DAT error, EEPROM error, ROM error, RAM error)
  Alarm (Process error: measuring range exceeded, v ≥12.5 m/s)
  Supply failure

The status output acts as a normally closed contact, i.e. in normal operation fault, the output is closed (transistor conducting, see Fig. 38).

Note!

Note!
The behaviour of the outputs in the event of a fault is described in section 5.1.

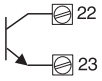
Configuration of status output	Status	Behaviour of open collector output 
Signalling of system and process errors	System OK	closed 
	Fault signal/alarm	open 
	Supply failure	open 
Flow direction recognition	forward 	open 
	reverse 	closed 
	"closed": open collector ⇒ conducting "open": open collector ⇒ not conducting	

Fig. 38

➤ System units

Works setting: SI units
Switch No. 3: OFF

SI units: volume in [dm^3, m^3]
US units: volume in [US gal]

1 US gallon = 3.7854 dm^3 (Litre)

➤ Current range

Works setting: 4...20 mA
Switch No. 4: OFF

The current at zero flow (Q = 0) can be set to 0 or 4 mA. The current for the full-scale value is always 20 mA. Extension to 25 mA is possible (≥125 % of the full-scale value). The hydraulic transmitter Promag 31 is always bidirectional (i.e. it always measures in both directions).

Note!
The Promag 31 measuring system can be operated in a bidirectional or unidirectional mode. Selecting this mode is dependent on the status output and functions as follows:

Configuration of status output	Operating mode	Function
Flow direction	Bidirectional	• Continuous current and pulse output
System and process errors	Unidirectional	• Current and pulse output for positive flow direction only

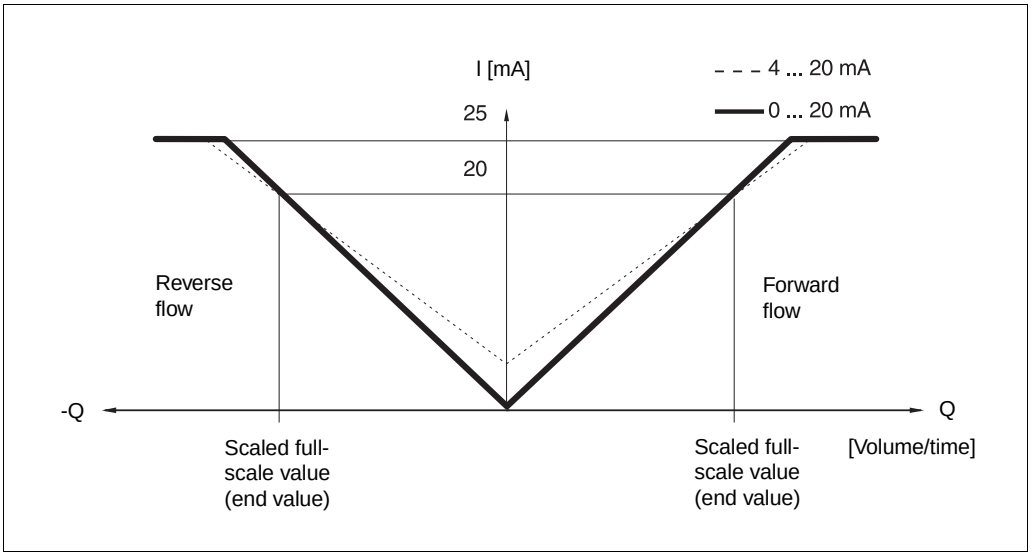


Fig. 39

➤ Pulse value

Works setting: at v ~ 2.5 m/s
Switches No. 5, 6, 7: OFF-OFF-ON

The pulse value indicates for what freely selected volume flow an output pulse is emitted. With an external counter these pulses can be totalled enabling the total volume flow to be determined.

The pulse-pause ratio is approx. 1:1. The pulse width is limited to a maximum of 2 s (≤0.25 Hz). At f = 400 Hz the maximum pulse width is 1 ms.

For the Promag 31 measuring system eight preset pulse-value steps can be selected in terms of the nominal diameter. Setting is made by means of three miniature switches (see section 4.2).

➤ Setting the full-scale value

Works setting: at v ~ 2.5 m/s
Switches No. 8, 9, 10: OFF-OFF-ON

The current output supplies signals between 0/4 and 20 mA, corresponding to the momentary value of the flow.

By setting the full-scale, a flow is assigned to the current of 20 mA. This setting always applies to both directions of flow (bidirectional). The direction of flow is emitted at the status output with appropriate configuration.

In practice the maximum rate of flow that occurs is not always reliably known. Therefore it is possible to extend to 25 mA up to a medium velocity of 10 m/s (see Fig. 39).

For the Promag 31 measuring system eight preset pulse-value steps can be selected in terms of the nominal diameter. Setting is made by means of three miniature switches (see section 4.2).

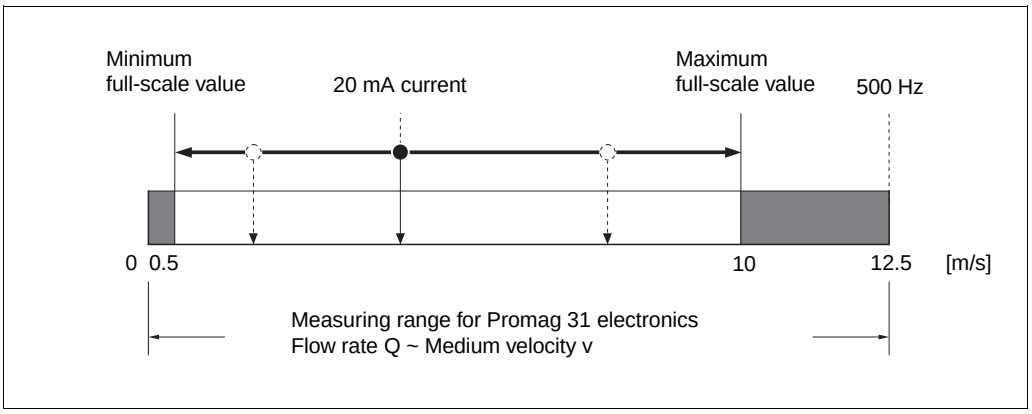


Fig. 40

➤ Auxiliary input

The auxiliary input cannot be affected by the miniature switches

Measured value suppression
By setting an external voltage (3...30 V DC) on the auxiliary input various functions can be activated:

As long as this external voltage remains, the current output is set on 0, respectively 4 mA; the pulse output on the open circuit (transistor non-conductive).

Typical application:
Interrupting measurement to clean the piping system.

Electrode Cleaning Circuit ECC (Option)
Conductive material build-up on the electrodes (e.g. magnetite) can lead to errors in measurement. The electrode cleaning circuit (ECC) has, therefore, been developed to prevent such a build-up. The cleaning cycles are carried out every 30 minutes for 2...5 secs each depending on the scanning frequency. If the Promag 31 measuring system is equipped with the electrode cleaning circuit option (ECC), then this can be switched on and off using the miniature switches on the amplifier board (see Fig. 46). When delivered from the factory, the electrode cleaning circuit is always switched on. The ECC is not available with the FL version.

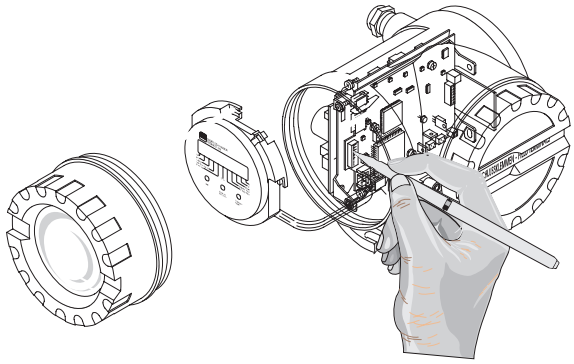
Caution!
If the ECC is switched off for a long period of time in an application with conductive build-up, then material build-up in the measuring pipe can lead to measuring errors. If there is a large concentration of build-up at one point, then, under certain circumstances, switching on the ECC may not remove it. In such cases the measuring pipe is to be cleaned and the build-up removed.

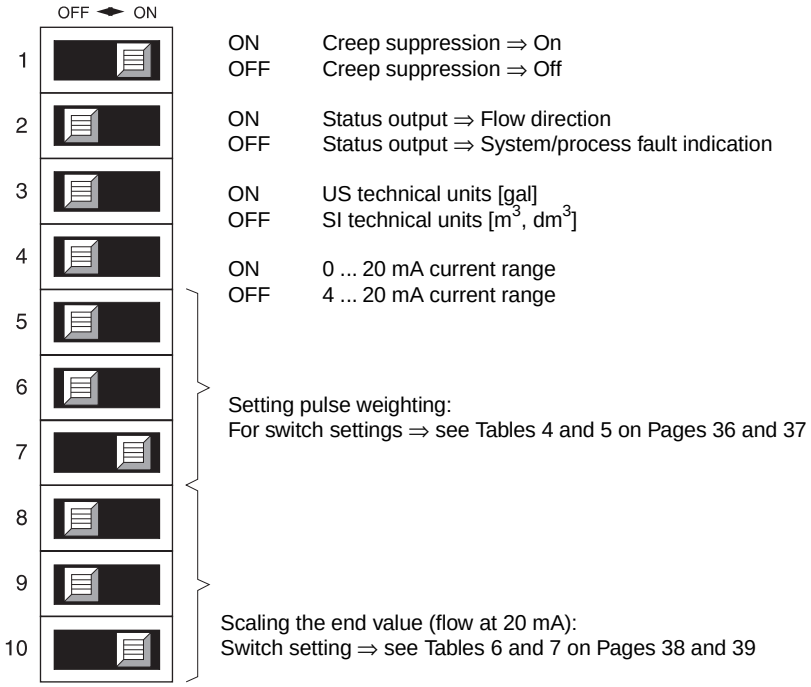

Caution!

4.2 Setting unit parameters with miniature switches

Warning!
Danger of electric shock.
Switch off the supply voltage before you unscrew the cover of the electronic compartment of the transmitter housing.

Procedure:
1. Loosen the screws of the safety grip (3 mm Allen key).
2. Unscrew the cover of the electronics area.
3. Remove the local display (if present).
4. Set the miniature switches.
5. Put back the local display
6. Screw the cover to the electronics area securely on the transmitter housing and tighten the Allen screws of the safety grip securely.





