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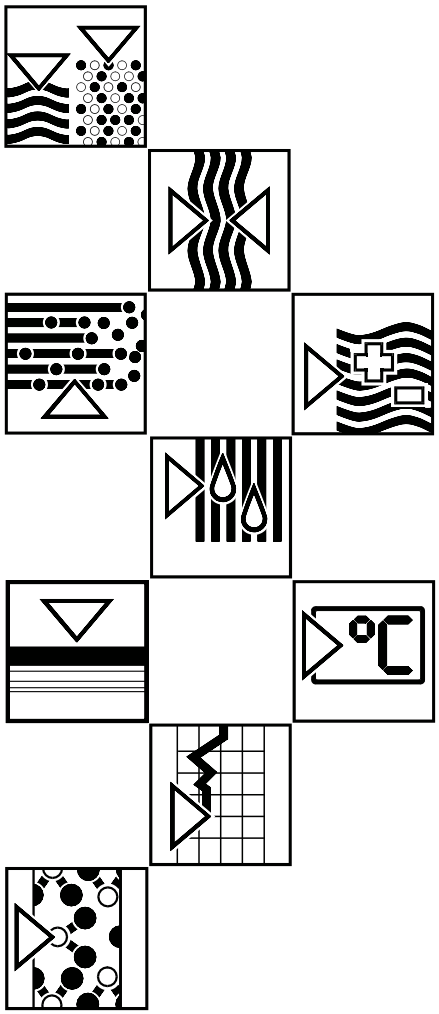
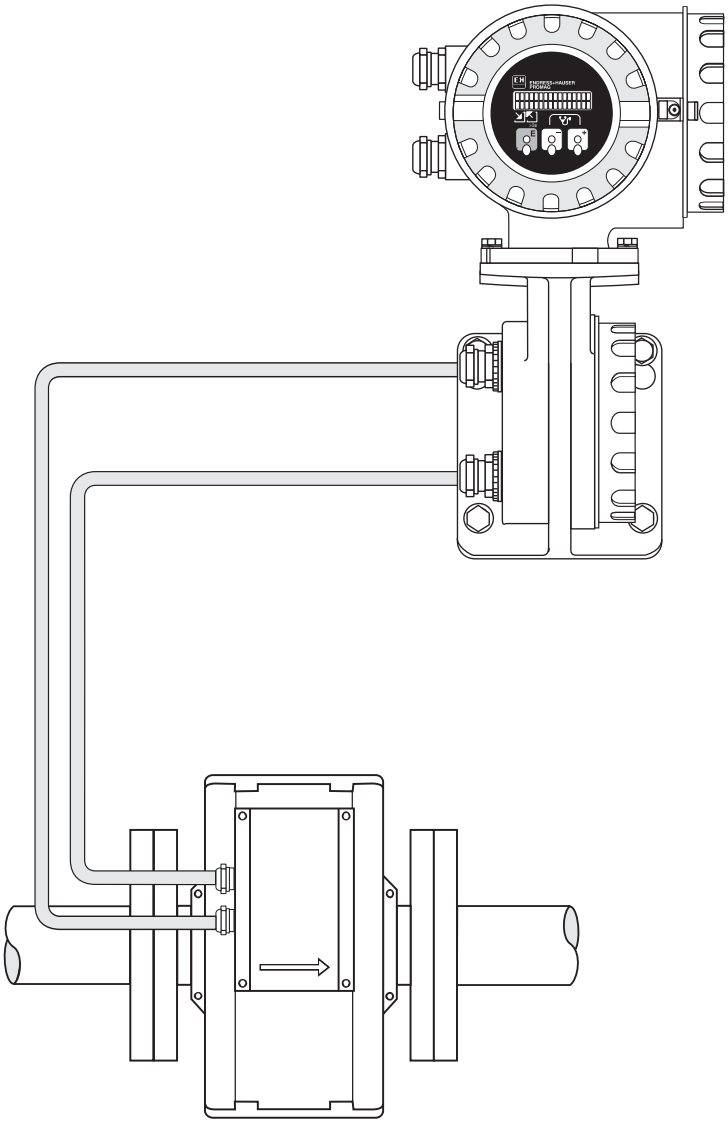
No. 50075366

Valid from software version
V3.01.XX (measuring amplifier)
V2.04.XX (communication)

promag 35
Electromagnetic Flow Measuring System

Operating Manual





Endress+Hauser

Nothing beats know-how

Safety Instructions

Please observe without fail the safety instructions in Chapter 1 (page 5).

Contents

1 General Safety Instructions

1.1 Correct usage

- The Promag 35 S flow meter 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 works in an operationally perfectly safe condition. The devices were developed according to EN 61010, ANSI/ISA-S 82.01 and CAN/CSA-C22.2 No.1010.1 “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.

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.

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

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 authorized by the operator of the facility. Personnel must absolutely and without fail read and understand this Operating Manual before carrying out its instructions.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed without fail.
- With special fluids, 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 connecting housing cover is unscrewed.

- During operation the instrument must not be cleaned.
- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.

1.4 Repairs, dangerous products

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 to us 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 Fields of application

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 solid content, high abrasiveness, and a highly inhomogeneous distribution of additives and chemicals.
Any fluids with a minimum conductivity of 1 µS/cm may be measured.
For difficult-to-measure media, Promag 35 S is mainly used for the following applications:

the paper and pulp industry	• pulp with up to 15% solids contents • cellulose • additives/chemicals
the mining industry	• ore slurries • coal washings
the building materials industry	• cement, concrete, pastes
the food industry	• yoghurt with pieces of fruit • fruit mash
the sewage industry	• slurries of up to 30% dry solids

2.2 Principle of measurement

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

$U_e = B \cdot L \cdot v$
$Q = v \cdot A$
U_e = inducted voltage
B = magnetic induction (magnetic field)
L = distance between electrodes
v = flow rate
Q = volume flow
A = pipe cross-section

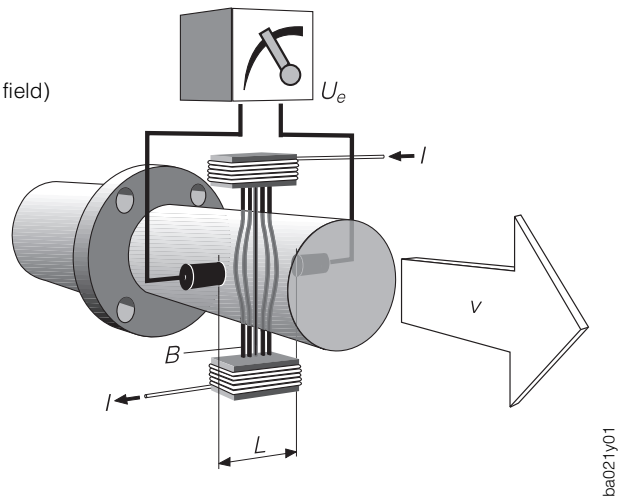


Fig. 1

2.3 The 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 supplemented.

The following illustration is a synopsis of the entire Promag 35 S measuring system.

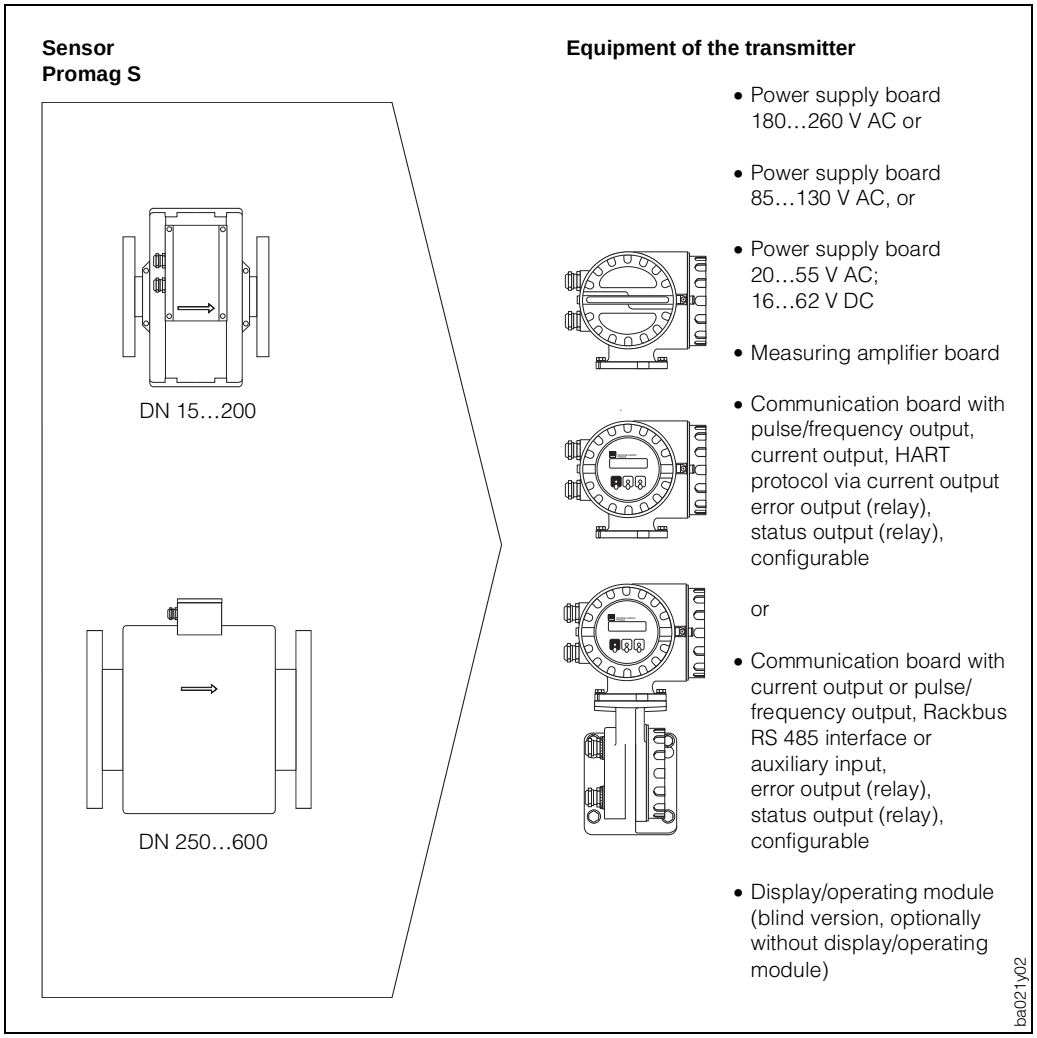


Fig. 2

Note!
For standard applications, the cost-effective Promag 30 version is available with microswitch operation or the convenient Promag 33 version with the E+H matrix operation mode.

Note

All information on these measuring systems are available from your E+H representant.

2.4 A brief description of the measuring system

The measuring system consists of:
- Promag 35 transmitter and
- Promag S sensor

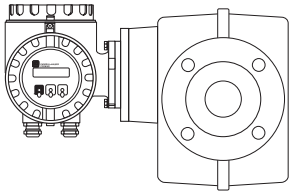
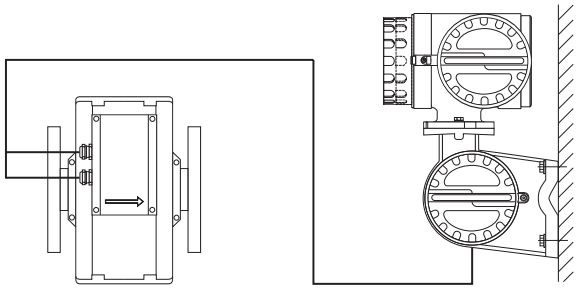
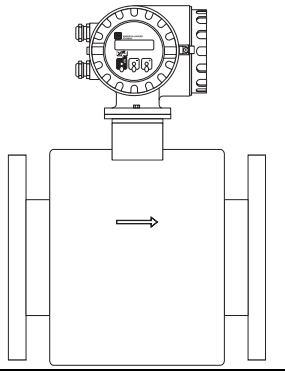
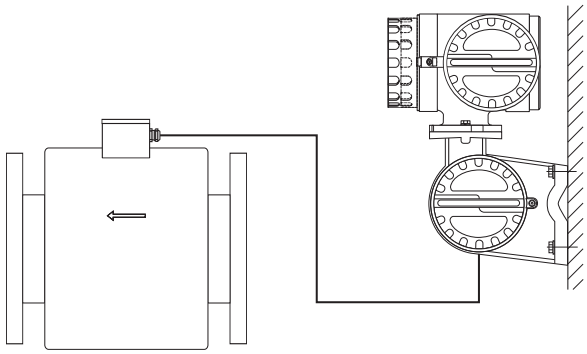
Compact version	**Remote version**
The transmitter Promag 35 and the sensor Promag S are a mechanical unit	The transmitter is mounted remote from the sensor: • up to 10 m distance: medium conductivity min. 1 µS/cm • from 10…50 m distance: max. cable length in terms of the medium conductivity (1…50 µS/cm) • the electrical connection between transmitter and sensor is made in the connection housing. The wall mounting for the transmitter allows you to mount the device either on the wall or on a support and is an integral part of the connecting housing.
Promag 35 S (DN 15…200)  ba021y91	Promag S Promag 35  ba021y93
Promag 35 S (DN 250…600)  ba021y92	Promag S Promag 35  ba021y94

Fig. 3

Design of the Promag 35 S measuring system

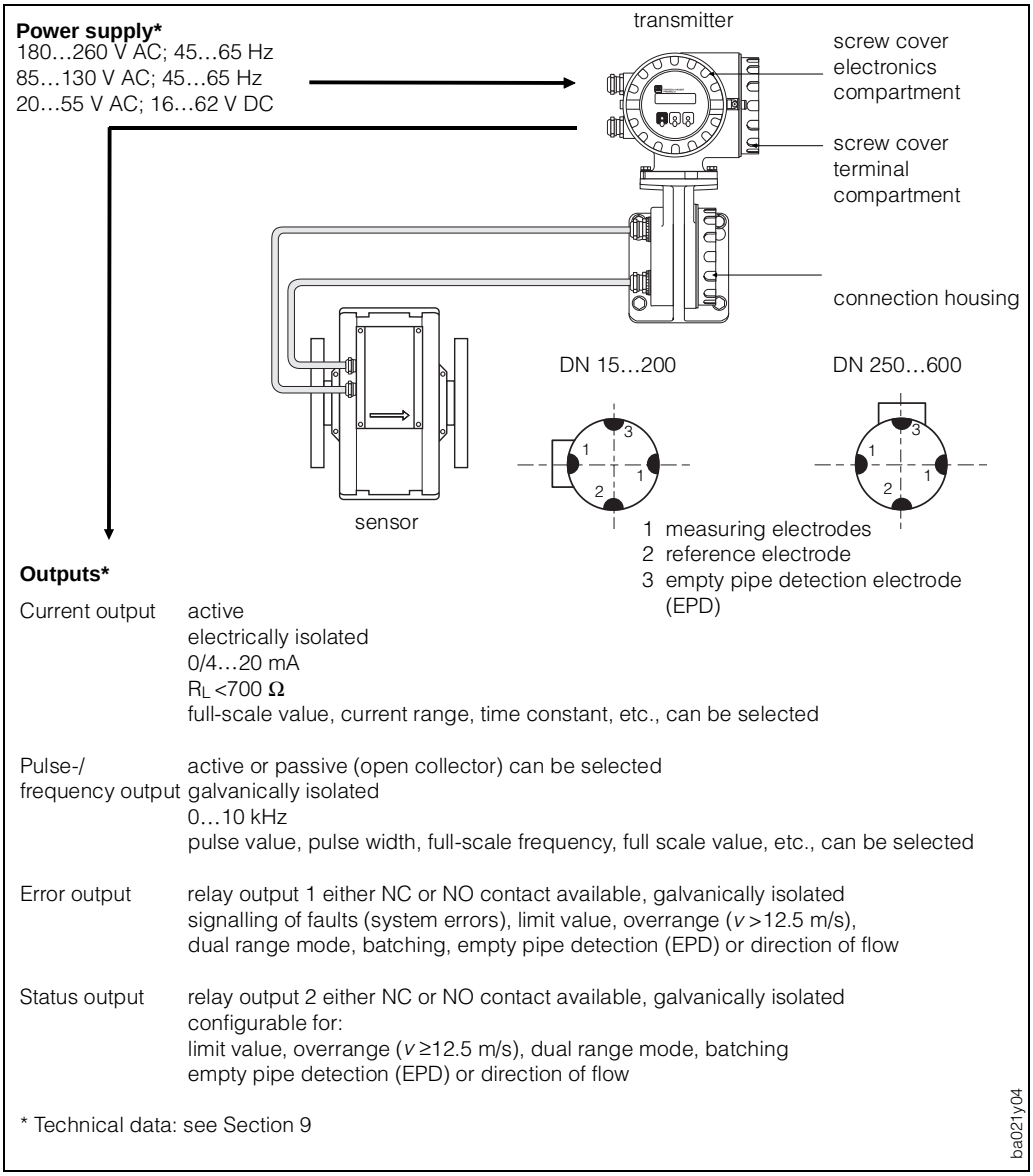


Fig. 4

Operation

The Promag 35 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 totaliser
- functions of the pulse/frequency output
- relay functions
- limit values
- batching function with integrated pre-selection counter
- display parameters
- creep suppression
- empty pipe detection (EPD)

Twelve languages may be selected for the display text. During calibration, the auxiliary function (diagnosis) is available.

Dynamic response
The Promag 35 measuring amplifier shows a very high dynamic response of more than 1000 :1. It measures at medium velocities from 0 m/s to more than 10 m/s at the specified accuracy. If the flow is pulsating, the amplifier is not overloaded even above the pre-set end value if velocities up to 12.5 m/s. Thus, there is no falsification of the measured value, provided that outputs are not overloaded.

Operational safety
- A comprehensive self-monitoring facility of the measuring system assures high safety. 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 a separate error output.
- Corresponding error messages also appear on the transmitter display. Any errors present can be systematically scanned and their cause determined by means of the diagnostic function.
- In the event of a power supply failure, all data in the measuring system are safely stored in the EEPROM (no batteries required).
- In addition, the Promag 35 S measuring system complies with safety requirements according to EN 61010 and with the requirements for general electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2, as well as the respective NAMUR recommendations.

Data memory (DAT)
The DAT is an exchangeable memory module. Stored in it are all characteristic data of the sensor, such as calibration factors, nominal diameter, sampling rate, software 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

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 protection IP 65:

- Housing gaskets must be clean and undamaged when inserted into the gasket groove. The gaskets may need to be dried, cleaned or replaced.
- All housing screws and the housing cover must be firmly tightened.
- The cables used for connecting must have the correct outer diameter (see page 96, 101).
- The cable gland must be firmly tightened (see Fig. 5).
- The cable must loop down before entering the cable gland to ensure that no moisture can enter it (see Fig. 5).
- Any cable gland not used must be replaced with a blind plug.
- The protective bushing should not be removed from the cable gland.

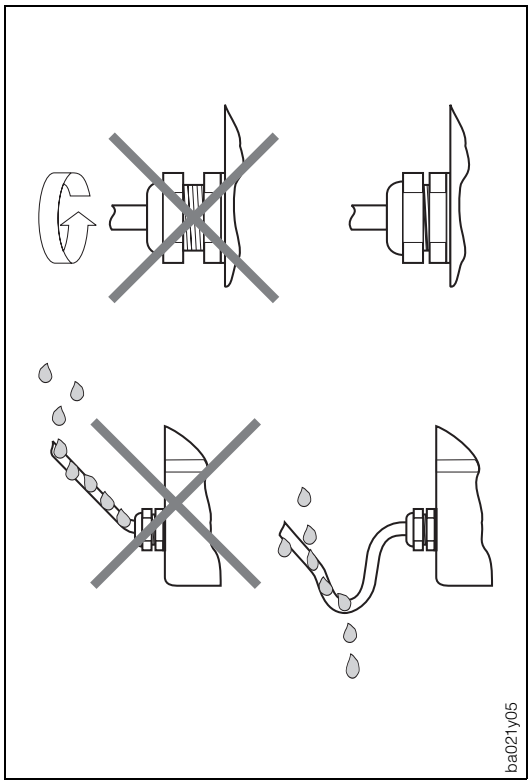


Fig. 5

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

Note!
The Promag S sensors can optionally be supplied with protection types IP 67 and IP 68 (permanently under water up to a depth of 3 m). As a rule, the transmitter is supplied with IP 67.

Temperature ranges
The maximum approved ambient and product temperatures must be observed (see page 96, 98). An all-weather cover should be used to protect from direct sunlight when mounting in the open.

3.2 Transport instructions for Promag from >DN 200/8"

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

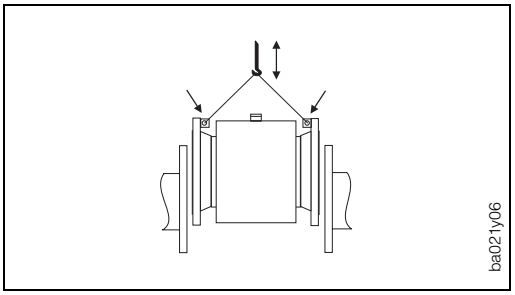


Fig. 6

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").

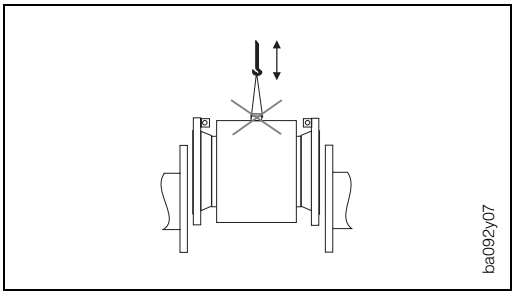


Fig. 7

The sensor must not be lifted by the transmitter housing.

