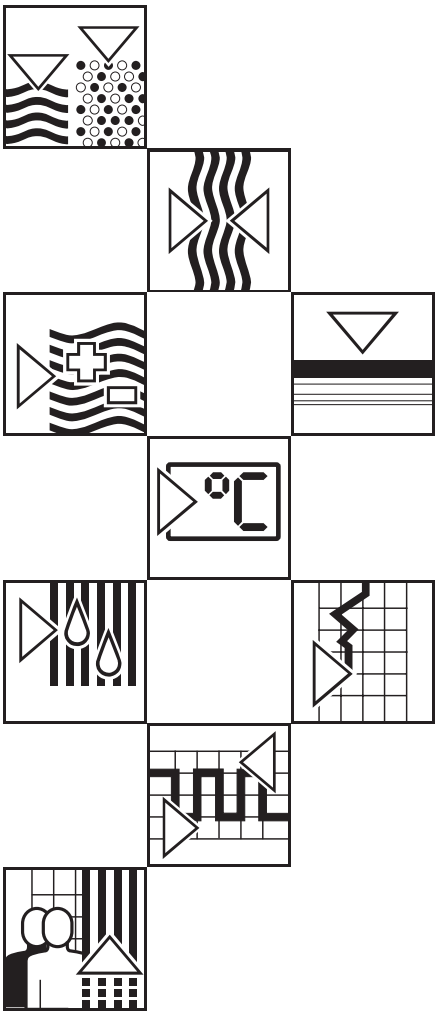
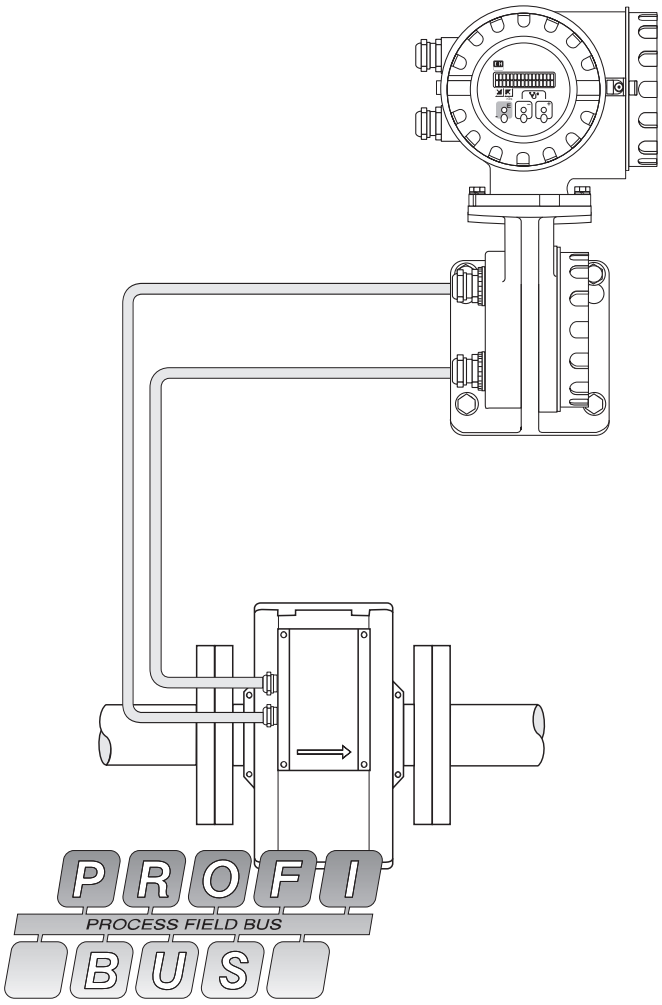
BA 035D/06/en/01.98
No. 50085724
CV 5.0

valid from software version
V 3.01.XX (amplifier)
V 2.05.XX (communication)

promag 35 (PROFIBUS PA) Electromagnetic Flow Measuring System

Operating Manual





Endress+Hauser

Nothing beats know-how

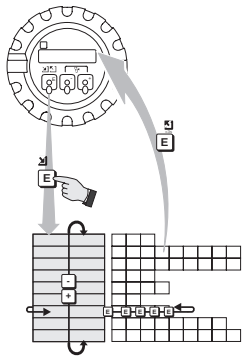
Short Instruction

With the following instructions, you may configure your measuring instrument quickly and easily.

Safety instructions → see page 5

Mounting and electrical connection:
- Mounting → see page 11
- Electrical connection → see page 23

Operation → see page 29
(Programming the device)



Programming the display
- Contrast → see page 42
- Language → see page 42
- Display upper line → see page 41
- Display lower line → see page 41

Unit selection → s. page 35/36
(Flow rate/volume)

Configuration of outputs

Current output
- Full scale → see page 37
- Current span → see page 38

PROFIBUS PA
- Bus address → see page 56
- Adressing by DIP switch → see page 57

For highest accuracy:
- Creep suppression → see page 44
- Empty pipe detection (EPD) → see page 45

Note!

Note!
Complex applications require programming of additional functions. You will find the appropriate pages and functions in:
- Contents → see page 3
- Index → see page 77
- Operating matrix → see page 31

Contents

Registered Trademarks

HART®
Registered Trademark of HART Communication Foundation, Austin, USA

KALREZ®, VITON® and TEFLON®
Registered Trademark of E.I. Du Pont de Nemours & Co., Wilmington, USA

PROFIBUS®
Registered Trademark of PROFIBUS Nutzerorganisation e.V., Karlsruhe, Germany

TRI-CLAMP®
Registered Trademark of Ladish & Co., Inc., Kenosha, USA

1 Safety Instructions

1.1 Correct usage

- The Promag 35 S is only to be used for measuring the flow of conductive fluids.
- The manufacturer assumes no liability for damage caused by incorrect use of the instrument.

1.2 Dangers and notes

All instruments are designed to meet state-of-the-art safety requirements, have been tested, and have left the factory in an operational perfectly safe condition.

The devices were developed according to EN 61010 “Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures”.
A hazardous situation may occur if the flowmeter 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:

Warning!
A “warning” indicates actions or procedures which, if not performed correctly, may lead to personal injury or a safety hazard.
Please strictly observe the instructions supplied and proceed carefully.


Warning!

Caution!
A “caution” indicates actions or procedures which, if not performed correctly, may lead to faulty operations or the destruction of the instrument.
Please strictly observe the respective instructions.


Caution!

Note!
A “note” indicates actions or procedures which, if not performed correctly, may indirectly affect operations or lead to an unexpected instrument response.


Note!

1.3 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 authorised 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 authorised 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 up according to the wiring diagrams. The measuring system is to be grounded.

Danger of electric shock!
Protection against accidental contact is no longer assured when the connection housing cover is unscrewed.

- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.

1.4 Repairs, dangerous chemicals

The following procedures must be carried out before a Promag 35 S 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, carcinogenic, radioactive, etc.
- No instrument should be returned without all dangerous material being removed first (e.g. in scratches or diffused through plastic).

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.

1.5 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.

2 System Description

2.1 Correct usage

The Promag 35 S measuring system is used whenever a system has to meet high requirements. It is particularly suitable for media characterised by a high solids content, high abrasiveness, and a highly inhomogeneous distribution of additives and chemicals. Any fluids with a minimum conductivity of ≥ 1 µS/cm, ≥ 20 µS/cm for demineralised and desalinised water, may be measured.
For difficult-to-measure media, Promag 35 S is mainly used for the following applications:

Paper and pulp industry	pulp with 15% solids contents, cellulose, additives/chemicals
Mining industry	ore slurries, coal washings
Building material industry	cement, concrete, pastes
Food industry	yoghurt with pieces of fruit, fruit mash
Sewage industry	slurries of up to 30% dry solids

2.2 Promag 35 S measuring system

The Promag measuring system is fully modular, both electrically and mechanically.
The measuring system can be updated at any time by exchanging electronic boards.
The measuring point can always be optimally equipped and upgraded.
The following illustration is an overview of the entire Promag 35 S measuring system.

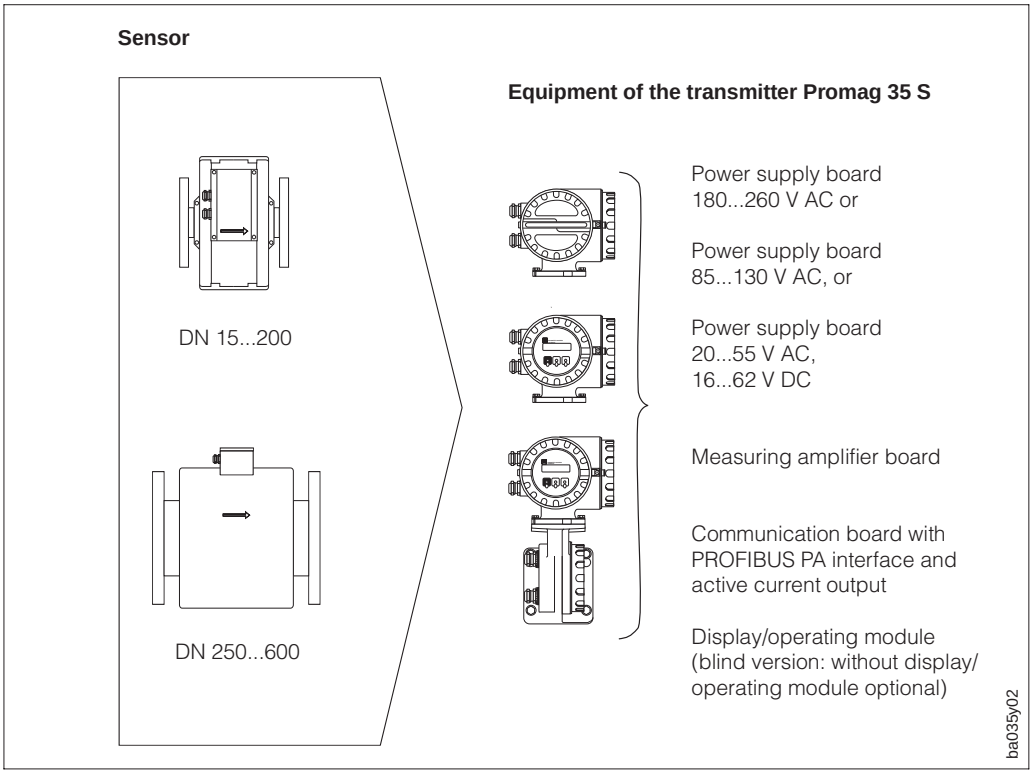


Fig. 1
Promag 35 S PROFIBUS PA measuring system

Note!
For standard applications, the cost-effective Promag 30 version is available or the convenient Promag 33 version with the E+H matrix operation mode.
All information on these measuring systems are available from your E+H representative.

Note!

2.3 Design of the measuring system

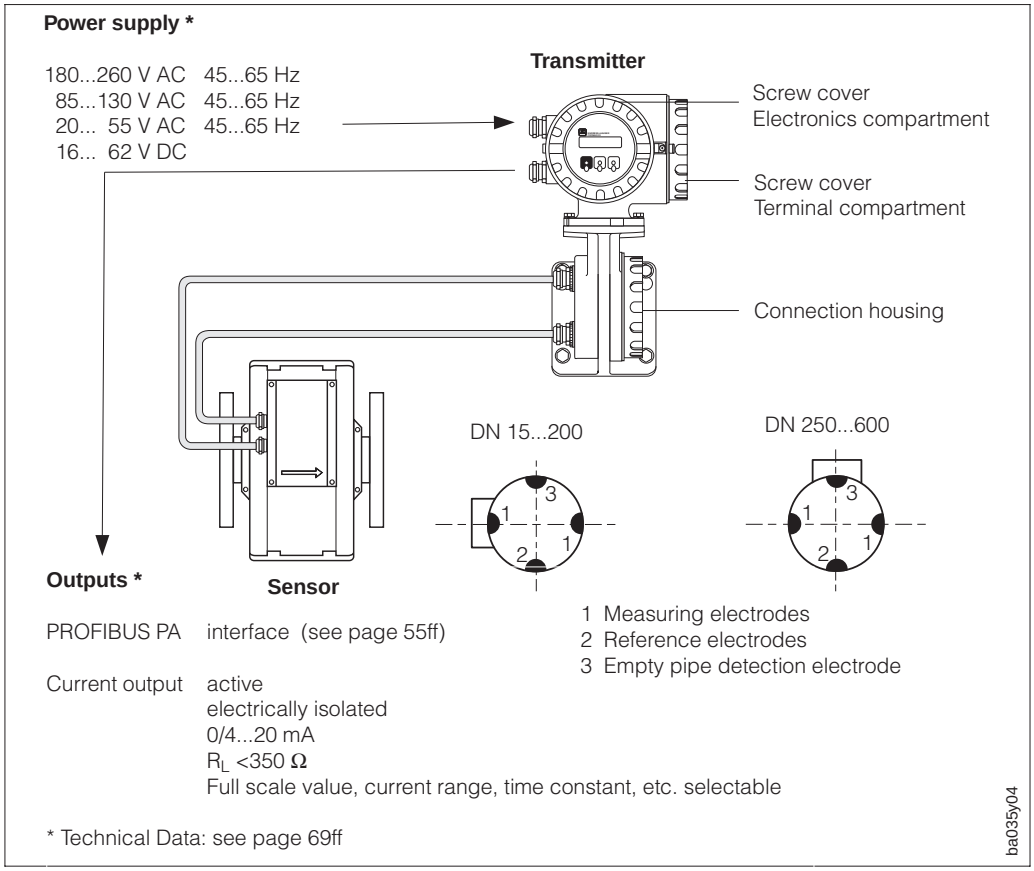


Fig. 2
Design of measuring system

Operation
The Promag 35 transmitter is equipped with a two-line, illuminated LCD. Configuration is very simple to carry out using the E+H matrix-driven operation. All parameters can be selected and varied with only three control elements, e.g.
- Engineering units
- Functions of the current output
- Functions of the totalizer
- Display parameters
- Creep suppression
- Empty Pipe Detection (EPD)

Twelve languages are selectable for the display text. During configuration a help function (diagnosis) is available.

Dynamic response
The Promag 35 measuring amplifier has a very high dynamic response of over 1000:1. It measures at fluid velocities from less than 0.01 m/s to over 10 m/s within the specified accuracy. When the flow is pulsating the amplifier is not overloaded even if above the preset end value and at a flow velocity of up to 12.5 m/s. There is no falsification of the measured value as long as the outputs are not overloaded.

Operational safety

- A comprehensive measuring system self-monitoring facility assures high availability. Any system errors (coil current error, amplifier error, DAT error, EEPROM error, ROM error, RAM error) or power supply failures that do occur are immediately signalled via the PROFIBUS PA interface or the fail-safe mode of the current output.
- Corresponding error messages also appear on the transmitter display. By means of the diagnostic function any errors present can be systematically scanned and their cause determined.
- In the event of a power supply failure, all data in the measuring system are safely stored in the EEPROM (no batteries required).
- The Promag 35 S measuring system fulfils the safety requirements according to EN 61010 “Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures”, as well as the general requirements for electromagnetic compatibility (EMC) according to EN 50081 Part 1 and Part 2 / EN 50082 Part 1 and Part 2 as well as the NAMUR recommendations.

Data Memory (DAT)

The DAT is an exchangeable memory module. It stores all characteristic data of the sensor, such as calibration factors, nominal diameter, sampling rate, version, serial number. When the transmitter has been changed, the previous DAT 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 assures maximum safety and optimum ease of operation when components of the equipment are exchanged.

3 Mounting and Installation

Warning!
The instructions given in this section are to be observed at all times in order to ensure safe and reliable operation of the measuring system.

3.1 General information

Degree of protection IP 65 (EN 60529)
The instruments fulfil all the requirements for IP 65. After successful installation in the field or after servicing, the following points must always be observed in order to ensure the degree of protection IP 65:

- Housing gaskets must be clean and undamaged when inserted in the gasket groove. The gaskets may need to be dried, cleaned or replaced.
- All housing screws and the housing cover must be tightened firmly.
- The cables used for connecting must have the correct outer diameter (see page 26).
- The cable gland must be tightened firmly (see Fig. 3).
- The cable must loop down before entering the cable gland to ensure that no moisture can enter it (see Fig. 3).
- Any cable gland not used must be replaced with a blind plug.
- The protective bushing should not be removed from the cable gland.

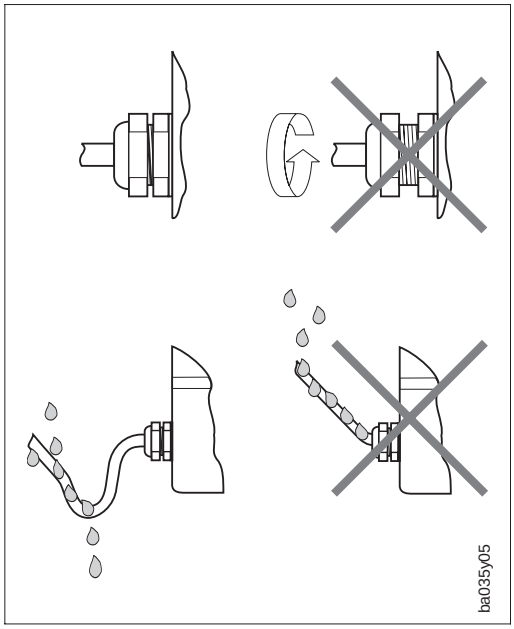


Fig. 3
Mounting cable entries

Caution!
The screws of the Promag sensor housing must not be loosened or the degree of protection guaranteed by E+H is no longer valid.

Note!
The Promag 35 S sensor can optionally be supplied with the IP 67 or IP 68 degree of protection (permanently under water to a depth of 3 m). In this case the transmitter (generally supplied in IP 67) has to be mounted remote from the sensor.

Temperature ranges
The maximum approved ambient and process temperatures must be observed (see page 71). An all-weather cover should be used to protect from direct sunlight when mounting in the open.

3.2 Transport instructions (for DN > 200/8")

The pipe lining on the flanges is protected by disks to prevent damage when transporting to the measuring point. These are to be removed when installing. Instruments are to be transported in the containers they are delivered in.

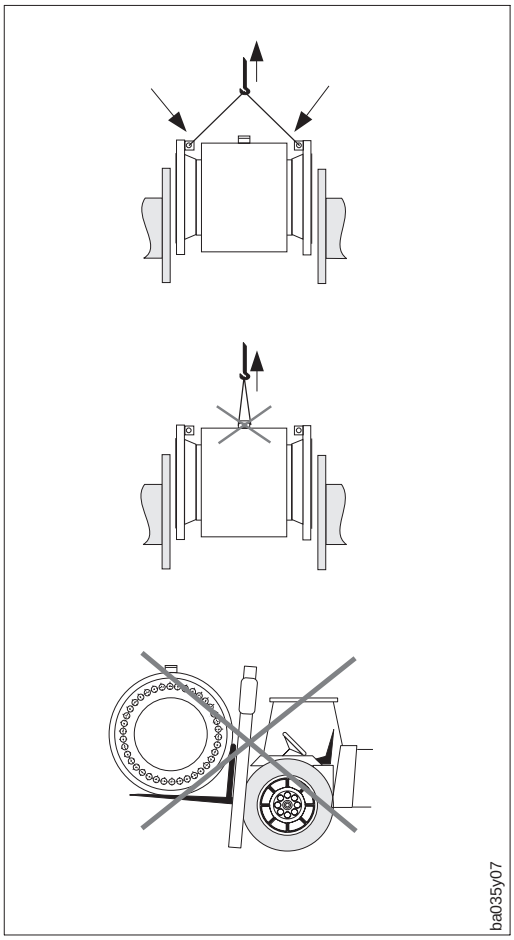


Fig. 4
Transport instructions for Promag 35 S

Transporting to the measuring point

- The grips on the flange must be used when lifting the sensor and when installing the sensor in the pipeline (from DN 200/8").
- The sensor must not be lifted by the transmitter housing.
- The sensor must not be lifted by the metal casing using a fork lift truck. The casing may be dented and so damage the magnetic coils inside the sensor.