Miniature switches 1-10
Works settings

Fig. 41

Table 4

Pulse value ⇒ SI units [dm³/pulse, m³/pulse]

Switch settings (No. 5, 6 and 7)

ON / OFF / DN [mm]	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7 (f_{max} = 400 Hz at v = 10 m/s)
2	0.0001 dm³	0.001 dm³	0.01 dm³	0.1 dm³	1 dm³	10 dm³	100 dm³	0.000079 dm³
4	0.001 dm³	0.01 dm³	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	0.000314 dm³
8	0.01 dm³	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	0.001257 dm³
15	0.01 dm³	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	0.004418 dm³
25	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	0.012272 dm³
32	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	0.020106 dm³
40	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	0.031416 dm³
50	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	0.049087 dm³
65	0.1 dm³	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	0.082958 dm³
80	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	0.125664 dm³
100	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	0.196350 dm³
125	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	0.306796 dm³
150	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	0.441786 dm³
200	1 dm³	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	0.785398 dm³
250	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	1.22718 dm³
300	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	1.76715 dm³
350	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	2.40528 dm³
400	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	3.14159 dm³
450	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	3.97608 dm³
500	10 dm³	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	4.90874 dm³
600	10 dm³	100 m³	1 m³	10 m³	100 m³	1000 m³	10000 m³	7.06858 dm³
700	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	100000 m³	9.62113 dm³
800	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	100000 m³	12.5664 dm³
900	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	100000 m³	15.9043 dm³
1000	100 dm³	1 m³	10 m³	100 m³	1000 m³	10000 m³	100000 m³	19.6350 dm³


Caution!

Caution!
Work with this table only when you have turned switch No. 3 to "OFF" (SI units).
For switching position "ON-ON-ON", set values may differ from those shown in the table. In such cases, the valid value may be read from the service plate in the electronics compartment cover. Also, the pulse duty cycle of 1:1 can deviate.

For each nominal diameter is a choice of eight pulse values (in decadic steps).
A definite frequency value (f_{max} = 400 Hz at v = 10 m/s, pulse width = 1 ms) is only available for a single switch position.

Example:
A maximum permissible pulse frequency f_{max} = 20 Hz (input frequency of electronic counter) should not be exceeded. The nominal diameter is assumed to be 25 mm; the rate of flow Q = 10.8 m³/h

$$\text{Pulse value} = \frac{Q}{f_{max}} = \frac{10.8\ m^3/h}{20\ s^{-1}} = \frac{3\ dm^3/s}{20\ s^{-1}} = 0.15\ dm^3$$

At DN 25 select the switch position for the next higher pulse value ⇒ 1 dm³ per pulse.
(Conversely, when the flow rate Q is known and a pulse value has been selected, the exact pulse frequency can be calculated)

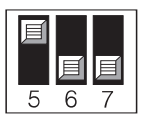

5 6 7

Table 5

Pulse value ⇒ US units [gal/pulse]

Switch settings (No. 5, 6 and 7)

ON / OFF	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7	 5 6 7
DN [mm]								(f_{max} = 400 Hz at v = 33 ft/sec)
2	0.0001 gal	0.001 gal	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	0.00002087 gal
4	0.0001 gal	0.001 gal	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	0.00008348 gal
8	0.001 gal	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	1000 gal	0.0003339 gal
15	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	0.001174 gal
25	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	0.003261 gal
32	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	0.005343 gal
40	0.01 gal	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	0.008348 gal
50	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	0.01304 gal
65	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	0.02204 gal
80	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	0.03339 gal
100	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	0.05217 gal
125	0.1 gal	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	0.08152 gal
150	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	0.1174 gal
200	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	0.2087 gal
250	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	0.3261 gal
300	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	0.4696 gal
350	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	0.6391 gal
400	1 gal	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	0.8348 gal
450	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	1.057 gal
500	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	1.304 gal
600	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	1.878 gal
700	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	2.556 gal
800	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	3.339 gal
900	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	4.226 gal
1000	10 gal	100 gal	1000 gal	10000 gal	100000 gal	1000000 gal	10000000 gal	5.217 gal


Caution!

Caution!
Work with this table only when you have turned switch No. 3 to "ON" (US units).
For switching position "ON-ON-ON", set values may differ from those shown in the table. In such cases, the valid value may be read from the service plate in the electronics compartment cover. Also, the pulse duty cycle of 1:1 can deviate.

For each nominal diameter there is a choice of eight pulse values (in decade steps). A definite frequency value (f_{max} = 400 Hz at v = 33 ft/s, pulse width = 1 ms) is only available for a single switch position.

Example:
A maximum permissible pulse frequency f_{max} = 20 Hz (input frequency of an electronic counter) should not be exceeded. The nominal diameter is assumed to be 80 mm; the rate of flow Q = 600 USgal/min.

$$\text{Pulse value} = \frac{Q}{f_{max}} = \frac{600\ \text{gal/min}}{20\ s^{-1}} = \frac{10\ \text{gal/s}}{20\ s^{-1}} = 0.5\ \text{gal}$$

At DN 80 select the switch position for the next higher pulse value ⇒ 1 gal per pulse.
(Conversely when the flow rate Q is known and a pulse value has been selected, the exact pulse frequency can be calculated.)

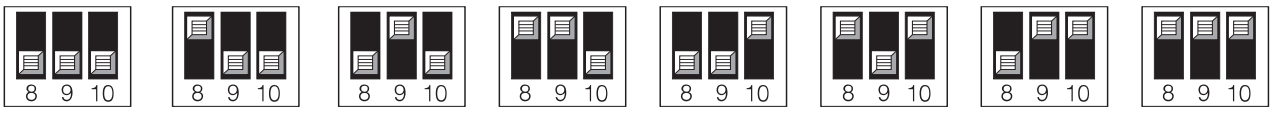

5 6 7

Table 6

Full-scale value setting ⇒ SI units [m^3/h]

Switch settings (No. 8, 9 and 10)

ON
OFF



DN [mm] (v = 10 m/s)

DN [mm]	0.5 m/s	1 m/s	1.5 m/s	2 m/s	2.5 m/s	4 m/s	8 m/s	10 m/s
2	0.005 m^3/h	0.01 m^3/h	0.015 m^3/h	0.02 m^3/h	0.025 m^3/h	0.05 m^3/h	0.08 m^3/h	0.1 m^3/h
4	0.02 m^3/h	0.04 m^3/h	0.06 m^3/h	0.08 m^3/h	0.1 m^3/h	0.2 m^3/h	0.32 m^3/h	0.4 m^3/h
8	0.1 m^3/h	0.2 m^3/h	0.3 m^3/h	0.4 m^3/h	0.5 m^3/h	1 m^3/h	1.6 m^3/h	2 m^3/h
15	0.3 m^3/h	0.6 m^3/h	0.9 m^3/h	1.2 m^3/h	1.5 m^3/h	3 m^3/h	4.8 m^3/h	6 m^3/h
25	1 m^3/h	2 m^3/h	3 m^3/h	4 m^3/h	5 m^3/h	10 m^3/h	16 m^3/h	20 m^3/h
32	1.5 m^3/h	3 m^3/h	4.5 m^3/h	6 m^3/h	7.5 m^3/h	15 m^3/h	24 m^3/h	30 m^3/h
40	2 m^3/h	4 m^3/h	6 m^3/h	8 m^3/h	10 m^3/h	20 m^3/h	32 m^3/h	40 m^3/h
50	4 m^3/h	8 m^3/h	12 m^3/h	16 m^3/h	20 m^3/h	40 m^3/h	64 m^3/h	80 m^3/h
65	6 m^3/h	12 m^3/h	18 m^3/h	24 m^3/h	30 m^3/h	60 m^3/h	96 m^3/h	120 m^3/h
80	10 m^3/h	20 m^3/h	30 m^3/h	40 m^3/h	50 m^3/h	100 m^3/h	160 m^3/h	200 m^3/h
100	15 m^3/h	30 m^3/h	45 m^3/h	60 m^3/h	75 m^3/h	150 m^3/h	240 m^3/h	300 m^3/h
125	20 m^3/h	40 m^3/h	60 m^3/h	80 m^3/h	100 m^3/h	200 m^3/h	320 m^3/h	400 m^3/h
150	30 m^3/h	60 m^3/h	90 m^3/h	120 m^3/h	150 m^3/h	300 m^3/h	480 m^3/h	600 m^3/h
200	50 m^3/h	100 m^3/h	150 m^3/h	200 m^3/h	250 m^3/h	500 m^3/h	800 m^3/h	1000 m^3/h
250	100 m^3/h	200 m^3/h	300 m^3/h	400 m^3/h	500 m^3/h	1000 m^3/h	1600 m^3/h	2000 m^3/h
300	150 m^3/h	300 m^3/h	450 m^3/h	600 m^3/h	750 m^3/h	1500 m^3/h	2400 m^3/h	3000 m^3/h
350	200 m^3/h	400 m^3/h	600 m^3/h	800 m^3/h	1000 m^3/h	2000 m^3/h	3200 m^3/h	4000 m^3/h
400	200 m^3/h	400 m^3/h	600 m^3/h	800 m^3/h	1000 m^3/h	2000 m^3/h	3200 m^3/h	4000 m^3/h
450	300 m^3/h	600 m^3/h	900 m^3/h	1200 m^3/h	1500 m^3/h	3000 m^3/h	4800 m^3/h	6000 m^3/h
500	400 m^3/h	800 m^3/h	1200 m^3/h	1600 m^3/h	2000 m^3/h	4000 m^3/h	6400 m^3/h	8000 m^3/h
600	600 m^3/h	1200 m^3/h	1800 m^3/h	2400 m^3/h	3000 m^3/h	6000 m^3/h	9600 m^3/h	12000 m^3/h
700	800 m^3/h	1600 m^3/h	2400 m^3/h	3200 m^3/h	4000 m^3/h	8000 m^3/h	12800 m^3/h	16000 m^3/h
800	1000 m^3/h	2000 m^3/h	3000 m^3/h	4000 m^3/h	5000 m^3/h	10000 m^3/h	16000 m^3/h	20000 m^3/h
900	1000 m^3/h	2000 m^3/h	3000 m^3/h	4000 m^3/h	5000 m^3/h	10000 m^3/h	16000 m^3/h	20000 m^3/h
1000	1500 m^3/h	3000 m^3/h	4500 m^3/h	6000 m^3/h	7500 m^3/h	15000 m^3/h	24000 m^3/h	30000 m^3/h

Caution!

Caution!
Work with this table only when you have turned switch No. 3 to "OFF" (SI units).
For switching position "ON-ON-ON", set values may differ from those shown in the table. In such cases, the valid value may be read from the service plate in the electronics compartment cover. Also, the pulse duty cycle of 1:1 can deviate.

For each nominal diameter, at a current of 20 mA, eight flow values (full-scale values) can be selected from the above table.

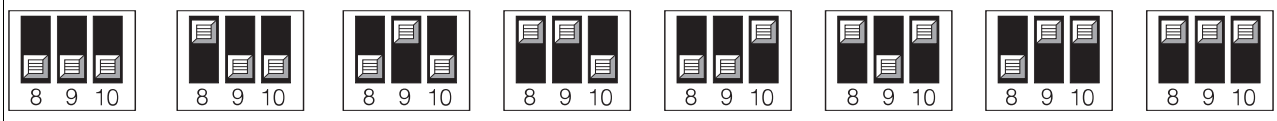
Note!