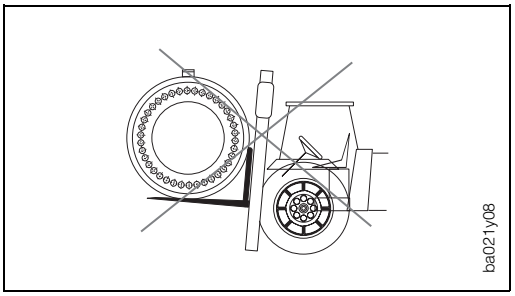


Fig. 8

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.

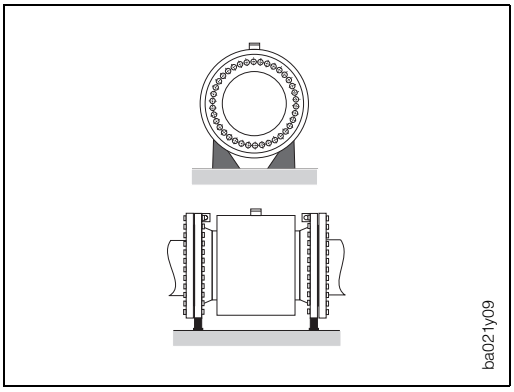


Fig. 9

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

Note

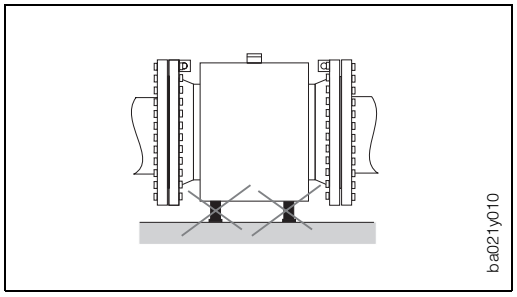


Fig. 10

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 (sensor)

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 best, with the flow direction upwards. Entrained solids sink, and fatty components in the stationary medium rise away from the measuring electrodes.

In case of a 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.

Position of the electrode axis
The position of the electrode axis is based on the nominal diameter and has to be respected.

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

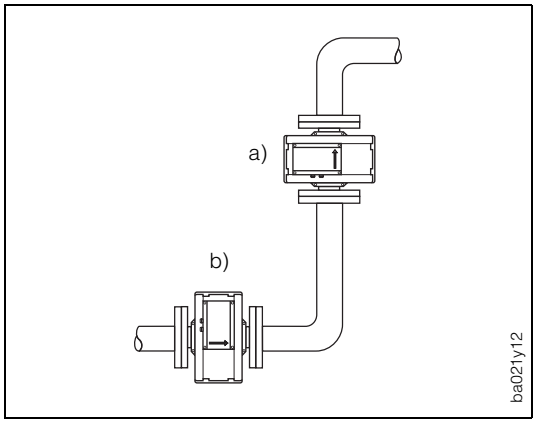


Fig. 11

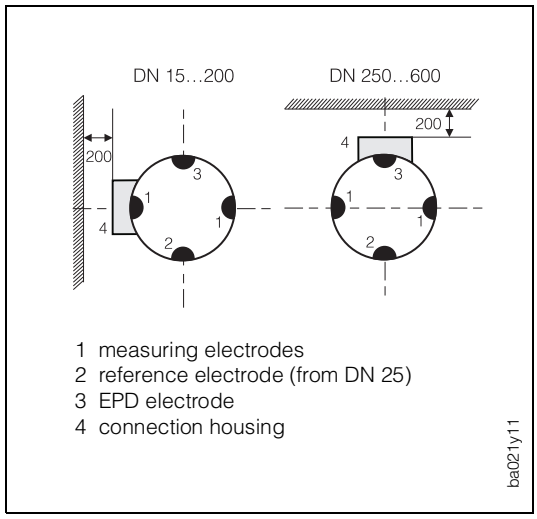


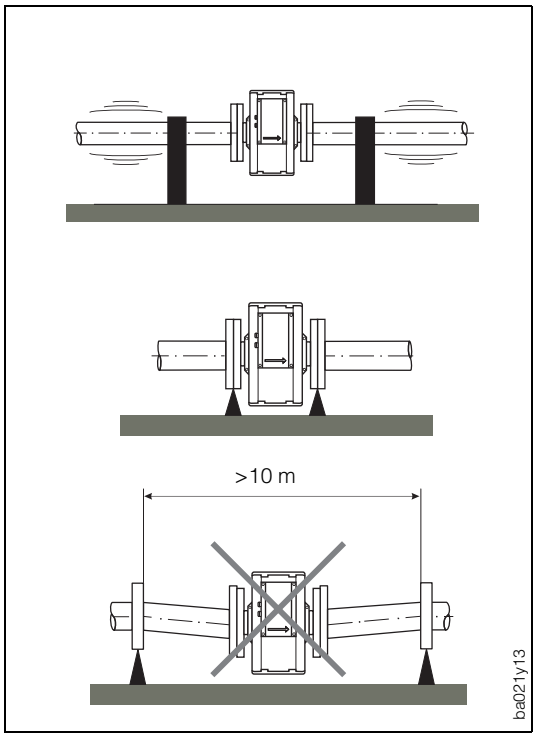
Fig. 12

Vibration

- Secure the piping upstream and downstream of the sensor.

  Caution!
  Excessive vibration necessitates separate mounting of the sensor and transmitter (see Section 3.6).

- Mechanical supports are recommended for free runs of piping of more than 10 m.



Caution

Fig. 13

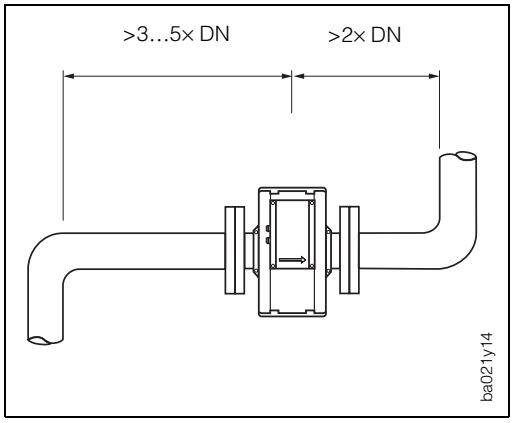


Fig. 14

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

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

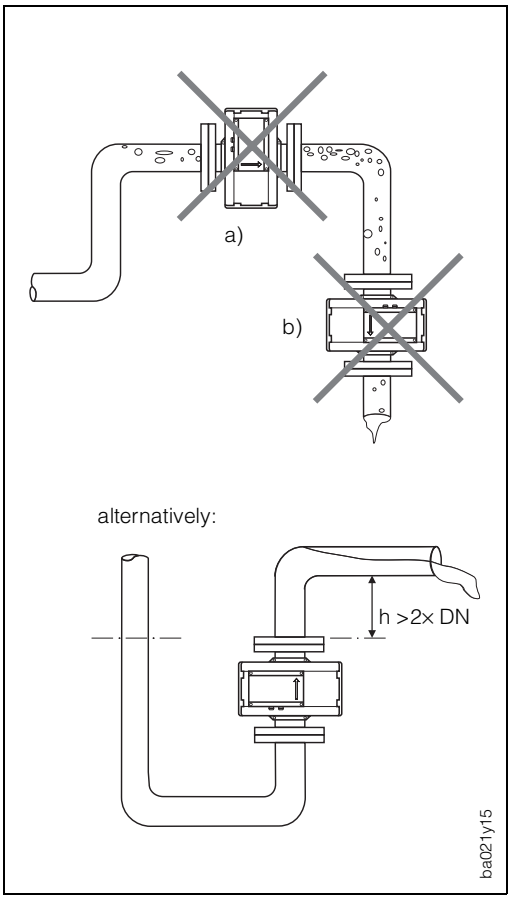


Fig. 15

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 in front of an open pipe outlet in a downward line. The alternative suggestion, however, permits such a location.

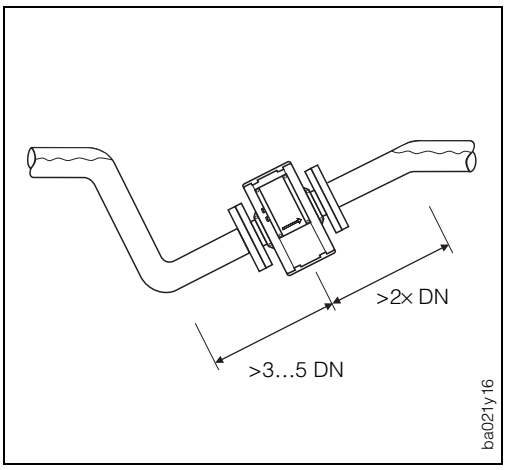


Fig. 16

Note

Partially 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).

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

Downward pipe
With the installation suggested opposite, no partial vacuum is created with such a downward pipe >5 m (siphon, vent valve downstream of the sensor).

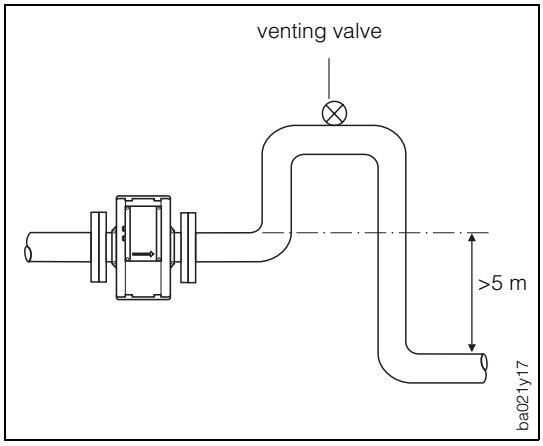


Fig. 17

Installation of pumps
Do not mount the sensors on the suction side of pumps. There is a risk of vacuum! Information on the vacuum resistance of the measuring pipe lining to be found on page 97.

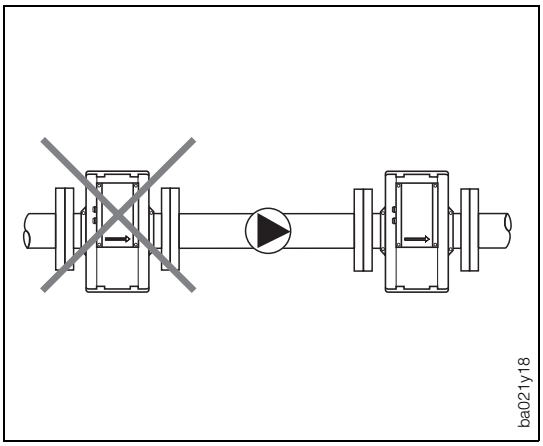


Fig. 18

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

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

Procedure:
1. Determine the ratio of the diameters d/D
2. From the nomogram read off the pressure loss at a specific flow rate and d/D ratio.

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

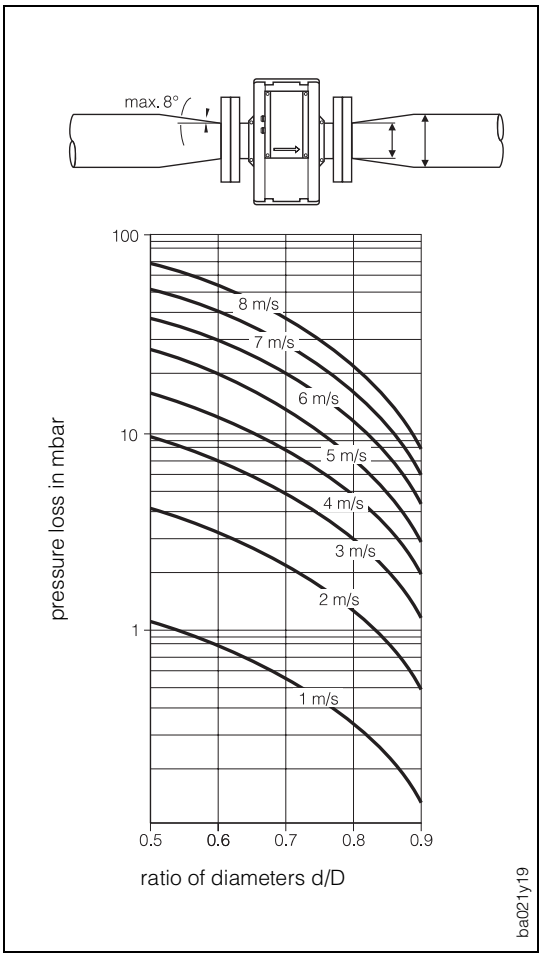


Fig. 19

Note

3.4 Mounting Promag S (sensor)

Lengths and dimensions
See Section 9.1 “Dimensions and Weights”.

Mounting
The sensor is mounted between the flanges of the pipe. Since the lining of the measuring pipe covers the sensor flange, it also functions as a seal.

Caution

Caution!
The Teflon-lined (PTFE) measuring pipe of the Promag S is fitted with protective disks to guard the lining which is turned over the flanges. These disks may only be removed immediately before mounting the sensor. Make sure that the lining on the flange is not damaged or removed (these disks must remain in position during storage).

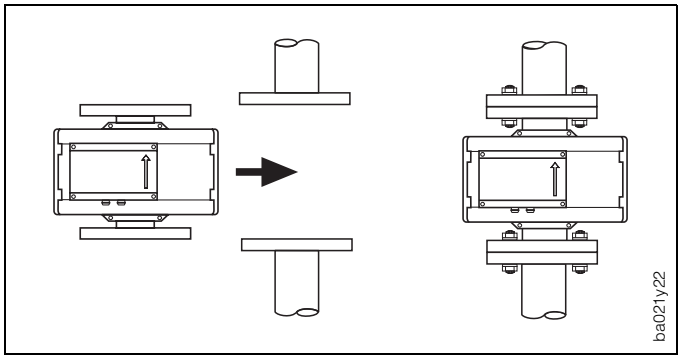


Fig. 20

DN		Pressure				Screws	Max. tightening torque [Nm]		
[mm]	[inch]	DIN [bar]	ANSI [lbs]	AWWA	JIS		Hard rubber	Soft rubber (EPDM)	Teflon (PTFE)
15	½"	40			–	4×M 12	–	–	15
25	1"		Class	–	20K	4×M 12	25	5	33
32	–	16	150		20K	4×M 16	40	8	53
40	1½"				20K	4×M 16	50	11	67
50	2"				10K	4×M 16	64	15	84
65	–				10K	4×M 16	87	22	114
80	3"				10K	8×M 16	53	14	70
100	4"	16	Class		10K	8×M 16	65	22	85
125	–		150		10K	8×M 16	80	30	103
150	6"				10K	8×M 20	110	48	140
200	8"				10K	12×M 20	108	53	137
250	10"	10	Class	–	–	12×M 20	104	29	139
300	12"		150		–	12×M 20	119	39	159
350	14"					16×M 20	141	39	188
400	16"					16×M 24	192	60	255
–	18"		Class	–	–	20×M 24	170	58	227
500	20"	10	150			20×M 24	197	70	262
600	24"					20×M 27	261	108	348

Screw-tightening torques
- The listed tightening torques apply to greased threads.
- Screws tightened too tightly warp the sealing surface (this particulary applies to soft rubber).

Gaskets
- For soft rubber/Teflon lining (PTFE) applications, a flange gasket can be dispensed with.
- For soft rubber lining applications, the mating flange should have a thin film of non-conductive sealing grease applied.
- Use a gasket conforming to DIN 2690.

Caution

Caution!
Do not use sealing material which is electrically conductive, such as e.g. graphite. This could result in an electrically conductive layer forming on the inside of the measuring pipe and short-circuit the measuring signal.

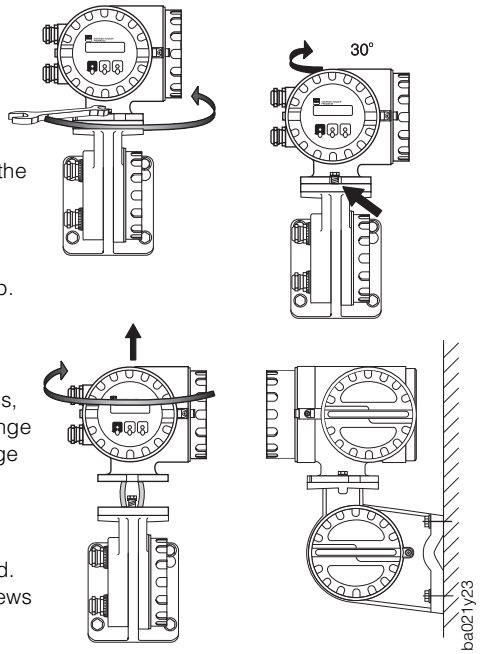
3.5 Turning the transmitter housing and local display

The transmitter housing as well as the local display of the Promag 35 S measuring system may be rotated in steps of 90° each, thus enabling the unit to be adapted to different mounting positions in the pipe and simplifying its 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. 1.5 cm).
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.



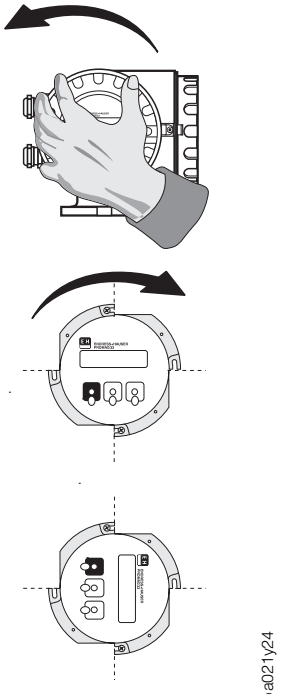
Note

Fig. 21

Turning the local display

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

1. Release the safety grip of the cover of the electronics area. Loosen the Allen screws with a 3 mm Allen key.
2. Unscrew the cover from the electronics area of the transmitter.
3. Unscrew the two Phillips screws with which the display module is fastened.
4. Rotate the display module into the desired position.
5. Securely tighten the fixing screws.
6. Firmly screw the cover of the electronic area back onto the unit.
7. Fix the safety grip.



Warning

Fig. 22

3.6 Mounting the transmitter (remote version)

A separate mounting remote transmitter and sensor is necessary given the following conditions:
- difficult access
- lack of space
- extreme fluid and ambient parameters (temperature ranges: see page 98).
- strong vibration (tested according to EN 601010 and IEC 68-2-6 safety requirements)

Caution

Caution!
- The permissible cable length L_{max} between sensor and transmitter at a distance >10 m is governed by the conductivity of the medium.
- 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) option, the maximum possible cable length between transmitter and sensor is limited to 10 m.
- Fix the cable gland or fix it in a conduit. If the conductivity of the medium is low, cable movements can cause serious changes in capacitance and thus falsify the measuring signal.
- Do not lay cable in the vicinity of electrical machines or switching elements.
- Ensure potential equalisation between the transmitter and the sensor.

Cable length

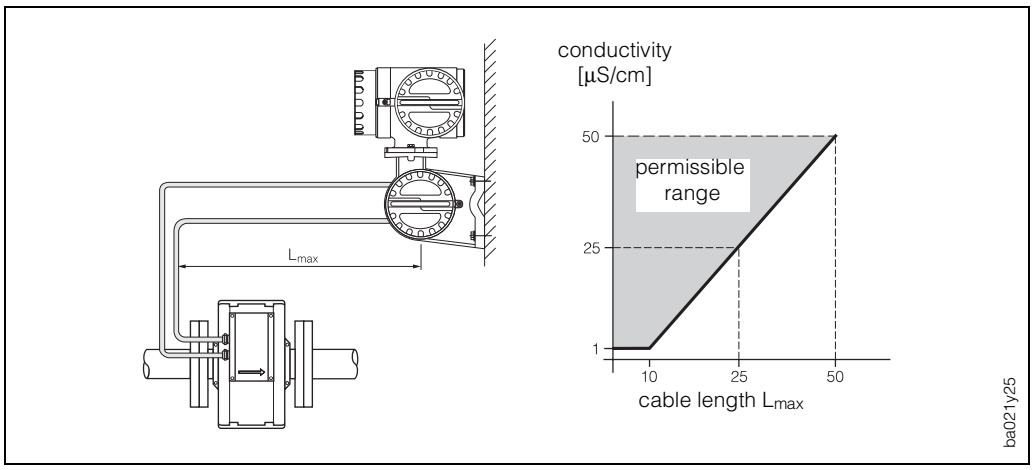


Fig. 23

Fixing the wall-mounted holder

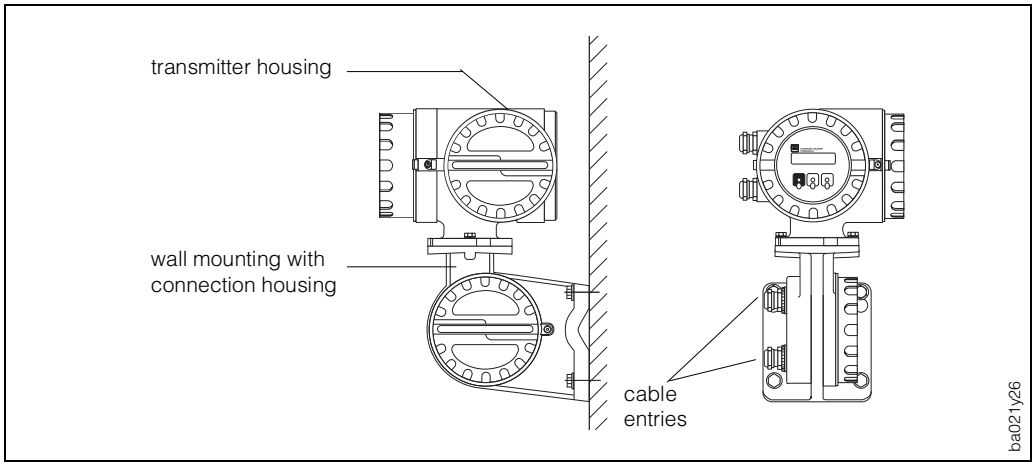


Fig. 24

3.7 Potential equalisation

The sensor and the medium must have roughly the same electrical potential to ensure that measurement is accurate and no electrical erosion takes place at the electrodes. Normally the reference electrode in the sensor or the metal pipe ensures that the potentials are equalised. With an existing reference electrode and for media carried in earthed metal piping it is, therefore, sufficient to connect the earth terminal of the Promag 35 transmitter housing to the potential equalising line. Fig. 11 shows the reference electrode of the Promag S sensor. Depending on the material used for the electrodes, the reference electrode is already integrated into the sensor or available as an option. For the DN 15 device, you will have to use earthing disks instead of the reference electrode.