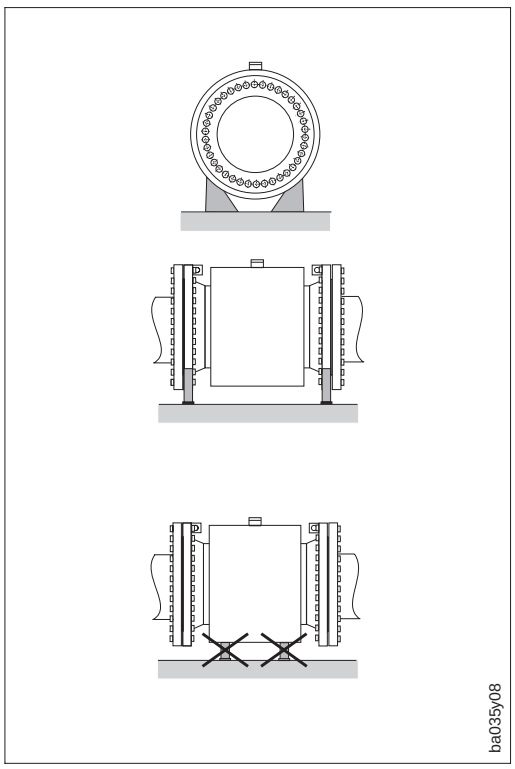


Fig. 5
Correct sensor supporting for large diameter

Base support for the sensor

The sensor should stand on a base strong enough to support its weight.

Note!

Note!
Do not support the sensor by its metal casing! The casing may be dented and so damage the magnetic coils inside the sensor.

3.3 Mounting instructions

Please observe the following instructions when mounting for correct operation and to prevent damage to the equipment.

Mounting position (as preferred)

a) Vertical:
This is the best with the flow direction upwards. Entrained solids sink downward and fatty components in the stationary fluid always rise away from the measuring electrodes.

In case of vertical mounting, the PGs are always pointing downward (inlet side).

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

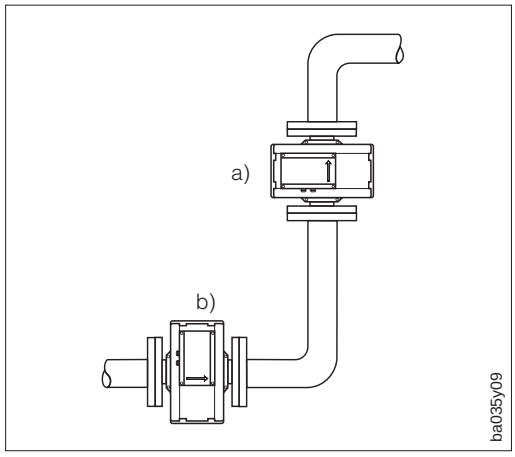


Fig. 6
Mounting position

Position of the electrode axis
The position of the electrode axis is based on the nominal diameter and has to be respected (see Fig. 7).

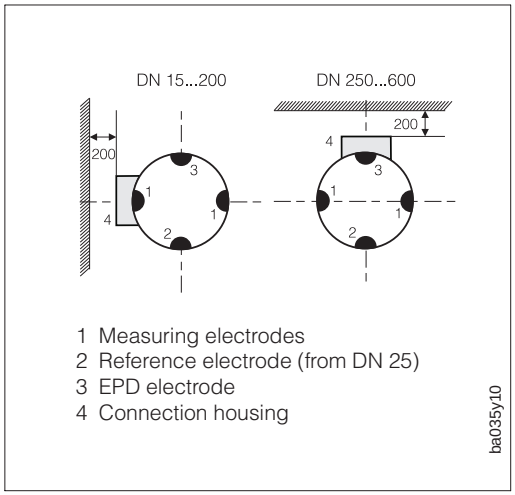


Fig. 7
Plane of electrode axis

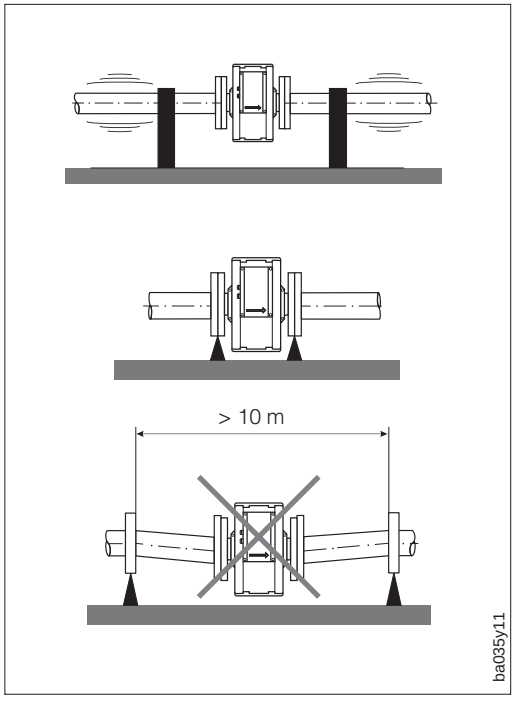
Position of the cable glands
For the compact version, the transmitter PGs have to be either oriented downwards or laterally, independently of the mounting position.

Vibration

Secure the piping upstream and downstream of the sensor.

Caution!
Excessive vibration necessitates separate mounting of the sensor and transmitter (see pages 19, 71).

Mechanical supports are recommended for free runs of piping over 10 m long.



Caution!

Fig. 8
Remedies to avoid vibrations

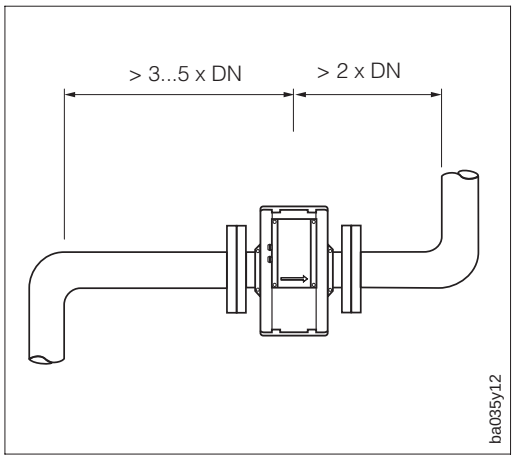


Fig. 9
Inlet and outlet runs

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

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

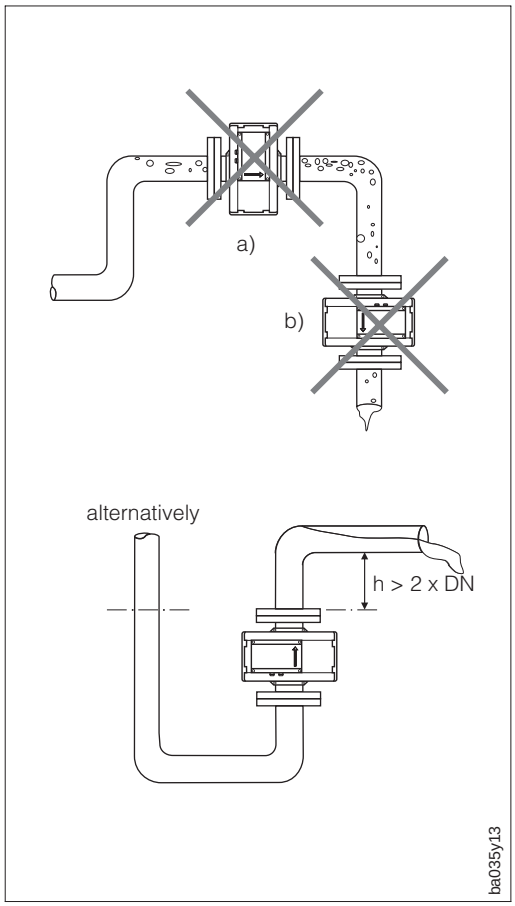


Fig. 10
Mounting location

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

a) No installation at the highest point (air accumulation).

b) No installation immediately before an open pipe outlet in a downward line. The alternative suggestion, however, permits such a location.

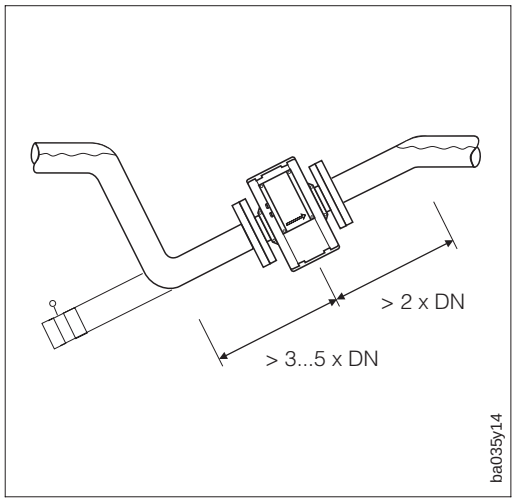


Fig. 11
Partly filled pipes

Partly filled pipes
For inclines, a mounting similar to a drain should be adopted. Do not mount the sensor at the lowest point (risk of solids collecting). In this case we recommend to install a sliding valve.

Added security is offered by Empty Pipe Detection (EPD). This option provides an extra electrode in the flowmeter.

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

Downward pipe

With the installation suggested opposite, partial vacuum is avoided even with a downward pipe >5 m long (siphon, vent valve downstream of the sensor).

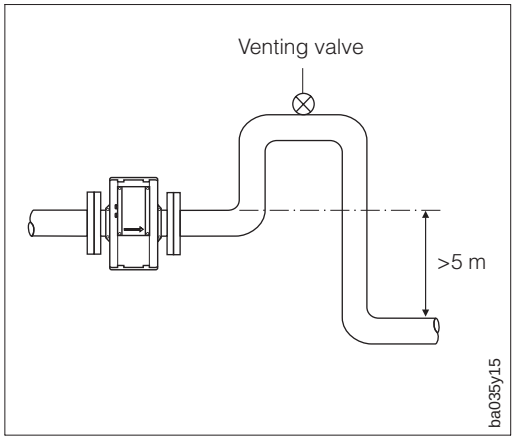


Fig. 12
Installation downward pipe

Installation of pumps

Do not mount the sensors on the suction side of pumps. There is a risk of vacuum! Information on the resistance to vacuum of the flowmeter lining can be found on page 73.

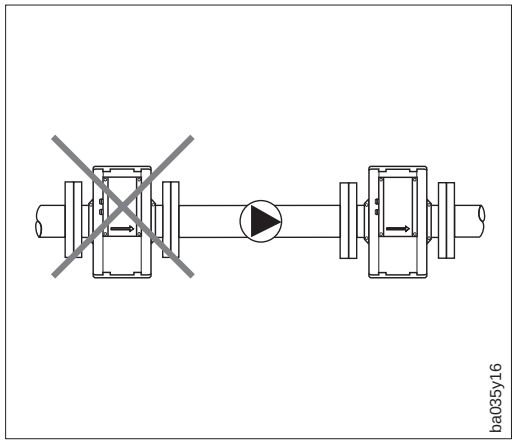


Fig. 13
Installation of pumps

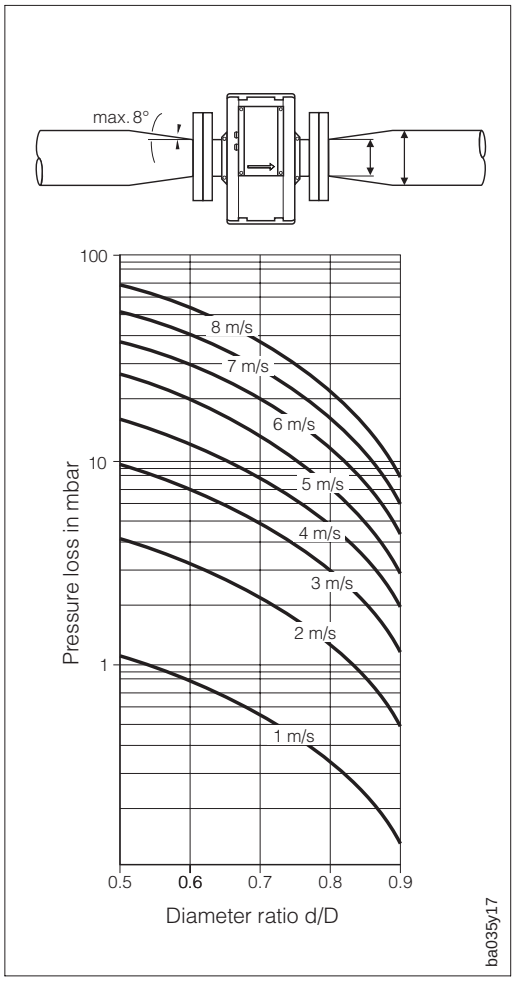
Adapters

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

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

Procedure:
1. Determine the ratio of the diameter d/D.
2. From the nomogram read off the pressure loss at the flow velocity and d/D ratio.

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



Note!

Fig. 14
Adapters

3.4 Mounting Promag 35 S

Length and dimensions
See pages 65 - 67

Mounting
The sensor is mounted between the flanges of the pipe (Fig. 15). Since the lining of the measuring pipe also covers the sensor flange, it also performs as a seal.

Caution!
The Teflon (PTFE) lined Promag S is fitted with protective discs to guard the lining which is turned over the flanges. These discs are to be removed just before mounting the sensor. Ensure that the lining on the flange is not damaged or removed (these discs must remain in position during storage).

Caution!

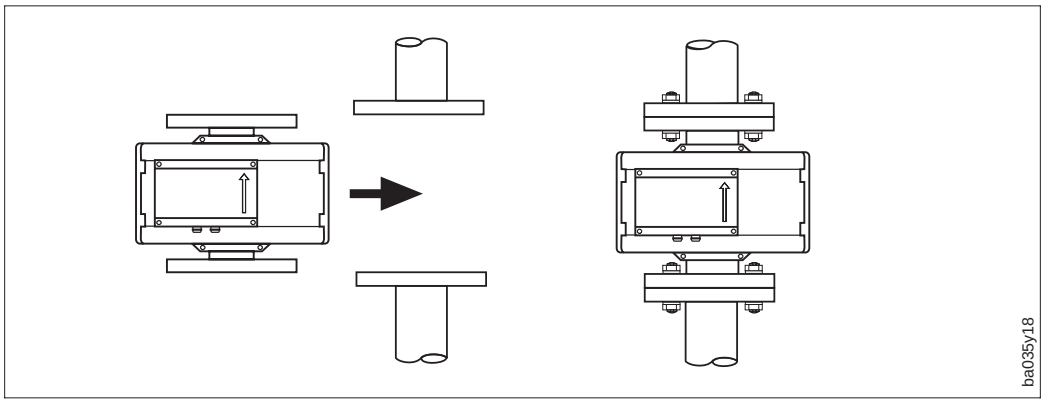


Fig. 15

Gaskets
With soft rubber/Teflon (PTFE) lining a flange gasket is not required.
With soft rubber lining the mating flange should have a thin film of non-conductive sealing grease applied.
Use a gasket according to DIN 2690.

Caution!
Do not use sealing material that is electrically conductive, e.g. graphite. This could result in an electrically conductive layer on the inside of the flowmeter and result in a short-circuit of the measuring signal.

Caution!

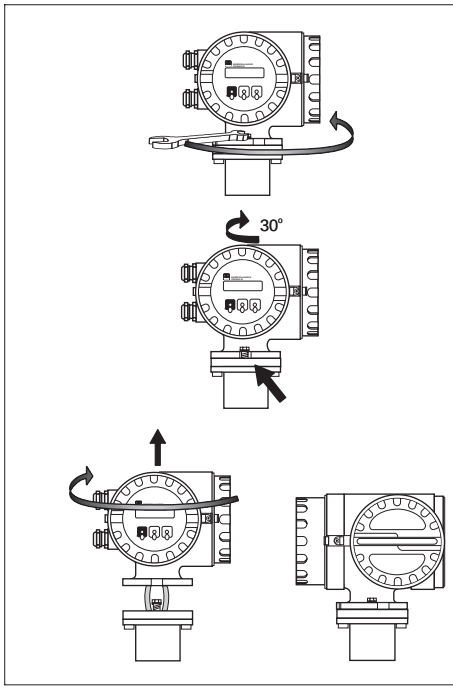
Screw tightening torques

The listed tightening torques apply to greased threads.
Screws tightened too tightly deform the sealing surface (this applies especially to soft rubber).

DN		Pressure ratings				Screws	Max. tightening torques [Nm]		
[mm]	[inch]	DIN [bar]	ANSI [lbs]	AWWA	JIS		Hard rubber	Soft rubber (EPDM)	PTFE (Teflon)
15	$^1/_2$"	PN 40	–	–	–	4 x M 12	–	–	15
25	1"	PN 16	Class 150	–	20K	4 x M 12	25	5	33
32	–				20K	4 x M 16	40	8	53
40	$1^1/_2$"				20K	4 x M 16	50	11	67
50	2"				10K	4 x M 16	64	15	84
65	–	PN 16	Class 150	–	10K	4 x M 16	87	22	114
80	3"					8 x M 16	53	14	70
100	4"					8 x M 16	65	22	85
125	–					8 x M 16	80	30	103
150	6"					8 x M 20	110	48	140
200	8"	PN 10	Class 150	–	10K	12 x M 20	108	53	137
250	10"				–	12 x M 20	104	29	139
300	12"				–	12 x M 20	119	39	159
350	14"	PN 10	Class 150	–	–	16 x M 20	141	39	188
400	16"					16 x M 24	192	60	255
–	18"					20 x M 24	170	58	227
500	20"					20 x M 24	197	70	262
600	24"					20 x M 27	261	108	348

3.5 Turning the transmitter housing and local display (compact version)

Both the transmitter housing and the display of the compact version can be rotated in 90° steps, thus enabling the unit to be adapted to different mounting positions in the pipe and simplifying reading and operation.



Turning the transmitter housing

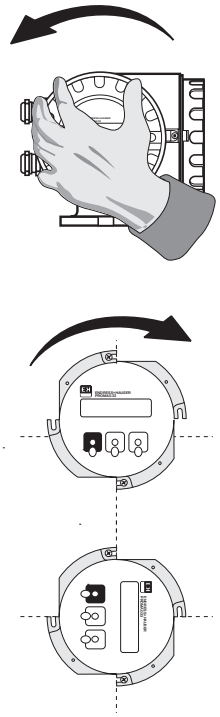
1. Loosen the two mounting screws of the transmitter bayonet catch (approx. two turns)
2. Turn the bayonet catch of the transmitter as far as the groove of the nut (approx. 15 mm).
3. Carefully pull out the transmitter housing to the stop.

   Note!
   During servicing (and only then) the transmitter housing can be removed from the sensor. To do this, the marking notches on the side of the bayonet flange have to be aligned with one another. Do not damage the connecting cable!
4. Turn the transmitter housing to the position required.
   Engage the bayonet catch and tighten the two screws again.

ba035y19

Note!

Fig. 16
Instructions for turning the transmitter housing



Turning the local display

Warning!
Risk of electric shock. Switch off the power supply.

1. Release the safety claw of the cover of the electronics compartment. Loosen the Allen screws with a 3 mm Allen key.
2. Unscrew the cover from the transmitter electronics compartment.
3. Unscrew the two Phillips screws with which the display module is fastened.
4. Rotate the display module into the desired position.
5. Tighten the fixing screws securely.
6. Screw the cover of the electronics compartment back on to the unit securely.
7. Fasten the safety claw.

ba035y20

Warning!