Note!
To determine the velocity of flow use the appropriate nomograms in section 6.4.

Table 7

Full-scale value setting ⇒ US units [gal/min]

Switch settings (No. 8, 9 and 10)



DN [mm] v = 33 ft/sec

	0.5 m/s	1 m/s	1.5 m/s	2 m/s	2.5 m/s	4 m/s	8 m/s	33 10 m/s
2	0.02 gal/min	0.05 gal/min	0.075gal/min	0.1 gal/min	0.125gal/min	0.25 gal/min	0.4 gal/min	0.5 gal/min
4	0.1 gal/min	0.2 gal/min	0.3 gal/min	0.4 gal/min	0.5 gal/min	1 gal/min	1.6 gal/min	2 gal/min
8	0.5 gal/min	1 gal/min	1.5 gal/min	2 gal/min	2.5 gal/min	5 gal/min	8 gal/min	10 gal/min
15	1.5 gal/min	3 gal/min	4.5 gal/min	6 gal/min	7.5 gal/min	15 gal/min	24 gal/min	30 gal/min
25	5 gal/min	10 gal/min	15 gal/min	20 gal/min	25 gal/min	50 gal/min	80 gal/min	100 gal/min
32	7.5 gal/min	15 gal/min	22.5 gal/min	30 gal/min	37.5 gal/min	75 gal/min	120 gal/min	150 gal/min
40	10 gal/min	20 gal/min	30 gal/min	40 gal/min	50 gal/min	100 gal/min	160 gal/min	200 gal/min
50	20 gal/min	40 gal/min	60 gal/min	80 gal/min	100 gal/min	200 gal/min	320 gal/min	400 gal/min
65	30 gal/min	60 gal/min	90 gal/min	120 gal/min	150 gal/min	300 gal/min	480 gal/min	600 gal/min
80	50 gal/min	100 gal/min	150 gal/min	200 gal/min	250 gal/min	500 gal/min	800 gal/min	1000 gal/min
100	75 gal/min	150 gal/min	225 gal/min	300 gal/min	375 gal/min	750 gal/min	1200 gal/min	1500 gal/min
125	100 gal/min	200 gal/min	300 gal/min	400 gal/min	500 gal/min	1000 gal/min	1600 gal/min	2000 gal/min
150	150 gal/min	300 gal/min	450 gal/min	600 gal/min	750 gal/min	1500 gal/min	2400 gal/min	3000 gal/min
200	250 gal/min	500 gal/min	750 gal/min	1000 gal/min	1250 gal/min	2500 gal/min	4000 gal/min	5000 gal/min
250	500 gal/min	1000 gal/min	1500 gal/min	2000 gal/min	2500 gal/min	5000 gal/min	8000 gal/min	10000 gal/min
300	750 gal/min	1500 gal/min	2250 gal/min	3000 gal/min	3750 gal/min	7500 gal/min	12000 gal/min	15000 gal/min
350	1000 gal/min	2000 gal/min	3000 gal/min	4000 gal/min	5000 gal/min	10000 gal/min	16000 gal/min	20000 gal/min
400	1000 gal/min	2000 gal/min	3000 gal/min	4000 gal/min	5000 gal/min	10000 gal/min	16000 gal/min	20000 gal/min
450	1500 gal/min	3000 gal/min	4500 gal/min	6000 gal/min	7500 gal/min	15000 gal/min	24000 gal/min	30000 gal/min
500	2000 gal/min	4000 gal/min	6000 gal/min	8000 gal/min	10000 gal/min	20000 gal/min	32000 gal/min	40000 gal/min
600	3000 gal/min	6000 gal/min	9000 gal/min	12000 gal/min	15000 gal/min	30000 gal/min	48000 gal/min	60000 gal/min
700	4000 gal/min	8000 gal/min	12000 gal/min	16000 gal/min	20000 gal/min	40000 gal/min	64000 gal/min	80000 gal/min
800	5000 gal/min	10000 gal/min	15000 gal/min	20000 gal/min	25000 gal/min	50000 gal/min	80000 gal/min	100000 gal/min
900	5000 gal/min	10000 gal/min	15000 gal/min	20000 gal/min	25000 gal/min	50000 gal/min	80000 gal/min	100000 gal/min
1000	7500 gal/min	15000 gal/min	22500 gal/min	30000 gal/min	37500 gal/min	75000 gal/min	120000 gal/min	150000 gal/min

Caution!

Caution!
Work with this table only when you have turned switch No. 3 to "ON" (US units).
For switching position "ON-ON-ON", set values may differ from those shown in the table. In such cases, the valid value may be read from the service plate in the electronics compartment cover. Also, the pulse duty cycle of 1:1 can deviate.

For each nominal diameter. at a current of 20 mA. eight flow values (full-scale values) can be selected from the above table.

Note!
To determine the velocity of flow use the appropriate nomograms in section 6.4.

Note!

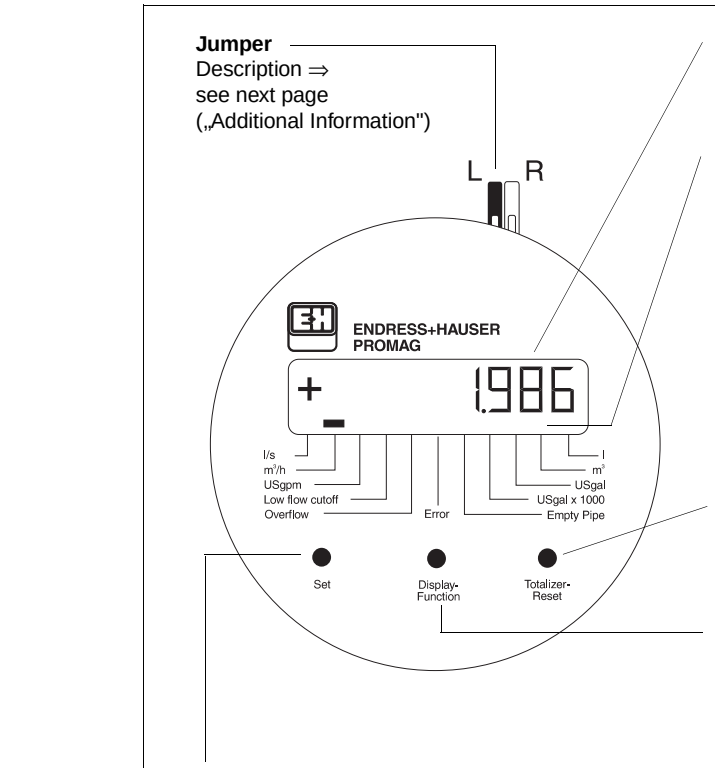
4.3 Local display Promag 31

With the Promag 31 local display important variables can be read off and controlled directly at the measuring point:
- Flow rate and/or totaliser value.
- Technical units (SI or US).
- Process conditions (creep. partially empty pipe).
- Error messages.

Three operating keys are used to select and activate the various functions.
They are operated with a thin rod (a switching cycle takes approx. 0.5...0.8 s).

Note!
- The three keys are only accessible by unscrewing the cover of the electronics area. To do this. loosen the safety grip using a 3-mm Allen key. Screw the cover of the electronics area securely back onto the transmitter housing once the settings have been done (maintain protection IP 67!).

Note!



Jumper
Description ⇒
see next page
(„Additional Information")

LCD. 8-character
All measured values. operating and status indications are shown here.

11 Display segments
The appropriate segments serve to provide clear information on technical units and current instrument function:
- Current technical unit.
- Creep to low
  (Low flow cut-off)
- Velocity of fluid > 12.5 m/s
- System fault (error)
- Partially filled pipe (Empty Pipe. Empty Pipe Detection)

Totaliser reset
This key is used for resetting totaliser to “0” (in the “tot” function only).

Display function
This key is used for selecting the function required (= display mode). By continuously pressing the key. the individual functions are called up automatically on at a time:

- Current flow rate.
- Current totaliser display.
- Alternating display flowrate/totaliser
- Empty pipe detection
- Empty pipe calibration
  (for Empty Pipe Detection)
- Full pipe calibration
  (for Empty Pipe Detection)
- Test function for checking the display elements.

Set
This key is used for carrying out the following operations within the appropriate function:

- Selecting the technical units.
  Note!
  SI/US units are selected using the miniature switches on the amplifier board (see Sect. 4.2 of the Installation and Operating Manual)
- Switching on/off the EPD
  (Empty Pipe Detection)
- Starting the empty/full pipe calibration
  (for Empty Pipe Detection)

Fig. 42

Display functions

Display	Function	Description
rAtE	Display flow rate	Display of the current flow rate or totaliser volume; a neg. flow direction is indicated by a neg. digit To select the measuring unit ⇒ press “Set”
tot	Display totaliser	Caution! Setting of SI/US units is done by miniature switches on the measuring amplifier board (see chapter 4.2. Operating and Installation Manual)
dISP-OF	Display overflow totaliser	Display the number of overflows at numerical values > 99’999’999. Note! A maximum of 21 overflows is displayed; starting with the 22nd overflow. the totaliser begins to sum up from “0” upwards.
rAtE-tot	Display Flow rate/totaliser	Alternating display (about every 10 seconds) of the current flow rate and totaliser value.
EPd-oFF	EPD = Empty Pipe Detection	The EPD function detects whether a measuring pipe is only partially filled with liquid for ON/OFF switching ⇒ press “Set”
EPd-Ad_E	Empty pipe adjustment (for EPD)	For empty/full pipe adjustment To start adjustment ⇒ press “Set”
EPd-Ad_F	Full pipe adjustment (for EPD)	Note! • Any adjustment has to be done **before** switching on EPD (otherwise the ADJ_ERROR message is displayed for about 0.5 s. • After any adjustment. ADJ_DONE is displayed
tESt	Test function	Accessing this function activates an automatic test sequence of all display elements; the following displays are shown: 1. + 88 888 888 (incl. display segments) 2. - 00 000 000 (without display segments) 3. All display elements are blank 4. Flow indication

Additional Information!

- Jumper:
  Left position ⇒ auxiliary input configured for “measured value suppression”.
  If the measuring value suppression is activated an eight-bar symbol is displayed.
  Right position ⇒ auxiliary input configured for “totaliser reset” to allow resetting the totaliser to “0” independently of the current display mode. The function of the “Totaliser Reset” key is maintained.
- In case of system or process errors (incl. EPD). outputs react as described in section 5.1 of the Operating and Installation Manual.
- In case of a supply breakdown, all measuring data (e.g. totaliser value) and configurations are saved and again available once the device is restarted.
- If a sensor equipped with an EPD electrode has to be exchanged during servicing, then the EPD calibration must always be carried out again.

Caution!

Note!

Note!

Note!

4.4 Commissioning

Before switching the measuring equipment on for the first time repeat the following checks:

- Check the electrical connections and the allocation of the terminals.
- Compare the data on the nameplate with the local mains voltage and frequency.
- Does the direction of the arrow on the nameplate (sensor) agree with the actual direction of flow in the piping?