Potential equalisation in specific cases are described below:

Potential equalisation for lined pipes with cathode protection
If, for operational reasons, the medium may not be earthed, installation of the measuring unit must be potential-free.

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 with the measuring unit and that the material can withstand the tightening torque used.

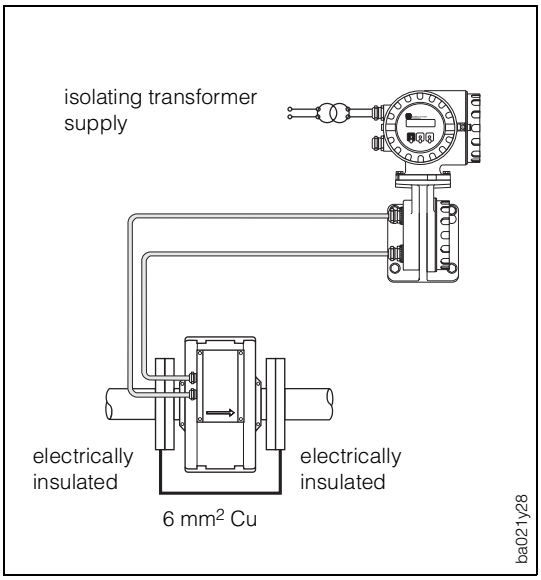


Fig. 25

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

Caution!
Ensure the earthing disks are corrosion-resistant!
Earthing disks made of the same material as the reference electrodes are to be used as the electrodes might otherwise be destroyed in extreme cases by galvanic degradation.

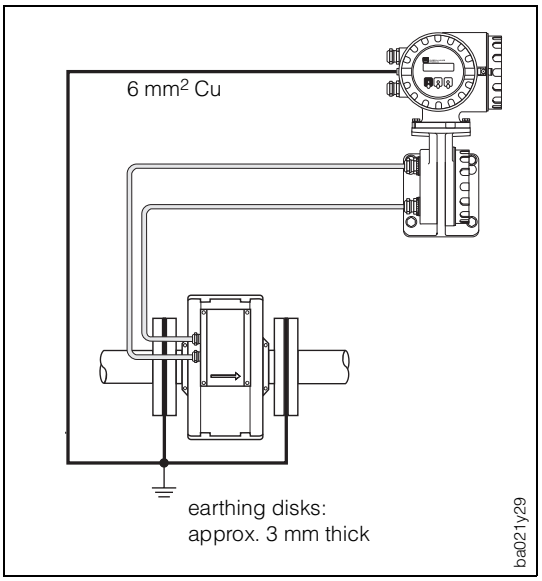


Fig. 26

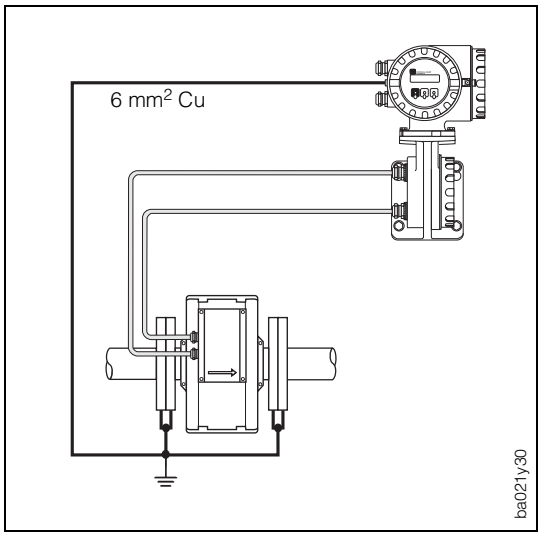


Fig. 27

Equalising currents in unearthed metal pipes
The medium may be earthed. Ensure an electrical connection from flange to flange and to the measuring unit.

3.8 Earthing in an area with severe electrical interference

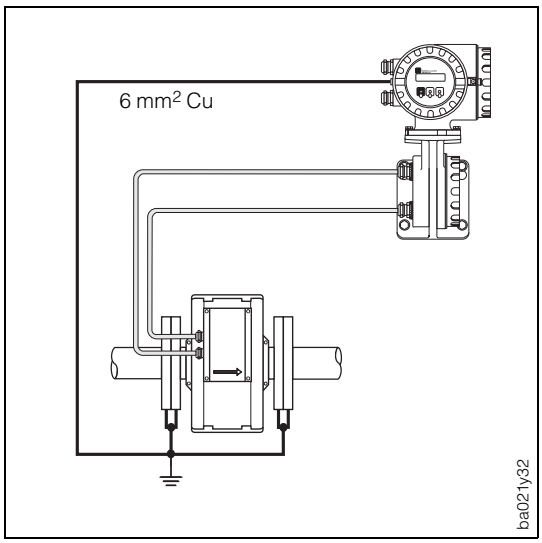


Fig. 28

In order to make the most of the electromagnetic compatibility (EMC) of the Promag 35 S, it is advisable to provide two flange-to-flange links and to connect them jointly with the transmitter housing to earth potential.

4 Electrical Connection

4.1 General information

A circuit breaker shall be included in the building in close proximity to the instrument and shall be marked as disconnecting device for the instrument.

Warning!
Note the information provided in Section 3.1 on maintaining a type IP 65 protection.

4.2 Connecting the transmitter (compact version)

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

1. Loosen the safety grip of the screw cover of the terminal area using a 3 mm Allen key.
   Unscrew the cover from the terminal area of the transmitter.

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 earth terminal (⏚).
   - Fine-wire leads: max. 4 mm^2; put sleeve at the end of the cores. Single-core lead: max. 6 mm^2.

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

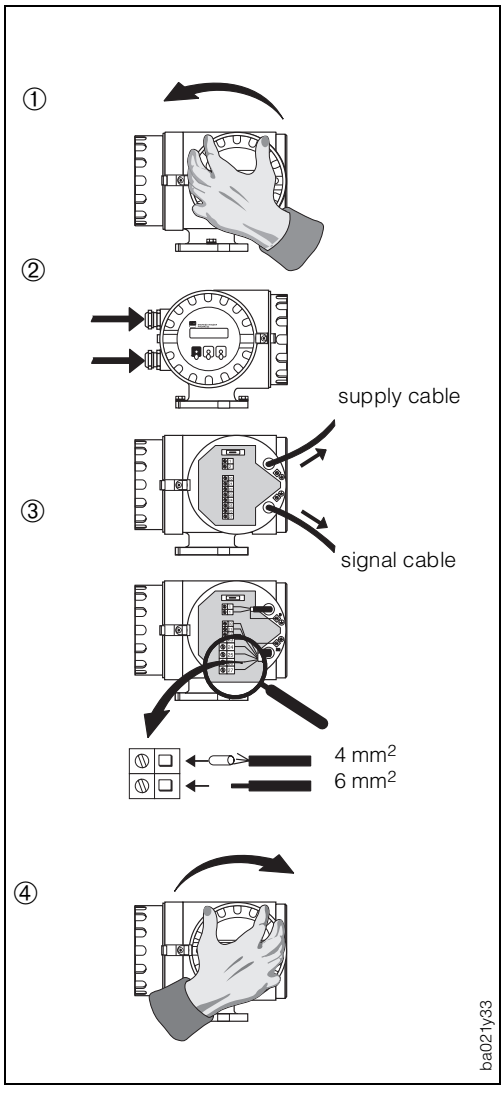


Fig. 29

4.3 Connecting the transmitter (remote version)

1. The connection to the terminal area is executed according to the description (see Section 4.2).

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 the signal and the coil cable through the appropriate cable glands of the two terminal housings.

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

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

5. Firmly tighten the covers of the two connection housings.

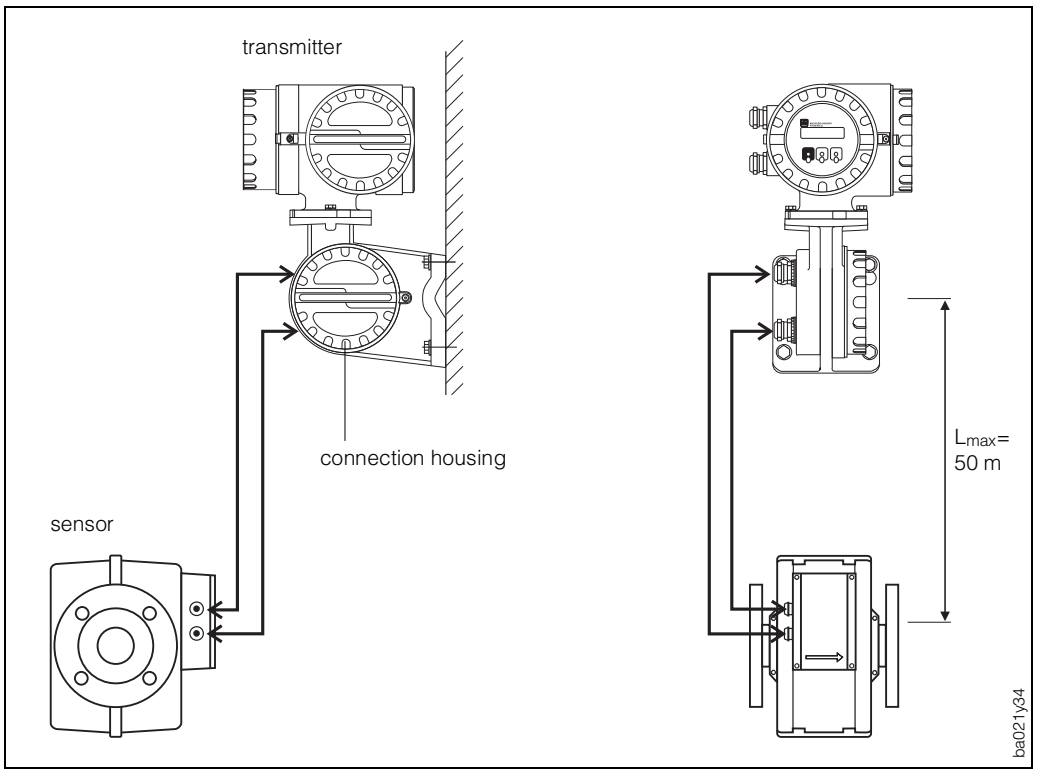


Fig. 30

4.4 Wiring diagrams (power supply and outputs)

Electrical connection: HART® communication module

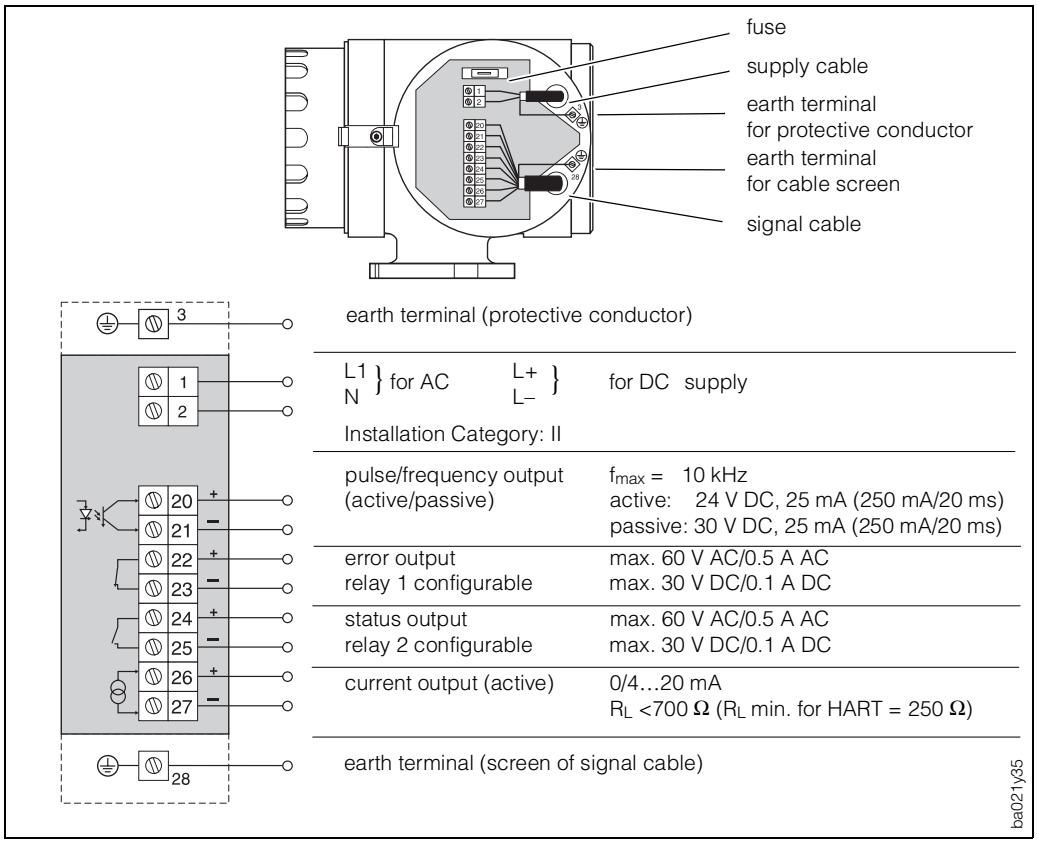


Fig. 31

Electrical connection: the RS 485 communication module

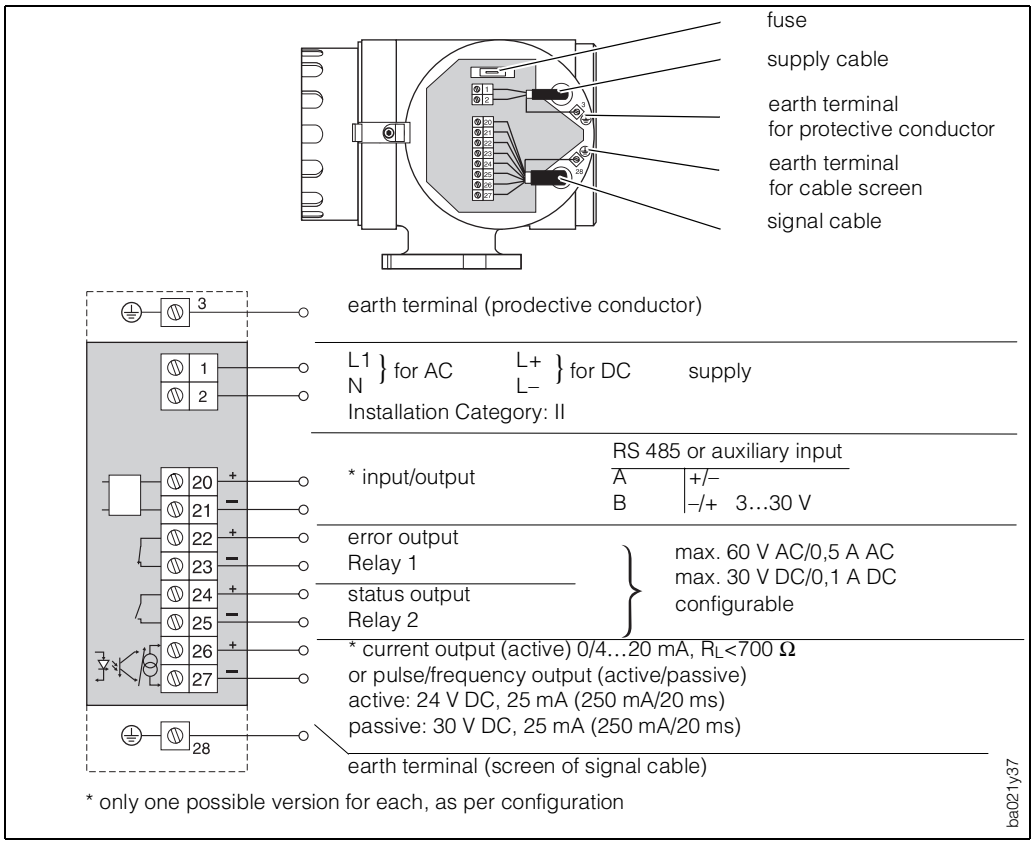


Fig. 32

Connection between sensor and transmitter

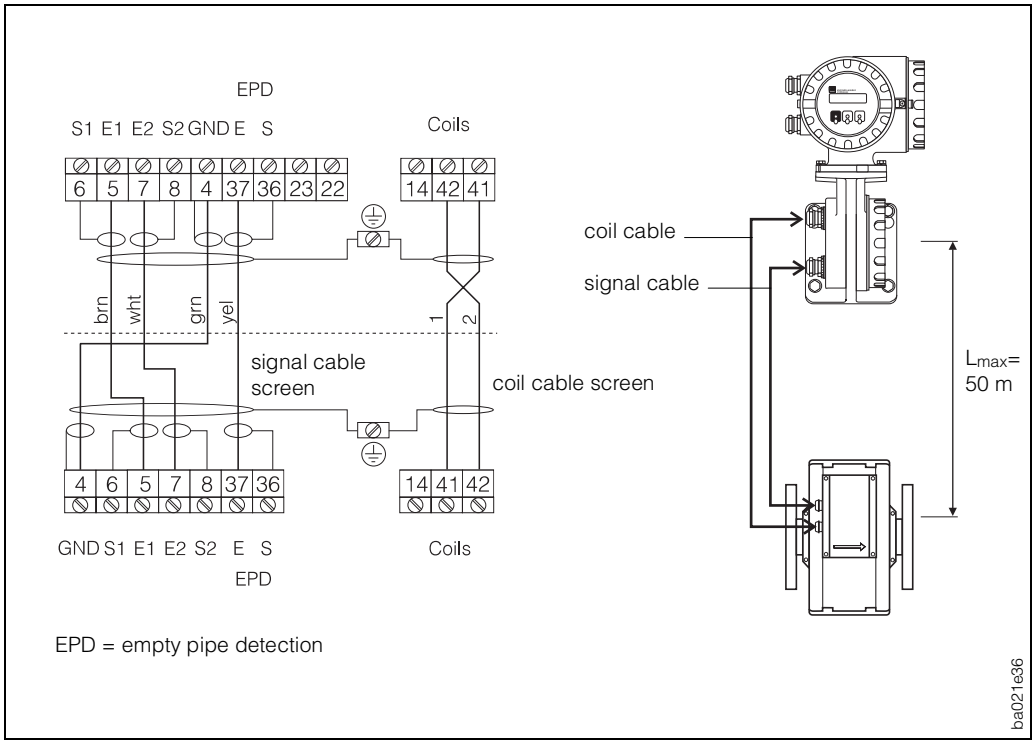


Fig. 33

4.5 Cable specifications

Coil cable: 2×0.75 mm² PVC cable with common screen
conductor resistance: ≤12.5 Ω/km
capacitance: core/core, screen earthed ≤120 pF/m
permanent operating temperature: –20…+70 °C
(cable length/further information: see page 20 "Mounting the remote version")

Signal cable: 3×0.38 mm² PVC cable with common screen and separately screened cores
with EPD (empty pipe detection): 4×0.38 mm² PVC cable
conductor resistance: ≤50 Ω/km
capacitance: core/screen ≤420 pF/m
permanent operating temperature: –20…+70 °C
(cable length/further information: see page 20 "Mounting the remote version")

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 and EN 50082 Part 1 and 2, if installed in accordance with the respective NAMUR recommendations.

Note

Note!
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. 33).

4.6 Commissioning

Before the measuring system is switched on for the first time, the following checks should be carried out:
- 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 measuring system undergoes various self-test routines. During this procedure, the following sequence of messages appears on the display of the unit:

P	R	O	M	A	G		3	5					
V	2	.	0	4	.	x	x			H	A	R	T
V	2	.	0	4	.	x	x			R	S	4	8	5

The communication board software will appear on the display. The displayed software version shows whether the transmitter has a HART interface or a Rackbus RS 485 interface respectively an auxiliary input.

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

Upon starting the system, a value of 0 will be displayed for about 30 seconds.
Having started up successfully, normal operation continues.

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

The display simultaneously shows the current flow and the total value.

Note!
If it should prove impossible to start up successfully, a message is displayed, depending on the causes of the fault. A list of possible fault messages can be found in Section 8.3.


Note

5 Operation

Note!
The double folding pages at the end of this Operating Manual shows all important information required for programming at a glance (operating matrix, display and operating elements, function/page cross references, factory settings).

Note

5.1 Operating and display elements

The transmitter is operated with the help of three operating elements. They are activated when the appropriate field on the protective glass of the front is touched with a fingertip ("touch control"). The corresponding transmitting and receiving diode is immune to external influences, e.g. direct solar radiation. The software and hardware installed in Promag 35 rule out any malfunction caused by this.

With the help of an operator's guide, all fields within the E+H programming matrix may be accessed and varied with the help of these three elements.

The LCD consists of two lines and is illuminated. It displays messages in clear as well as error, alarm, and status messages.

HOME position
During normal operation, two measured values simultaneously appear on screen, e.g. actual flowrate, totalised value, batch quantity, batch cycles, etc.