Fig. 17
Instructions for turning the local display

3.6 Mounting the transmitter (remote version)

The transmitter has to be mounted remote from the sensor when:
- access is difficult
- space is restricted
- extreme process and ambient temperatures prevail (for temperature ranges see page 71)
- there is severe vibration (tested according to EN 61010 and IEC 68-2-6)

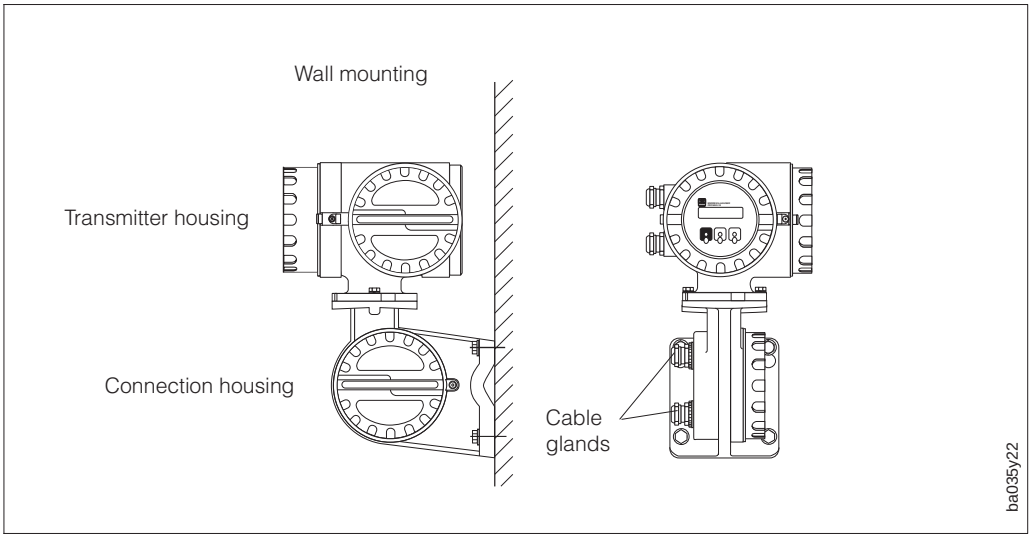


Abb. 18
Fixing the wall-mounted holder

Caution!
- The permissible length L_{max} of cable between the sensor and the transmitter at a distance of >10 m is governed by the fluid conductivity (Fig. 19).
- The overall conductor resistance of the coil-loaded cable has to be $R_{Cu\ max} \leq 2.5\ \Omega$. With the coil-loaded cable available from E+H, the maximum admissible distance is L_{max} = 50 m between sensor and transmitter.
- With the Empty Pipe Detection (EPD) the maximum possible cable length between transmitter and sensor is limited to 10 m.
- Fasten the cable gland or lay it in a conduit. When the fluid conductivity is low, cable movements can cause serious changes in capacitance and thereby falsify the measuring signal.
- Do not run the cable in the vicinity of electrical machines or switching elements.
- Ensure potential equalization between the transmitter and the sensor.

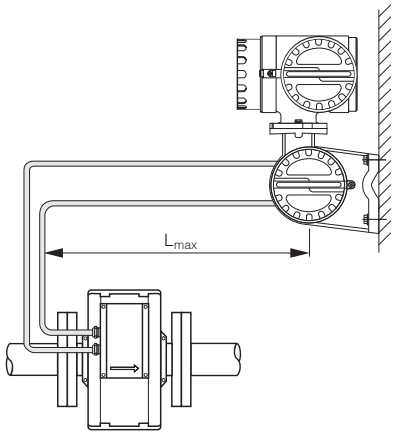


Fig. 19
Cable length of the remote version

ba035y24

3.7 Potential equalisation

The sensor and the fluid must be at roughly the same electrical potential to ensure that the measurement is accurate and no galvanic erosion takes place at the electrodes. Normally the reference electrode in the sensor or the metal pipe ensures that the potentials are equalised. When an reference electrode exists and for fluid carried in grounded metal piping it is sufficient to connect the ground terminal of the Promag 35 transmitter housing to the potential equalisation grid. Depending on the material used for the reference electrode, the electrode is already intergrated into the sensor or available as an option. For the DN 15 device, you will have to use grounding rings instead of the reference electrode.

Potential equalization for certain special cases is described below:

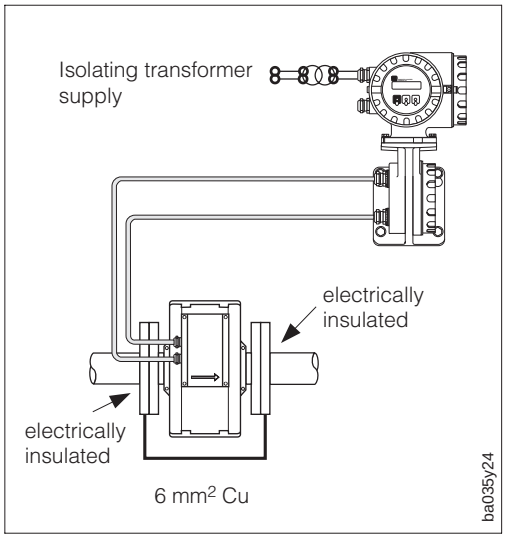


Fig. 20
Potential equalisation for lined pipes with cathodic protection

Potential equalisation for lined pipes with cathodic protection
If, for operational reasons, the fluid can not be grounded, installation of the flowmeter must be potential-free (Fig. 20).

In this case it is important that the sensor is equiped with a reference electrode.

Observe all national regulations for potential-free installations (e.g. VDE 0100).

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

Plastic or lined pipes

Grounding rings are needed if there is no reference electrode present or the fluid has to be grounded on account of equalisation current.

Observe that no strong equalisation current (fluid and mains ground/pipeline) flows via the reference electrode, since in extreme cases it can be destroyed by galvanic deterioration.

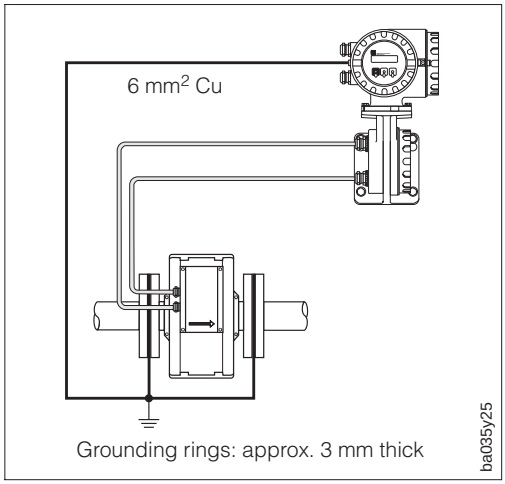


Fig. 21
Plastic or lined piping

Caution!
Ensure the grounding rings are corrosion-resistant! Grounding rings must be of the same material as the reference electrode.

Equalisation currents in ungrounded metal pipes
and
Grounding in an area with severe electrical interference

The fluid may be grounded.
In order to get the most out of the electromagnetic compatibility (EMC) of the Promag 35, it is advisable to provide two flange-to-flange links and to connect them jointly with the transmitter housing to the ground potential (Fig. 22).

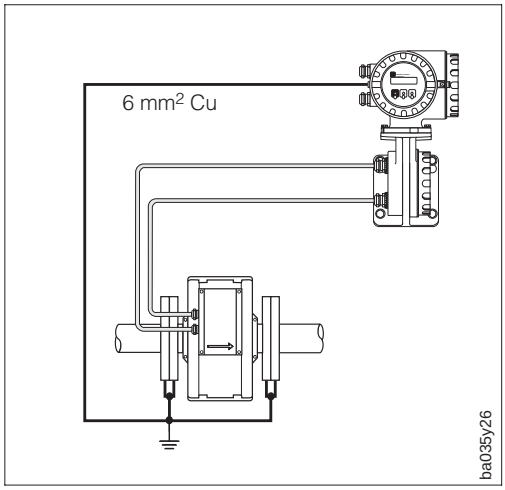


Fig. 22
Equalisation currents in ungrounded metal pipes

4 Electrical Connection

Warning!
Note the information given in Section 3.1 on maintaining the degree of protection IP 65.

Warning!

4.1 Connecting the transmitter for the compact version

Warning!
- Risk of electric shock! Do not install or wire the unit while connected to the power supply. Failure to comply may also result in damage of electronic components.
- Connect the protective conductor to the ground terminal on the housing before the power supply is switched on.
- Check that local power supply and frequency agree with the information on the nameplate. All relevant national regulations for mounting must also be observed.

Warning!

1. Loosen the safety claw on the screw cover of the wiring compartment using a 3 mm Allen key.
   Unscrew the wiring compartment cover.

2. Push the power and signal cables through the appropriate cable glands.

3. Wire up according to the wiring diagrams (see also the wiring diagram in the screw cover):

   - Power supply is connected to terminal 1 (L1, L+), terminal 2 (N, L-) and the ground terminal (3).
   - Fine-wire leads: max. 4 mm^2; put sleeve on the end of the cores. Single-core lead: max. 6 mm^2.

4. Having made the connection, screw on the cover tightly again. Tighten the Allen screw of the safety claw securely.

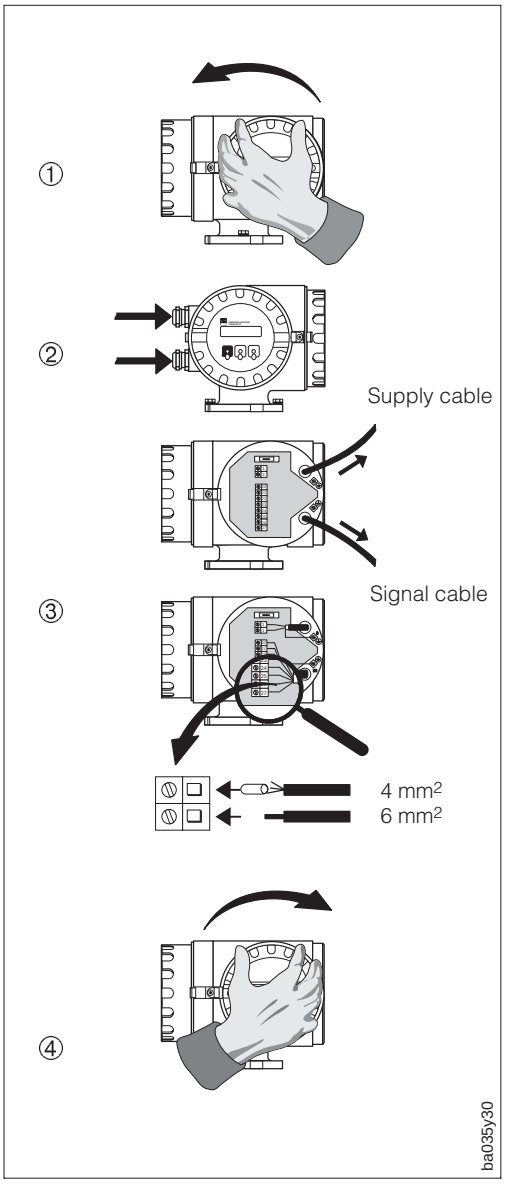
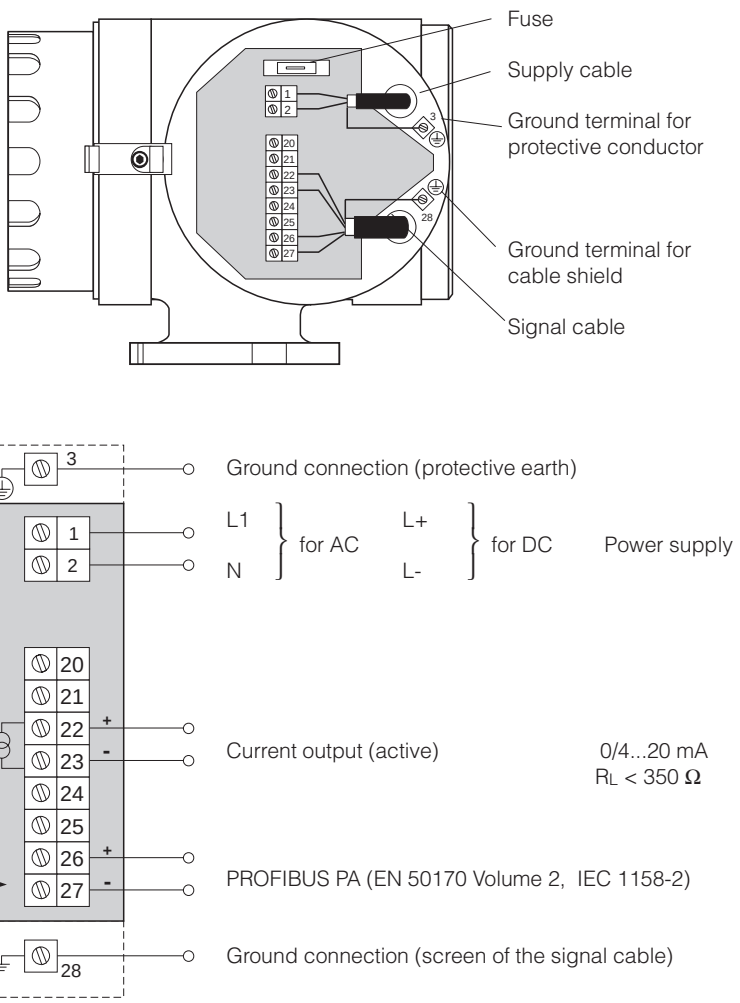


Fig. 23
Connecting the transmitter

4.2 Connection diagrams



Note!

Note!
Selection of the bus address via:
a) local display (see page 29)
b) DIP switches on the communication board (see page 57)

The signal cables are specified in the Technical Information
TI 260F/00/en “Field Communications-Planning Notes PROFIBUS PA”.

Fig. 24
Electrical connection of Promag 35 S PROFIBUS PA

4.3 Connection diagram for the remote version

1. The connection to the transmitter wiring compartment is made as described on page 24.

2. Open the covers of the connection housing of both sensor and transmitter by loosening the four recessed-head screws on the sensor and the safety clamp on the transmitter and unscrew the lock cover.

3. Push both cables (signal and coil cable) in through the appropriate cable glands of both terminal housings.

   Caution!
   Only connect or disconnect the coil cable when the power supply to the instrument is switched off.

4. Wire up the sensor and the transmitter according to the wiring diagrams.

5. Tighten the covers of the connection housings securely.

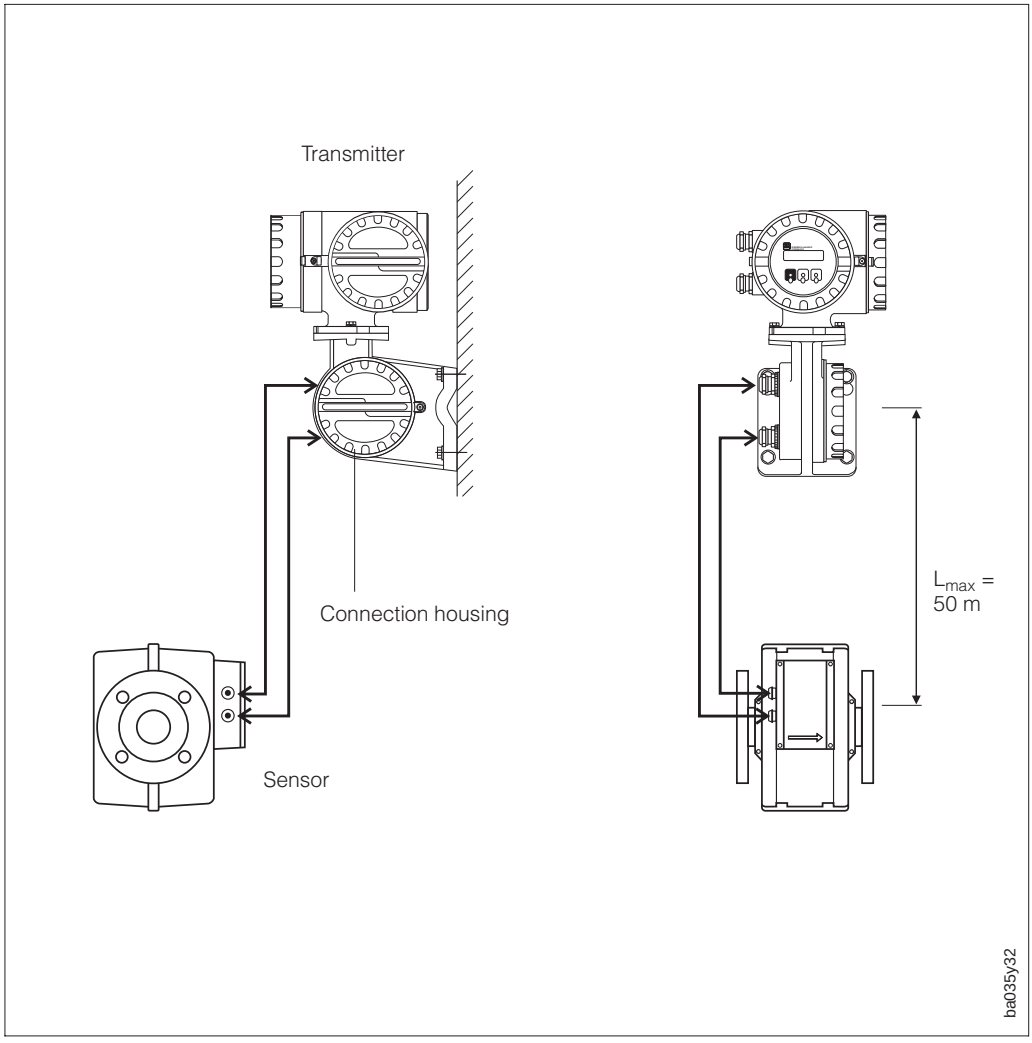


Fig. 25
Connecting the remote version

Remote version: Connection between sensor and transmitter

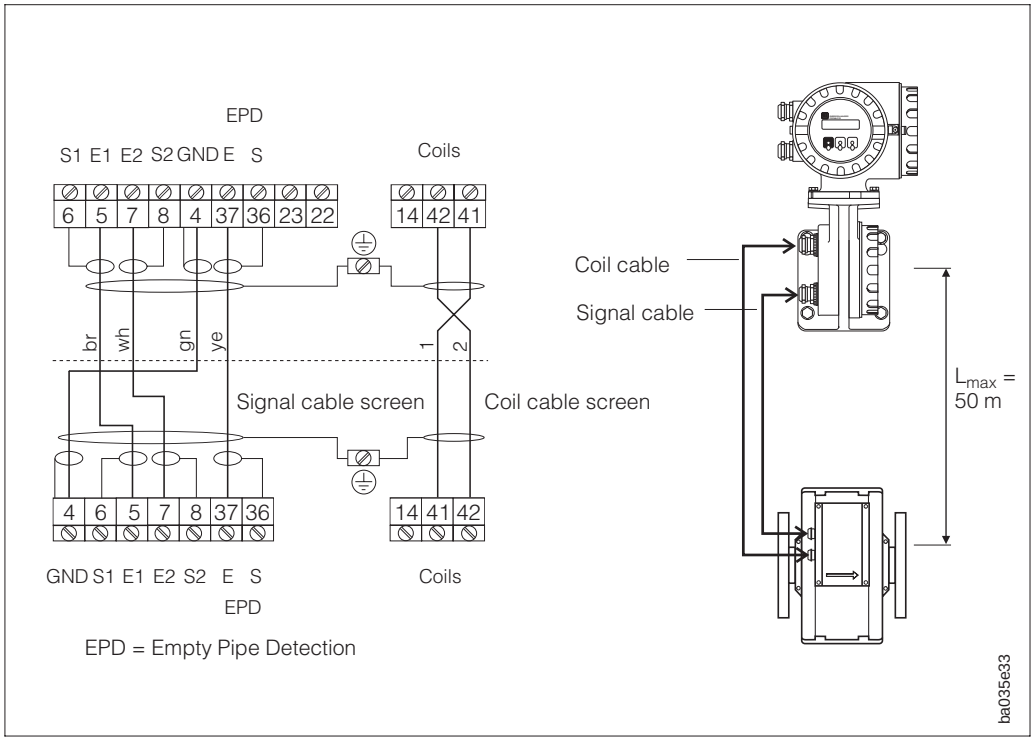


Fig. 26
Wiring diagram of the remote version

4.4 Cable specifications

Cable specifications for the remote version FS

Coil cable: 2 x 0.75 mm^2 PVC cable with common screen
Conductor resistance ≤12.5 Ω/km
Capacitance: core/core, screen grounded ≤120 pF/m
Permanent operation temperature –20...+70 °C
(Cable length and additional information see page 19)

Signal cable: 3 x 0.38 mm^2 PVC cable with common screen and separately screened cores
With EPD (Empty Pipe Detection) 4 x 0.38 mm^2 PVC cable
Conductor resistance: ≤50 Ω/km
Capacitance: core/screen ≤420 pF/m
Permanent operation temperature –20...+70 °C
(Cable length and additional information see page 19)

Cable specifications for use in areas with severe electrical interference
The Promag 35 S measuring system fulfils all general requirements for electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as to NAMUR recommendations.