If the results of these checks are satisfactory. switch on the supply voltage.
The unit is ready for operation.

5. Fault Location and Remedies

5.1 Behaviour of the measuring equipment in the event of a fault or alarm

Notes!


Note!

- Errors which occur while operation is in progress are emitted at the status output, provided its configuration is appropriate (see chapter 4).
- An LED is also situated on the amplifier board of the Promag 31 (see Fig. 46). This LED is always lit as long as the measuring system is operating correctly. In case of error the LED is flushing, thus indicating an error. If the LED is neither lit nor flashing there is a power supply breakdown.
- The hydraulic transmitter Promag 31 reacts to faults or an alarm in the following manner:

Type of fault	Behaviour of the outputs
System error (fault, failure) Process error (alarm) Supply failure	➤ Status output open, i.e. open collector not conducting (see Fig. 38). ➤ Pulse output: No output of pulses until the fault has been cleared. ➤ Current output: The current is set to a definite value until the fault has been cleared. 0...20 mA ⇒ 0 mA 4...20 mA ⇒ 2 mA

Note!


Note!

With measured value suppression the following points are important:

- System errors are given as usual over the status output.
- Process errors have a lower priority and are not given at the status output with active measured value suppression.

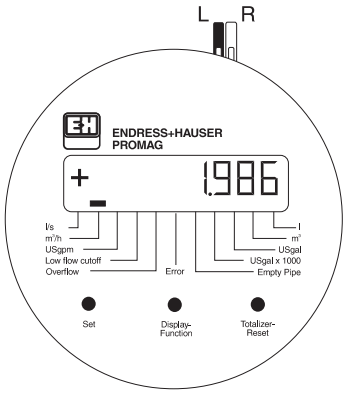
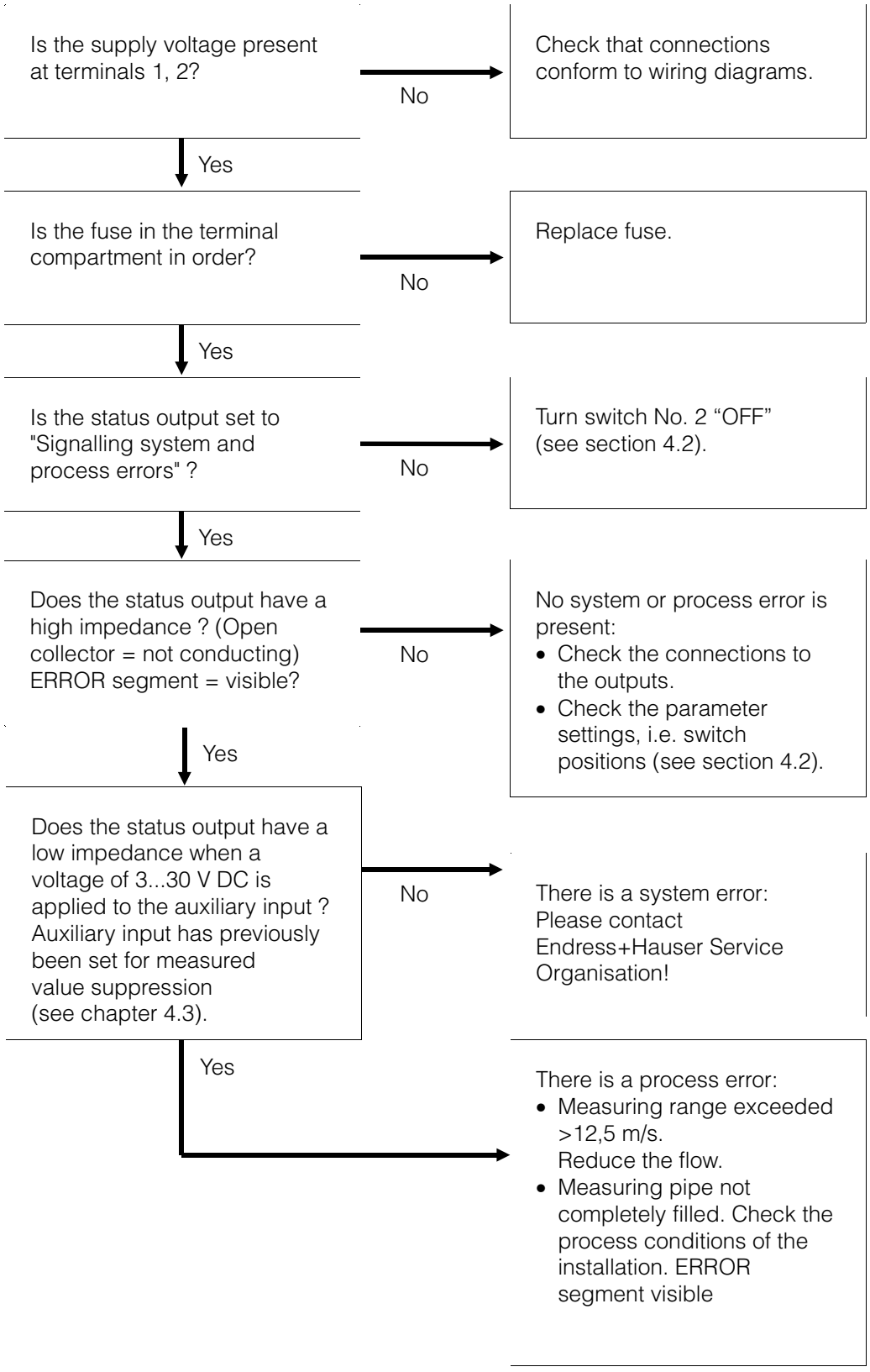
Error messages on the display	Error
	➤ System error ⇒ ERROR segment visible ➤ Process error ⇒ EDP segment visible (Empty Pipe) ➤ Overflow ⇒ Overflow segment visible

Fig. 43

5.2 Instructions for fault location and remedies

During manufacture all units pass through various stages of quality control. The last inspection is wet calibration, which is carried out on a calibration rig designed according to the latest state of the art.

As an initial help in the location of faults, here is an overview of possible causes of faults:



5.3 Replacing the transmitter electronics

Warning!
- Danger from electric shock! Switch off the power supply before removing the cover to the electronics area of the transmitter housing.

Caution!
- When replacing the electronic boards, ensure that their markings are identical.
- The local power supply voltage and frequency must be the same as the technical specifications of the power supply boards.

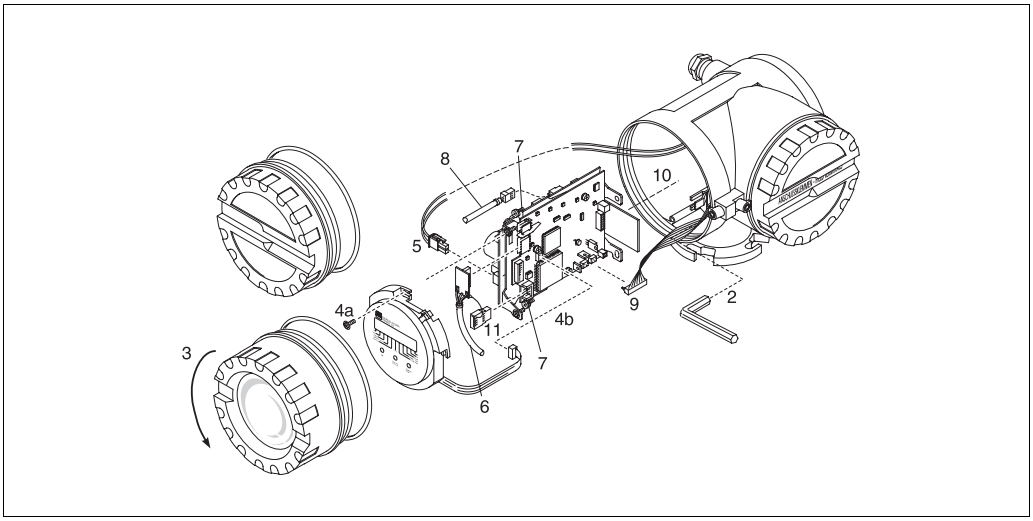


Fig. 44

Procedure:
1. Switch off the power supply (isolating the measuring system).
2. Loosen the Allen screws of the safety grip (3-mm Allen key).
3. Unscrew the cover of the electronics area of the transmitter housing.
4. Remove the local display (if present):
   a) Loosen the mounting screws of the display module.
   b) Unplug the ribbon cable of the display module form the amplifier board.
5. Remove the 2-pole plug of the power supply cable by pressing the catch of the power supply board at the same time (Fig. 45: V4).
6. Remove the cable board of the screened signal cable from the amplifier board (Fig. 46: V5).
7. Loosen the two Phillips screws of the board support plate. Carefully remove the support plate approx. 4-5 cm out of the transmitter housing.
8. Remove the coil current cable plug from the power supply board (Fig. 45: V1).
9. Remove the ribbon cable plug (connection cable to the connection terminal area) from the amplifier board (Fig. 46: V8, V9).

   Note!
   When inserting the new ribbon cable note the correct positioning of the "polarisation pin".

10. The entire transmitter electronics, together with the board support plate can now be completely removed from the housing.
11. If necessary, remove the DAT module from the pin strip (Fig. 46: V10) on the amplifier board.
    - Required when replacing the transmitter electronics plug the old DAT in the new amplifier board.
    - Required when replacing a defective DAT plug the new DAT on the old amplifier board.
12. Replace the old transmitter electronics with new transmitter electronics.
13. Reassemble in reverse sequence.