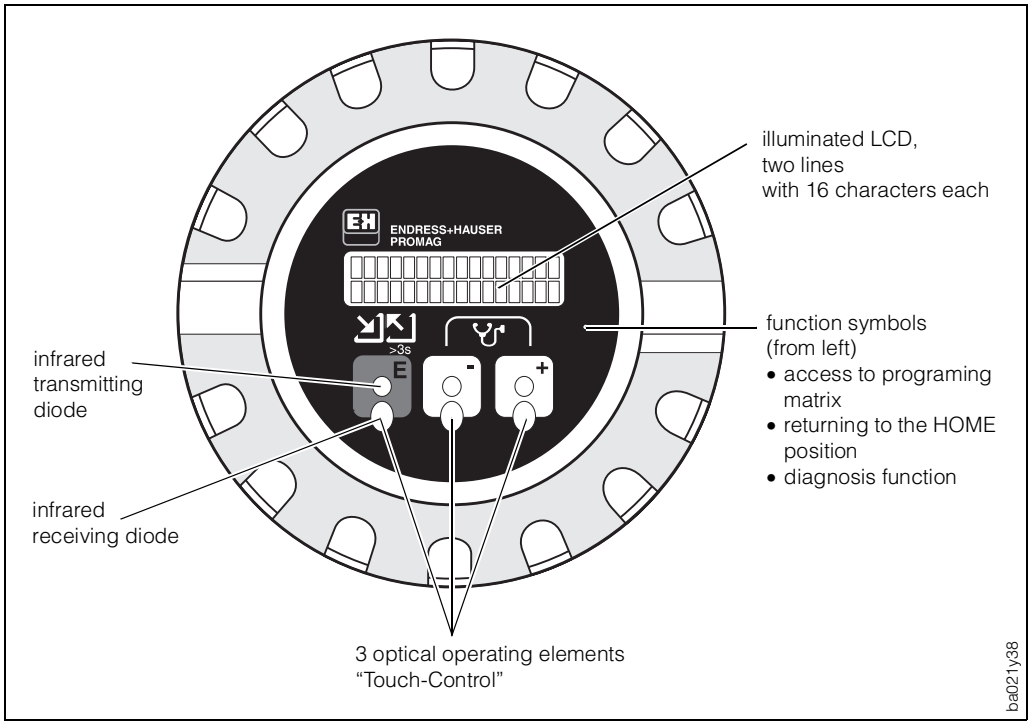


Fig. 34

5.2 The Promag 35 S operating concept (E+H matrix)

There is a wide choice of functions and parameters for the Promag 35 S measuring system, which the user can set individually and adapt to his process.

The individual functions are allocated to various function groups (Fig. 35). Selection of these functions within the E+H matrix is carried out as described on page 104. Numerical values or factory settings which may be altered are indicated on the LCD by flashing signals.

Note!
The double folding pages at the end of this Operating Manual show all important information required for programming at a glance (operating matrix, display and operating elements, function/page cross references, factory settings).

Note

Enabling programming (access code)
Normally, the programming function is locked. It is, therefore, impossible for system functions, numbers, or factory settings to be accidentally changed. Parameters may only be entered or altered if the code (factory setting = 35) has been entered first. The use of a freely chosen personal code prevents unauthorised persons from gaining access to data (see page 64).
A few parameters, e.g. all sensor data, are protected by a special service code known only to the E+H Service Organisation and cannot be changed by entering the personal code. Any change in the data of these parameters directly influences the accuracy of the system. If problems arise, then please contact your E+H Service Organisation.

Caution!
- If the programming function is locked and the ± operating elements are activated for any given function, a call to enter the code is automatically displayed.
- With customer code = 0, programming is **always** enabled!

Caution

Locking programming
Following a return to the HOME position, programming is locked again after 1 minute if no operating element is activated. In addition, programming can be deliberately locked by re-entering the code number in the function “ACCESS CODE” (see page 65).

Note!
If your personal code is no longer on hand, the E+H Service Organisation will be able to help you.

Note

Programming Matrix Promag 35

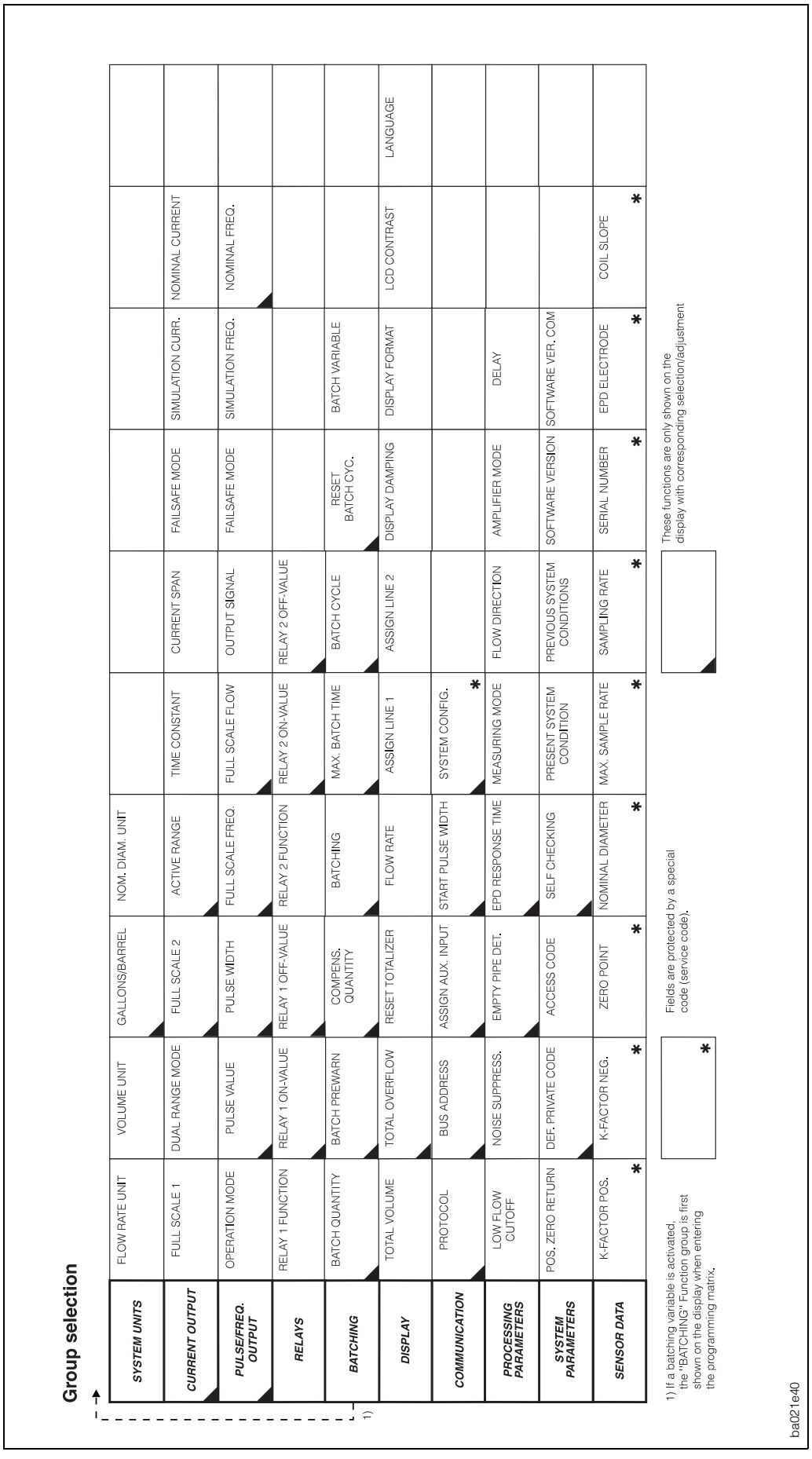
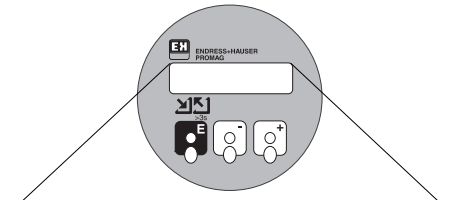


Abb. 35

5.3 Programming example

If you would like to change the current span set in the factory at 4…20 mA to 0…20 mA (with the HART interface, the current output cannot be programmed to 0…20 mA), proceed as follows:



E

Entering the E+H 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 “CURRENT OUTPUT”.

C	U	R	R	E	N	T		O	U	T	P	U	T		
>		G	R	O	U	P		S	E	L	E	C	T	.	<

E

Selecting the function “CURRENT SPAN”.

4	–	2	0		m	A								
C	U	R	R	E	N	T		S	P	A	N			

\+ / –

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				

E

Programming is now enabled.

E	D	I	T	I	N	G		E	N	A	B	L	E	D	

The programmable value flashes.

4	–	2	0		m	A								
C	U	R	R	E	N	T		S	P	A	N			

\+ / –

Select the desired current span. The display stops flashing.
Select: 0…20 mA or 4…20 mA

0	–	2	0		m	A								
C	U	R	R	E	N	T		S	P	A	N			

E

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

		I	N	P	U	T		S	T	O	R	E	D		

0	–	2	0		m	A								
C	U	R	R	E	N	T		S	P	A	N			

E (>3s)

Return to HOME position (press the E element for more than 3 seconds position the programming level is locked again after 1 minute, without actuating any of the three operating elements).

or

E

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

	B	A	C	K		T	O		G	R	O	U	P		
			S	E	L	E	C	T	I	O	N				

6 Functions

This section is an in-depth description of the individual functions and specifications of Promag 35. Factory settings are indicated in ***bold italics***.
On request, Promag 35 measuring instruments are also available with customised parametrisation. In such cases, values/settings may differ from the factory settings shown here.

Function Group **SYSTEM UNITS**	
FLOW RATE UNIT	Selection of the required and indicated flow unit (volume/time). Note! The unit selected here is the same as that for the • creep rate, • relay switch points, and the • full-scale values for current and frequency 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 is displayed on screen.

Note

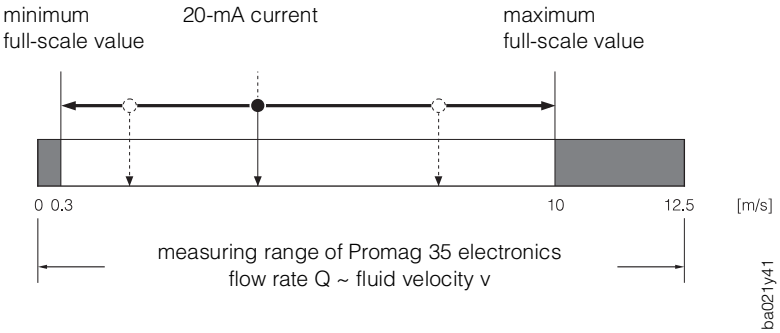
Function Group SYSTEM UNITS	
VOLUME UNIT	Selection of the required and indicated volume unit. Note! The unit selected here is the same as that for the • batching rate • pulse value, and the • totaliser value (and totaliser overflow) **Selection** dm^3, ***m^3***, l, hl, gal, bbl, 10^3 gal, ft^3 Diagnosis The actual totaliser value is displayed on the screen.
GALLONS/ BARREL	In the USA and the UK, the relationship between the units “barrel” (bbl) and “gallon” (gal) is defined differently from one medium and branch to the other. The required relationship can be selected here. Selection is also necessary on whether to use US or imperial gallons. Note! This function is only available if barrel or gallon are selected as “FLOW RATE UNIT” or “VOLUME UNIT”. **Selection** US: 31.0 gal/bbl ⇒ beer ***US: 31.5 gal/bbl*** ⇒ normal fluids US: 42.0 gal/bbl ⇒ petrochemicals US: 55.0 gal/bbl ⇒ filling tanks Imp: 36.0 gal/bbl ⇒ beer Imp: 42.0 gal/bbl ⇒ petrochemicals
NOM. DIAM. UNIT	This function is used to programme the required unit for nominal diameter. Note! The unit selected here is shown under the function “NOMINAL DIAMETER” (see page 69). **Selection** ***mm*** inch Diagnosis The nominal diameter set is shown for the unit selected.

Function Group
CURRENT OUTPUT

With this group of functions, the user is able to adjust the output current to suit his requirements (full-scale value, time constant, current span, etc.). We thus offer two basic versions of the current output. If programming “0/4...20 mA (25 mA)”, the current output can overrun to 125% of the calibrated full-scale value (25 mA), if programming “0/4...20 mA”, the current output functions according to NAMUR recommendations. This allows a maximum full-scale overrun of up to 102.5% (20.5 mA). If a system configuration with an RS 485 communication module is selected for pulse/frequency output, the complete current output function group is suppressed. See also page 63 “system configuration”.

FULL SCALE 1

By scaling the full-scale value, a flow rate is assigned to the 20 mA current. Scaling always applies to both flow directions (bidirectional), but with the unidirectional mode, no signal is shown for a negative flow. The direction of flow with appropriate configuration is emitted at the status output (relay 1 or 2).



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

Note

Input

5-digit number with floating decimal point
(e.g. 250.00 m^3/h)

Diagnosis

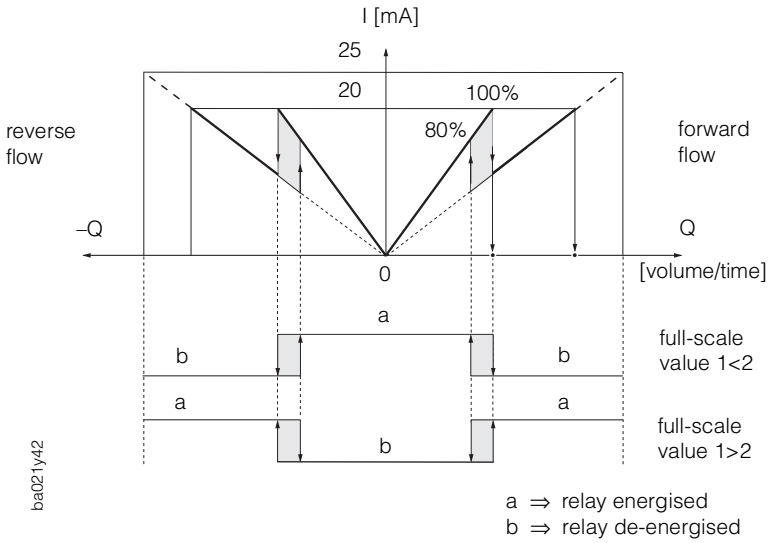
The unit can be selected in the “FLOW RATE UNIT” function.

Function Group
CURRENT OUTPUT

DUAL RANGE MODE

For special applications, scaling of a second full-scale value may prove helpful. Thus a better resolution of the measured value signal can be obtained at low flow rates.

By activating the dual range mode, the system automatically changes between full-scale value 1 and 2. This changeover takes place at 100% or 80% of the lower full-scale value (hysteresis = 20%). Full-scale values 1 and 2 can be selected freely.
With the RS 485 communication module, the changeover of the full-scale values can also be carried out via the auxiliary input, if one is available
(see page 58, 59).



Note

Note!
Full-scale value 1 active: ➞ relay 1 or 2 energised (live)
Full-scale value 2 active: ➞ relay 1 or 2 de-energised (dead)

Relay 1 or 2 must first be programmed for the dual range mode.

Selection

OFF
ON

Function Group **CURRENT OUTPUT**	
FULL SCALE 2	By scaling the full-scale value, a flow rate is assigned to the 20 mA current. Scaling always applies to both flow directions (bidirectional), but with the unidirectional mode, no signal is shown for a negative flow. The direction of flow with appropriate configuration is emitted at the status output (relay 1 or 2). Note! This function is only available if the dual range mode is activated. **Input** 5-digit number with floating decimal point (e.g. 3600.0 m^3/h) Diagnosis The unit can be selected in the “FLOW RATE UNIT” function.
ACTIVE RANGE	Display of the current full-scale value if the dual range mode is active. **Display** ***FULL SCALE 1*** or FULL SCALE 2
TIME CONSTANT	Selecting the time constant determines whether the current-output signal responds rapidly to a varying flow (short time constant) or is delayed (long time constant). Note! The time constant does not affect the behaviour of the flow indicator. **Input** Max. 3-digit number with floating decimal point: 0.01...100 s Factory setting: ***1 s***

Note

Note

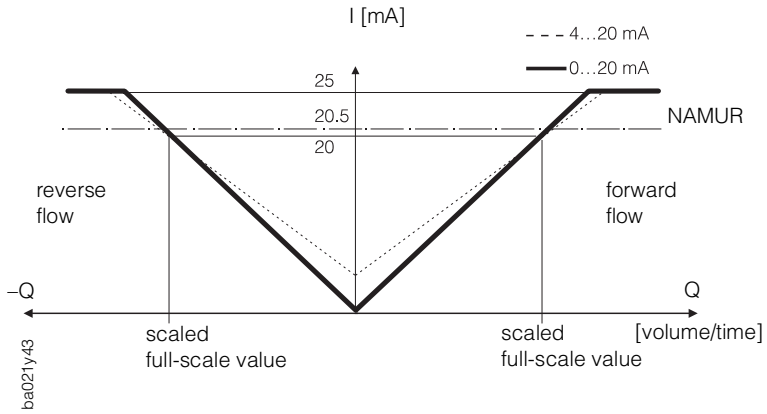
Function Group
CURRENT OUTPUT

CURRENT SPAN

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

Note

Note!
The current output can only be programmed to 0…20 mA if the HART communication is first switched off.



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

In the event of a fault and for safety reasons it is useful for the current output to assume a previously defined status.

Note

Note!
The setting only affects the current output.

Selection

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

MAX. CURRENT
(Current signal set to 25 mA for 0/4…20 mA (25 mA) or 22 mA for 4…20 mA) [NAMUR]

HOLD VALUE
(Last valid measured value is maintained)

ACTUAL VALUE
(Normal measured output despite fault)

Function Group
CURRENT OUTPUT

SIMULATION CURR.

With this function an output current can be simulated.
The simulation values that can be selected correspond to 0%, 50% or 100% of the scaled full-scale value. The two errors 2 mA (at 4…20 mA) and 25 mA (maximum possible value) or 22 mA for NAMUR can also be simulated.

Specimen application 1: for checking downstream units.
Specimen application 2: for checking the internal adjustment of the current signal.

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


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 point is shown on-screen (0.00…25.00 mA).

Diagnosis


The actual flow rate is shown on-screen.

Function Group
PULSE/FREQ. OUTPUT

With this group of functions, the pulse/frequency output can be configured.

Note!
With the RS 485 communication module, if a version is programmed with current output (see page 60), this function group is suppressed.

Note

OPERATION MODE

Select operation as pulse **or** frequency output.

Note!
Depending on the selection (pulse or frequency), different functions are available in this group.

Note

Selection

PULSE
FREQUENCY

PULSE VALUE

The pulse value indicates what volume flow an output pulse will be supplied for. By means of an external counter the sum of these pulses can be recorded so that the total volume flow since the start of measurements is known.

Note!
This function is only available if the “PULSE” mode is selected.

Note

Input

5-digit number with floating decimal point
(e.g. 75.000 dm^3/p)

Diagnosis

The unit can be selected in the “VOLUME UNIT” function.

Function Group
PULSE/FREQ. OUTPUT

PULSE WIDTH

Pulse width can be set between 0.05 and 2.00 s.

Note!
This function is only available if the “PULSE” mode is selected.

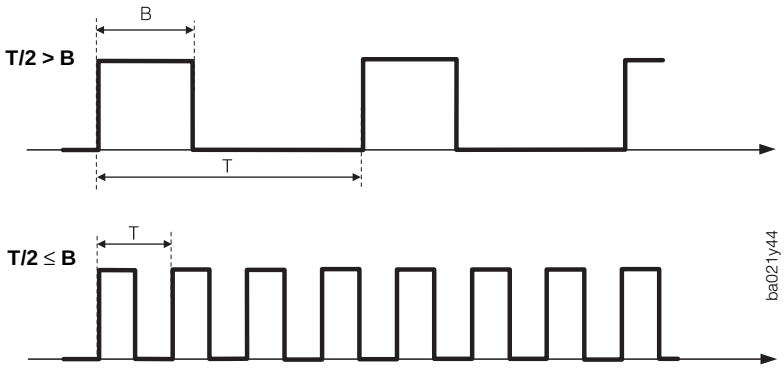
Note

Input

3-digit number with fixed decimal point (0.05…***2.00 s***)

Diagnosis

If the frequency resulting from the selected pulse value and actual flow rate is too high (T/2 < the selected pulse width B), the pulses emitted are automatically reduced to half a cycle. The pulse/pause ratio will now be 1:1.



The above diagram applies to positive pulses.
B = pulse width

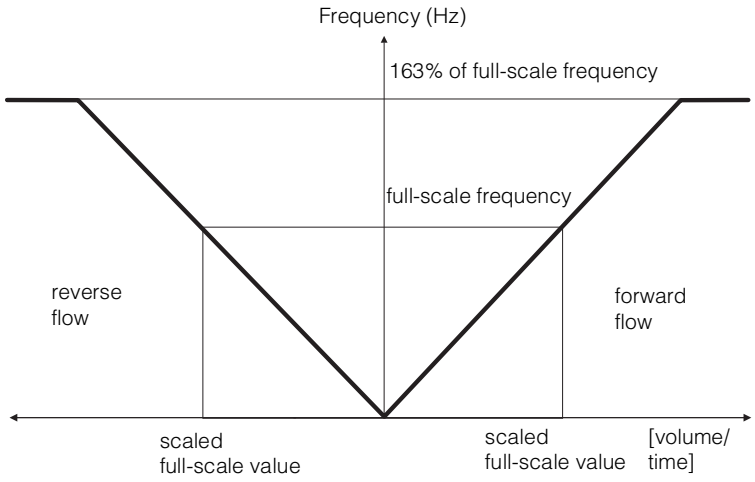
Function Group
PULSE/FREQ. OUTPUT

FULL SCALE FREQ.

Select the full-scale frequency f_{End} = 2…10,000 Hz for setting the full-scale value.

Note

Note!
- This function is only available if the “FREQUENCY” mode is selected.
- An extension up to 163% of the selected full-scale value is possible.
- With the unidirectional mode, no signal is shown for a negative flow.



ba021y45

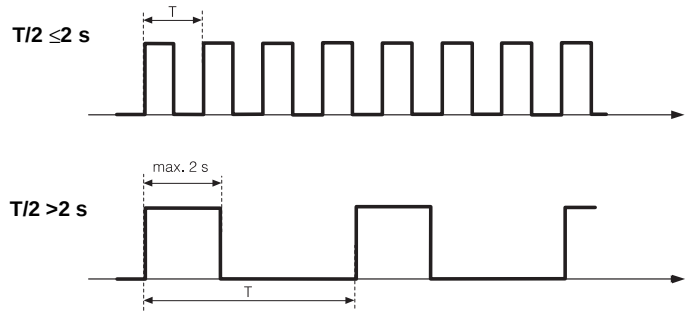
Full-scale frequency: 2…10 000 Hz

Input

Max. 5-digit number: 2…***10,000 Hz***

Diagnosis

In the “FREQUENCY” mode, the output signal is symmetrical. The pulse/pause ratio is now 1:1. At low frequencies, the pulse duration is limited to max. 2 seconds.



ba021y46

The above diagram applies to positive pulses.