Note!
With the remote-mounted version the signal and the coil cables between the 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 Fig. 26).

Note!

4.5 Commissioning

Before the measuring system is turned on for the first time, the following checks should be carried out again:
- Check the electrical connections and terminal assignments.
- Compare the data on the nameplate with the local mains voltage and frequency.
- Does the direction of the arrow on the nameplate of the sensor correspond with the actual direction of flow in the pipe?

If the results of these checks are satisfactory, then the power supply should be switched on. The unit is now ready for operation.

After switching on, the system performs various self-test routines. During this procedure the following sequence of messages appears on the display:

The version of the communication board software appears on the display.
The PROFIBUS PA communications board identifies itself by displaying “PBUS” and the actual software version.

P	R	O	M	A	G		3	5						
V	2	.	0	5	.	0	0		P	B	U	S		

Having started up successfully, normal operation continues.
On the display the momentary flow and the total value appear simultaneously.

S	:		S	T	A	R	T	-	U	P				
			R	U	N	N	I	N	G					

In the HOME position the communication with a PROFIBUS PA master is indicated by a flashing double arrow. During programming and in error status the double arrow disappears.

	2	9	0	.	8	2		m	^{3}	/	h			↔
			2	.	1	0	8	0		m	^{3}			

Note!
If it is not possible to start up successfully, a message is displayed, depending on the cause of the fault. The possible fault messages are listed on page 62, 63.

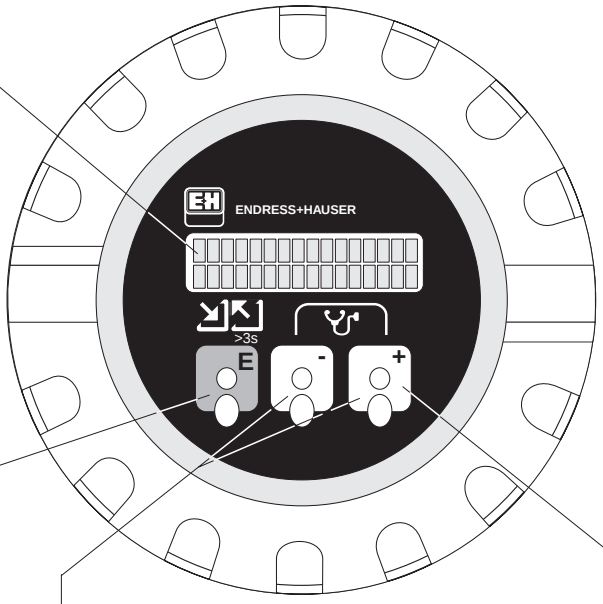

Note!

5 Operation

5.1 Operating and display elements

Liquid Crystal Display

- Illuminated, two lines with 16 characters each
- Messages and values appear in plain text on the display as well as error, alarm and status messages
- HOME position (display during normal operation of the device):
  upper line → factory setting “FLOW RATE”
  lower line → custom selectable measuring value (factory setting “TOTAL VOLUME”)



3 optical operating elements (“Touch-Control”)

above: infrared transmitting diode
below: infrared receiving diode

+ / – keys

Selecting function groups (>GROUP SELECTION<) or programming, e.g. numerical values; setting parameter
(When the two keys are held down, the numbers on the display will change at increasing speed)

Diagnosis and help function
(simultaneously pushing + and – keys)

“Enter-key”

E Access to the programming matrix

E (>3s) Quit the programming matrix, return to the HOME position
(when E-key is pressed for more than 3 seconds)

E Selecting individual functions within the function group, saving data or settings

ba035y34

Fig. 27
Operating and display elements Promag 35 S PROFIBUS PA

5.2 Functions of the operating elements

Procedure:

1. Access to the programming matrix

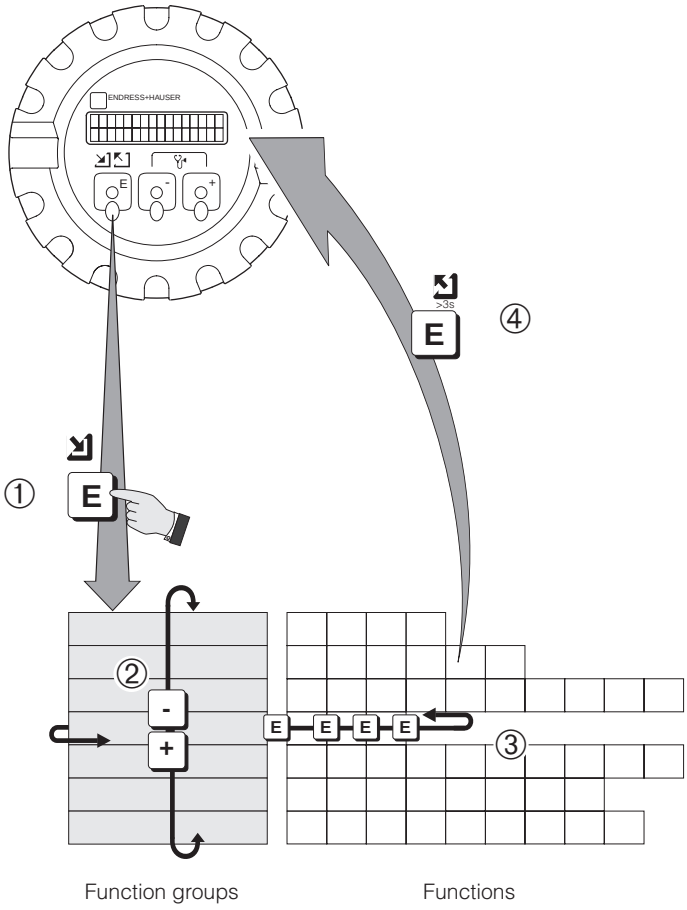
2. Select function group (>GROUP SELECTION<)

3. Select function

4. Quit programming matrix
   Return to HOME position
   (from every matrix position, e.g. after programming)

Note!

Note!
Programming matrix ⇒ see page 31
Programming example ⇒ see page 33
Description of functions ⇒ see page 35ff.



Note!

Note!
- When in operating mode, an automatic return to the HOME position will be made if the operating elements are not actuated for 1 minute (only when the programming is locked).
- If the diagnosis function ± is activated from the HOME position, an automatic return to the HOME position will be made if the operating elements are not pressed within 60 seconds; no matter whether the programming is enabled or locked.

ba035y35

Fig. 28
Function principle of the operating elements

5.3 Programming matrix Promag 35 S PROFIBUS PA

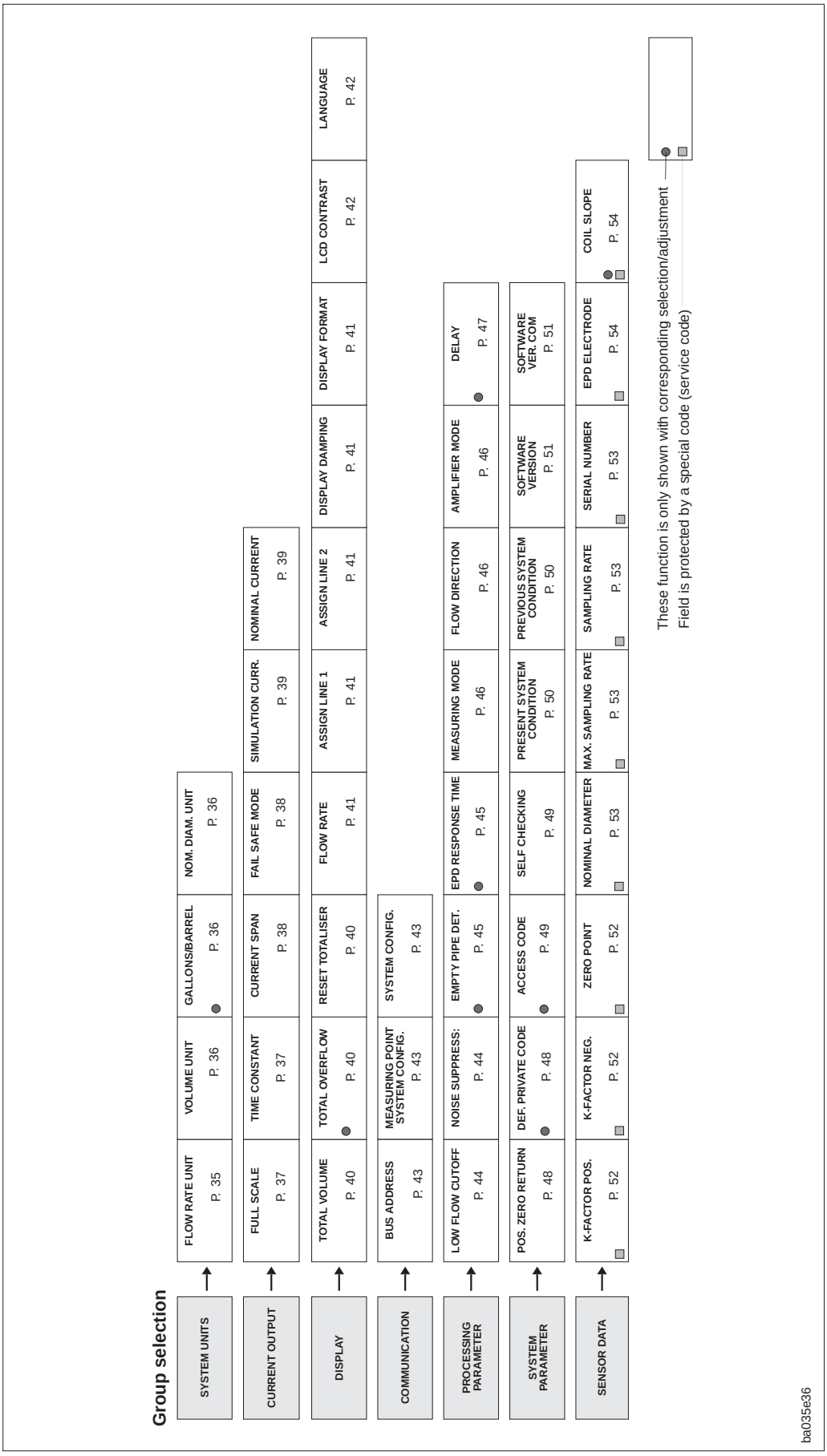


Fig. 29
Programming matrix
Promag 35 S PROFIBUS PA

5.4 Information for programming

For the Promag 35 S measuring system, there is a choice of many functions and parameters which the user can set individually and adapt to the process conditions.

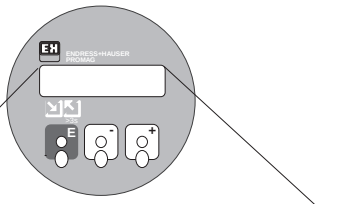
Please observe the following important programming notes:
- If the power supply breaks down, all calibrated and set values are stored safely in the EEPROM (without requiring batteries).
- Functions which are not required, e.g. current output, can be turned “OFF”. The corresponding functions in other function groups then no longer appear on the display (see programming matrix on page 31).
- If, during programming, you wish to undo a setting carried out with ± then select “CANCEL”. This is only possible for settings which have not yet been stored by pressing E.
- For certain functions, a prompt is given after entering data for safety reasons. Select “SURE? [YES]” with the ± keys and confirm by pressing E again. The setting is then stored or a function, e.g. zero point calibration, is then activated.

Enable programming (access code)
Normally programming is locked. It is therefore impossible to change system functions, numbers or factory settings accidentally. Only after the access code has been entered (factory setting = 35) parameters may be entered or altered.
The use of a personal code, which can be chosen freely, prevents data access from unauthorised personal (see page 48).

Locking programming
Following a return in the HOME position, programming is locked after 1 minute without activating an operating element. In addition, programming can be deliberately locked by re-entering any code number (other than the customer code) in the function “ACCESS CODE”.

5.5 Programming example

You would like to change the bus adress to 25, which is set to default 126 in the factory.
Proceed as follows:



Entering the programming matrix.

S	Y	S	T	E	M		U	N	I	T	S			
>		G	R	O	U	P		S	E	L	E	C	T	<

Selecting the desired function group, in this case“COMMUNICATION”

C	O	M	M	U	N	I	C	A	T	I	O	N		
>		G	R	O	U	P		S	E	L	E	C	T	<

Select the function “BUS ADDRESS”

				1	2	6								
B	U	S		A	D	D	R	E	S	S				

On pressing + or - the entry of the code is automatically prompted

						0								
A	C	C	E	S	S		C	O	D	E				

Enter the code number (Factory setting: 35)

					3	5								
A	C	C	E	S	S		C	O	D	E				

Programming is now enabled

	P	R	O	G	R	A	M	M	I	N	G			
					E	N	A	B	L	E				

The programmable value flashes

				1	2	6								
B	U	S		A	D	D	R	E	S	S				

Select the desired bus adress
The display stops flashing
New setting: 25

					2	5								
B	U	S		A	D	D	R	E	S	S				

Save the input.
The display flashes and the value can be changed again if required.

					I	N	P	U	T					
					S	A	V	E	D					

					2	5								
B	U	S		A	D	D	R	E	S	S				

Return to HOME position
(press the E element for more than 3 seconds). Programming is locked again after 1 minute, in case no operating element is activated.

or

Selecting other functions.
Following the last function an automatic return to the function group concerned takes place.

	R	E	T	U	R	N		T	O					
G	R	O	U	P		S	E	L	E	C	T			

6 Functions

This section is an in-depth description of the individual functions and specifications of Promag 35 S. Factory settings are indicated in ***bold italics***.
With Promag 35 S instruments with customer-specific configuration, values/settings may differ from the factory settings shown here.

Function group SYSTEM UNITS	
FLOW RATE UNIT	Selection of the required and indicated units for the flow (volume/time). The unit selected here is also defining the unit for: • creep rate • full scale value of the current output **Selection:** dm^3/s, dm^3/min, dm^3/h m^3/s, m^3/min, ***m^3/h*** l/s, l/min, l/h hl/min, hl/h gal/min, gal/hr, gal/day gpm, gph, gpd, mgd bbl/min, bbl/hr, bbl/day cfs (cubic feet per second) cc/min Diagnosis: The actual flow rate appears on the display.

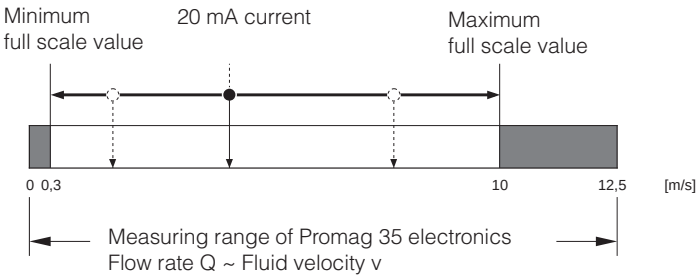
Function group SYSTEM UNITS	
VOLUME UNIT	Selection of the required and indicated units for the volume flow. The units selected here are also the same as those for the totaliser value (and totaliser overflow). **Selection:** dm³, ***m³***, l, hl, gal, bbl, 10³ gal, ft³ Diagnosis: The actual totaliser value appears on the display.
GALLONS / BARREL Note!	In the USA and in the UK the relationship between the units barrel (bbl) and gallon (gal) is differently defined, depending on the fluid and the industry. The relationship required can be selected here. Selection is also made on whether it is US or imperial gallons. Note! This function is only available when barrel or gallon is selected as “FLOW RATE UNITS” or “VOLUME UNITS”. **Selection:** US: 31.0 gal/bbl ⇒ for beer ***US: 31.5 gal/bbl*** ⇒ standard for liquids US: 42.0 gal/bbl ⇒ petrochemicals US: 55.0 gal/bbl ⇒ filling tanks US: 36.0 gal/bbl ⇒ for beer US: 42.0 gal/bbl ⇒ petrochemicals
NOM. DIAM. UNIT Note!	This function is used for selecting the required units for nominal diameter. Note! The units selected here is shown under the function “NOMINAL DIAMETER” (see page 53). **Selection:** ***mm*** inch Diagnosis: The nominal diameter set is shown in the units selected.

Function group
CURRENT OUTPUT

With this group of functions, the user is able to adjust the output current to suit the requirements (full scale value, time constant, current span, etc.). Two basic modes of the current output are offered. When programming “0/4...20 mA (25 mA)”, the current output can overrun to 125% of the calibrated full scale value (25 mA), with the programming “0/4...20 mA”, the current output operates according to the NAMUR recommendations. This allows a maximum full scale overrun of up to 102.5% (20.5 mA).

FULL SCALE

By scaling the full scale value, a flow rate is assigned to the 20 mA current. Scaling always applies to both directions of flow (bidirectional), but with the unidirectional mode, only for a positive flow (forward).



Note!
When programming according to NAMUR, the range is reduced from 12.5 m/s to 10.25 m/s.

Note!

Input:

five-digit number with floating decimal point
(e.g. 520.00 dm^3/min)

Diagnosis:

The units can be selected in the function “FLOW RATE UNIT".

TIME CONSTANT

Selecting the time constant determines whether the current output signal responds especially rapidly to widely varying flow (short time constant) or is delayed (long time constant).

The time constant does not affect the behaviour of the display.

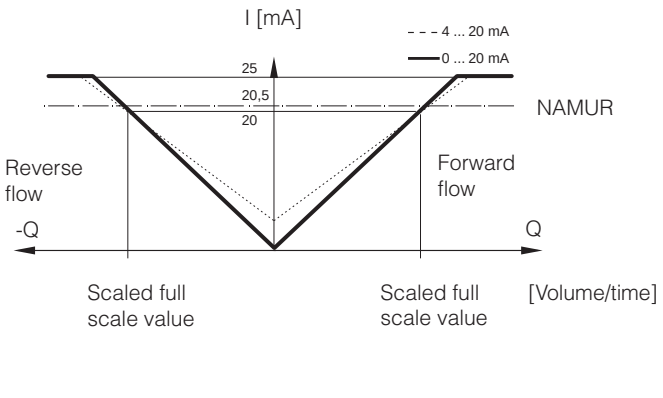
Input:

three-digit number with floating decimal point: 0.01...100 s
Factory setting: ***1 s***

Function group
CURRENT OUTPUT

CURRENT SPAN

Selecting the 0/4...20 mA current range. This allows a choice between the current output in compliance with NAMUR recommendations (max. 20.5 mA) or the current output with a maximum of 25 mA.



Selection:

0...20 mA	current output according to NAMUR
4...20 mA	current output according to NAMUR
0...20 mA (25 mA)	maximum 25 mA
4...20 mA (25 mA)	maximum 25 mA

FAILSAFE MODE

For safety reasons, in the event of a fault it is useful for the current output to assume a previously defined status.

The setting only affects the current output.

Selection:

MIN. CURRENT
When a fault occurs, the current signal is set to 0 mA (0...20 mA) or 2 mA (4...20 mA).

MAX. CURRENT
The current signal is set to 25 mA for 0/4...20 mA (25 mA) or 22 mA for 0/4 ...20 mA.

HOLD VALUE
Last valid measured value is held.

ACTUAL VALUE
Normal measured output despite fault.

Function group
CURRENT OUTPUT

SIMULATION CURRENT

With this function an output current can be simulated.
The selection of simulated values correspond to 0%, 50% or 100% of the full scale value. In addition, the two error modes 2 mA (at 4...20 mA) and 25 mA (maximum possible value) or 22 mA for NAMUR can also be simulated.

Example application 1: Checking auxiliary units.
Example application 2: Checking the internal current signal calibration.

Note!
- The specified current span 0/4...20 mA determines what simulation values can be selected here.
- The flowmeter is fully operational for measuring during simulation, i.e. the totaliser and the display of the flow rate continue to operate normally.
- The "POSITIVE ZERO RETURN" function deactivates any simulation in progress and sets the output current to 0/4 mA.
- For programming according to NAMUR, the 25 mA simulation value is not available.