Power supply board (Promag 31)

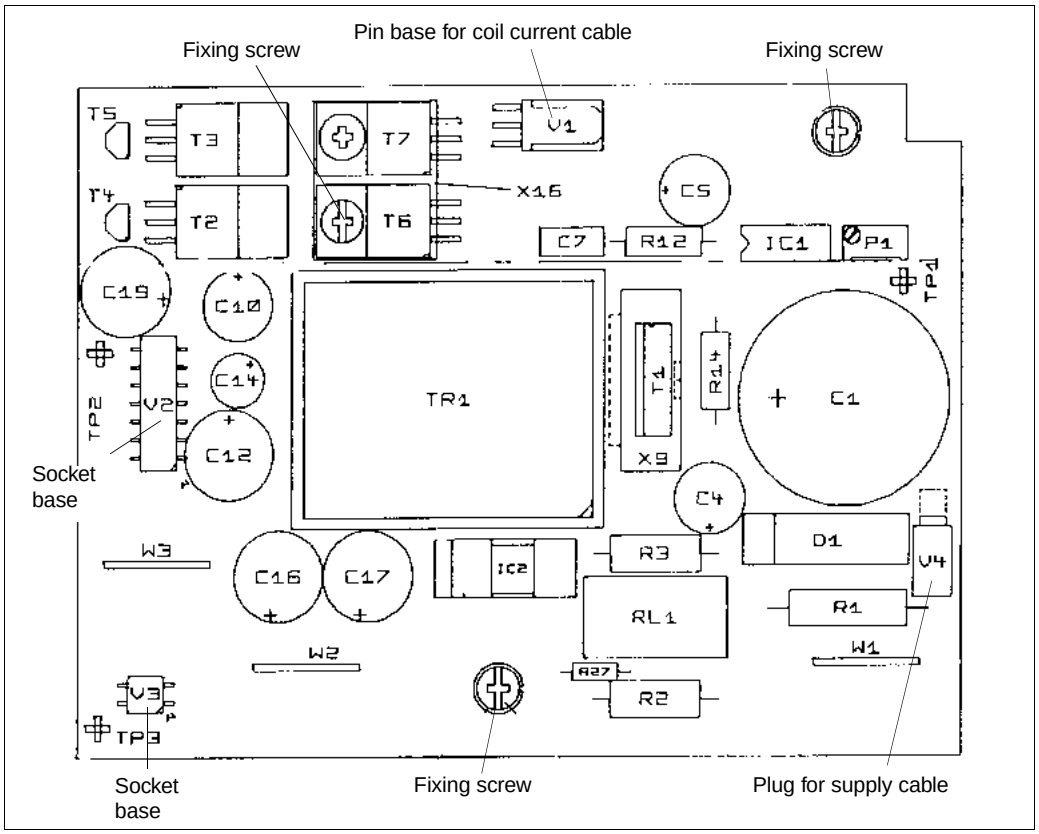


Fig. 45

Measuring amplifier board (Promag 31)

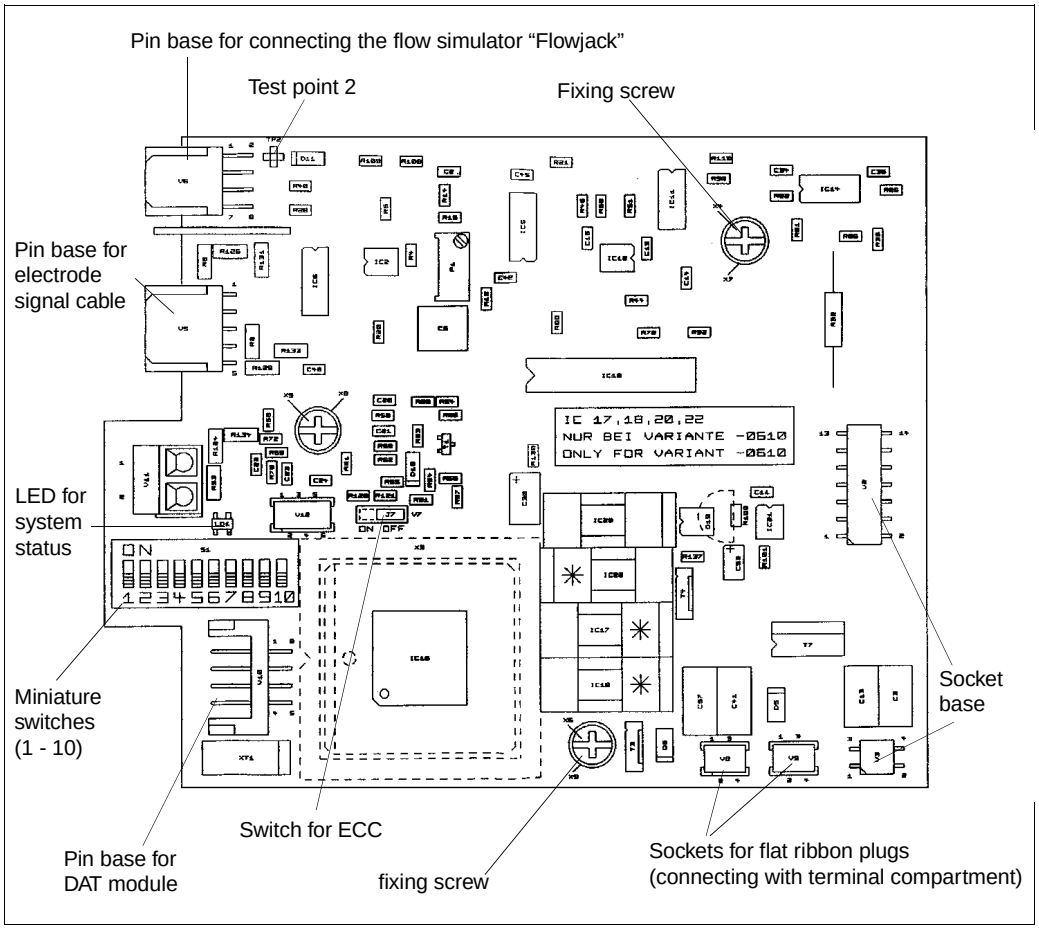


Fig. 46

5.4 Replacing the fuse


Warning!

Warning!
- Danger from electric shock! Switch off the power supply before unscrewing the cover of the terminal compartment from the transmitter housing.

5.5 Repairs

If you return a Promag 31 measuring unit to Endress+Hauser for repair, please enclose a note giving the following information:
- Description of the application
- Description of the fault
- Chemical and physical properties of the medium measured.


Caution!

Caution!
Please carry out the following before you return the Promag 31 unit for repair:
- Remove all traces of the medium still adhering.
- This is particularly important if the medium is harmful for health, i.e. caustic, poisonous, cancerogenous, radioactive, etc. Please ensure that full handling details i.e. “Fluid Data Sheets” are enclosed.
- We must request you not to return a unit if it is not completely certain that harmful substances can be removed (e.g. cracks have been penetrated or substances have diffused through plastics).

Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc). Any costs arising from this will be charged to the owner of the instrument.

6. Technical Data

6.1 Dimensions and weights

Promag 31 A

Compact version

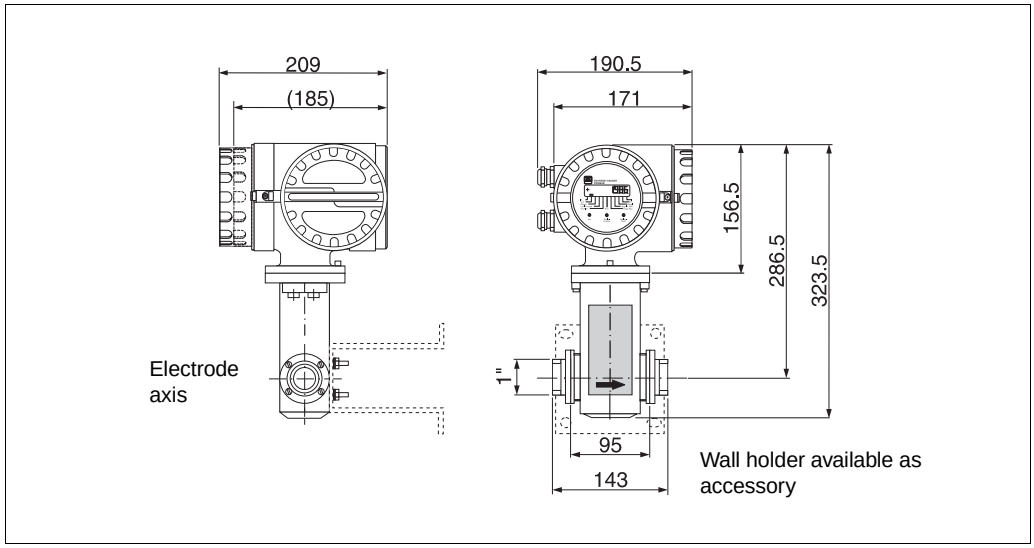


Fig. 47

Remote-mounted version (FS)

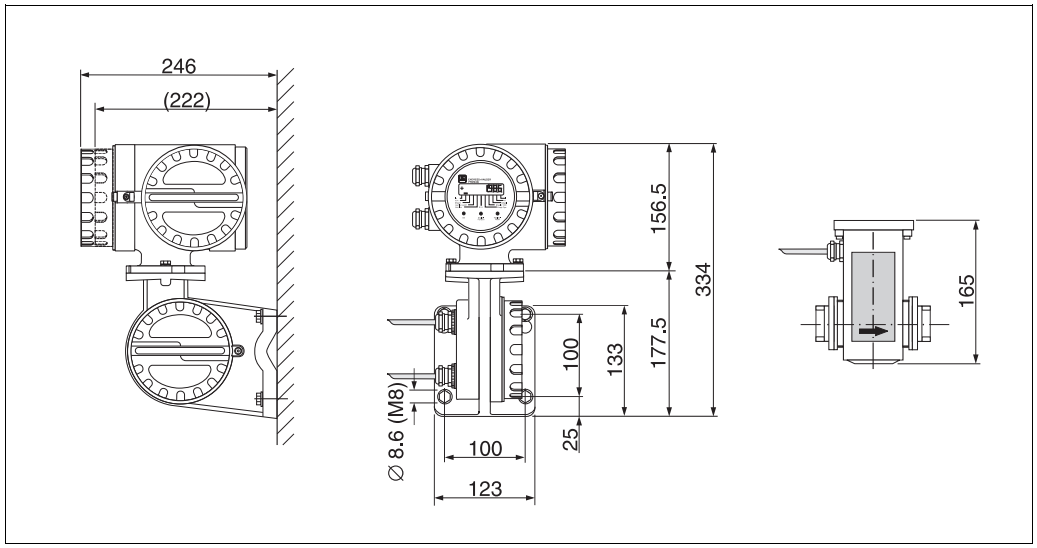
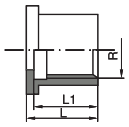


Fig. 48

Weights
Compact version: 5 kg (without insert parts)
Promag 31 transmitter: 3 kg (5 kg when wall-mounted)
Promag A sensor: 2 kg

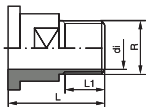
Dimensions of the inserted parts for sensor Promag A

Internal thread



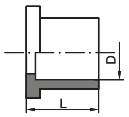
DN	L	L1	R
2...15	20	18	1/2"
25	45	22	1"
Standard thread ISO 228/DIN 2999			

External thread



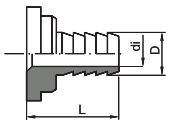
DN	L	L1	di	R
2...15	35	13.2	16.1	1/2"
25	50	16.8	22.0	1"
Standard thread ISO 228/DIN 2999				

PVC adhesive coupling



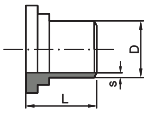
DN	L	D
2...15	19	20
25	66	25
25	69	32

Hose connection



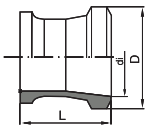
DN	L	D	di	LW
2...15	30	14.5	8.9	13
2...15	30	17.5	12.6	16
2...15	30	21.0	16.1	19
LW = hose inner diameter				

Welded nipple DN 2...15



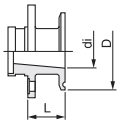
DN	L	D	s
2...15	20	21.3	2.6
Dimensions for aseptic version are identical			