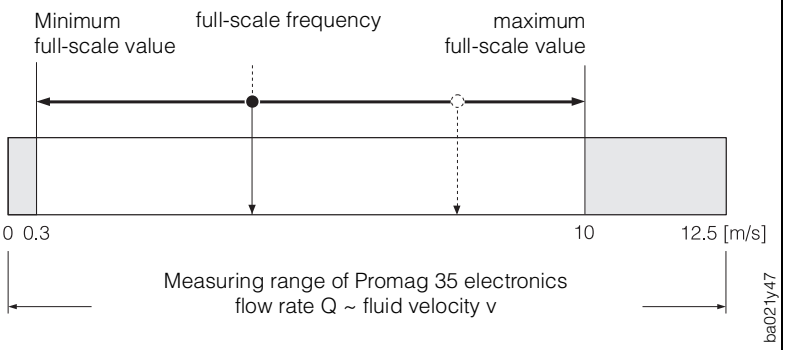
Function Group
PULSE/FREQ. OUTPUT

FULL SCALE FLOW

By scaling the full-scale value a flow rate is assigned to the selected full-scale frequency f_{End} = 2...10,000 Hz. Scaling always applies to both flow directions (bidirectional), but with the unidirectional mode, no signal is shown for a negative flow.

Note!
This function is only available if the “FREQUENCY” mode is selected.

Note



Input

5-digit number with floating decimal point
(e.g. 6400.0 dm^3/min)

Diagnosis

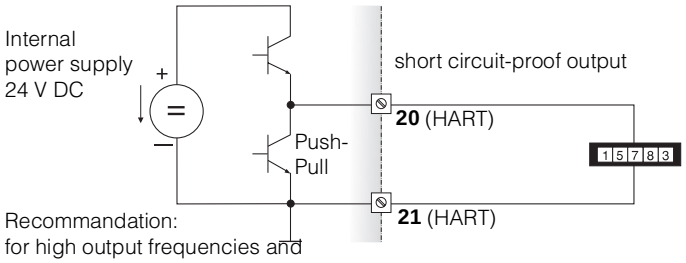
The unit can be selected in the “FLOW RATE UNIT” function.

Function Group
PULSE/FREQ. OUTPUT

OUTPUT SIGNAL

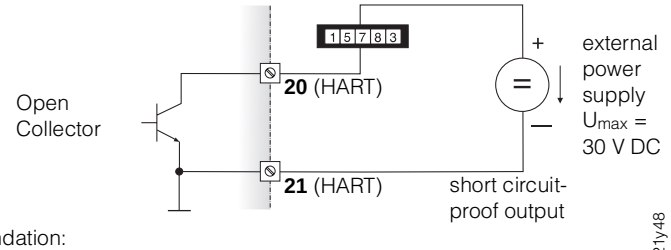
Various configurations are possible for the pulse/frequency output:
- ACTIVE: internal power supply available (+24 V)
- PASSIVE: external power supply required

ACTIVE



Recommandation:
for high output frequencies and continuous currents up to 25 mA (I_{max} = 250 mA for 20 ms)

PASSIVE

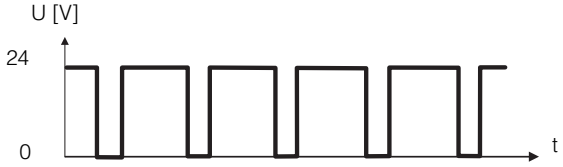


ba021y48

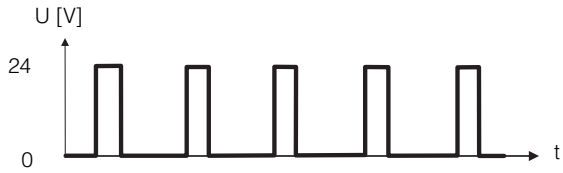
Recommendation:
only for low output frequencies or high continuous currents up to 25 mA (I_{max} = 250 mA for 20 ms).

Positive or negative pulses can also be generated:
- POSITIVE: fallback value at 0 V
- NEGATIVE: fallback value at 24 V or external power supply

NEGATIVE pulses



POSITIVE pulses



ba021y49

Selection (with prompt)

PASSIVE / POSITIVE
PASSIVE / NEGATIVE
ACTIVE / POSITIVE
ACTIVE / NEGATIVE

Diagnosis

PASSIVE = OPEN COLL or ACTIVE = PUSH-PULL
(see above diagrams for details)

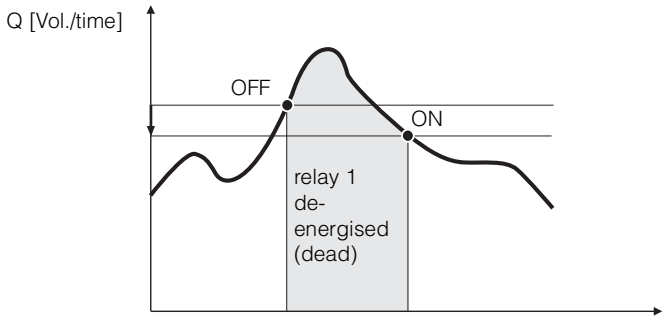
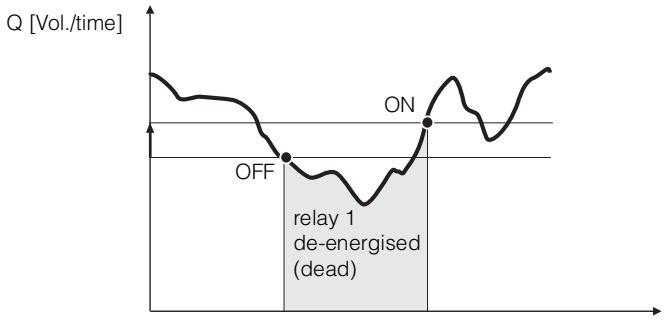
Function Group **PULSE/FREQ. OUTPUT**	
FAILSAFE MODE	In the event of a fault and for safety reasons, it is useful for the pulse/frequency output to assume a previously defined status. Note! The setting selected here only affects the pulse/frequency output. **Selection** ***FALLBACK VALUE*** (In the event of a fault or EPD the signal is set to the fallback value.) LAST VALUE (Last valid measured value is maintained.) ACTUAL VALUE (Normal measured output despite fault.)
SIMULATION FREQ.	With this function, a frequency signal can be simulated, for instance to check downstream equipment. Simulated signals are always symmetrical (pulse/pause ratio = 1:1). Note! • The flow meter is fully operational for measuring during simulation, i.e. the totaliser and the flow indicator continue to act correctly. • The “POSITIVE ZERO RETURN” function deactivates a simulation in progress and sets the output signals to the fallback value. **Selection** ***OFF*** 0 Hz (fallback value) 2 Hz 10 Hz 1 kHz 10 kHz
NOMINAL FREQ.	Display of the frequency calculated from the measured flow. Note! In the “PULSE” mode, this display does not operate at very low frequencies. **Display** The actual set-point is displayed on-screen (0.00…16,383 Hz). Diagnosis The actual flow rate is displayed on-screen.

Note

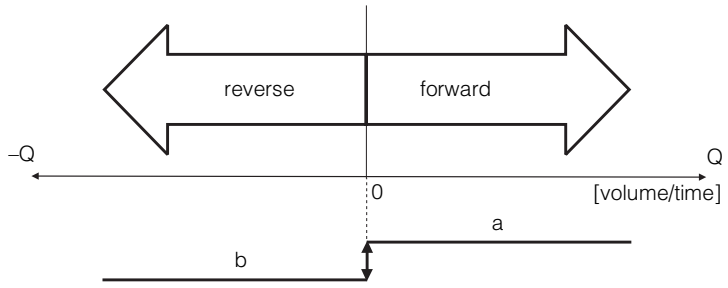
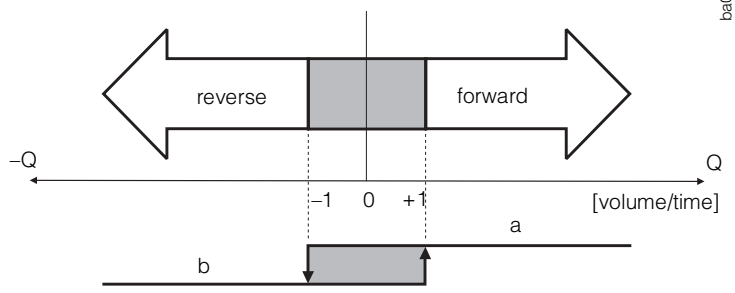
Note

Note

Function Group RELAYS	
RELAY 1 FUNCTION	With the Promag 35 transmitter, relay 1 can be assigned to various functions. The error function can only be assigned to this relay. Note! • Depending on what relay function is selected different functions are available. • As standard the normal open contact of relay 1 (and the normally closed contact of relay 2) are brought out. This configuration, however, can be altered by connecting a jumper on the communication board (see page 89, 90). **Selection** ***FAILURE*** Signalling system errors EPD Empty Pipe Detection * ERROR+EPD Signalling system errors or EPD DUAL RANGE MODE full-scale value 1 ⇒ 2 * BATCH PRECONTACT filling * FLOW DIRECTION forward/reverse LIMIT FLOWRATE 1 MAX/MIN safety or exceeding measuring range * Only appears on the display when the appropriate function has already been activated. Caution! Refer to the figures on pages 50 and 51 for the response of relay 1.

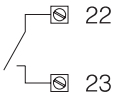
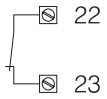
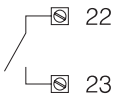
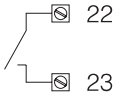
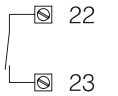
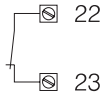
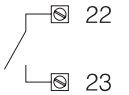
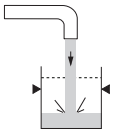
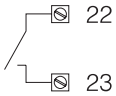
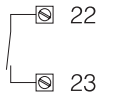
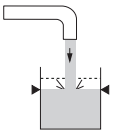
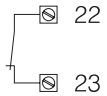
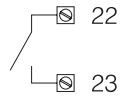
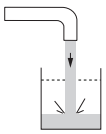
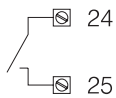
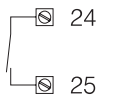
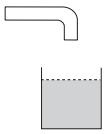
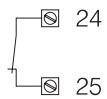
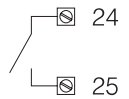
Function Group RELAYS	
RELAY 1 ON-VALUE	Specifying the switch-on point for relay 1. Note! This function is only available when relay 1 is configured for “LIMIT FLOWRATE 1” or “FLOW DIRECTION”. **Relay 1 → “LIMIT FLOWRATE 1”** Relay 1 switches over as soon as the actual flow is above or below a defined switch point. • **MAX** safety: Exceeding the limit causes the relay to switch over. If you intend to use the limit function to detect when a measuring range has been exceeded, then proceed as follows: Set the switch on and switch off point to the maximum possible value. Press the key (**+**) until the message “LIMIT REACHED” appears on the display. Relay 1 is dead as soon as the max. permissible measuring range (≥12.5 m/s) is exceeded. • **MIN** safety: Dropping below the limit enables the relay to switch over. **MAX safety** (switch-on point ≤ switch off point)  **MIN safety** (switch-on point > switch off point)  ba021y51 (Continued next page)

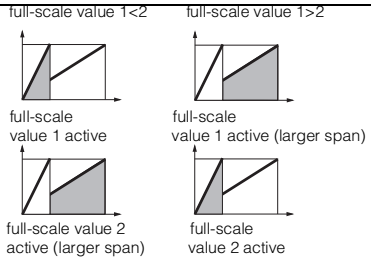
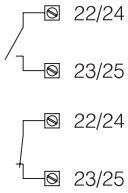
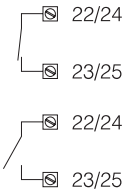
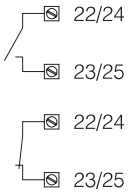
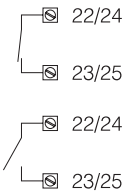
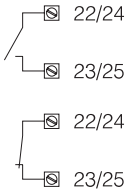
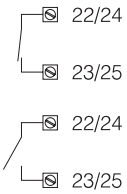
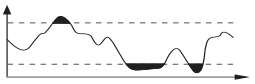
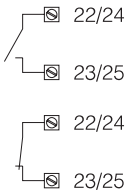
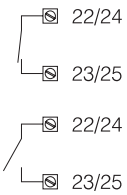
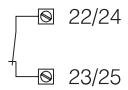
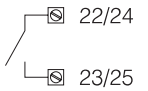
Note

Function Group RELAYS	
RELAY 1 ON-VALUE (Continued)	**Relay 1 → "FLOW DIRECTION"** Detection of flow direction operates with a hysteresis determined by the switch point. For instance, if the switch point is at 1 dm^3/min, the relay does not de-energise until –1.0 dm^3/min and picks up again at +1.0 dm^3/min. If a direct changeover is required (no hysteresis), then set the switch point to zero. **Example 1:** switch-on point = 0  **Example 2:** switch-on point = 1 dm^3/min  ba021y52 a: relay 1 energised b: relay 1 de-energised **Input** 5-digit number with floating decimal point (e.g. 1.0000 dm^3/min) Diagnosis The units can be selected in the function "FLOW RATE UNIT".

Function Group **RELAYS**	
RELAY 1 OFF-VALUE	Set the switch-off point required for relay 1 (see page 47). The switch-off point is given in flow units. • **MAX** safety if switch-on point ≤ switch-off point: relay 1 de-energises on exceeding the switch off point. • **MIN** safety if switch-on point > switch-off point: relay 1 de-energises on falling below the switch-off point. Note! This function is only available when relay 1 is configured to “LIMIT ALARM 1”. **Input** 5-digit number with floating decimal point (e.g. 10.000 dm^3/min) Diagnosis The unit can be selected in the function “FLOW RATE UNIT”.
RELAY 2 FUNCTION	With the Promag 35 transmitter, relay 2 can be assigned various functions. Note! Depending on what function is selected, different functions are available. As standard, the normally closed contact of relay 2 is brought out. This configuration, however, can be altered by connecting a jumper on the communication board. **Selection** EPD — Empty Pipe Detection * DUAL RANGE MODE — full-scale value 1 ⇒ 2 * BATCH CONTACT — filling FLOW DIRECTION — forward/reverse ***LIMIT FLOWRATE 2*** — MIN/MAX safety or exceeding measuring range * Only appears on the display when the appropriate function has already been activated. Caution! Refer to the figures on pages 50 and 51 for the response of relay 2.
RELAY 2 ON-VALUE **RELAY 2 OFF-VALUE**	For description of this function, see function “RELAY 1 ON-VALUE” or “RELAY 1 OFF-VALUE”.

Relay 1 and 2 – functions

Functions	State	Relay	Relay contact*	
Relay 1			NC contact brought out (clamps 22/23)	NO contact brought out* (clamps 22/23)
FAILURE	no error present 	energised		
	error (system error) 	de-energised		
ERROR + EPD (EPD = Empty Pipe Detection)	system okay  and pipe full 	energised		
	error (system error)  or pipe partially empty 	de-energised		
BATCH PRECONTACT	batching cycle running and pre-batch quantity *not* reached 	energised		
	batching cycle running and pre-batch quantity reached or no batching cycle 	de-energised		
Relay 2			(clamps 24/25)	(clamps 24/25)
BATCH CONTACT	batching cycle running and batch quantity *not* reached 	energised		
	batch quantity is reached (batching cycle not running) 	de-energised		
	* factory setting for relay 1: NO contact brought out. By way of a plug-in bridge (jumper) on the communication board, either the NO or NC contact can be brought out (see page 89, 90).			

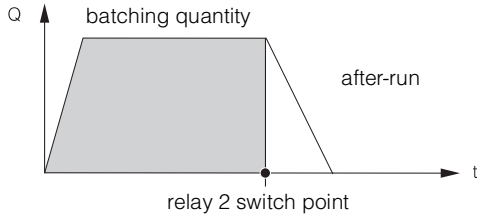
Common functions **Relay 1 and Relay 2**	Condition	Relay	Relay contact* NC contact brought out* (Rel. 1: clamps 22/23) (Rel. 2: clamps 24/25)	 NO contact brought out* (Rel. 1: clamps 22/23) (Rel. 2: clamps 24/25)
DUAL RANGE MODE		energised de-energised		
EPD (Empty Pipe Detection)	measuring pipe full  measuring pipe partially full 	energised de-energised		
FLOW DIRECTION	forward flow  reverse flow 	energised de-energised		
LIMIT FLOWRATE	limit value *not* exceeded or fallen below  limit value exceeded or fallen below 	energised de-energised		
	supply failure	de-energised		
	* factory setting relay 1 → NO contact brought out factory setting relay 2 → NC contact brought out By way of a jumper on the communication board, either the NO or NC contact can be brought out (see page 89, 90).			

Function Group
BATCHING

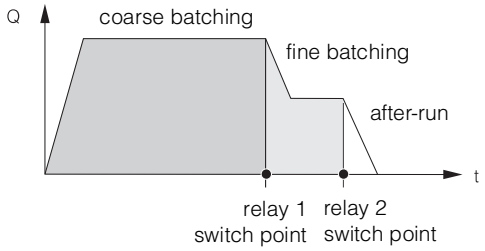
Introductory remarks

With the help of a preselection counter (batching quantity), simple batching operations may be controlled with the batching function. The Promag 35 transmitter has two relays which may be used to control the batching operation. Thus, either single-stage (one relay) or two-stage (two relays) batching operations may be carried out.

Single-stage batching (with one switch point)



Two-stage batching (with pre-batch contact)



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If the BATCHING function is activated, relay 2 may be assigned as *batching contact*. Relay 1 can also be assigned as *pre-batch contact* for two-stage batching cycles. By entering a compensation quantity, system-caused error quantities (e.g. caused by the continued operation of a pump, the closing time of a valve, etc.) may be balanced. Positive and negative compensation quantities are possible.

Note

Note!
- For short batching cycles (filling times <20 s) → see the “SELF CHECKING” function explained on page 65.
- If a system error (failure) occurs during a batching cycle or a partially filled pipe is detected (EPD function), the filling procedure is immediately stopped.

Starting/stopping of a batching cycle
The batching cycle may be started and stopped in four different ways:
- with a HART®interface or RS 485 Rackbus,
- with an auxiliary input (only with RS 485 communication module),
- with the BATCHING function, or
- from the HOME position (starting the batching cycle from the HOME position is always possible if a batching variable is selected in the function “BATCH VARIABLE”, see page 54.

[+] [-] START – STOP – CANCEL
([E] confirms the above selection)

Note

Note!
The batching function is switched off upon shipment from the factory. If a batching variable is activated, the “BATCHING” function group is first shown on the display when entering the operating matrix. This makes using the matrix much easier for the user. In addition all batching functions can be changed without entering a code number (except “BATCH VARIABLE”).

Function Group BATCHING	
BATCH QUANTITY	With the help of this function, the filling quantity is preselected. Note! Relay 2 can be assigned as batching contact (see “FUNCTION RELAY 2”, page 49). **Input** 5-digit number with floating decimal point (e.g. 240.00 l) Factory setting: ***0.0000*** (Unit according to the selection in the function “VOLUME UNIT”, see page 34) Diagnosis Display showing which function relay 2 is assigned to.
BATCH PREWARN	In this function a *pre-batch quantity* can be defined which is used for two-stage batching cycles. Note! Relay 1 can be assigned as a pre-batch contact (see “FUNCTION RELAY 1”, page 46). **Input** 5-digit number with floating decimal point (e.g. 200.00 l) Factory setting: ***0.0000*** (Unit according to the selection in the function “VOLUME UNIT”, see page 34) Diagnosis Display showing which function relay 1 is assigned to.
COMPENS. QUANTITY	In this function a positive or negative compensation quantity is defined. This quantity compensates for a consistent error in batching amounts due to plant operation. This can be caused, e.g. due to after running of a pump or the closing time of a valve. The compensation quantity is determined by the operator of the plant. The compensation quantity only affects the batching quantity. • overfilling → negative compensation quantity required • underfilling → positive compensation quantity required *Example* Batching quantity = 100 l; pre-batch quantity = 90 l → maximum positive compensation quantity = 100 l → maximum negative compensation quantity = –10 l Note! If no sufficiently large compensation quantity may be set, the pre-batch quantity has to be reduced. **Input** 5-digit number with floating decimal point and arithmetical sign (e.g. -10.000 l) Factory setting: ***0.0000*** (Unit according to the selection in the function “VOLUME UNIT”, see page 34) Diagnosis The unit can be selected under “VOLUME UNIT”.