Note!

Selection:

OFF

0 mA	0%		0...20 mA
10 mA	50%		
20 mA	100%		
22 mA	110%		
25 mA	125%	(overflow)	
2 mA	error		4...20 mA
4 mA	0%		
12 mA	50%		
20 mA	100%		
22 mA	110%		
25 mA	125%	(overflow)	

NOMINAL CURRENT

Display of the current calculated from the measured flow. The effective current may vary slightly due to external factors such as temperature.

Display:

The actual set value appears on the display (0.00...25.00 mA).

Diagnosis:

The actual flow rate value appears on the display.

Function group DISPLAY	
TOTAL VOLUME	Here, the summed flow quantity is shown as a floating-point number of maximum seven digits. **Display:** Max. seven-digit number (0.0000....9999999) Factory setting: ***0.0000*** Diagnosis: The units can be selected in the function “VOLUME UNIT” (see page 36).
TOTAL OVERFLOW	The total flow quantity is displayed in the HOME position by a max. seven-digit number with variable decimal point. Larger numbers (>9,999,999) are shown in this function as overflow. The effective quantity is thus the sum of the overflow and the value shown in the HOME position (or in the function “TOTAL VOLUME”). *Example:* The display shows 2e7 dm^3 ⇒ overflow = 2 x 10^7 dm^3 = 20,000,000 dm^3. The actual totaliser value is 196,845.7 dm^3. The total amount, added together since measurement started, is therefore 20,196,845.7 dm^3. Note! • This display only appears when there is an overflow. In addition, in the HOME position an overflow is made visible by optically inverting the “>”sign. • With bidirectional measurement, the totaliser value may have a positive or a negative sign. **Display:** Integer to a decimal point (e.g. 10e7 dm^3) Diagnosis: The actual totaliser value (HOME position) appears on the display.
RESET TOTALISER	The totaliser can be reset to zero. Note! Not only the “overflow” but also the value displayed in the HOME position is reset to zero. **Selection (with prompt):** ***NO*** YES Diagnosis: The actual totaliser value appears on the display.

Note!

Note!

Function group DISPLAY	
FLOW RATE	Here, the current flow value is shown. This is particularly advantageous if the HOME position is assigned to other measured variables. **Display:** Max. five-digit number (-99999...+99999). Unit according to the selection in the function "FLOW RATE UNIT".
ASSIGN LINE 1	With this function the variable is defined which is to be displayed on the *upper* display line during normal operation (HOME position). **Selection:** ***FLOW RATE*** - TOTAL VOLUME
ASSIGN LINE 2	With this function the variable is defined which is to be displayed on the *lower* display line during normal operation (HOME position). **Selection:** OFF - FLOW RATE - ***TOTAL VOLUME*** - TOTAL OVERFLOW
DISPLAY DAMPING	Selecting a time constant determines whether the display reacts quickly (small time constant) or slowly (large time constant) to changing flow values. Note! • Damping is inactivated when set to "zero". • The damping of the display does not affect the behaviour of the current output. **Input:** Max. two-digit number: 0...99 seconds Factory setting: ***1 s***
DISPLAY FORMAT	The number of significant digits for displaying the actual flow rate is selected. Along with the function "DISPLAY DAMPING", this serves to stabilise heavily fluctuating flows. Note! • Insignificant digits in front of the decimal point are shown as zeros. • Insignificant digits after the decimal points are not shown, and the last digit displayed is rounded. **Selection:** ***X.XXXX*** (five significant digits) X.XXX (four significant digits) X.XX (three significant digits)

Note!

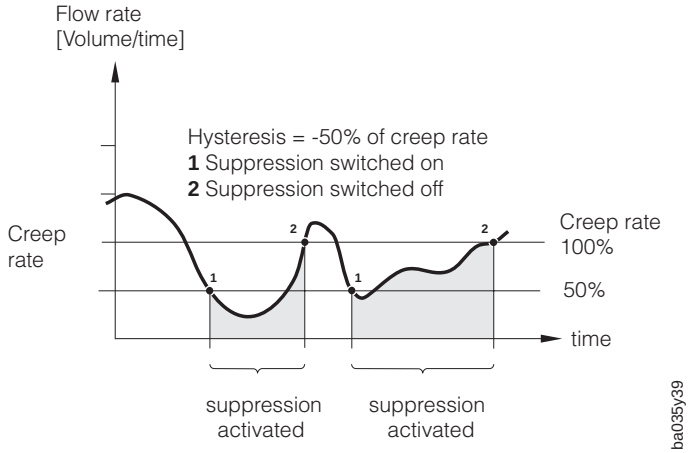
Note!

Function group DISPLAY	
LCD CONTRAST	The contrast can be adjusted optimally to match the operating conditions on site. Caution! At temperatures below the freezing point (<0 °C) the visibility of the display text is no longer assured, even with maximum contrast. If no display is visible, then see page 60. **Adjustment:** A change in contrast is immediately indicated with a bar graph (**IIIIIIIII**.....).
LANGUAGE	Selection of the operating language required. **Selection:** ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS DANSK NORSK SVENSKA SUOMI BAHASA INDONESIA JAPANESE Factory setting: ***country-specific*** Note! By simultaneously pressing the keys during power-up the Promag 35 starts with “ENGLISH” and maximum contrast.

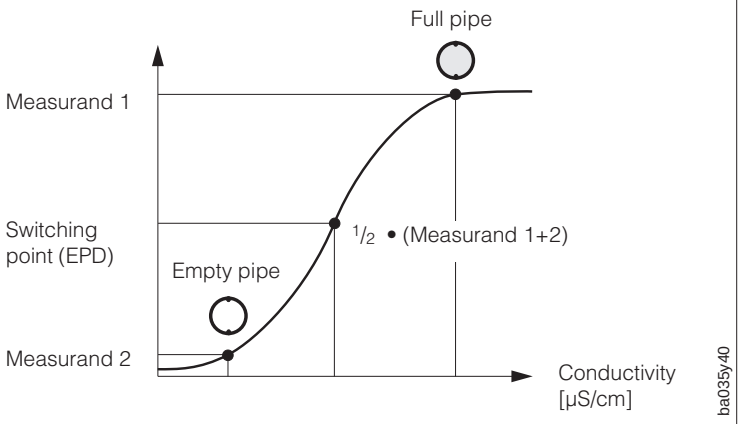
Caution!

Note!

Function group COMMUNICATION	
BUS ADDRESS	In this function the bus address is set. Local configuration can be deactivated using a miniature switch (DIP switch) on the communications board. When this is done, “DIP switch” is displayed (see page 57). **Input:**  three-digit number: 0...127 Factory setting: ***126*** Diagnosis:  In case the DIP switch addressing mode is selected, the choosen address is displayed.
MEASURING POINT DESIGNATION	In this function, the actual measuring point designation (name) is displayed. It is set by the PROFIBUS master, e.g. Commuwin II. The measuring point designation corresponds to the TAG-DESC of the Physical Block, as defined in the PROFIBUS PA profile B. Diagnosis:  The complete measuring point designation is displayed (up to 32 characters).
SYSTEM CONFIG.	This function enables switching between local operation (via E+H matrix) and remote operation via PROFIBUS PA. The device can only be operated in either local or remote mode at one time. The system configuration and parameters are independent of the operation mode and are carried out in the event of a change of the operating mode. **Display:**  ***LOCAL*** - REMOTE

Function group **PROCESSING PARAMETER**	
LOW FLOW CUTOFF	Set the required switch point for the creep rate (volume/time). Creep suppression prevents a rate of flow being measured in the lower part of the range (e.g. fluctuating head at standstill). The creep function always operates with negative hysteresis:  Note! • When creep suppression is active, the sign of the flow appears optically inverted on the display. • The max. creep rate depends on the nominal diameter of the sensor currently being used and corresponds to a flow velocity v = 1 m/s. • The units shown can be selected in the function “FLOW RATE UNIT”. **Input:** five-digit number with floating decimal point (e.g. 15,000 dm^3/min.) Diagnosis: Hysteresis = 50% Creep suppression operates with a negative hysteresis of 50%.
NOISE SUPPRESS.	A software filter (= interference blanking) can be used to reduce the sensitivity of the output signals to transient flows and interference peaks, e.g. with fluids containing solids. **Selection:** OFF LOW ***MEDIUM*** HIGH

Note!

Function group **PROCESSING PARAMETER**	
EMPTY PIPE DET.	Only a completely full flowmeter pipe enables correct readings to be obtained. This can be continuously checked by Empty Pipe Detection (= EPD). EPD is based on measuring the conductivity of the fluid. If conductivity drops below a specific value defined by EPD, then the display shows the error message “EMPTY PIPE”. The alarm effects also the other outputs according to their settings. Note! • The EPD function is available only if the sensor is fitted with an extra electrode. • Before switching on EPD, the full/empty adjustment necessary for EPD must be carried out within this function. • If the alarm message “EMPTY PIPE” appears, though the pipes are filled, a new full/empty adjustment must be carried out. • If different fluids with different conductivity are measured, a new full/empty adjustment must be made for each fluid! • EPD can be switched on and off by software at any time. • EPD has the same effect on the outputs as if there was a fault.  **Selection:** ***OFF*** - ON - EMPTY PIPE ADJ. - FULL PIPE ADJ.
EPD RESPONSE TIME	The response time of Empty Pipe Detection can be selected by the user to suit process conditions. An alarm is not given until this response time has expired. Brief air bubbles in the flowmeter are then not interpreted as a partly filled pipe. This function is only available when Empty Pipe Detection is switched “ON”. **Selection:** 60 s 30 s 10 s 5 s 2 s ***1 s***

Note!

Function group **PROCESSING PARAMETER**	
MEASURING MODE	The measuring system is able to measure in both flow directions (bidirectional). The signal outputs (PROFIBUS PA interface, current output, and the internal totaliser) can all be switched to a unidirectional mode. In this case, a signal is only given or internally totalised for positive flow. The flow display in the HOME position still operates in both flow directions. **Selection:** UNIDIRECTIONAL ***BIDIRECTIONAL***
FLOW DIRECTION	There is an arrow on the flowmeter nameplate to indicate the positive (forward) flow direction. Under certain circumstances it may be necessary to operate the flowmeter in the reverse direction. This can be done by inverting the sign of the flow rate measured (reverse). **Selection:** ***FORWARD***[1)] REVERSE[2)] [1)] Positive flow according to the arrow on the nameplate. [2)] Positive flow opposite the direction of the arrow on the nameplate.
AMPLIFIER MODE	The Promag 35 amplifier has an automatic amplifier gain control. This ensures that the amplifier always operates at optimum amplification according to the flow velocity of the fluid. High accuracy is thus maintained over a wide dynamic range of 1000:1. Applications with rapid and heavily fluctuating flow rates can still affect the measurement and the desired accuracy will not be achieved. In such applications it may be better under certain circumstances to program the amplifier at a fixed amplification step. Caution! With selection of “MODE 3” or “MODE 4”, it must be ensured that the actual flow velocity is not higher than the selected velocity range. Overshooting will not be registered as an error and can lead to false measurements. **Selection:** ***NORMAL*** automatic amplifier gain control MODE 1 for flow rates 0...>12 m/s MODE 2 for flow rates 0...12 m/s MODE 3 for flow rates 0...4 m/s MODE 4 for flow rates 0...1 m/s

Caution!

Function group **PROCESSING PARAMETER**	
DELAY	Within the measuring amplifier, the delay of the automatic amplification switchover may be varied. In case of an overload, the amplification is immediately reduced, independent of the value set originally. In case of a massive underload, the 'n' measured results (samples) are waited for before the amplification is once again increased. This is especially useful if occasional and rapid flow peaks occur (e.g. piston pumps). The programmed number thus corresponds to the number of measuring events (samples) to be ignored before a switch-over of the amplifier gain control is necessary. **Selection:**  Max. four-digit number: ***10***...1000

Function group **SYSTEM PARAMETER**	
POS. ZERO RETURN	With positive zero return (PZR) the output signals can be deliberately set to zero. Measured value suppression is equivalent to zero flow: • PROFIBUS PA interface: flow = 0 • Current output signal ⇒ 0/4 mA • Display of HOME position: flow = 0; totaliser remains at the actual value Caution! This function has top priority over all other functions of the instrument. Simulation in progress is interrupted by the PZR. **Selection:** ***OFF*** ON
DEF. PRIVATE CODE	Selection of a personal code number, to enable programming. For the Promag 35 S measuring system the factory setting is 35. • When programming is locked, this function is not available and access to the personal code by third parties is excluded. • The code number can only be altered when programming has been enabled. Caution! Programming is always enabled when code number = 0 is selected. **Input:** Max. four-digit number: 0...9999 Factory setting: ***35***

Function group **SYSTEM PARAMETER**	
ACCESS CODE	All data of the Promag 35 S measuring system are protected against unauthorised access. By entering a code number, programming is enabled and the settings of the instrument can be altered: • Entering code set in the factory “35" • Entering personal code number Note! • If, in any function, the + or - key is pressed when programming is locked, a call to enter the code number is automatically issued. Once this number has been entered, programming is enabled. • Following a return to the HOME position, programming is again locked after 1 minute if no key is pressed during this time. • Programming can also be locked by entering another code number in the function ”ACCESS CODE" (not the same number as the personal code). • A set of functions can only be altered once a special code (service code) has been entered as changing these parameters would lead to inaccuracies in measurement. This code is known by your E+H Service organisation. For more information, please contact your E+H Service organisation. Caution! If you can no longer find your personal code, the Endress+Hauser Service organisation will be able to help you. **Input:** Max. four-digit number: ***0***...9999
SELF CHECKING	Switching the periodical self check of the amplifier on or off. The amplifier is fitted with an automatic temperature compensation. Any temperature drift occurring in the region of the amplifier path can be compensated for by a periodical measurement against an internal reference voltage. **Selection:** OFF **ON**


Note!


Caution!

Function group
SYSTEM PARAMETERS

PRESENT SYSTEM CONDITION

System and process errors, as well as status messages which occur while measurement is in progress, are displayed in the HOME position, alternating with the measured values. A jump to the diagnostic function is made automatically by pressing the diagnostic key. The user can scan the error and status messages currently on hand.


Note!

Note!
- The messages are displayed in order of message importance (first message = highest priority)
- A complete list of all possible error and status messages can be found on page 62f.
- With error-free measurement the message “S: SYSTEM WORKS NORMALLY” appears.
- This function can also be selected directly through the function group “SYSTEM PARAMETERS”.

Procedure (example):


In the HOME position, press the diagnostic function key (or select this function via the programming matrix).

F	:		S	Y	S	T	E	M		E	R	R	O	R	
			P	O	W	E	R		S	U	P	P	L	Y	


With the diagnostic function, additional error descriptions can be scanned (with system errors only!)

	:		L	O	W		V	O	L	T	A	G	E		
			D	E	T	E	C	T	E	D					

(Example)


Ask for further error or status messages.

PREVIOUS SYSTEM CONDITIONS

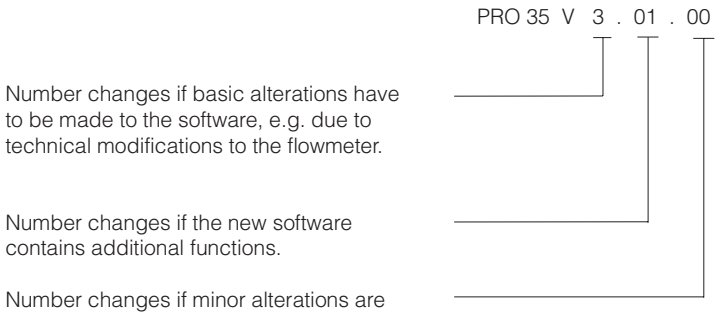
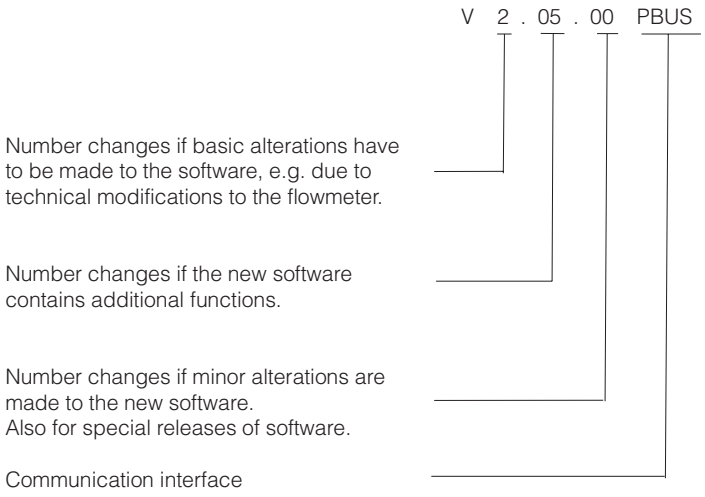
In this function all error and status messages that have occurred are listed in chronological order (max. 10 messages).


Note!

Note!
- Storage of this list is volatile and is lost if the power supply is interrupted.
- A complete list of all possible error and status messages can be found on page 62f.
- If no error or status messages have occurred since the measuring equipment was last started up, then the message “S: NO ENTRY EXISTING” will appear.

Selection:


Other system/process parameters and status messages are called up:
”+” lists chronologically the oldest, second oldest ... etc. message
”–” lists the most recent, second most recent ... etc. message.

Function group SYSTEM PARAMETER	
SOFTWARE VERSION	Display of the software version installed on the amplifier board. The numbers of the software version have the following meaning: 
SOFTWARE VER. COM	Display of the software version installed on the communication board. The numbers of the software version have the following meaning:  Note! If the display does not show “PBUS”, no PROFIBUS PA communications board is installed, but another type!


Note!

Function group
SENSOR DATA

Sensor data, such as nominal diameter, calibration factor, etc., are set in the factory. All characteristic values of the sensor are stored in the DAT memory. The functions of this line can only be saved after entering a special code (service code) and cannot be altered using the personal code. Please contact your E+H Service organisation for more information.


Caution!

Caution!
Normally these characteristic data should not be altered. A change to the data of the sensor affects a number of functions of the whole measuring system, especially its accuracy.

K-FACTOR POS.	The calibration for the positive direction of flow depends on the particular sensor. The factor is determined and set in the factory.
 Caution!	Caution! Normally the calibration factor should not be altered. The special code (service code) is known to your E+H Service organisation. Please contact it for more information.
	Selection:
	 five-digit number with fixed decimal point (0.5000...2.0000) Factory setting: ***dependent on*** the sensor: nominal diameter and its calibration
K-FACTOR NEG.	The calibration for the negative direction of flow depends on the particular sensor. The factor is determined and set in the factory.
 Caution!	Caution! Normally the calibration factor should not be altered. The special code (service code) is known to your E+H Service organisation. Please contact it for more information.
	Selection:
	 five-digit number with fixed decimal point (0.5000...2.0000) Factory setting: ***dependent on*** the sensor: nominal diameter and its calibration
ZERO POINT (OFFSET)	The zero point error depends on the particular sensor. It is determined and set in the factory.
 Caution!	Caution! Normally the calibration factor should not be altered. The special code (service code) is known to your E+H Service organisation. Please contact it for more information.
	Selection:
	 Max. four-digit number (-1000...+1000) Factory setting: ***dependent on*** the sensor: nominal diameter and its calibration

Function group SENSOR DATA	
NOMINAL DIAMETER	The nominal diameter is determined by the size of the sensor. It is set in the factory. Caution! The nominal diameter given should not, in general, be altered. Numerous functions depend directly on the nominal diameter (technical units, full scale values, switch points, creep rate, etc.). When the nominal diameter is changed, all dependent parameters are set to a **new** plausible value. **Selection:** Value 15...600 mm or ½" ...24" Factory setting: ***dependent*** on the sensor Diagnosis: The unit can be selected in the function “NOM. DIAM. UNIT”.
MAX. SAMPLING RATE	The maximum permissible sampling rate (SAPS) depends on the particular sensor being used. It is set in the factory. Caution! Under normal circumstances, the max. sampling rate should not be altered. **Input:** Max. three-digit number with fixed decimal point (1.0...60.0 per second) Factory setting: ***dependent*** on the sensor
SAMPLING RATE	The sampling rate (= SAPS) is set in the factory. The standard value is 16.7 per second. Note! • The sampling rate is usually set to the “MAX. SAMPLING RATE”. It should only be altered in special cases. • The Promag 35 measuring system is synchronised with the main power supply. Therefore, the sampling rate entered is set to the nearest possible value or rounded off towards it. **Input:** Max. three-digit number with floating decimal point; upper limit: depending on the nominal diameter, max. 60.0/s; lower limit: 1.0/s). Factory setting: ***dependent*** on the sensor
SERIAL NUMBER	Display of the serial number of the sensor. Note! The serial number is normally entered in the factory. **Input:** Max. six-digit number

Caution!