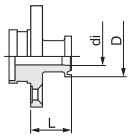
Welded nipple DN 25



DN	L	D	di
25	30	33.7	26

Tri-Clamp®
Stainless steel
1.4404/316L

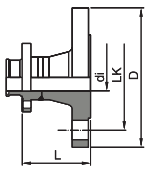




DN		L	D	di
2...8	1/2"	24	25	9.5
15	3/4"	24	25	16
2...8	1"	24	50.4	22.1
15	1"	24	50.4	22.1
25	1"	24	50.4	22.1

Flange
Stainless steel 1.4404/316L
with joint dimensions
to DIN 2501/ANSI B 16.5/JIS B 2210

DN 2...15:
with DN 15 or ½" flanges
DN 25:
with DN 25 or 1" flanges

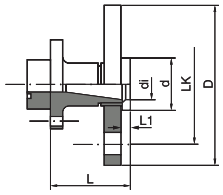


Flange as per DIN 2501, PN 40				
DN	L	D	di	LK
2...15	52.5	95	17.3	65
25	52.5	115	28.5	85
Flange as per JIS B 2210				
DN	L	D	di	LK
2...15	62.5	95	16	70
25	62.5	115	25	90

Flange as per ANSI B 16.5							
DN	Class 150				Class 300		
	L	D	LK	di	L	D	LK
2...15	62.5	88.9	60.5	15.7	67.0	95.2	66.5
25	68.3	108.0	79.2	26.7	74.7	123.9	88.9
Face-to-Face length (DIN) as per DVGW (200 mm)							

Flange
PVDF with joint dimensions
to DIN 2501/ANSI B 16.5/JIS B 2210

DN 2...15:
with DN 15 or ½" flanges
DN 25:
with DN 25 or 1" flanges



Flange as per DIN 2501/ANSI B 16.5/JIS B 2210 PN 16/Class 150/10K									
DN	L	L1	D	d	di	LK DIN	LK ANSI	LK JIS	LK D
2...15	52.5	6	95	34	16.2	65	60	70	95
25	52.5	7	115	50	27.2	85	79	90	125
Face-to-Face length (DIN) as per DVGW (200 mm)									

Length:
2 x L + 143 mm;
2 x L + 95 mm (for flanged or Tri-Clamp® versions)

(all Dimensions in mm)

Fig. 49

Promag 31 F
DN 25...300

Compact version

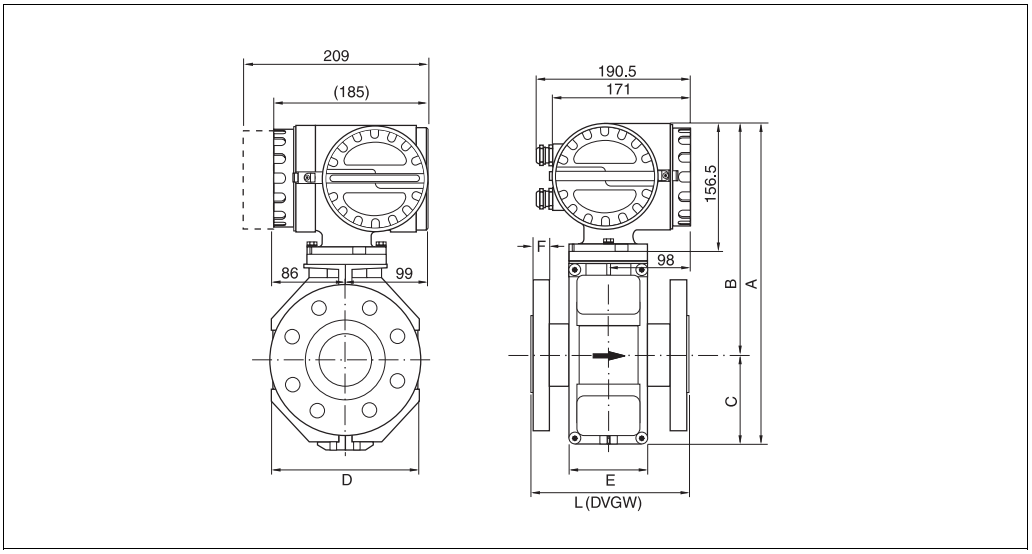


Fig. 50

Remote-mounted version

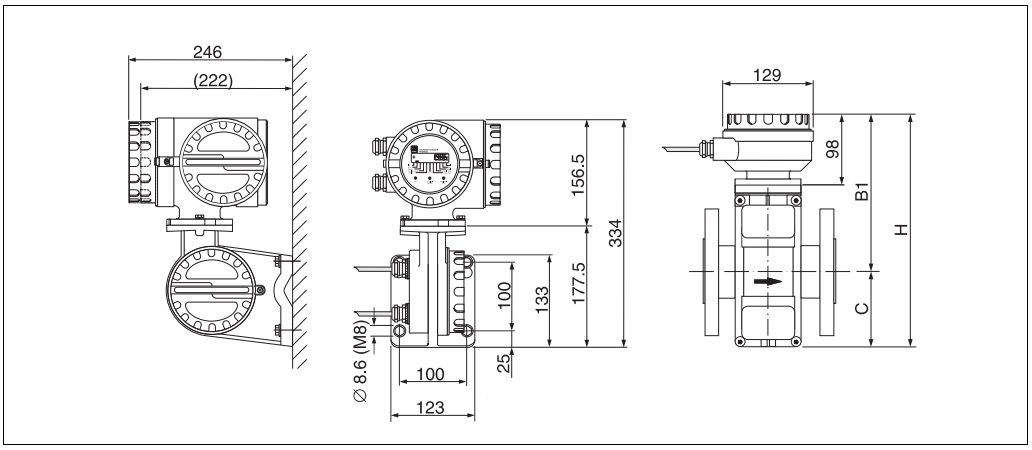


Fig. 51

DN		PN			L^1	A	B	C	D	E	F		H	B1	Weight[2]
[mm]	[inch]	DIN [bar]	ANSI [lbs]	JIS	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	DIN [mm]	ANSI [mm]	[mm]	[mm]	[kg]
25	1"	40	150	20K	200	340.5	256.5	84	120	94	16	14.2	325	241	7.3
32	-	40	-	20K	200	340.5	256.5	84	120	94	18	-	325	241	80
40	1½"	40	150	20K	200	340.5	256.5	84	120	94	18	17.5	325	241	9.4
50	2"	40	150	10K	200	340.5	256.5	84	120	94	20	19.1	325	241	10.6
65	-	16	-	10K	200	390.5	281.5	109	180	94	18	-	375	266	12.0
80	3"	16	150	10K	200	390.5	281.5	109	180	94	20	23.9	375	266	14.0
100	4"	16	150	10K	250	390.5	281.5	109	180	94	22	23.9	375	266	16.0
125	-	16	-	10K	250	471.5	321.5	150	260	140	24	-	456	306	21.5
150	6"	16	150	10K	300	471.5	321.5	150	260	140	24	25.4	456	306	25.5
200	8"	10	150	10K	350	526.5	346.5	180	324	156	26	28.4	511	331	35.3
250	10"	10	150	10K	450	576.5	371.5	205	400	166	28	30.2	561	356	48.5
300	12"	10	150	10K	500	626.5	396.5	230	460	166	28	31.8	611	381	57.5

[1] The face-to-face length is identical with the selected nominal diameter and independent of pressure rating.
[2] Weight of compact version

Weights

Compact version: see table above
Promag 31 transmitter: 3 kg (5 kg when wall-mounted)
Sensor connection housing: appr. 1 kg