Function Group BATCHING	
BATCHING	This function is used to manually start a batching cycle or to stop a batching cycle already running. Starting or stopping a batching cycle has a direct influence on relay 1 and 2, if configured for “BATCH PRECONTACT” and/or “BATCH CONTACT”. A running batching cycle can be stopped at any time. **Selection** START – STOP – ***CANCEL*** (E activates START or STOP)
MAX. BATCH TIME Note	With this function a maximum filling interval can be set after Relay 2 (batching contact) has been de-energised, for example, due to safety reasons with a plant fault. Note! If the batching time is set to zero seconds, then batching time monitoring is inactivated. **Input** Max. 5-digit number (0…30 000 s) Factory setting: ***0 s***
BATCH CYCLE	This function shows the number of batching cycles executed. **Display** A maximum of 7 digits is possible (0…9999999) factory setting: ***0***
RESET BATCH CYC.	With this function the batching totalizer can be reset. **Selection (with prompt)** ***NO*** – YES Diagnosis Display showing the number of successfully completed batching cycles.
BATCH VARIABLE	With the help of this function, the batching function may be activated. **Selection** ***OFF*** VOLUME

Function Group DISPLAY	
TOTAL VOLUME	Here, the summed up flow quantity is shown as a floating-point number of maximally 7 digits. **Display** Max. 7-digit number (0,000000…9999999) Factory setting: ***0,000000*** Diagnosis The units can be selected in the function "VOLUME UNIT", see page 34.
TOTAL OVERFLOW	The summed up flow quantity is displayed by a floating-point number with a maximum of 7 digits. In this function, larger numbers (>9 999 999) are displayed as an overflow. Therefore, the actual quantity is the sum of the overflow and the value displayed in the HOME position or the "TOTAL VOLUME" function respectively. *Example* Supposing the overflow is 2e7 dm^3 → overflow = $2 \times 10^7 dm^3$ = 20,000,000 dm^3. The actual totaliser value is 196,845.7 dm^3. The total amount, added since measurement started, is therefore 20,196,845.7 dm^3. Note! • This value is only displayed if there is an overflow. In addition, in the HOME position an overflow is made visible by optically inverting the > sign. • The totaliser value may have a positive or negative sign as a result of the bidirectional measurement. **Display** Integer to a decimal power (e.g. 10 e7 dm^3) Diagnosis The actual totaliser value (HOME position) is displayed.
RESET TOTALIZER	The totalizer can be reset to zero (reset function). 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 totalizer value (HOME position) is displayed.

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 measuring devices (e.g. to BATCHING). **Display** Max. 5-digit number (-99999...+99999). Unit according to the selection in the function "FLOW RATE UNIT", see page 34.
ASSIGN LINE 1	With this function the variable is defined which should be displayed on the *upper* display line during normal operation ("HOME" position). **Selection** ***FLOW RATE*** – TOTAL VOLUME – BATCH QUANTITY(1) – BATCH UPWARDS(1) – BATCH DOWNWARDS – BATCH CYCLE(1) (1) These parameters only appear if the function "BATCH VARIABLE" is set to "VOLUME" (see page 54).
ASSIGN LINE 2	With this function the variable is defined which should be displayed on the *lower* display line during normal operation ("HOME" position). **Selection** OFF – FLOW RATE – ***TOTAL VOLUME*** – TOTAL OVERFLOW – BATCH QUANTITY(1) – BATCH UPWARDS(1) – BATCH DOWNWARDS – BATCH CYCLE(1) (1) These parameters only appear if the function "BATCH VARIABLE" is set to "VOLUME" (see page 54).
DISPLAY DAMPING	Selecting a time constant determines whether the display reacts quickly (small time constant) or slowly (large time constant) to widely changing flow variables. Note! Damping is inactivated when set to "zero". **Entry** Max. 2-digit number: 0…99 seconds Factory setting: ***1 s***

Note

Function Group DISPLAY	
DISPLAY FORMAT	Here, it is determined with how many significant digits the actual flow rate value is shown on the display. Along with the function "DISPLAY DAMPING", this serves to stabilize strongly fluctuating flows. Note! • Insignificant digits in front of the decimal point are shown as zeroes. • Insignificant digits after the decimal points are not shown, while the last digit displayed is rounded. **Selection** ± ***X.XXXX*** (5 significant digits) X.XXX (4 significant digits) X.XX (3 significant digits)
LCD CONTRAST	The contrast can be optimally adjusted to match the operating conditions on site. Caution! At minus temperatures, the visibility of the display is no longer assured even at maximum contrast. If no display is visible, refer to Section 8.2. **Adjustment** ± **IIIIIIIII**..... A change in contrast is immediately recognizeable on the bar graph.
LANGUAGE	Selection of the operating language required. **Selection** ± ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS DANSK NORSK SVENSKA SUOMI BAHASA INDONESIA JAPANESE Factory setting: **according** to the respective country Note! By simultaneously pressing the ± keys when starting the Promag 35 (power supply ON), the system starts with "ENGLISH".

Note

Caution

Note

Function Group
COMMUNICATION

With this group of functions, the user can programme the interfaces or assign a function to the auxiliary input. More information on both interfaces can be found in Chapter 7.

PROTOCOL

With this function, the respective communication protocol can be selected.

Selection

for the HART communication module
OFF – HART

for the RS 485 communication module
OFF – RACKBUS RS 485

BUS ADDRESS

With this function, you may determine the bus address for your Promag 35 by which a data exchange via HART protocol or RS 485 shall be executed.

Note!
HART: the analog output 4…20 mA is only active if the address is "0" (→ point-to-point network).
If the address is ≠ 0, the output is fixed to the value of 4 mA (→ multidrop network).

Input

2-digit number
HART: ***0***…15
Rackbus RS 485: ***0***…63

ASSIGN AUX. INPUT

Here various functions can be assigned to the auxiliary input.
This is only possible if:
- the transmitter is fitted with an "RS 485" communications module.
- the function "SYSTEM CONFIG." is set to "AUX. INPUT/....." (see page 60).

The functions of the auxiliary input are started or activated by applying an external voltage. Two types of activating are to be distinguished:
- *Pulse trigger:* It is necessary to programme an appropriate minimum width for the start pulse in the function "START PULSE WIDTH" (see page 60).
- *Level trigger.*

Note!
- Refer to the table on page 59. This gives a summary of *all* possible functions of the auxiliary input.
- If the auxiliary input is not available or an instrument with the HART communication module is used, then this function is blanked out.

Note

Selection

Pulse trigger:
RESET TOTALIZER
BATCHING

Level trigger:
DUAL RANGE MODE
POS. ZERO RETURN

Functions of the auxiliary input

Pulsed mode

Assignment	Pulse at auxiliary input	Function	Remarks
RESET TOTALIZER	• No pulse at auxiliary input	No function	–
	• Pulse between 3...30 V at auxiliary input, at least for the time of the set start pulse width	Totalizer is reset	
BATCHING	• No pulse at auxiliary input	No function	
	• Pulse between 3...30 V at auxiliary input, at least for the time of the set start pulse width	Batching is started	The option “BATCHING” is only available, if the function “BATCH VARIABLE” (see page 59) is set to “VOLUME”. By deactivating the batching function (→ “OFF”) the auxiliary input is automatically set to “POS. ZERO RETURN”.
	• Another pulse at auxiliary input during the filling procedure, at least for the time of the set start pulse width	Batching is stopped	

Level mode

Assignment	Voltage at auxiliary input	Function	Remarks
DUAL RANGE MODE	• No voltage at auxiliary input	Current output operates at full-scale value 1	
	• Voltage of 3…30 V at the auxiliary input	Current output operates at full-scale value 2	This parameter is only available if the current output is switched on and dual range mode activated. If the current output is switched off or the dual range mode deactivated, then the auxiliary input is automatically set to the function positive zero return (measured value suppression).
POS. ZERO RETURN	• No voltage at the auxiliary input	Instrument operates normally	–
	• Voltage of 3…30 V at the auxiliary input	All output signals are set to 0 (no flow)	

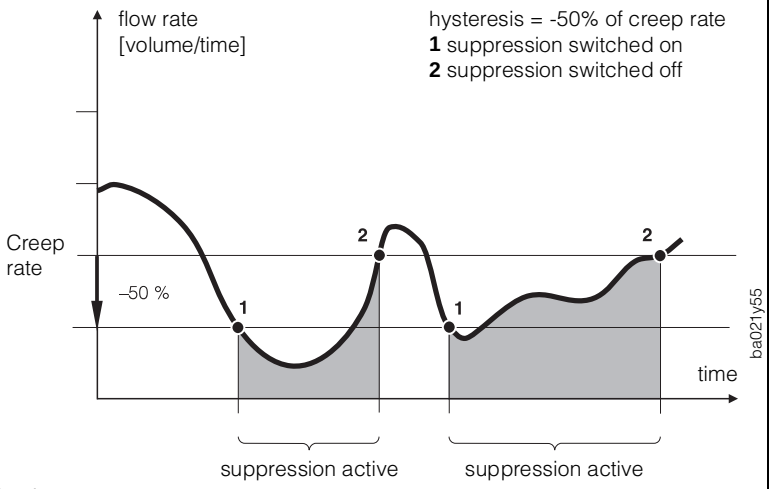

Note

Function Group COMMUNICATION	
START PULSE WIDTH	If the auxiliary input is assigned to the pulsed function (BATCHING or RESET TOTALIZER), the minimum required pulse width can be set in this function. The input pulse must reach at least the set pulse width so that the function is activated. This ensures that the function is not activated by transient voltage peaks (interference pulses). Note! If the auxiliary input is not available or has no function assigned to it with a pulse control, then this function is blanked out. **Selection** Max. 3-digit number: ***20***...100 ms
SYSTEM CONFIG.	This function shows how the RS 485 communication module is configured. This function can only be reprogrammed after entering a special service code. If you have a problem with the existing configuration, then please contact your E+H Service organisation. **Selection** RS 485 / CURRENT [1, 2] RS 485 / FREQUENCY [2, 3] ***AUX. INPUT / CURRENT*** [1, 4] AUX. INPUT / FREQ. [3, 4] [1] The function group “PULSE / FREQ. OUTPUT” is blanked out. [2] The matrix fields for auxiliary input are blanked out. [3] The function group “CURRENT OUTPUT” is blanked out. [4] The matrix fields for RS 485 are blanked out.

Function Group
PROCESSING PARAMETERS

LOW FLOW CUTOFF

Set the required switch point for the creep rate (volume/time). Creep suppression prevents a flow rate being determined in the lower part of the range (e.g. fluctuating head at standstill). The creep function always operates with negative hysteresis:



Note!

- If creep suppression is active, the flow sign is displayed inverted.
- The max. creep rate depends on the nominal diameter of the sensor currently being used and corresponds to a flow velocity of v = 1 m/s.
- The unit shown can be selected in the “FLOW RATE UNIT” function.

Note

Input

5-digit number with floating decimal point
(e.g. 15.000 dm^3/min)

Diagnosis

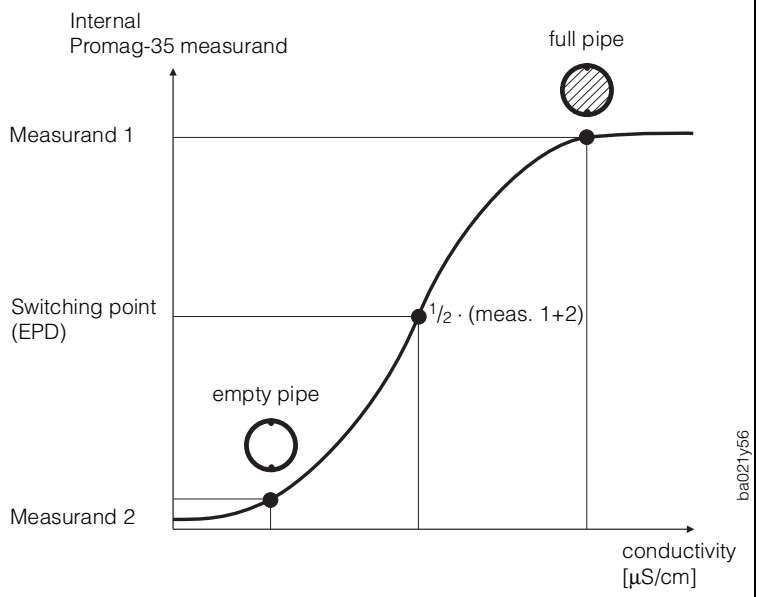
Creep suppression operates with a negative hysteresis of 50%.

NOISE SUPPRESS.

A software filter (= interference blanking) can be used to reduce the sensitivity of the output signals with response to transient flows and interference peaks, e.g. with fluids containing solids.

Selection

OFF
LOW
MEDIUM
HIGH

Function Group **PROCESSING PARAMETERS**	
EMPTY PIPE DET.	Only a completely full measuring 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, the relay 1 de-energizes. Note! • The EPD function is only available if the sensor is fitted with an extra electrode. • In this function, the full/empty adjustment necessary for EPD can be carried out. This adjustment must be made **before** EPD is switched on. • If different fluids with different conductivity are measured, a new full/empty adjustment must be made for each fluid! • EPD has the same effect on the outputs as if there were a fault.  **Selection** ***OFF*** ON EMPTY PIPE ADJUSTMENT FULL PIPE ADJUSTMENT
EPD RESPONSE TIME	The EPD response time can be selected by the user to suit his process conditions. No alarm is given until this response time has expired. Intermittently occurring air bubbles in the measuring pipe are thus not interpreted as a partial filling of the pipe. Note! This function is only available if Empty Pipe Detection is switched to “ON”. **Selection** 60 s (in seconds) 30 s 10 s 5 s 2 s ***1 s***

Function Group **PROCESSING PARAMETERS**	
MEASURING MODE	The measuring system is able to measure both flow directions (bidirectional). The signal outputs (current output, pulse/frequency output and the internal totalizer) can all be switched to an unidirectional mode. In this case, a signal is only shown or totalized internally for a 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 type plate of the flowmeter to indicate a 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 flowrate measured (reverse). **Selection** ***FORWARD*** [1] REVERSE [2] [1] Positive flow according to the arrow on the type plate. [2] Positive flow in the opposite direction to the arrow on the type plate.
AMPLIFIER MODE	The Promag 35 amplifier has an automatic amplifier booster controller. This ensure that the amplifier always operates at optimum amplification according to the flow velocity of the medium. High accuracy is thus maintained over the wide dynamic range of 1000:1. Applications with rapid and strongly fluctuating flowrates can still affect 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. **Selection** ***NORMAL*** automatic amplifier booster controller MODE 1 for flowrates 0...>12 m/s MODE 2 for flowrates 0...12 m/s MODE 3 for flowrates 0...4 m/s MODE 4 for flowrates 0...1 m/s Note! Please note that from SW version 3.01.00 (measuring amplifier) function name and settings have been modified.
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 independently of the value originally set. 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 booster is necessary. **Selection** Max. 4-digit number: ***10***...1000


Note

Function Group SYSTEM PARAMETERS	
POS. ZERO RETURN	With the positive zero return (PZR), output signals can be deliberately set to zero. Positive zero return is equivalent to zero flow: • current output signal ⇒ 0/4 mA • pulse/frequency output signal ⇒ at fallback value • display of HOME position: flow = 0; totalizer remains at actual value. Caution! • This value has top priority over all other instrument functions. • Both relays are live, i.e. energized. Any faults that occur during positive zero return can only be scanned directly using the diagnostic function or with the "PRESENT SYSTEM CONDITION" function. Note! Any simulation in progress is stopped by the PZR. **Selection** + / - ***OFF*** ON
DEF. PRIVATE CODE	Selection of a personal number which programming can be enabled with. For the Promag 35 measuring system the factory setting is 35. Caution! Programming is always enabled if code number = 0 is selected. Note! • If programming is blocked, this function is not available and access to the personal code by third parties is excluded. • The code number can only be altered if programming has been enabled first. **Input** + / - Max. 4-digit number (0...9999) Factory setting: ***33***

Function Group
SYSTEM PARAMETERS

ACCESS CODE

All data of the Promag 35 measuring system are protected against unauthorized 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” or
→ Entering personal code number

Note!
- If, in any function, the ± keys are pressed if 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 blocked after 1 minute if no key is pressed during this time.
- Programming can also be blocked by entering another code number in the “ACCESS CODE” function (not the same number as the personal code).
- A number 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 further information, please contact your E+H Service Organisation.

Note

Caution!
If you can no longer find your personal code, the Endress+Hauser Service Organisation will be able to help you.

Caution

Input

± Max. 4-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.

Note!
This function is not available if the function “BATCH VARIABLE” (see page 54) is set to “OFF”. In this case no periodical self check is carried out.

Note

Selection

± OFF
ON

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, alternately to the measuring 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 available in their order of importance.

Note

Note!
- A complete list of all possible error and status messages can be found in Section 8.3.
- For error-free measurements, the message “S: SYSTEM WORKS NORMALLY” will be displayed.
- This function can also be selected directly by accessing 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					

Ask for further error or status messages.

PREVIOUS SYSTEM CONDITIONS

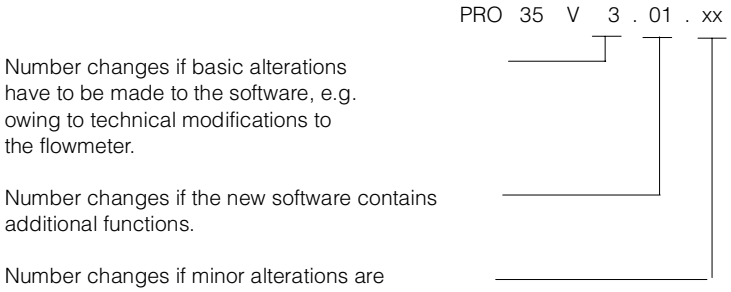
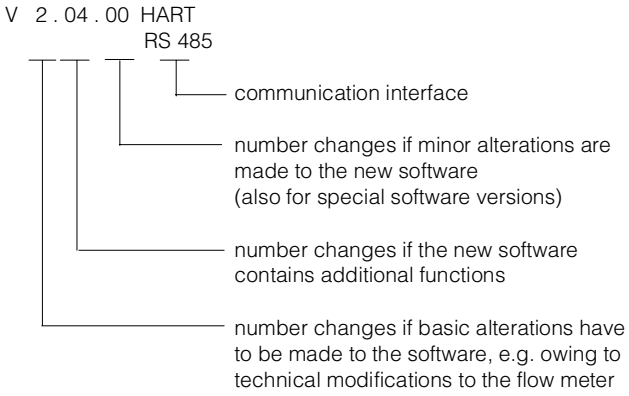
This function lists all error and status messages which have occurred in chronological order (max. 10 messages).

Note

Note!
- Storage of this list is volatile and lost if the power supply is interrupted.
- A complete list of all possible error and status messages can be found in Section 8.3.
- If no error or status messages have occurred since the measuring equipment was last started up, the message “S: NO ENTRY EXISTING” is shown.

Selection

Scanning of additional system/process errors and status reports
- **+** listing is continued with the chronologically oldest, second-oldest, etc. report;
- **–** listing is continued with the chronologically most recent, second most recent, etc. report.

Function Group **SYSTEM PARAMETERS**	
SOFTWARE VERSION	Display of the software version installed on the amplifier board. The meaning of the numbers of the software version is as following: 
SOFTWARE VER. COM	Display of the software version installed on the communication board. The meaning of the numbers of the software version is as following: 

Function Group
SENSOR DATA

Sensor data, such as nominal diameter, calibration factor, etc., are set at the factory. All characteristic values of the sensor are stored in the DAT memory (see Section 2.4). The functions of this line can only be changed after entering a special code (service code) and cannot be altered using the personal code. Please contact your E+H Service Organisation for additional information.

Caution!
As a rule, these characteristic data may not be altered. A change to the data of the sensor affects a number of functions of the whole measuring system, in particular its accuracy.

K-FACTOR POS.

The calibration for the positive flow direction depends on the particular sensor. This factor is determined and set at the factory.

Caution!
As a rule, the calibration factor may not be altered.
The special code (service code) is known to your E+H Service Organisation. Please contact it for additional information.

Selection

5-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 flow direction depends on the particular sensor. The factor is determined and set at the factory.

Caution!
As a rule, the calibration factor may not be altered.
The special code (service code) is known to your E+H Service Organisation. Please contact it for additional information.

Selection

5-digit number with fixed decimal point (0.5000…2.0000)
Factory setting: ***dependent on*** the sensor (nominal diameter) and its calibration

ZERO POINT

Zero-point depends on the particular sensor. It is determined and set at the factory.

Caution!
As a rule, the zero-point may not be altered.
The special code (service code) is known to your E+H Service Organisation. Please contact it for additional information.

Selection

Max. 4-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 at the factory. Caution! The nominal diameter given may, as a rule, not be altered. Numerous functions directly depend on the nominal diameter (technical units, full-scale values, switch points, creep rate, etc.). If the nominal diameter is changed, all dependent parameters are set to a **new** and plausible value. **Selection** Value: 15…600 mm or ½…24" Diagnosis The unit can be selected under “VOLUME UNIT”, page 34.
MAX. SAMPLE RATE	The maximum permissible sampling rate (SAPS) depends on the particular sensor being used. It is set at the factory. Caution! Under normal circumstances, the max. sampling rate should not be altered. **Input** 2- or 3-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 for the Promag A, D and F flowmeters 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 synchronized with the main power supply. Therefore, the sampling rate entered is set to the nearest possible value or rounded off to it. **Input** Max. 3-digit number with fixed decimal point (upper limit: ***depending on*** nominal diameter, maximum 60.0/s, lower limit: 1.0/s)
SERIAL NUMBER	Display of the serial number of the sensor. Note! The serial number is normally entered at the factory. **Input** Max. 6-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. This setting is made at the factory to suit the sensor installed. Note! Empty pipe detection can only be activated if an EPD electrode is fitted. **Selection** YES – NO Factory setting: with standard EPD electrodes the factory setting is “YES”.
COIL SLOPE	To optimise 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. 3-digit number (0…255)

7 Interfaces

Promag 35 is available with two different communication modules:

- Communication *module "RS 485":*
  This version enables the instrument to be configured and operated with the Rackbus RS 485 interface or for measured data to be read.
  More information can be found in Section 7.1 of this Operating Manual.

- *Communication module "HART":*
  This version is supplied with the HART interface and the standard 4…20 mA output. The instrument can be programmed either with a hand-held terminal (HART Communicator, Model 275 by Rosemount) or connected to a process-control system.
  More information on function and operation can be found in Section 7.2 of this Operating Manual and in the Operating Manual supplied with the Rosemount hand-held terminal.

Warning!
All appropriate instructions and installation regulations given in the "Ex Documentation" must be observed when using Ex certified instruments.