Caution!

Note!

Note!

Function group SENSOR DATA	
EPD ELECTRODE	This function indicates whether the sensor is equipped with an electrode for Empty Pipe Detection (EPD). This setting is made in the factory to suit the sensor installed. Note! Empty Pipe Detection can only be activated when an EPD electrode is fitted. **Selection:** YES NO Factory setting with standard EPD electrodes: ***"YES"***
COIL SLOPE	To optimize the field coil slope, the coil voltage is briefly exalted. The duration of this period of exalted voltage varies according to the diameter and is set at the factory. Caution! The value set at the factory may only be altered after consulting your E+H Service Organisation. This function is protected by a service code. **Selection:** Max. three-digit number (0...255)


Note!


Caution!

7 PROFIBUS PA Interface

7.1 PROFIBUS PA

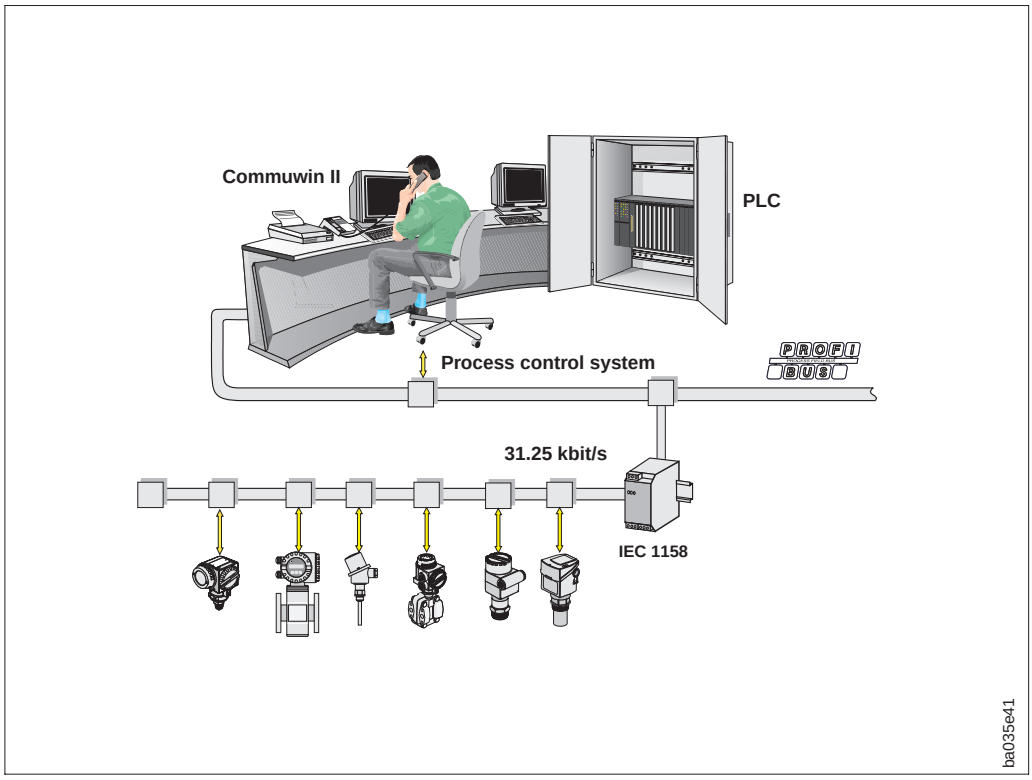


Fig. 30
PROFIBUS PA

Note!
Refer to Technical Information Manual TI 260F/00/en “Field Communications-Planning Notes PROFIBUS PA” for detailed project information about PROFIBUS PA.

Note!

7.2 GSD- and Type-Files

To integrate PROFIBUS PA devices in a control system, GSD and type files are required.

A floppy disk is shipped with each order. The files on this disk have to be loaded in the control system (e.g. COMET 200 or COM PROFIBUS) prior start-up of a field bus system.

This files are stored as follows:
- all *.200-files in the directory of the type-files ... \TYPDAT5X
- all *.GSD-files in the directory of the GSD-files ... \GSD
- all *.BMP-files in the directory of the bitmaps ... \BITMAPS

The meaning of this parameters is defined in the PROFIBUS PA specification.

The floppy disk is supplied with the delivery and may also be ordered from E+H Flowtec AG (Order No. 50087303).

7.3 Setting the bus address

The address of a PROFIBUS PA device is an obligatory setting. An incorrect setting of the address will result in the fieldbus not recognising the device. Valid device addresses range from 0...127.

All devices are delivered with the default address 126. This address can be used for testing the device. This address must be changed before installing the device into a PROFIBUS PA network. The address is a unique identifier and must only be used once in a PROFIBUS network.
The configuration of a PROFIBUS PA device address for a Promag 35 can be done either through local operation or by using the DIP switches on the communications board (see page 57).

7.4 PROFIBUS PA addressing via touch control

See page 43
Device function → Group function “COMMUNICATION” → Function “BUS ADDRESS”.

7.5 Addressing PROFIBUS PA by DIP switches

With DIP switch No. 8 the address mode is selected. The addressing is done by local operation (touch control), when the DIP switch No. 8 is set to “OFF”. Addressing is done by the DIP switches 1...7 (see Fig. 31), when DIP switch No. 8 is set to “ON”.

Note!
Factory setting is DIP switch No. 8 = OFF (local operation).

Note!

Procedure:

Warning!
Danger from electrical shock! Switch off the power supply before opening the electronics housing.

Warning!

1. Loosen the screw of the safety claw (3 mm Allen key).
2. Unscrew the cover of the transmitter electronics compartment.
3. Remove the local display (if present), by loosening the mounting screws of the display module.
4. Set the DIP switches on the communications board using an appropriate object.
5. Reassemble in reverse sequence.

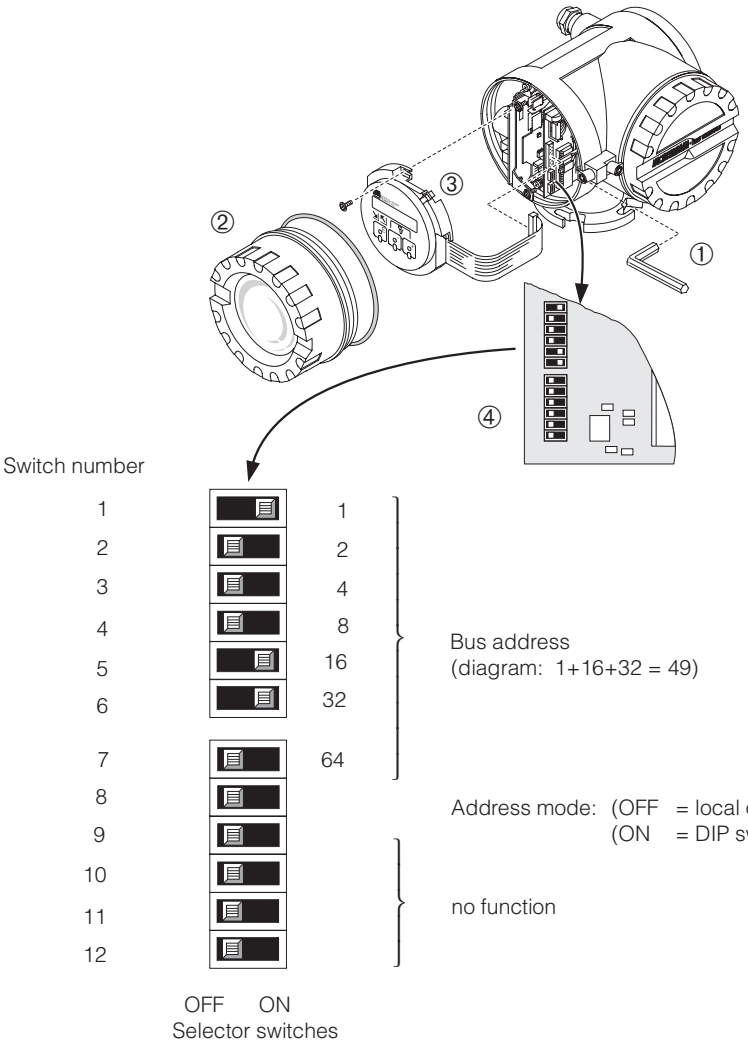


Fig. 31
Addressing with the DIP switches on the communications board

7.6 PROFIBUS PA Parameters

The function block model of the Promag 35

The Promag 35 software contains the following function blocks:

- One *AI block* (AI = Analogue Input)
  The universal AI block supplies all flow rate parameters to the control system.

Three specialised function blocks related to flow measurement are implemented in accordance with the recommendation of the PROFIBUS PA profile definition.

- One *Totaliser function block*
  The totaliser block allows direct access to the Promag 35 from the control system.
- One *Transducer block for flow rate*
  The transducer block contains the sensor data, e.g. the calibration factor.
- One *Physical block*
  The physical block contains information such as language, measuring point designation or the contrast of the LC display etc.

In addition, the control system is able to control important parameters of these blocks such as the time constant of the flow or type of functions, e.g. reset of the totaliser.

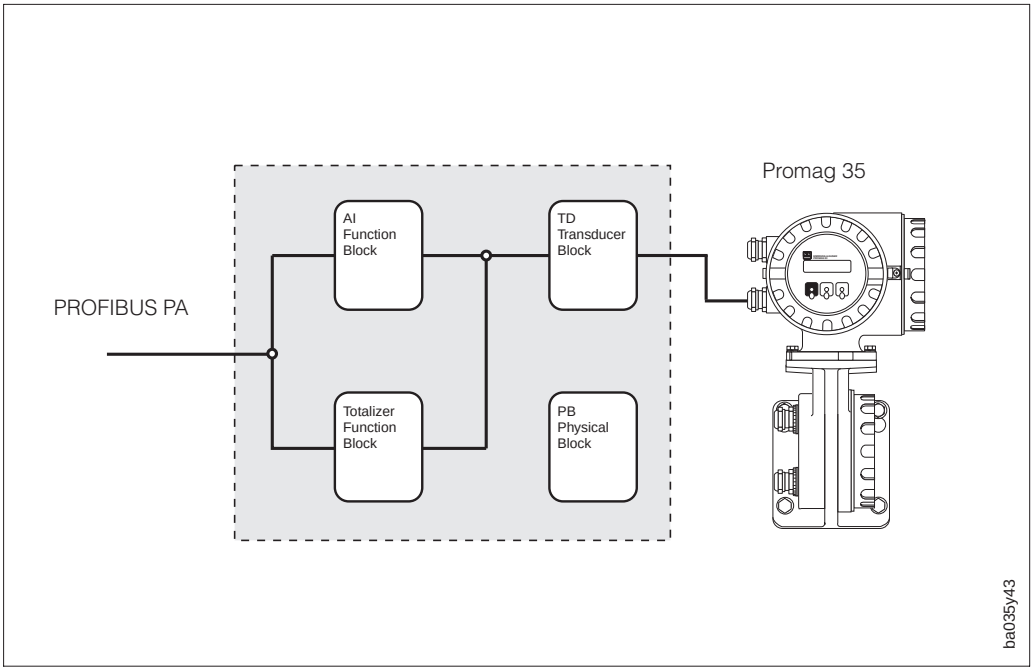


Fig. 32
Function block model of the Promag 35 PROFIBUS PA

8 Troubleshooting and Remedies

8.1 Response of the measuring system to faults or alarm

Error messages which occur while measuring is in progress are displayed in the HOME position alternately to the measured values. The Promag 35 S measuring system distinguishes between two kinds of error:

Type of error	Response of the measuring instrument
Fault (system error) Fault due to failure of the instrument	→ Corresponding message on the display → The signal outputs respond according to their error settings.
Alarm (process error) Fault due to factors influencing the process	→ Corresponding message on the display

Caution!
Note the following points when measured value suppression or simulation is active:


Caution!

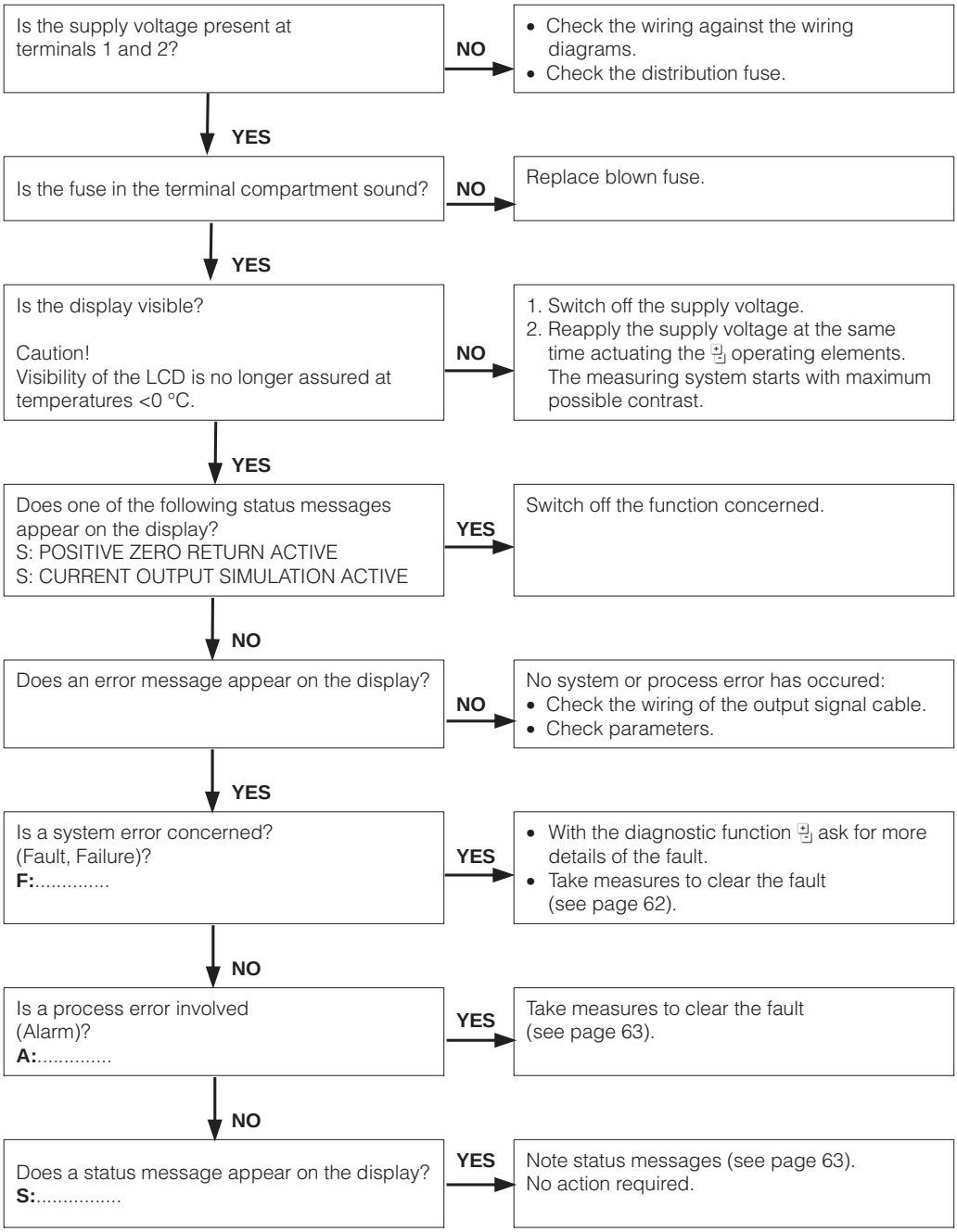
Measured value suppression
- This function has top priority. The appropriate status message “S: POSITIVE ZERO RETURN ACTIVE” is also displayed with priority in the HOME position. Any error messages which occur during this time can only be asked for and displayed with the aid of the diagnostic function.
- Measured value suppression sets all signal outputs to zero (corresponding to zero flow).

Simulation
- This function has second highest priority, likewise the corresponding status message. Any error messages which occur during this time can only be asked for and displayed with the aid of the diagnostic function.

8.2 Instructions for troubleshooting

During manufacture, all units undergo quality control at numerous stages. The last of these stages is wet calibration, carried out on a calibration rig conforming to the latest state of the art technology.

To help you locate faults, some of their possible causes are given here.



8.3 Diagnostic function for fault location

1: In the HOME position an error message is displayed alternately to the measured value (provided neither measured value suppression no simulation is active).

F	:		S	Y	S	T	E	M		E	R	R	O	R	
			P	O	W	E	R		S	U	P	P	L	Y	

2. Actuate diagnostic function (by pressing the ± keys simultaneously).
A change is automatically made to the function “PRESENT SYSTEM CONDITION”, in which all current error and status messages are listed.

By actuating the diagnostic function again additional information of the fault can be asked for in the event of a system fault (see page 62).
The stethoscope symbol appears on the display.

	:		L	O	W		V	O	L	T	A	G	E		
			D	E	T	E	C	T	E	D					

3. Ask for further faults with lower priority, if present.

4. Return to HOME position

8.4 Error and status messages

Diagnosis code	Error messages F:.... (system error, failure)	Cause (call up by ⊞)	Remedy
4	**F: SYSTEM ERROR POWER SUPPLY**	**LOW VOLTAGE DETECTED** The voltage from the power supply board is too low.	By E+H Service
5		**COIL CURRENT CONTROL** Coil current out of tolerance.	By E+H Service
7	**F: SYSTEM ERROR AMPLIFIER**	**EEPROM FAILURE** Error when accessing EEPROM data (adjusted values of the amplifier)	By E+H Service
6		**DAT FAILURE** Error when accessing DAT data (adjusted value of sensor).	Call your E+H Service
8		**ROM / RAM FAILURE** Error when accessing program memory (ROM) or main memory (RAM) of the processor.	By E+H Service
9		**GAIN ERROR AMPLIFIER** Gain error of the amplifier.	By E+H Service
10		**NO AMPLIFIER RESPONSE** Faulty data transmission between communication module and amplifier.	By E+H Service
17	**F: VALUE NOT ACCEPTED**	The value entered was not correctly accepted by the amplifier.	Repeat input
11	**F: SYSTEM ERROR COM-MODULE**	**MODULE NOT COMPATIBLE** Communication module and amplifier are not compatible	By E+H Service
12		**EEPROM FAILURE** Error when accessing EEPROM data (process and adjustment data of the communication module).	By E+H Service
13		**RAM ERROR** Error when accessing the main memory (RAM).	By E+H Service
14		**ROM ERROR** Error when accessing the program memory (ROM).	By E+H Service
15		**LOW VOLTAGE DETECTED** The voltage supplied by the DC/DC converter on the communication module is too low.	By E+H Service
16		**VOLTAGE REFERENCE** Voltage reference of the communication module is out of tolerance, i.e. correct functioning of the current output is not assured.	By E+H Service

Diagnosis code	Alarm messages A:.... (process errors)	Cause	Remedy
18	**A: EPD ADJUSTMENT VALUES MISSING**	EPD switched on. No adjustment has taken place.	Adjust EPD as descriped on page 45.
20	**A: EPD ADJUSTMENT FULL = EMPTY**	EPD switched on, but alarm given because adjustment values for full and empty pipe are identical.	Repeat adjustment as descriped on page 45.
21	**A: EPD ADJUSTMENT FULL <=> EMPTY**	EPD switched on, but alarm given because adjustment did not take place with full or empty pipe.	Repeat adjustment as descriped on page 45.
19	**A: EPD ADJUSTMENT NOT POSSIBLE**	EPD switched on, adjustment not possible because the conductivity of the medium is outside the permissible range (too high or too low).	EPD function cannot be used.
22	**A: EMPTY PIPE DETECTED**	The measuring pipe is not completely full or may be empty.	Check the process conditions of the installation.
23	**A: FLOW TOO HIGH**	Fluid velocity in flowmeter >12.5 m/s. Measuring range of transmitter electronics exceeded.	Reduce flow rate.
24	**A: CURRENT OUTP. TOO HIGH**	The actual flow rate is too high for the scaled full scale value (I_{max} = 25 mA).	Scale a higher full scale value (see page 37) or reduce flow rate.