Promag 31 F
DN 350...1000

Compact version

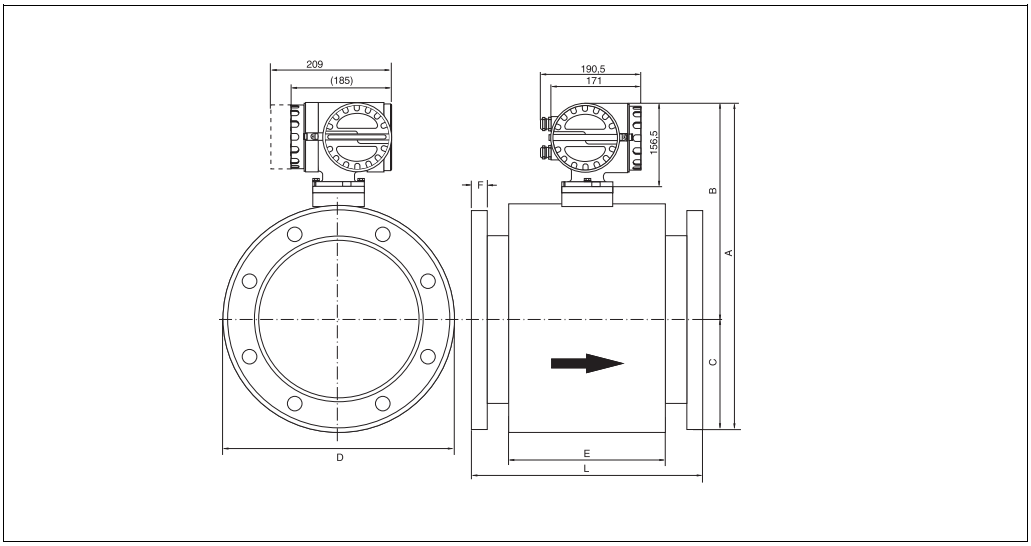


Fig. 52

Remote-mounted version

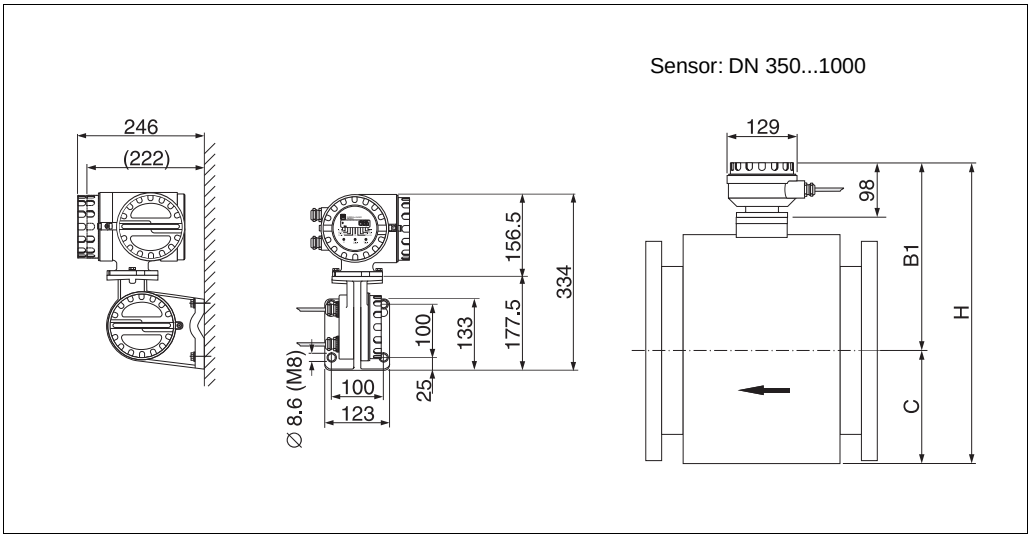


Fig. 53

DN	PN			L[1]	A	B	C	D	E	F			H	B1	Weight[2]
	DIN [bar]	ANSI [Class]	AWWA [Class]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	DIN [mm]	ANSI [mm]	AWWA [mm]	[mm]	[mm]	[kg]
350	10	150	-	550	738	456	282	564	276	26	34.9	-	722.5	440.5	106
400	10	150	-	600	790	482	308	616	276	26	36.5	-	774.5	466.5	124
450	-	150	-	650	840	507	333	666	292	-	39.7	-	824.5	491.5	230
500	10	150	-	650	891	532.5	358.5	717	292	28	42.9	-	875.5	517	170
600	10	150	-	780	995	584.5	410.5	821	402	28	47.6	-	979.5	569	220
700	10	-	D	910	1198	686	512	1024	589	30	-	33.3	1182.5	670.5	340
750	-	-	D	975	1198	686	512	1024	626	-	-	34.9	1182.5	670.5	440
800	10	-	D	1040	1239	706.5	532.5	1065	647	32	-	38.1	1223.5	691	420
900	10	-	D	1170	1392	783	609	1218	785	34	-	41.3	1376.5	767.5	560
1000	10	-	D	1300	1544	859	685	1370	862	34	-	41.3	1528.5	843.5	670

[1] The face-to-face length is identical with the selected nominal diameter and independent of pressure rating.
[2] Weight of compact version

6.2 Technical data: Sensor

	Sensor Promag A	**Sensor Promag F**
Nominal diameter	DN 2, 4, 8, 15, 25	DN 25...1000
Nominal pressure	PN 40	DIN: PN 10 (DN 200...1000) PN 16 (DN 65...150) PN 40 (DN 25...50) PN 16/25 (DN 200...300), Option PN 40 (DN 65...100), Option ANSI: Class 150 (1...24") Class 300 (1...6"), Option
Process connection	Internal and external thread PVC adhesive coupling, hose connection, welded nipple, aseptic welded nipple according to DIN 11850, Tri-Clamp®, Flange connection (DIN, ANSI, JIS)	Flange connection (DIN) JIS: 10K (DN 50...300) 20K (DN 25...40) 20K (DN 25...300), Option
Flange material	DIN: stainless steel 1.4404; PVDF ANSI: 316L; PVDF JIS: 316L; PVDF Threaded stub: 1.4435; PVC	DIN: St. 37.2, stainless steel 1.4571 ANSI: A105, 316L JIS: S20C, SUS 316L
Fluid temperature range and liner material	-20...+130 °C PFA	-40...+130 °C PTFE (DN 25...600) 0...+ 80 °C hard rubber (DN 65...1000)
Ambient temperature range	-20...+60 °C	-20...+60 °C
Electrode material	1.4435, Platinum/Rhodium 80/20, Hastelloy C-22, Tantalum	1.4435, Platinum/Rhodium 80/20, Hastelloy C-22, Tantalum
Electrodes fitted	Measuring and reference electrodes Option: Measuring, reference and empty pipe detection electrodes	DN 15...1000: Measuring, reference and EPD electrode (standard for 1.4435 and Hastelloy C-22)
Min. conductivity	5 µS/cm	5 µS/cm
Gasket material	Viton Kalrez (optional) Silicon (aseptic version)	—
Housing material	1.4435 incl. threaded stub (see also dimensions of inserted parts)	DN 25...300: powder-coated die-cast aluminium DN 350...1000: varnished steel
Type of protection (DIN 40050)	IP 67 (IP 68 option)	IP 67 (IP 68 option)
Suitable for cleaning with CIP (note max. temperature)	Yes (note max. temperature)	Yes (note max. temperature)
Power supply	The sensor is supplied by the measuring transmitter	
Cable entries (Remote-mounted version)	PG 13.5 cable glands (5...15 mm) or NPT $^1/_2$", M20 x 1.5 (8...15 mm) G $^1/_2$" threads for cable glands	PG 13.5 cable clands (5...15 mm) or NPT $^1/_2$", M20 x 1.5 (8...15 mm) G $^1/_2$" threads for cable glands

Inside diameter of measuring pipe [mm)

Sensor	DN	PN		Inside diameter of measuring pipe [mm] Lining		
	[mm]	DIN [bar]	ANSI [Class]	PFA	PTFE (Teflon) DIN / ANSI	Hard rubber DIN / ANSI
Promag A	2		-	2.2	-	-
	4		-	4.6	-	-
	8	40	-	8.6	-	-
	15		-	16.1	-	-
	25		-	22.0	-	-
Promag F	25	40	Class 150	-	26	-
	32	40	-	-	35	-
	40	40	Class 150	-	41	-
	50	40	Class 150	-	52	-
	65	16	-	-	68	65
	80	16	Class 150	-	80	78
	100	16	Class 150	-	105	100
	125	16	-	-	130	126
	150	16	Class 150	-	156	154
	200	10	Class 150	-	207/205	205/203
	250	10	Class 150	-	259/255	259/255
	300	10	Class 150	-	309/303	310/304
	350	10	Class 150	-	337.2/333.2	341/337
	400	10	Class 150	-	387/383	391/387
	450	-	Class 150	-	-/432	-/436
	500	10	Class 150	-	487/483	491/487
	600	10	Class 150	-	593/585	593/585
	700	10	Class D	-	-	692/690
	750	-	Class D	-	-	-/741
	800	10	Class D	-	-	794/792
	900	10	Class D	-	-	893/889
	1000	10	Class D	-	-	995/991

Resistance of the lining to vacuum (Standard version)

Sensor	DN	Lining	Limits for vacuum [mbar abs] at different medium temperatures					
	[mm]		25 °C	80 °C	100 °C	120 °C	130 °C	150 °C
Promag A	2...25	PFA	0	0	0	0	0	
Promag F	65...1000	hard rubber	✶	0				
	25... 50	PTFE (Teflon)	0	0	0	✶	100	
	65... 80		0	✶	40	✶	130	
	100		0	✶	135	✶	170	
	125...150		135	✶	240	✶	385	
	200		200	✶	290	✶	410	
	250		330	✶	400	✶	530	
	300		400	✶	500	✶	630	
	350		470	✶	600	✶	730	
	400		540	✶	670	✶	800	
	450-600	Vacuum not permitted!						

✶ Values not available

Temperature ranges of sensors
The maximum permissible ambient and medium temperatures must be adhered to at all times. When installed outdoors, specially in countries with high ambient temperatures please provide a weatherproof hood as protection against direct solar radiation.

- Promag A
  Ambient temperature: -20... + 60 °C
  Medium temperature: -20... +130 °C

- Promag F
  Ambient temperature: -20... + 60 °C
  Medium temperature: -40... +130 °C PTFE (Teflon)
  0... + 80 °C hard rubber

Caution!
At high medium and ambient temperatures it is necessary to mount the Promag F sensor and Promag 31 transmitter separately. Risk of the electronics becoming overheated (Fig. 54)!

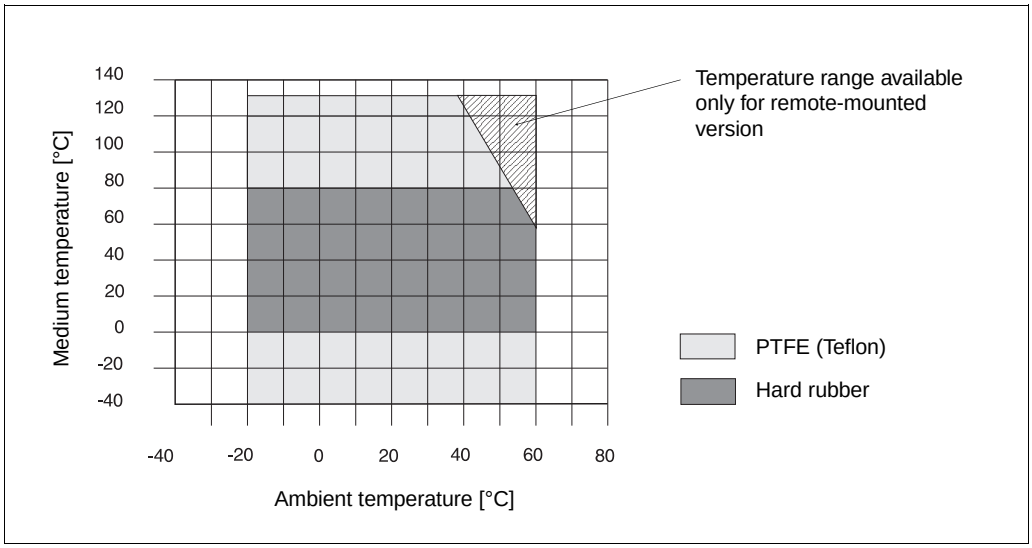


Fig. 54:
Limits of application in terms of temperature for the compact version Promag 31 F

Sensor Promag F (flange-mounted)

Pressure limitations due to fluid temperature (DIN 2413 and 2505)
Flange material: steel 37.2

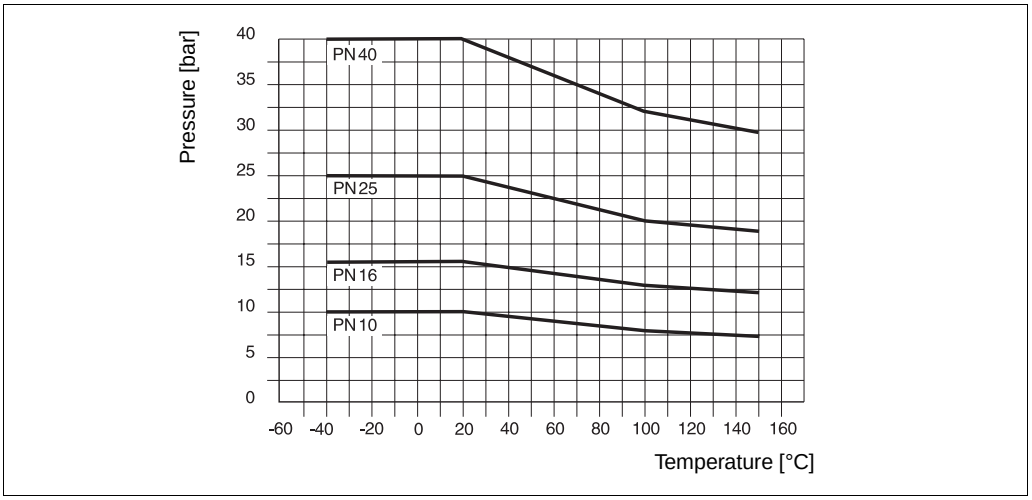


Fig. 55

Pressure limitations due to fluid temperature (DIN 2413 and 2505)
Flange material: stainless steel 1.4571