7.1 Rackbus RS 485

There are two possibilities to integrate Endress+Hauser instrumentation with an RS 485 interface into a bus structure:
- direct connection of the transmitters to a personal computer via an RS 485 serial interface card or RS 232C/RS 485 converter (see Fig. 38);
- indirect connection to a supervisory bus system via an FXA 675 interface card and MODBUS, PROFIBUS or FIP gateway (see Fig. 39).

Transmitters can be configured, operated, and their measured values displayed on a personal computer by using "Fieldmanager 485" and "Commugraph 485" software.

Note!
This section only describes the connection of Promag 35 to an existing network. If installing a Rackbus RS 485 network for the first time, the operating manuals of both the instruments and other network components used must always be considered (see especially BA134/01/ Rackbus RS 485, Topology, Components, Software).

Connecting Promag 35 to the RS 485 Rackbus

Warning

Warning!
Danger from electric shock! Switch off power supply.

1. Open the connection compartment
2. Terminal 20 = Data A
   Terminal 21 = Data B
3. Ground the bus screening to terminal 28
4. Close the connection compartment

Note

Note!
If the bus is grounded on both sides, then a potential compensation must also be present!

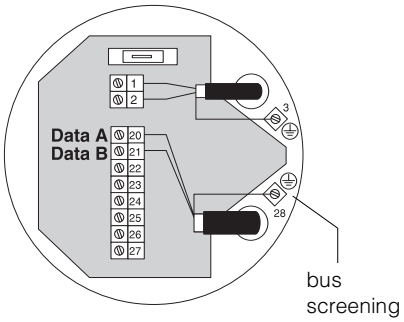


Fig. 36

The bus connection to the personal computer is handled by an RS 485 interface card or an external RS 232C/RS 485 adapter (both equipment with galvanical isolation).
Cable specifications:
- connection cable: twisted pairs, screened
- cable diameter: ≥0.20 mm² (24 AVG)
- cable length: max. 1,200 m (3,900 ft)

Each transmitter has an individual bus address. The address can be read or changed via the display and operating element (see page 58).

Setting the termination resistors

The termination switches are found on the RS 485 communication board.
The termination switches can usually remain in the default position (all switches → OFF).

Warning

Warning!
Danger from electric shock! Switch off the power supply before unscrewing the cover of the electronics area from the tansmitter, when setting the termination resistors.
- If a Promag terminates the bus, turn on the terminating resistor at switch SW1: OFF; ON; ON; OFF
- If a bus voltage is to be provided, then position switch SW1 to ON; ON; ON; ON.

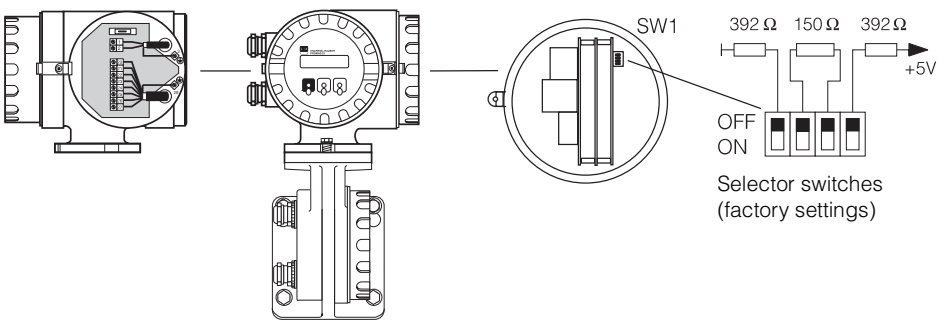


Fig. 37

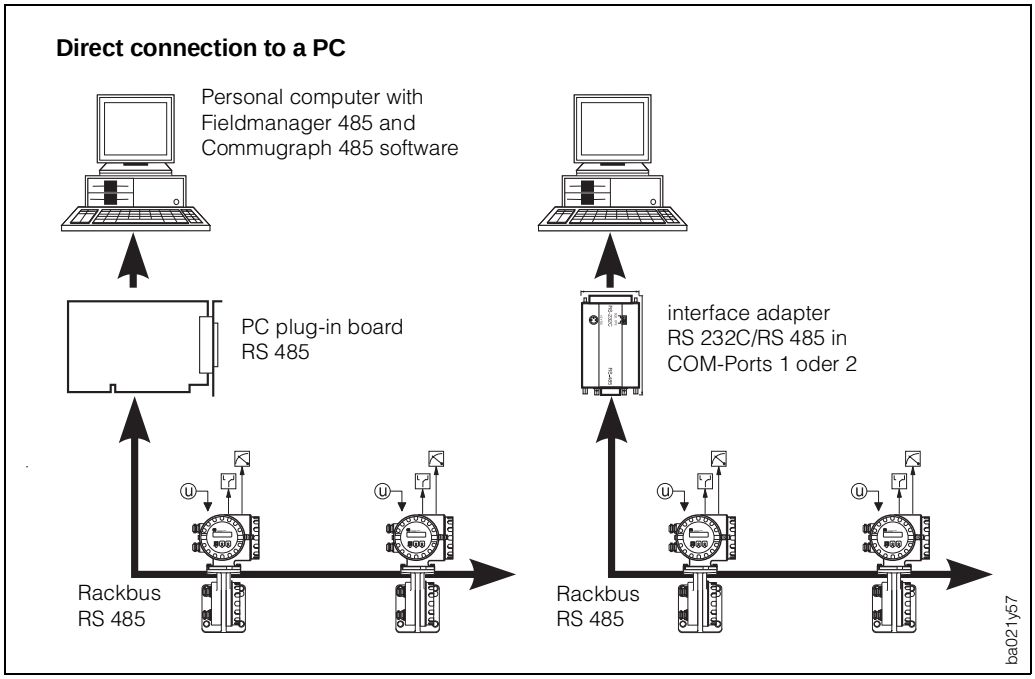


Fig. 38

If the RS 485 Rackbus is directly connected to a computer, the number of transmitters is limited:
As a rule, a maximum of 25 transmitters can be connected. The actual number depends on the topology and operating conditions.

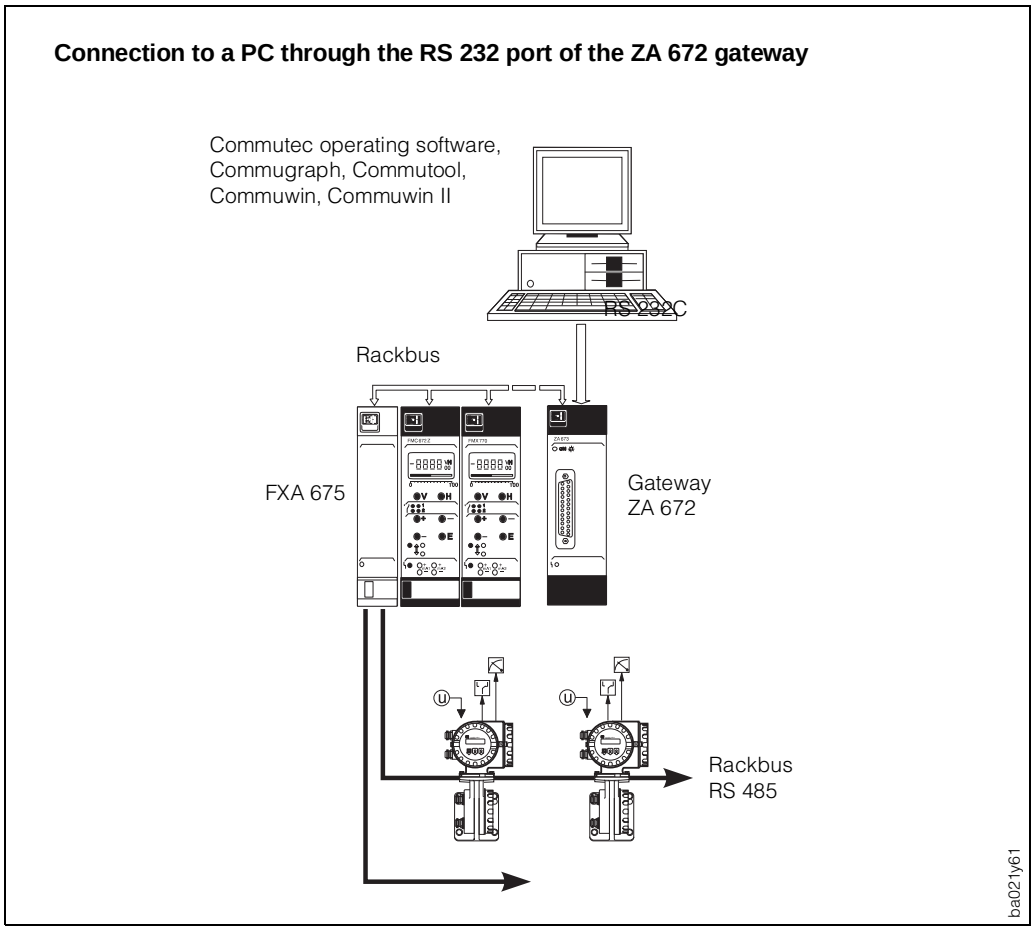


Fig. 39

Programming matrix for Rackbus RS 485

Group select.	0	1	2	3	4	5	6	7	8
0 MEASURED VALUE	FLOW	TOTAL VOLUME	FLOW UNITS 0: dm^3/s 11: gal/min 1: dm^3/min 12: gal/h 2: dm^3/h 13: gal/day 3: m^3/s 14: gpm 4: m^3/min 15: gph 5: m^3/h 16: gpd 6: l/s 17: mgd 7: l/min 18: bbl/min 8: l/h 19: bbl/h 9: hl/min 20: bbl/d 10:hl/h 21: ft^3/s 22: cc/min	UNITS VOLUME 0: dm^3 1: m^3 2: l 3: hl 4: gal 5: bbl 6: kgal 7: ft^3	GALLONS/ BARREL 0: 31 gal 1: 31.5 gal 2: 42 gal 3: 55 gal 4: 36 Imp gal 5: 42 Imp gal	UNITS NOMINAL DIAMETER 0: mm 1: inch			
1 CURRENT OUTPUT	FULL-SCALE VALUE 1	DUAL RANGE MODE 0: OFF 1: ON	FULL-SCALE VALUE 2	ACTIVE FULL-SCALE VALUE 0: MEAS RANGEA 1 1: MEAS RANGE 2	TIME CONSTANT	CURRENT SPAN 0: 0…20 mA 1: 4…20 mA 2: 0…20 mA NAMUR 3: 4…20 mA NAMUR	ERROR RESPONSE 0: MIN. 1: MAX. 2: LAST MEAS. VALUE 3: ACT. MEAS. VALUE	SIMULATION CURRENT 0: OFF 1: 0 mA 2: 2 mA 3: 4 mA 4: 10 mA 5: 12 mA 6: 20 mA 7: 22 mA 8: 25 mA	NOMINAL CURRENT
2 PULSE/FREQ. OUTPUT	OPERATION MODE 0: FRE-QUENCY 1: IULSE	PULSE VALUE	PULSE WIDTH	FULL-SCALE FREQUENCY	FULL-SCALE VALUE	OUTPUT SIGNAL 0: NO CONTACT 1: NC CONTACT 2: ACTIVE POS. 3: ACTIVE NEG.	ERROR RESPONSE 0: FALLBACK LEV 1: LAST MEAS. VAL. 2: ACT. MEAS. VAL.	SIMULATION FREQ. 0: OFF 1: 0 Hz 2: 2 Hz 3: 10 Hz 4: 1 kHz 5: 10 kHz	NOMINAL FREQUENCY
3 RELAY	FUNCTION RELAY 1 0: ERROR 1: EPD 2: ERROR + EPD 3: PZR 4: PRE AL BATCH 5: DIR. OF FLOW 6: LIMIT VALUE K1	SWITCH-ON POINT RELAY 1	SWITCH-OFF POINT RELAY 1	FUNCTION RELAY 2 0: – 1: EPD 2: – 3: PZR 4: BATCHING 5: DIR. OF FLOW 6: LIMIT VALUE K2	SWITCH-ON POINT RELAY 2	SWITCH-OFF POINT RELAY 2			
4 BATCHING	BATCH MODUS 0: OFF 1: VOLUME	BATCH QUANTITY	BATCH PREWARN	COMPENS. QUANTITY	BATCHING 0: CANCEL 1: START 2: STOP	MAX. BATCH TIME	BATCH CYCLE	RESET BATCH CYCLE 0: NO 1: YES	
5 MEAS. VAL DISPLAY	TOTAL OVERFLOW	RESET TOTAL 0: NO 1: YES	ASSIGN LINE 1	ASSIGN LINE 2	DISPLAY DAMPING	DISPLAY FORMAT 0: – 1: 5 2: 4 3: 3	CONTRAST LCD	LANGUAGE 0: ENGLISH 1: DEUTSCH 2: FRANCAIS 3: ESPANOL 4: ITALIANO 5: NEDERLANDS 6: DANSK 7: NORSK 8: SVENSK 9: SUOM	
6 COMMUNI-CATION	INTERFACE RS 485	RACKBUS ADDRESS			SYSTEM CONFIG. 0: RS 485 / 4–20 mA 1: RS 485/FREQ.				
7 SYSTEM PARAMETERS	POS. ZERO RETURN 0: OFF 1: ON		INPUT: CODE	SELF CHECK 0: OFF 1: ON	DIAGNOSIS CODE		SW VERSION	SW VERSION COM	
8 PROCESS PARAMETERS	LOW FLOW CUTOFF	INTER-FERENCE SUPPR. 0: OFF 1: LOW 2: MIDDLE 3: HIGH	EPD 0: OFF 1: ON 2: EMPTY 3: FULL	RESPONSE TIME EPD 0: 1 s 1: 2 s 2: 5 s 3: 10 s 4: 30 s 5: 1 min	INSTR. MODE 0: UNIDIREC-TIONAL 1: BIDIREC-TIONAL	DIRECTION OF FLOW 0: FORWARD 1: REVERSE	GAIN RANGE 0: AUTOM. 1: 1 2: 2 3: 3 4: 4	RECOVERY TIME ECC	
9 SENSOR DATA	K-FACTOR POSITIVE	K-FACTOR NEGATIVE	ZERO POINT	NOMINAL DIAMETERS	MAX. SAMPLING RATE	SAMPLING RATE	SERIAL NUMBER	EPD ELECTRODE 0: NO 1: YES	
A COMMIS-SIONING	MEAS. POINT								

The meaning of the individual matrix fields and their programming can be found in Chapter 6 of this Operating Manual.

7.2 HART® Protocol

Besides local operation, the Promag 35 flowmeter can also be calibrated and measured values called up using the HART Protocol.
Two procedures can be used:
- Operation using the “HART Communicator DXR 275” universal handheld terminal.
- Operation using a personal computer with specific software, e.g. “Commuwin II”, and the “Commubox FXA 191” HART modem.

Operation using the HART Communicator DXR 275
Furher information on the “HART Communicator DXR 275” handheld terminal is given in the appropriate operating manual in the carrying case. Please also refer to documentation published by the HART Communication Foundation, especially:
- HCF LIT 20: HART, eine technische Übersicht No. 50077233 (German)
- HCF LIT 20: HART, a Technical Overview No. 50077234 (English)

Connection
The following connection versions are available to the user:
- Direct connection to the Promag transmitter via Terminals 26/27
- Connection via the analogue 4...20 mA cable of current output (see Fig. 40).

Note!
In both cases the measuring loop must have a minimum resistance of 250 Ω.

Note

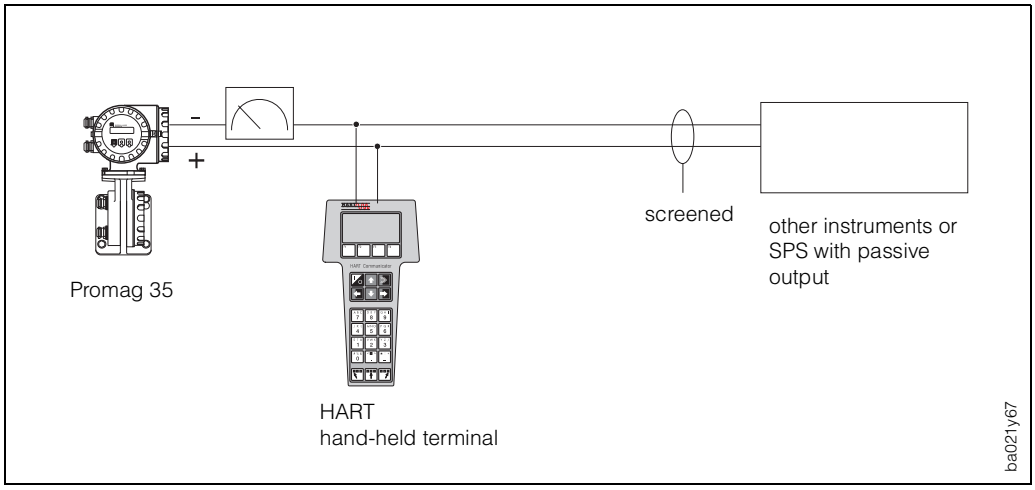


Fig. 40

Operating the Promag 35 with the HART Communicator

Operating the Promag measuring system using a hand-held terminal is different from operating it locally. All functions can be selected with the HART communicator via various menu levels as well as by using a special E+H operating menu (see Fig. 41, 42).

Caution

Caution!
The Promag 35 S measuring system is indicated as Promag 33 on the hand-held HART terminal.
The specific matrix fields (operation mode, delay, start-up time) cannot be operated via HART protocol.

Note

Note!
Assuming the HART interface of the Promag 35 is enabled (see page 58).

1. Turn on the hand-held terminal.
   a. The flowmeter is not yet connected → the HART main menu is displayed.
   This menu level is shown with every HART programming procedure, i.e. independent of the type of flowmeter used. For further information see the operating menu for the "DXR 275 Communicator". Continue with "Online".
   b. The flowmeter is already connected → the menu level "Online" is immediately shown.
   In the "Online" menu level the actual measurement data including flow, totalizer sum, etc. are continually shown while providing access to the acual Promag 35 programming matrix via the line "Group Select". All function groups and functions accessed by HART are systematically arranged and shown in this matrix.
2. Select the function group using "Group Select", e.g. "Analog output", and then the function required, e.g. "RV1" (full scale value). All settings or values of this particular function can be seen immediately.
3. Enter values or change setting.
4. The "SEND" field is shown by pressing the F2 function key. By pressing this key, all values/settings entered with the hand-held terminal are transferred to the Promag measuring system.
5. Press the F3 HOME function key to return to the "Online" menu level. The actual values measured by the Promag 35 flow meter with the new settings can now be read.

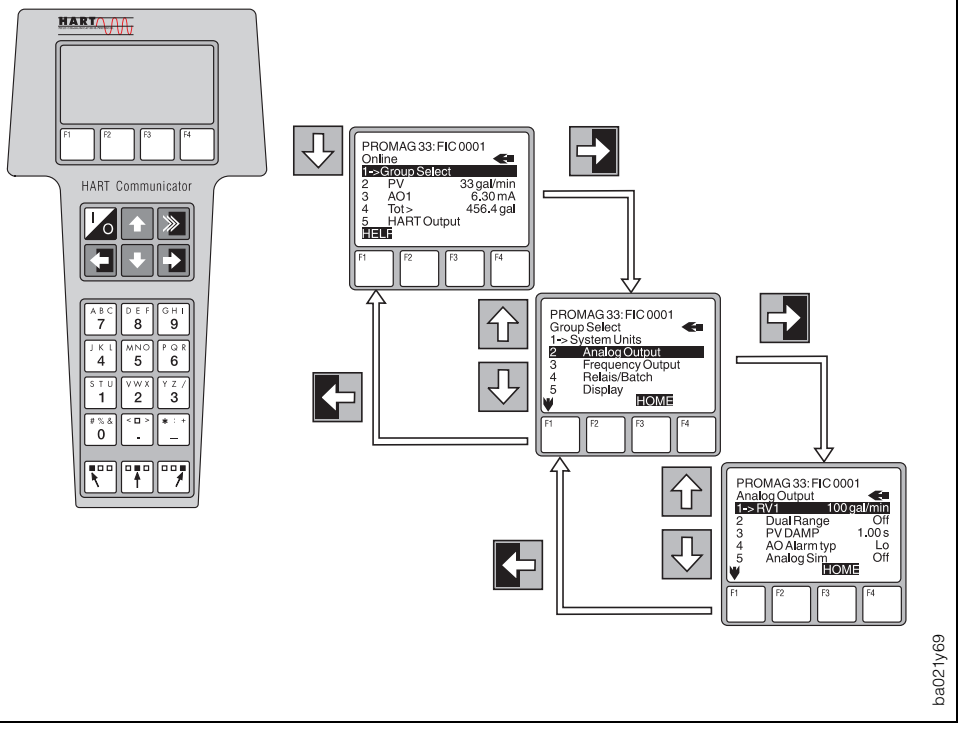


Fig. 41

HART operating matrix (Promag 35)

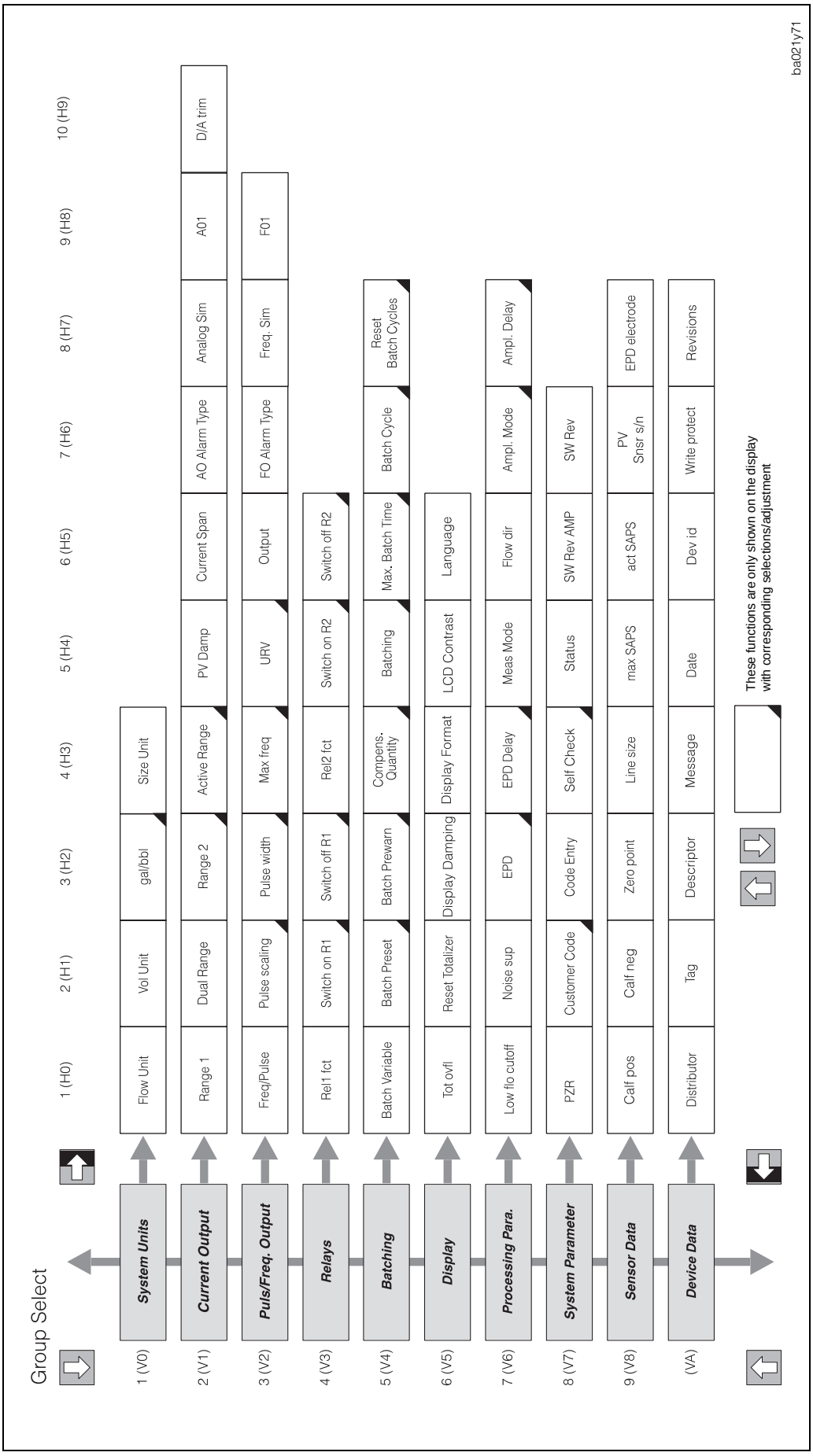


Fig. 42
HART operating matrix Promag 35

Write protect
Unlike the local operation, all functions are accessible via HART, i.e. programming is not locked. However, if you enter the value "–1" in the "Code Entry" function, data in the Promag measuring system may no longer be changed by using the hand-held terminal. This mode is stored in case of a power failure (cancelling is only possible by entering the personal code).