Diagnosis code	Status messages S:....	Cause	Remedy
1	**S: POS. ZERO RET. ACTIVE**	Measured value suppression active. This message has top priority for Promag 35.	Unnecessary
2	**S: CURRENT OUTP. SIMUL. ACTIVE**	Current simulation active.	Unnecessary
27	**S: EPD ADJUSTMENT RUNNING**	EPD adjustment in progress (full or empty pipe adjustment).	Unnecessary

8.5 Replacing the fuse


Warning!

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

Use only the following types of fuses:

Approval	Voltage	Location	Dimensions	Nominal current/ Nominal voltage	Typ
Non Ex	180...260 V AC	Supply board	5.2 x 20 mm	1 A / 250 V	slow blow
CSA General Purpose Non Ex	85...130 V AC	Supply board	5.2 x 20 mm	1 A / 250 V	slow blow
Non Ex	24 V AC/DC	Supply board	5.2 x 20 mm	1 A / 250 V	slow blow

8.6 Repairs

If a Promag 35 S flowmeter is to be sent to Endress+Hauser for repair, then it must always be accompanied by a note containing the following information:
- Description of the application
- Description of the fault
- Description of the chemical and physical properties of the product being measured.


Caution!

Caution!
The following procedures must be carried out before a Promag 35 S flowmeter is sent for repair:
- Remove all residue which 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 first completely removing all dangerous material (e.g. penetrated into scratches or diffused though plastic parts).

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.

9 Dimensions and Weights

DN 15...200

Compact version

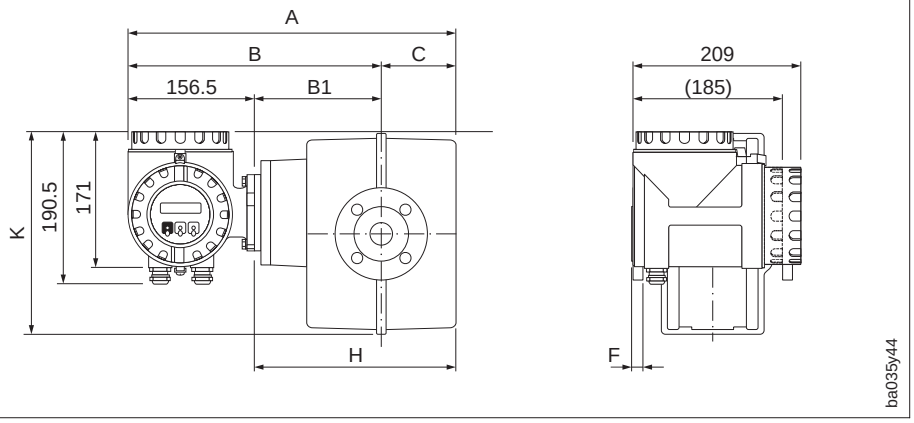


Fig. 33
Promag 35 S
Compact version
DN 15...200

Remote version (FS)

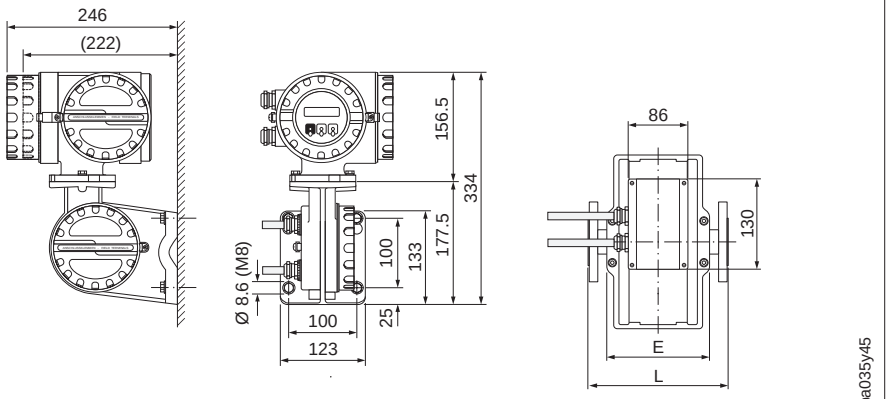


Fig. 34
Promag 35 S
Remote version
DN 15...200

DN		PN[1]			L		A	B	C	K	E		F			H	B1	Weight
[mm]	[inch]	DIN [bar]	ANSI Class	JIS	DIN/ANSI [mm]	JIS [mm]	[mm]	[mm]	[mm]	[mm]	PTFE [mm]	HG/WG [mm]	DIN [mm]	ANSI [mm]	JIS [mm]	[mm]	[mm]	[kg]
15	1/2"	40	150	–	156/152	–	361	291.5	69.5	200	94.2	–	14	12	–	194.5	125	6
25	1"	16	150	20K	202	228	409	315.5	93.5	247.6	121.2	120	14	15	20	242.5	149	8
32	–	16	150	20K	202	228	409	315.5	93.5	247.6	121.2	120	16	16	20	242.5	149	10
40	1 1/2"	16	150	20K	202	228	409	315.5	93.5	247.6	121.4	120	16	18	20	242.5	149	11
50	2"	16	150	10K	202	202	409	315.5	93.5	247.6	121.8	120	18	20	18	242.5	149	12
65	–	16	150	10K	272	272	451	336.5	114.5	308.6	165.9	164	18	23	18	284.5	170	25
80	3"	16	150	10K	272	272	451	336.5	114.5	308.6	166.8	164	20	24	20	284.5	170	26
100	4"	16	150	10K	272	272	451	336.5	114.5	308.6	167.2	164	22	24	22	284.5	170	27
125	–	16	150	10K	332	332	575.5	398.5	177	401.8	205.6	202	24	24	24	409	232	63
150	6"	16	150	10K	332	332	575.5	398.5	177	401.8	207.8	202	24	26	24	409	232	66
200	8"	10	150	10K	332	332	575.5	398.5	177	401.8	208.0	202	26	29	26	409	232	69

[1] Other pressure rates available as option, see page 17, 71
[2] Weights for sensor.

Weights Transmitter:

Compact version	3 kg
Remote version	5 kg (with wall mounted)

DN 250...600

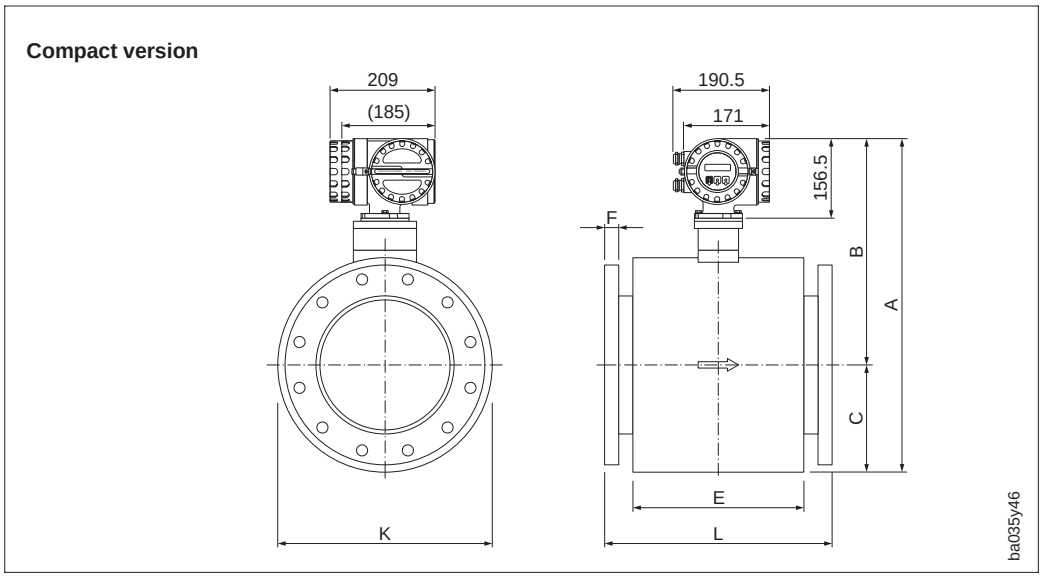


Fig. 35
Promag 35 S
Compact version
DN 250...600

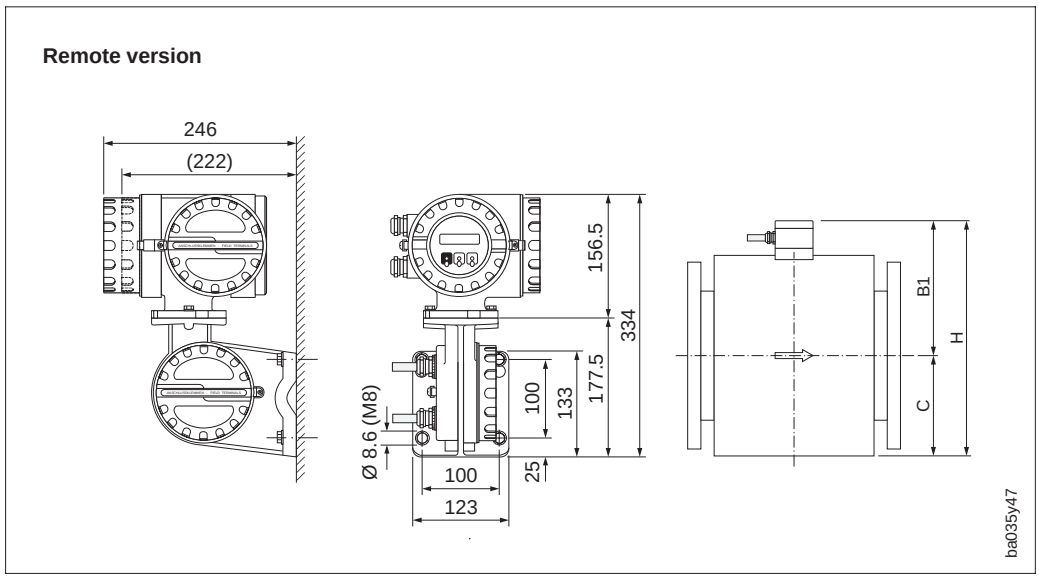


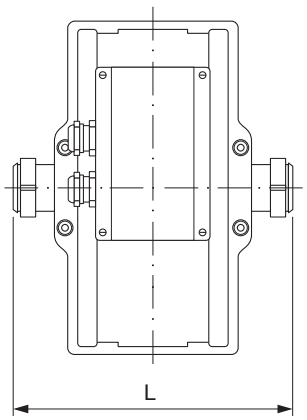
Fig. 36
Promag 35 S
Remote version
DN 250...600

DN		PN[1]			L		A	B	C	K	E		F			H	B1	Weight
[mm]	[inch]	DIN [bar]	ANSI Class	JIS	DIN/ANSI [mm]	JIS [mm]	[mm]	[mm]	[mm]	[mm]	PTFE [mm]	HG/WG [mm]	DIN [mm]	ANSI [mm]	JIS [mm]	[mm]	[mm]	[kg]
250	10"	10	150	–	450	–	658.5	446.5	212.0	424	338	338	28	30.5	–	497	285	73
300	12"	10	150	–	480	–	709.5	473.0	236.5	473	358	364	28	32	–	548	311.5	100
350	14"	10	150	–	530	–	773.5	505.5	268.0	536	404	410	30	35	–	612	344	125
400	16"	10	150	–	580	–	837.5	537.6	299.9	598	453	450	32	37	–	676	376.1	150
450	18"	10	150	–	690	–	870.5	554.5	316.0	632	531	528	32	42	–	709	393	180
500	20"	10	150	–	690/710	–	927.5	583.5	344.0	688	531	528	34	43	–	766	422	200
600	24"	10	150	–	820	–	1038.5	639.5	399.0	798	665	683	36	45	–	877	478	250

[1] Other pressure rates available as option, see page 17, 71
[2] Weights for sensor.

Weights Transmitter:
Compact version 3 kg
Remote version 5 kg (with wall mounted)

Pipe fittings according to DIN 11851 (milk coupling)



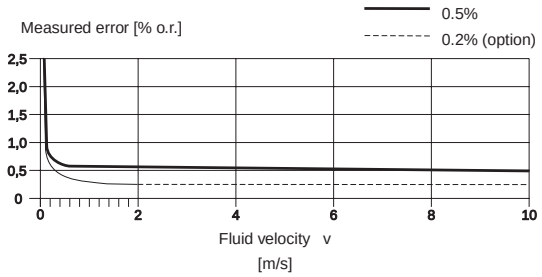
DN	PN	L [mm]
25...50	16	210
65...100	16	310

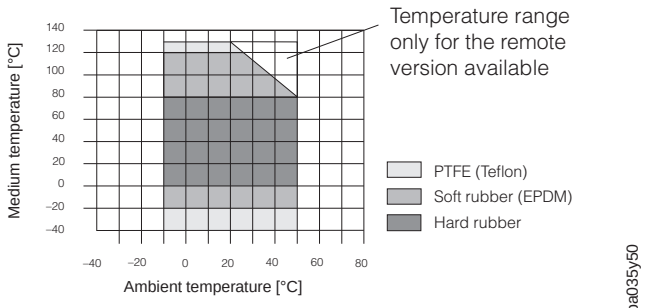
ba035y48

Fig. 37
Promag 35 S with milk coupling

10 Technical Data

Application	
Instrument name	Flow measuring system “Promag 35 S" PROFIBUS PA
Instrument function	Flow measurement of liquids in closed piping. Applications in measurement, control and regulation processes, for e.g. batching and dosing.
Function and system design	
Measuring principle	Electromagnetic flow measurement according to Faraday’s law (Generation of a voltage by induction in a magnetic field).
Measuring system	Instrument family “Promag 35 S" (PROFIBUS PA) consisting of: • Transmitter: Promag 35 • Sensor: Promag S (DN 15...600) Two versions are available: • Compact version (transmitter and sensor are one unit). • Remote version (FS version)
Input variables	
Measured variable	Flow velocity (proportional to induced voltage. Measured by two electrodes in the measuring pipe)
Measuring range	Measuring range electronics: v = 0...12.5 m/s Minimum full-scale value: < 0.01 m/s Maximum full-scale value: > 10.0 m/s
Electrical isolation	All circuits for inputs, power supply, and sensor are electrically isolated from each other.
Output variables	
Output signal	*PROFIBUS PA interface:* According EN 50 170 Volume 2, PROFIBUS Physical layer IEC 1158-2; galvanically isolated, PROFIBUS Profile Class B *Current output:* 0/4...20 mA, electrically insulated, R_L= max. 350 Ω, time constant selectable, full scale value selectable, temperature coefficient typical: 0.005% o.r./°C
Signal on alarm	PROFIBUS PA interface: Status and alarms according to Class B PROFIBUS profile. *Current output:* In case of an alarm the current output delivers the previous defined signal (see page 38).
Load	R_L = max. 350 Ω (current output)
Creep suppression	Selectable, the maximum creep quantity is dependent on the nominal diameter of the sensor and correspond to a medium velocity of v = 1 m/s (see page 44)
Electrical isolation	All circuits for inputs, power supply, and sensor are electrically isolated from each other.

Accuracy	
Reference conditions	According DIN 19200 and VDI/VDE 2641 Fluid temperature: +28 °C ±2 K Ambient temperature: +22 °C ±2 K Warm up period: 30 minutes Mounting: Inlet run > 10 x DN Outlet run > 5 x DN Transmitter and sensor are grounded. The sensor is build-in centered into the piping.
Measured error	*PROFIBUS PA interface:* ±0.5% o.r. ±0.01% o.f.s. (full scale value = 10 m/s) Additional measuring error of the current output: ±5 µA typical  ba035y49 *Option:* ±0.2% o.r. ±0.05% o.Q_k Q_k = desired reference flow quantity for calibration (v = 2...10 m/s). Q_k has to be noted for ordering Deviations in power supply voltage have no influence on the specified ranges.
Repeatability	±0.1% o.r. ±0.005% o.f.s.
Operating conditions	
Installation instructions	Orientation: vertical or horizontal Restrictions and other recommendations see page 13 ff
Inlet / and outlet sections	Inlet run: >3...5 x DN Outlet run: >2 x DN
Connection cable length for remote version	*FS version:* Cable length 0... 10 m → min. conductivity ≥ 1 µS/cm ≥ 20 µS/cm for demineralised and desalinised water Cable length 10...50 m → min. conductivity = f (L_{max}) *Instrument equiped with empty pipe detection (EPD):* max. cable length → 10 m see page 19

Operating conditions (continued)	
Ambient temperature range	Sensor: –10...+50 °C Transmitter: –20...+60 °C –20...+50 °C with 20...55 V AC; 16...62 V DC power supply board Depending on the fluid temperature, certain installation positions are to be observed to ensure that the permitted ambient temperature range for the transmitter is not exceeded. An all-weather cover should be used to protect the housing from direct sunlight when mounting in the open. This is especially important in warmer climates and with high ambient temperatures. Install the remote version if needed. 
Degree of protection	Sensor: IP 65 (EN 60529) NEMA 4X Transmitter: IP 67 (EN 60529) NEMA 4X Option Sensor: IP 67/IP 68 (EN 60529)
Shock and vibrational resistance	Tested according to EN 61010 and IEC 68-2-6 (complete measuring system)
Electromagnetic compatibility (EMC)	According to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as the NAMUR recommendations
Fluid conditions	
Fluid temperature/ Lining	Fluid temperature range depends on the sensor lining: –40...+ 130 °C (PTFE → Teflon) DN 15...600 –20...+ 120 °C (soft rubber → EPDM) DN 65...600 0...+ 80 °C (hard rubber) DN 65...600 on request: –40...65 °C for NR, PU
Nominal pressure	DIN PN 10 (DN 200...600) PN 16 (DN 25...150) PN 40 (DN 15) PN 25 (DN 200...600), optional PN 40 (DN 25...600), optional ANSI Class 150 ($^1/_2$...8") Class 150 (10...24"), optional Class 300 ($^1/_2$...24"), optional JIS 10K (DN 50...200) 20K (DN 25... 40) 20K (DN 50...200), optional
Fluid conductivity	Min. conductivity: ≥ 1 µS/cm ≥ 20 µS/cm for demineralised and desalinised water For remote version the minimum conductivity depends on the cable length between sensor and transmitter → see “Connection cable length”.
Pressure loss	No pressure loss, if sensor and piping have the same nominal diameter.
Mechanical construction	
Design / Dimensions	see page 65 - 67
Weight	see page 65 - 67