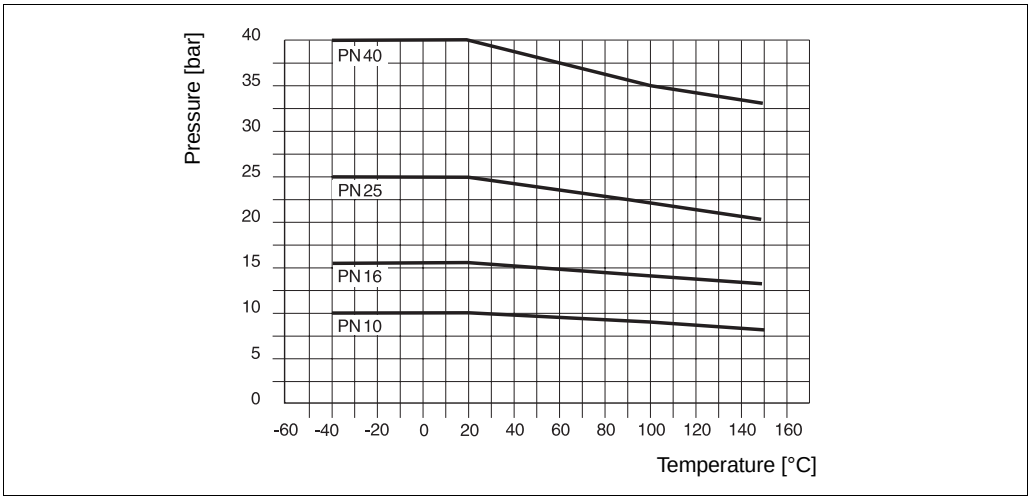


Fig. 56

Sensor Promag A

Pressure limitations due to fluid temperature
Flange material: steel 1.4404/1.4435, PVDF, PVC

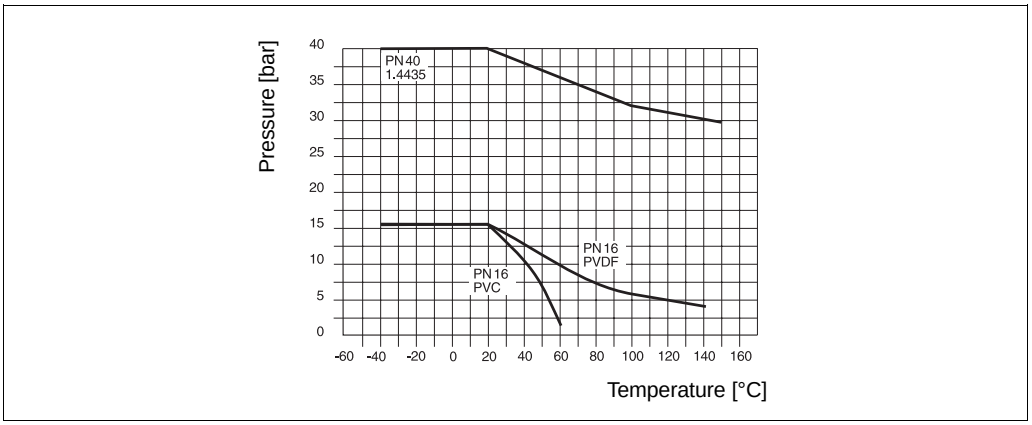


Fig. 57

6.3 Technical data: Transmitter and measuring system

Housing material	Powder-coated die-cast aluminium
Coating	Powder-coated 2-component epoxy resin
Protection (DIN 40050)	IP 67 (EN 60529)
Ambient temperature	-20...+60 °C
Resistance to shock and vibration	Acceleration up to 2 g/2 h per day; 10...100 Hz (complete measuring system)
Cable entries	Power supply cable and signal cable (inputs/outputs) PG 13.5 cable glands (5...15 mm) or NPT ½", M20 x 1.5 (8...15 mm), G ½" threads for cable glands Remote-mounted version: Coil cable and signal cable PG 13.5 cable glands (5...15 mm) or NPT ½", M20 x 1.5 (8...15 mm) G ½" threads for cable glands
Power supply	85...260 V AC, 45...65 Hz 20... 55 V AC, 16...62 V DC Supply failure: Bridging over min. 1 mains cycle (22 ms)
Power consumption	AC: <15 VA (incl. sensor) DC: <15 W (incl. sensor)
Galvanic separation	Input and output galvanically separated from supply (VDE 0160), from sensor and from one another (U_{max} = 500 V)
Full-scale value scaling	0.4...10 m/s
Current output	0/4...20 mA adjustable, galvanically separated, R_L <700 Ω, Time constant: automatically assigned full-scale value can be set, Temperature coefficient: 0.01 % o.r./°C. Additional error: 0.3% o.r.
Pulse output (open collector)	f_{max} = 400 Hz, U_{max} 30 V, I_{max} 250 mA, galvanically separated, pulse value adjustable, pulse/pause ratio appr. 1:1, pulse width max. 2 s,
Status output (open collector)	U_{max} 30 V, I_{max} 250 mA Adjustable for: System and process error messages, Flow direction recognition
Auxiliary input (Measured value suppression)	U = 3...30 V DC, R_i = 1.8 kΩ, galvanically separated Adjustable for measured value suppression or external totaliser reset (if instrument fitted with display).
Compatibility with interference (EMC)	As per EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2, and NAMUR recommendations (complete measuring system)
Options	ECC-circuit (electronic cleaning circuit) to act against influences from conductive deposits (Magnetite). Can be set on or off by a jumper which placed on the amplifier board, close to μP.

6.4 Nominal diameter and flow rate

As a rule the pipe diameter governs the nominal diameter of the sensor. When the volume flow is known, it is possible to estimate from the nomograms whether the optimal velocity range of 2...3 m/s can be adhered to.

According to OIML-approvals, system no. ZW 128 and the error tolerances/limits for partial devices of class 4 (+/-3% for hydraulic transmitters) the following counter units are allowed.

Promag 31 A	DN [mm]	Q_i (Q_{min}) [l/h]	Q_s (Q_{max}) [l/h]
	2	1.131	113.1
	4	4.524	452.4
	8	18.095	1809.5
	15	63.617	6361.7
	25	176.714	17671.4
Promag 31 F	DN [mm]	Q_i (Q_{min}) [m^3/h]	Q_s (Q_{max}) [m^3/h]
	25	0.177	17.671
	32	0.289	28.953
	40	0.452	45.239
	50	0.707	70.686
	65	1.194	119.459
	80	1.809	180.956
	100	2.827	282.743
	125	4.418	441.786
	150	6.362	636.173
	200	11.309	1130.973
	250	17.671	1767.146
	300	25.447	2544.69
	350	34.636	3463.60
	400	45.239	4523.89
	450	57.255	5725.55
	500	70.685	7068.58
	600	101.787	10178.7
	700	138.544	13854.4
	800	180.956	18095.6
	900	229.022	22902.2
	1000	282.743	28274.3

6.5 Error limits

Measuring uncertainty under reference conditions

Pulse output	± 0.5 % o.r. ± 0.01 % o.f.s. (full-scale value = 10 m/s)
Current output	plus typical ± 10 µA
Repeatability	± 0.1 % o.r. ± 0.005 % o.f.s.
Options	Promag 30 A and F: ± 0.2 % o.r. ± 0.05 % of Q_k Q_k =desired reference flow rate for calibration (v =2...10 m/s). Please quote Q_k when ordering
Power supply voltage	Within the specified range, fluctuation of the supply voltage has no effect.

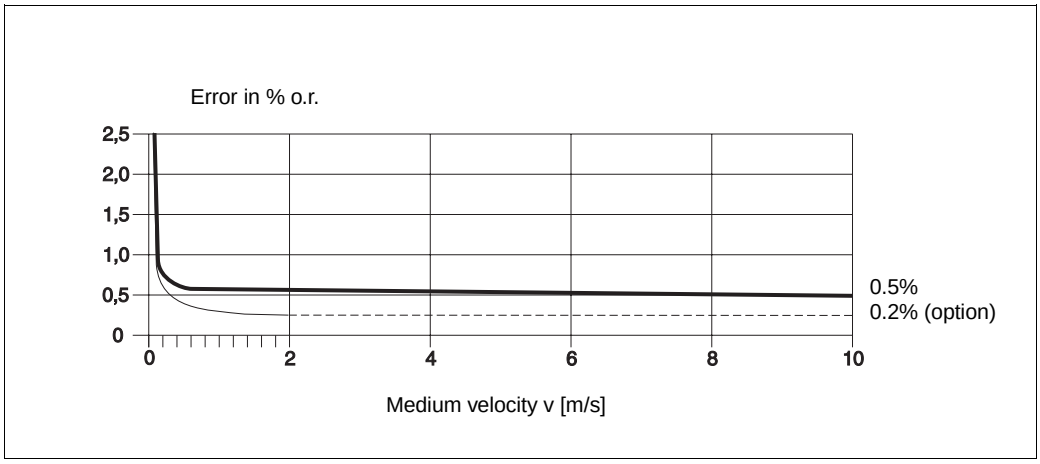


Fig. 58

Reference conditions (DIN 19200 and VDI/VDE 2641)

Medium temperature	+28 °C ± 2 K
Ambient temperature	+22 °C ± 2 K
Heating-up time	30 min.
Installation at reference conditions	inlet length >10 x DN outlet length >5 x DN Sensor and transmitter are earthed. The sensor is mounted centrally in the pipe.

7. Approvals

Eidgenössisches Amt für Messwesen
Office fédéral de métrologie
Ufficio federale di metrologia
Swiss Federal Office of Metrology

ZW 128

Zulassungszertifikat

Gestützt auf Artikel 17 des Bundesgesetzes vom 9. Juni 1977 über das Messwesen und Artikel 10 der Verordnung vom 17. Dezember 1984 über die Qualifizierung von Messmitteln (Eichverordnung) haben wir die folgende Bauart zur Eichung zugelassen:

Hydraulischer Geber als Teilgerät eines Wärmezähler
Magnetisch-induktiver Durchflussmesser

Typ:	Promag 31 A/D/F und Promag 34 A/D/F
Fabrikant:	Endress + Hauser Flowtec AG, Reinach (CH)
Zulassungsinhaber:	Endress + Hauser Flowtec AG, Reinach (CH)
Zulassungsnummer:	ZW128

Die Bauart, allfällige Auflagen und Eichvorschriften sind in der Beilage beschrieben. Diese ist Bestandteil der Zulassung.

Eidgenössisches Amt für Messwesen
Abteilung Mechanik, Strahlung und Thermometrie

Dr. Bruno Vaucher, Abteilungschef

Wabern, 20. September 1994
Zg

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