Mechanical construction (continued)	
Materials: *Transmitter housing*	Powder-coated die-cast aluminium
Sensor housing	Powder-coated die-cast aluminium (DN 15...200) Coated steel (DN 250...600)
Process connections	DIN → Stainless steel 1.4435 ; St. 37-2 ANSI → A 105 ; 316L JIS → S20C ; SUS 316 L
Electrodes	Platin/Rhodium 80/20; Hastelloy C-22; Tantal
Electrodes fitted	DN 15...600: Measuring, reference and empty pipe detection electrodes in Hastelloy C-22)
CIP cleanable	Yes (observe maximum temperature)
Cable entries	*Power supply and signal cable (outputs):* Cable glands PG 13.5 (5...12 mm) or $^1/_2$" NPT, M20 x 1.5 (8...15 mm), G $^1/_2$" A threads for cable glands. *Coil cable and signal cable (remote version)* Promag S Cable glands PG 11 (5...12 mm) or $^1/_2$" NPT, M20 x 1.5 (8...15 mm), G$^1/_2$" A threads for cable glands
Process connections	Flange connection (DIN, ANSI, JIS), Pipe fittings according to DIN 11851 (milk couplings) for DN 25...100
User interface	
Operation / Display	• On-site operation with three operating elements (Touch Control) for setting all instrument functions in the E+H programming matrix. • Operation via PROFIBUS PA • LC-display, illuminated, two lines (16 characters each) • Blind version without on-site operation and display.
Power supply	
Supply voltage / frequency	180...260 V AC, 45...65 Hz 85...130 V AC, 45...65 Hz 20... 55 V AC, 45...65 Hz 16... 62 V DC
Power consumption	AC: < 35 VA (incl. sensor) DC: < 35 W (incl. sensor)
Power supply failure	Bridges minimum one power cycle (22 ms at 50 Hz) EEPROM saves measuring system data on power failure (no batteries required).
Certificates and approvals	
CSA, General Purpose	For compact and remote version: 85...130 V AC
CE mark	By attaching the CE mark, Endress+Hauser confirms that the Promag 35 S measurement system has been successfully tested and fulfils all legal requirements of the relevant CE directives.
Order information	
Accessories	Local display for Promag 35
Supplementary documentation	Technical Information Promag 35 S (TI 035D/06/en) Technical Information PROFIBUS PA (TI 260F/00/en) System Information (SI 010D/06/en)
Other standards and guidelines	
EN 50170 Volume 2, PROFIBUS EN 60529 (IP protection classes) EN 61010 (Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures) EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 (interference immunity) NAMUR (Association of Standards for Control and Regulation in the Chemical Industry)	

Inside diameter of flowmeter

Sensor	DN		PN			Lining	
	[mm]	[inch]	DIN [bar]	ANSI [lbs]	JIS	PTFE (Teflon)	Hard rubber Soft rubber (EPDM)
Promag S	15	1/2"	40	Class 150	–	14.9	–
	25	1"	16	Class 150	20K	26.5	23.7
	32	–	16	Class 150	20K	35.2	32.4
	40	1 1/2"	16	Class 150	20K	40.9	37.3
	50	2"	16	Class 150	10K	51.3	48.1
	65	–	16	Class 150	10K	67.0	63.9
	80	3"	16	Class 150	10K	78.9	76.7
	100	4"	16	Class 150	10K	103.9	99.1
	125	–	16	Class 150	10K	128.9	124.5
	150	6"	16	Class 150	10K	154.1	151.9
	200	8"	10	Class 150	10K	204.7	202.7
	250	10"	10	Class 150		257.2	257.0
	300	12"	10	Class 150		306.7	307.9
	350	14"	10	Class 150		349.8	352.0
	400	16"	10	Class 150		387.4	390.4
	450	18"	10	Class 150		436.8	441.2
	500	20"	10	Class 150		485.0	492.0
	600	24"	10	Class 150		590.0	591.6

Resistance of the lining to vacuum (standard version)

Sensor	DN	DN	Measuring pipe lining	Limits for vacuum [mbar absolute] at different temperatures				
	[mm]	[inch]		25°C	80°C	100°C	120°C	130°C
Promag S	65...600	3...24"	Hard rubber	*	0	–	–	–
	25...600	1...24"	Soft rubber (EPDM)	*	0	*	0	–
	15...50	1/2...2"	PTFE (Teflon)	0	0	0	*	100
	65...80	3"		0	*	40	*	130
	100	4"		0	*	135	*	170
	125...150	6"		135	*	240	*	385
	200	8"		200	*	290	*	410
	250	10"		330	*	400	*	530
	300	12"		400	*	500	*	630
	350	14"		465	*	600	*	730
	400	16"		530	*	665	*	800
	450...600	18...24"		Vacuum not permitted!				
* no value available								

Pressure limitations

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

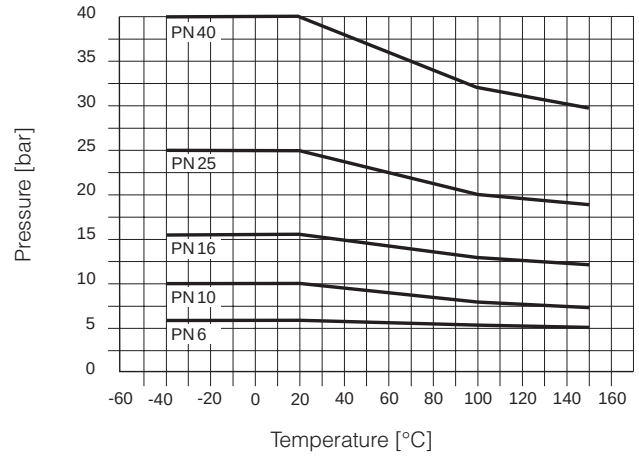


Fig. 38
Flange material steel 37.2

Pressure limitations due to fluid temperature (DIN 2413 and 2505)
Flange material: stainless steel 1.4435

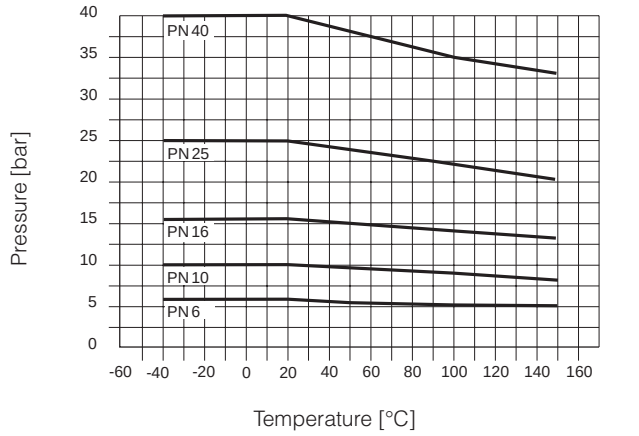


Fig. 39
Stainless steel 1.4435

Pressure limitations due to fluid temperature (ANSI B16.5)
Flange material: steel A 105

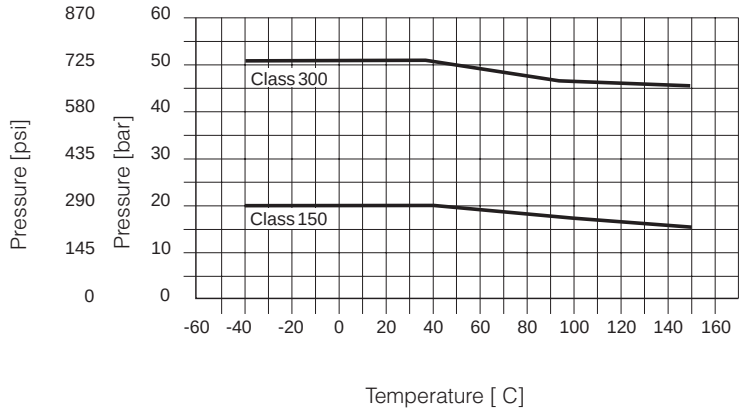


Fig. 40
Steel A 105

Pressure limitations (continued)

Pressure limitations due to fluid temperature (ANSI B16.5)
Flange material: steel 316L

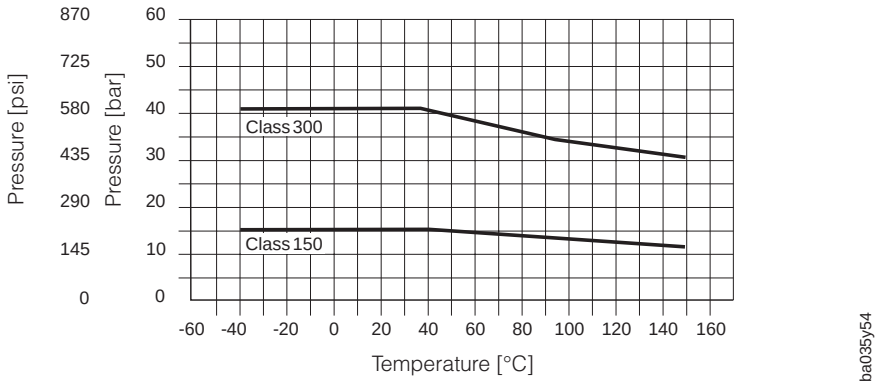


Fig. 41
Steel 316L

Nominal diameter and flow rate

The diameter of the pipe usually governs the nominal diameter of the sensor. The optimum flow velocity range is between v = 2...3 m/s (see table below). Furthermore, the flow velocity (v) has to be matched to the physical properties of the fluid:
- v <2 m/s: with abrasive media (potter's clay, lime milk, ore slurry)
- v >2 m/s: with media forming coating (waste water sludge, etc.)

If it is necessary to increase the flow velocity, this can be done by reducing the nominal diameter of the sensor (see page 15 "Adapters").

The table below shows the scalable minimum and maximum full scale values inclusive factory settings.

DN [mm]	**DN** [inch]	**Minimum full scale value** (Scaling at v ~ 0.3 m/s)	**Full scale value factory setting** (Scaling at v ~ 2.5 m/s)	**Maximum full scale value** (Scaling at v ~ 10 m/s)
15	1/2"	0.1909 m^3/h	1.5904 m^3/h	6.3617 m^3/h
25	1"	0.5310 m^3/h	4.4179 m^3/h	17.671 m^3/h
32	1 1/4"	0.8686 m^3/h	7.2382 m^3/h	28.953 m^3/h
40	1 1/2"	1.3572 m^3/h	11.310 m^3/h	45.239 m^3/h
50	2"	2.1206 m^3/h	17.671 m^3/h	70.686 m^3/h
65	2 1/2"	3.5838 m^3/h	29.865 m^3/h	119.46 m^3/h
80	3"	5.4287 m^3/h	45.239 m^3/h	180.96 m^3/h
100	4"	8.4823 m^3/h	70.686 m^3/h	282.74 m^3/h
125	5"	13.254 m^3/h	110.45 m^3/h	441.79 m^3/h
150	6"	19.085 m^3/h	159.04 m^3/h	636.17 m^3/h
200	8"	33.929 m^3/h	282.74 m^3/h	1131.0 m^3/h
250	10"	53.014 m^3/h	441.79 m^3/h	1767.1 m^3/h
300	12"	76.341 m^3/h	636.17 m^3/h	2544.7 m^3/h
350	14"	103.91 m^3/h	865.90 m^3/h	3463.6 m^3/h
400	16"	135.72 m^3/h	1131.0 m^3/h	4523.9 m^3/h
450	18"	171.77 m^3/h	1431.4 m^3/h	5725.6 m^3/h
500	20"	212.06 m^3/h	1767.1 m^3/h	7068.6 m^3/h
600	24"	305.36 m^3/h	2544.7 m^3/h	10179 m^3/h

Index

Europe

Austria
❏ Endress+Hauser Ges.m.b.H.
Wien
Tel. (01) 88056-0, Fax (01) 88056-35

Belarus
Belorgsintez
Minsk
Tel. (0172) 263166, Fax (0172) 263111

Belgium / Luxembourg
❏ Endress+Hauser S.A./N.V.
Brussels
Tel. (02) 2480600, Fax (02) 2480553

Bulgaria
INTERTECH-AUTOMATION
Sofia
Tel. (02) 652809, Fax (02) 652809

Croatia
❏ Endress+Hauser GmbH+Co.
Zagreb
Tel. (01) 6601418, Fax (01) 6601418

Cyprus
I+G Electrical Services Co. Ltd.
Nicosia
Tel. (02) 484788, Fax (02) 484690

Czech Republic
❏ Endress+Hauser GmbH+Co.
Ostrava
Tel. (069) 6611948, Fax (069) 6612869

Denmark
❏ Endress+Hauser A/S
Søborg
Tel. (31) 673122, Fax (31) 673045

Estonia
Elvi-Aqua-Teh
Tartu
Tel. (07) 422726, Fax (07) 422727

Finland
❏ Endress+Hauser Oy
Espoo
Tel. (90) 85961 55, Fax (90) 8596055

France
❏ Endress+Hauser
Huningue
Tel. 389696768, Fax 389694802

Germany
❏ Endress+Hauser Messtechnik GmbH+Co.
Weil am Rhein
Tel. (07621) 975-01, Fax (07621) 975-555

Great Britain
❏ Endress+Hauser Ltd.
Manchester
Tel. (0161) 2865000, Fax (0161) 9981841

Greece
I & G Building Services Automation S.A.
Athens
Tel. (01) 9241500, Fax (01) 9221714

Hungary
Mile Ipari-Elektro
Budapest
Tel. (01) 2615535, Fax (01) 2615535

Iceland
Vatnshreinsun HF
Reykjavik
Tel. (00354) 889616, Fax (00354) 889613

Ireland
Flomeaco Company Ltd.
Kildare
Tel. (045) 868615, Fax (045) 868182

Italy
❏ Endress+Hauser Italia S.p.A.
Cernusco s/N Milano
Tel. (02) 92106421, Fax (02) 92107153

Latvia
Raita Ltd.
Riga
Tel. (02) 264023, Fax (02) 264193

Lithuania
Agava Ltd.
Kaunas
Tel. (07) 202410, Fax (07) 207414

Netherlands
❏ Endress+Hauser B.V.
Naarden
Tel. (035) 6958611, Fax (035) 6958825

Norway
❏ Endress+Hauser A/S
Tranby
Tel. (032) 851085, Fax (032) 851112

Poland
❏ Endress+Hauser Polska Sp. z o.o.
Warsaw
Tel. (022) 6510174, Fax (022) 6510178

Portugal
Tecnisis - Tecnica de Sistemas Industriais
Linda-a-Velha
Tel. (01) 4172637, Fax (1) 4185278

Romania
Romconseng SRL
Bucharest
Tel. (01) 4101634, Fax (01) 4101634

Russia
Avtomatika-Sever Ltd.
St. Petersburg
Tel. (0812) 5561321, Fax (0812) 5561321

Slovak Republic
Transcom Technik s.r.o.
Bratislava
Tel. (07) 52131 61, Fax (07) 5213181

Slovenia
❏ Endress+Hauser D.O.O.
Ljubljana
Tel. (061) 1592217, Fax (061) 1592298

Spain
❏ Endress+Hauser S.A.
Barcelona
Tel. (3) 4803366, Fax (3) 4733839

Sweden
❏ Endress+Hauser AB
Sollentuna
Tel. (08) 6261600, Fax (08) 6269477

Switzerland
❏ Endress+Hauser AG
Reinach/BL 1
Tel. (061) 7156222, Fax (061) 7111650

Turkey
Intek Endüstriyel Ölcü ve Kontrol Sistemleri
Istanbul
Tel. (0212) 2751355, Fax (0212) 2662775

Ukraine
Industria Ukraïna
Kiev
Tel. (044) 2685213, Fax (044) 2685213

Africa

Morocco
Oussama S.A.
Casablanca
Tel. (02) 241338, Fax (02) 402657

South Africa
❏ Endress+Hauser Pty. Ltd.
Sandton
Tel. (11) 4441386, Fax (11) 4441977

Tunisia
Controle, Maintenance et Regulation
Tunis
Tel. (01) 793077, Fax (01) 788595

America

Argentina
Servotron SACIFI
Buenos Aires
Tel. (01) 7021122, Fax (01) 3340104

Bolivia
Tritec S.R.L.
Cochabamba
Tel. (042) 56993, Fax (042) 50981

Brazil
Servotek
Sao Paulo
Tel. (01) 5363455, Fax (011) 5363067

Canada
❏ Endress+Hauser Ltd.
Burlington, Ontario
Tel. (905) 6819292, Fax (905) 6819444

Chile
DIN Instrumentos Ltda.
Santiago
Tel. (02) 2050100, Fax (02) 2258139

Colombia
Colsein Ltd.
Santafe de Bogota D.C.
Tel. (01) 2367659, Fax (01) 6107868

Costa Rica
EURO-TEC S.A.
San Jose
Tel.(0506) 296154 2, Fax(0506) 2961542

Ecuador
Insetec Cia. Ltda.
Quito
Tel. (02) 461833, Fax (02) 461833

Guatemala
ACISA Automatiziacion Y Control
Ciudad de Guatemala, C.A.
Tel. (02) 334 5985, Fax (02) 332 7431

Mexico
Endress+Hauser Instruments International
Mexico City Office, Mexico D.F.
Tel. (05) 568 9658, Fax (05) 568 4183

Paraguay
INCOEL S.R.L.
Asuncion
Tel. (021) 203465, Fax (021) 26583

Peru
Esim S.A.
Lima
Tel. (01) 4714661, Fax (01) 4710993

Uruguay
Circular S.A.
Montevideo
Tel. (02) 925785, Fax (02) 929151

USA
❏ Endress+Hauser Inc.
Greenwood, Indiana
Tel. (0317) 535-7138, Fax (0317) 535-1489

Venezuela
H. Z. Instrumentos C.A.
Caracas
Tel. (02) 9798813, Fax (02) 9799608

Asia

China
❏ Endress+Hauser Shanghai
Tel. (021) 64646700, Fax (021) 64747860

Hong Kong
❏ Endress+Hauser (H.K.) Ltd.
Hong Kong Tel.(0852) 25283120,
Fax (0852) 28654171

India
❏ Endress+Hauser India Branch Office
Mumbai
Tel. (022) 6045578, Fax (022) 6040211

Indonesia
PT Grama Bazita
Jakarta
Tel. (021) 7975083, Fax (021) 7975089

Japan
❏ Sakura Endress Co., Ltd.
Tokyo
Tel. (422) 540611, Fax (422) 550275

Malaysia
❏ Endress+Hauser (M) Sdn. Bhd.
Petaling Jaya, Selangor Darul Ehsan
Tel. (3) 733 4848, Fax 03) 7338800

Pakistan
Speedy Automation
Karachi
Tel. (021) 772 2953, Fax (021)773 6884

Philippines
Brenton Industries Inc.
Makati Metro Manila
Tel. (2) 8430661, Fax (2) 8175739

Singapore
❏ Endress+Hauser (S.E.A.) Pte., Ltd.
Singapore
Tel. (065) 5668222, Fax (065) 5666848

South Korea
Hitrol Co. Ltd.
Bucheon City
Tel. (032) 672 3131, Fax (032) 6720090

Taiwan
Kingjarl Corporation
Taipei R.O.C.
Tel. (02) 7183938, Fax (02) 7134190

Thailand
❏ Endress+Hauser Ltd.
Bangkok
Tel. (02) 996 7811-20, Fax (02) 996 7810

Vietnam
Tan Viet Bao Co. Ltd.
Ho Chi Minh City
Tel. (08) 8335225, Fax (08) 8335227

Iran
Telephone Technical Services Co. Ltd.
Tehran
Tel. (021) 874675054, Fax (021) 873 7295

Israel
Instrumetrics Industrial Control Ltd.
Tel-Aviv
Tel. (03) 6480205, Fax (03) 6471992

Jordan
A.P. Parpas Engineering S.A.
Amman
Tel. (06) 559283, Fax (06) 559205

Kingdom of Saudi Arabia
Anasia
Jeddah
Tel. (03) 6710014, Fax (03) 6725929

Kuwait
Kuwait Maritime & Mercantile Co. K.S.C.
Safat
Tel. (05) 2434752, Fax (05)2441486

Lebanon
Network Engineering Co.
Jbeil
Tel. (01) 325405 1, Fax (01) 994080

Sultanate of Oman
Mustafa & Jawad Sience & Industry Co.
L.L.C.
Ruwi
Tel. (08)602009, Fax (08) 607066

United Arab Emirates
Descon Trading EST.
Dubai
Tel. (04) 359522, Fax (04) 359617

Yemen
Yemen Company for Ghee and Soap Industry
Taiz
Tel. (04) 230665, Fax (04) 212338

Australia + New Zealand

Australia
GEC Alsthom LTD.
Sydney
Tel. (02) 6450777, Fax (02) 9645081 8

New Zealand
EMC Industrial Instrumentation
Auckland
Tel. (09) 4449229, Fax (09) 4441145

All other countries

❏ Endress+Hauser GmbH+Co.
Instruments International
Weil am Rhein, Germany
Tel. (07621) 975-02, Fax (07621) 975345

Endress+Hauser

❏ Members of the Endress+Hauser Group

12. 97/E+H II