Operating using "Commuwin II" Software
The Promag 35 transmitter can be connected to the RS 232 C serial interface of a personal computer via the Commubox FXA 191. It can be remotely operated using the E+H "Commuwin II" program.

Connection
The following connection versions are available to the user
- Direct connection to the Promag transmitter via Terminals 26/27.
- Connection via the analogue 4...20 mA cable of current output (see Fig. 43).

Note

Note!
- In both cases the measuring loop must have a minimum resistance of 250 Ω.
- Move the switch on the Commubox to "HART".

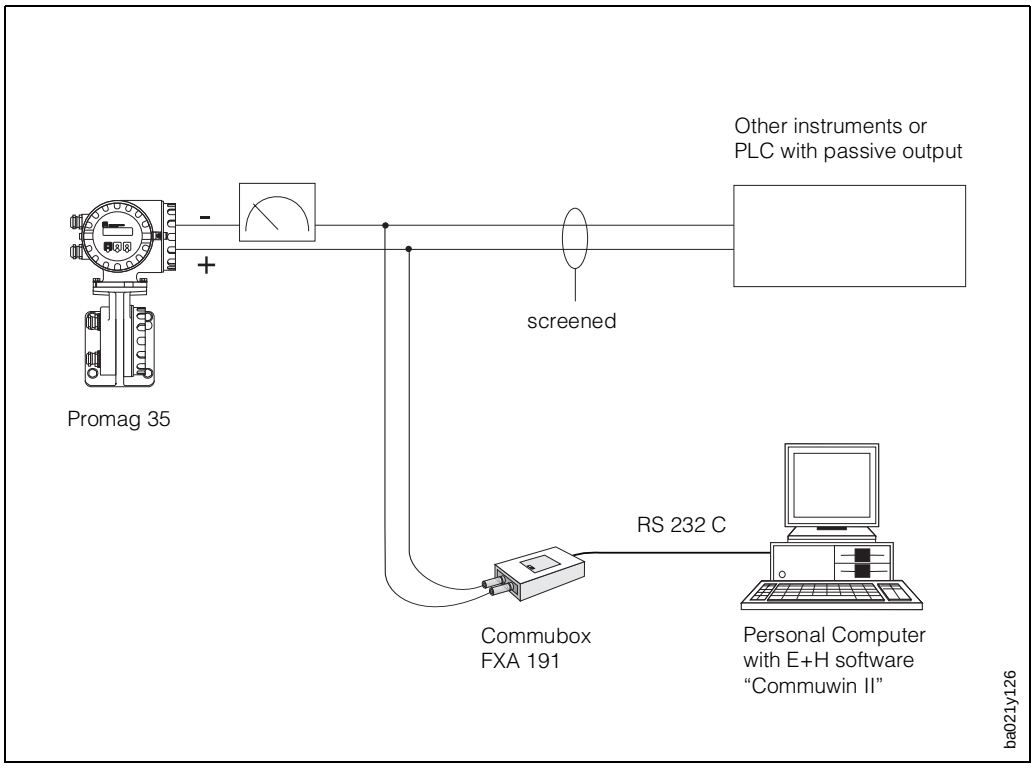


Fig. 43

8 Troubleshooting and Remedies

8.1 Response of the measuring system to faults or alarms

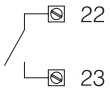
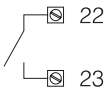
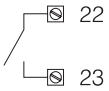
Error messages which occur while measuring is in progress are displayed in the HOME position, alternately to the measured values. The Promag 35 S measuring system distinguishes between two kinds of error:

Type of error	Response of the measuring instrument
Fault (system error) Fault due to failure of the instruments	➤ corresponding message on the display ➤ error output (see table on page 80) relay 1 dead ➤ the signal outputs respond according to their error settings (see page 38, 45)
Alarm (process error) Fault due to factors influencing the process	➤ corresponding message displayed ➤ response of relay 1 or 2 according to configuration (see page 50, 51)

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

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 accessed and displayed with the aid of the diagnostic function.
- Measured-value suppression resets all signal outputs to zero (corresponding to zero flow).
- Both relays are live, i.e. energised.

Simulation
- This function is accorded the second highest priority, as is the corresponding status message. Any error messages which occur during this time can only be accessed and displayed with the aid of the diagnostic function.
- Normal output of system errors via the error output (relay 1).
- Normal functioning of relay 1 or 2 (as per configuration, see pages 50 and 51).

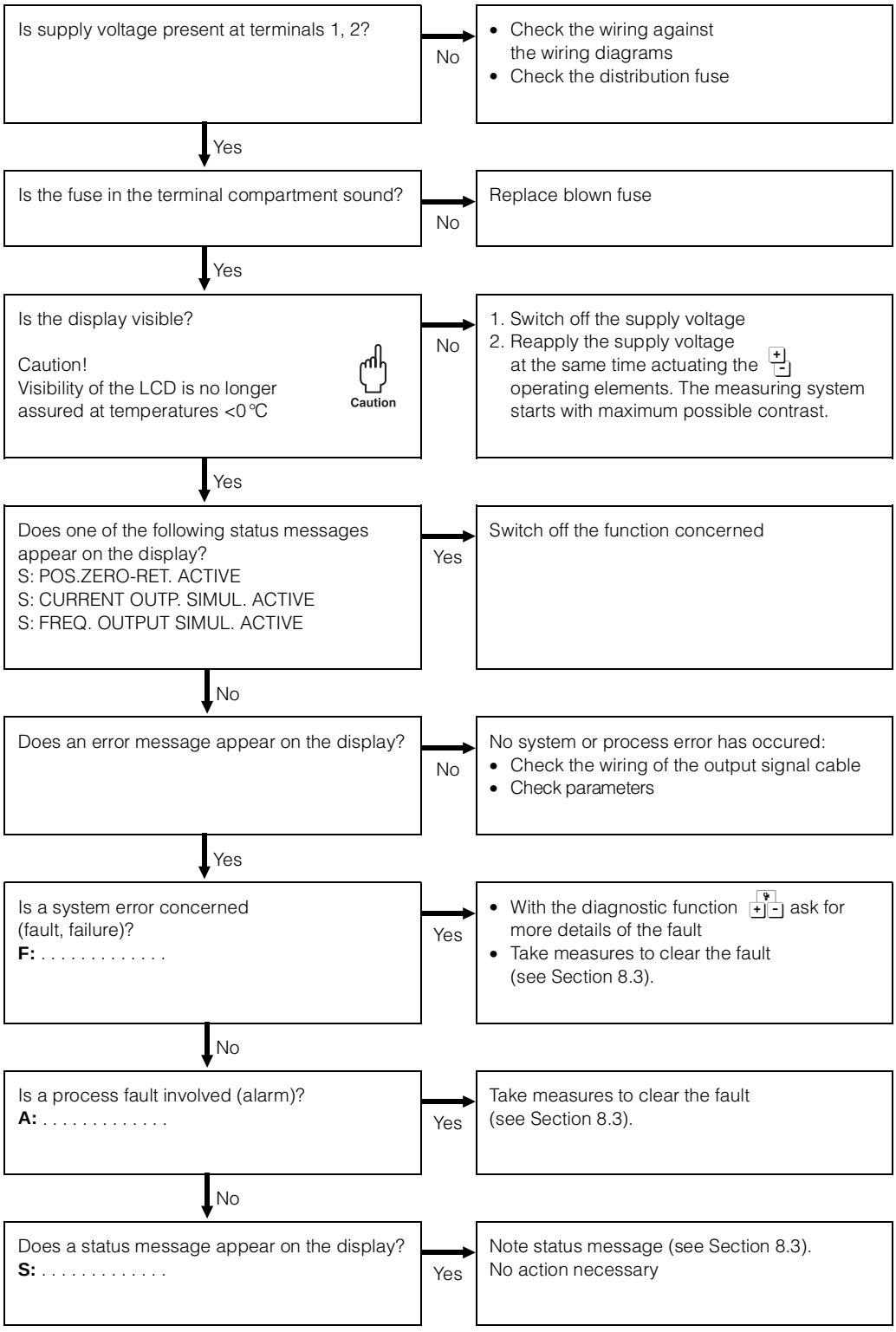
Function Relay 1	**State of measuring system**	**Relay coil**	**Relay contact***	
			NC contact brought out	NO contact* brought out
FAILURE Reporting system errors	measuring system working normally	energised		
	system error occurred (see Section 8.3)	de-energised		
	power supply failure	de-energised		

* Factory setting relay 1: NO contact brought out.
With a jumper on the communication board, the NC contact can also be brought out (see page 89, 90).

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 stae of the art technology.

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



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 or 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

(Example)

2. Activate diagnostic function (press ⊟ keys simultaneously). A change is automatically made to the function "PRESENT SYSTEM CONDITION", which lists all current error and status messages.

   By activating the diagnostic function once again, additional information of the fault can be asked for in the event of a system fault (see Section 8.3). The stethoscope symbol is shown.

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

(Example)

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

4. Return to HOME position.

8.3 Error and status messages

Fault messages F:... (system fault, failure)	**Causes** (call up using ⊞)	**Remedy**
F: SYSTEM ERROR POWER SUPPLY	⊞: LOW VOLTAGE DETECTED The voltage from the power supply board is too low.	by an Endress+ Hauser Service Organisation
	⊞: COIL CURRENT CONTROL Coil current beyond tolerance limits.	by an Endress+ Hauser Service Organisation
F: SYSTEM ERROR AMPLIFIER	⊞: EEPROM FAILURE Error when accessing EEPROM data (adjusted values of the amplifier).	by an Endress+ Hauser Service Organisation
	⊞: DAT FAILURE Error when accessing DAT data (adjusted value of sensor).	notify the Endress+Hauser Service Organisation
	⊞: ROM / RAM FAILURE Error when accessing programme memory (ROM) or main memory (RAM) of the processor.	by an Endress+ Hauser Service Organisation
	⊞: GAIN ERROR AMPLIFIER Gain error of the amplifier.	by an Endress+ Hauser Service Organisation
	⊞: NO AMPLIFIER RESPONSE Faulty data transmission between communication module and amplifier.	by an Endress+ Hauser Service Organisation
F: VALUE NOT ACCEPTED	The value entered was not correctly accepted by the amplifier.	repeat input

Fault messages F:... (system fault, failure)	**Causes** (call up using ⊞)	**Remedy**
F: SYSTEM ERROR COM-MODULE	: MODULE NOT COMPATIBLE Communication module and amplifier are not compatible.	by an Endress+ Hauser Service Organisation
	: EEPROM FAILURE Error when accessing EEPROM data (process and adjustment data of the communication module).	by an Endress+ Hauser Service Organisation
	: RAM ERROR Error when accessing the main memory (RAM).	by an Endress+ Hauser Service Organisation
	: ROM ERROR Error when accessing the programme memory (ROM).	by an Endress+ Hauser Service Organisation
	: LOW VOLTAGE DETECTED The voltage supplied by the DC/DC converter on the communication module is too low.	by an Endress+ Hauser Service Organisation
	: VOLTAGE REFERENCE The voltage reference of the communication module is beyond tolerance, i.e. correct functioning of the current output is not assured.	by an Endress+ Hauser Service Organization

Alarm messages A:... (process errors)	**Cause**	**Remedy**
A: EPD ADJUSTMENT VALUES MISSING	EPD switched on. No adjustment has taken place.	Adjust EPD as shown on p. 62.
A: EPD ADJUSTMENT FULL = EMPTY	EPD switched on, but alarm given because adjustment values for full and empty pipe are identical.	Repeat adjustment as shown on p. 62.
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 shown on p. 62.
A: EPD ADJUSTMENT NOT POSSIBLE	EPD switched on, but adjustment not possible because the conductivity of the medium is outside the permissible range (too high or too low).	EPD function cannot be used.
A: EMPTY PIPE DETECTED	The measuring pipe is not completely full or may be empty.	Check the process conditions of the installation.
A: FLOW TOO HIGH	Medium flow rate in measuring pipe >12.5 m/s. Measuring range of transmitter electronics exceeded.	Reduce flow rate.
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 p. 35ff.) or reduce flow rate.
A: FREQ. OUTPUT OVERFLOW	The actual flow rate is too high for the scaled full-scale value (f_{max} = approx. 163% of f_{End}).	Scale a higher full-scale value (see p. 43) or reduce flow rate.

Alarm messages A: ..... (process error)	**Cause**	**Remedy**
A: BATCH TIME EXCEEDED	The maximum time for a batching cycle has been exceeded.	Identify the cause for exceeding the time provided. Possible plant error (defective or blocked valve). It is possible that you have to increase the max. batching time (see page 54) or that you have to switch off batching time monitoring (batching time → 0 seconds).

Status messages S:...	**Cause**	**Remedy**
S: POS. ZERO RET. ACTIVE	Measured-value suppression active. This message has top priority for Promag 35.	unnecessary
S: CURRENT OUTP. SIMUL. ACTIVE	Current simulation active.	unnecessary
S: FREQ. OUTPUT SIMUL. ACTIVE	Frequency simulation active.	unnecessary
S: EPD ADJUSTMEN RUNNING	EPD adjustment in progress (full or empty pipe adjustment).	unnecessary
S: BATCHING IS RUNNING	Batching in progress until the selected quantity has been discharged.	unnecessary

8.4 Exchange of electronics boards

Warning!
- Danger of electric shock. Switch off power supply before unscrewing the cover of the electronics compartment and the transmitter housing.
- The locally used power and frequency have to conform to the technical data of the respective supply board.

Warning!
Danger from electric shock!
Switch off power supply before opening the transmitter housing (release of the measuring system).

1. Loosen Allen screw of the safety claw (3 mm Allen key).
2. Unscrew the cover of the electronics compartment from the transmitter housing.
3. Remove the local display (if available):
   a) unscrew the fixing screws of the display module;
   b) pull the flat ribbon cable of the display module from the communication board.
4. Unplug the 2-pole plug of the supply cable by pressing down the catch from the power supply board (Fig. 45).
5. Strip cable board of the screened sensor signal cable (incl. the DAT module connected to it) from the measuring amplifier board (Fig. 46).
6. Loosen the two Phillips screws of the board support. Carefully pull about 4–5 cm out of the transmitter housing.
7. Remove coil-loaded cable plug from the supply board (Fig. 45).
8. Pull off flat ribbon cable from the communication board (connection cable to the terminal area) (Fig. 47, 48).
9. The entire transmitter electronics may now, along with the board support, be pulled completely out of the housing.
10. Replace the old transmitter electronics with the new one.
11. Reassemble in reverse order.

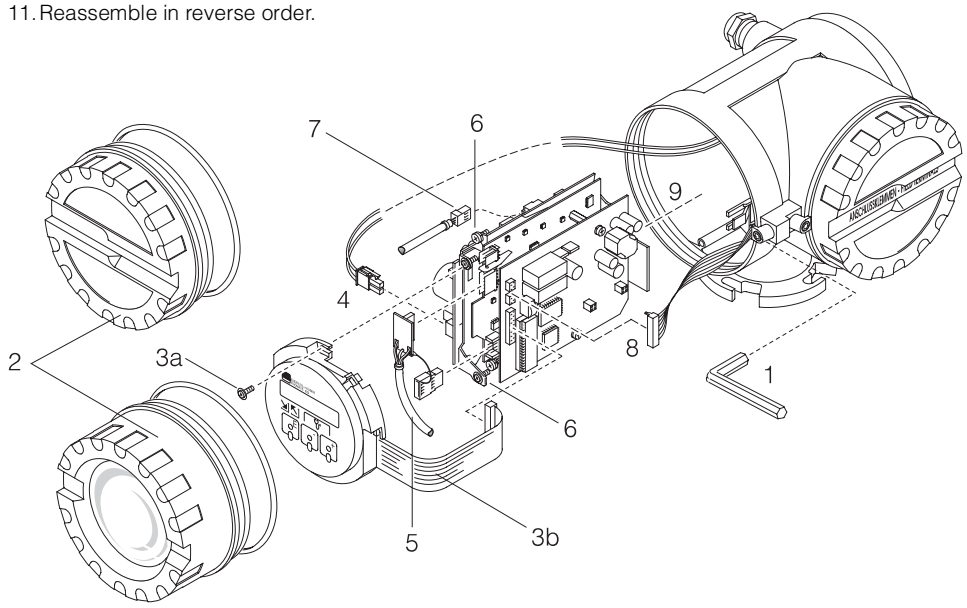


Fig. 44

The Promag 35 power supply board

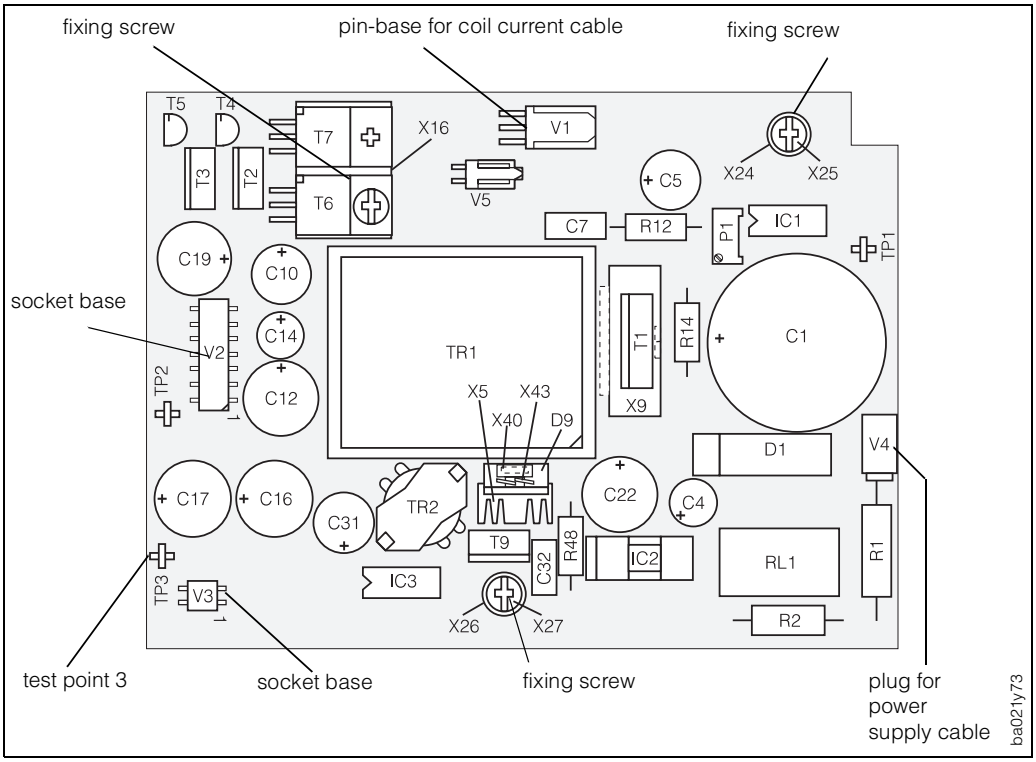


Fig. 45

The Promag 35 amplifier board

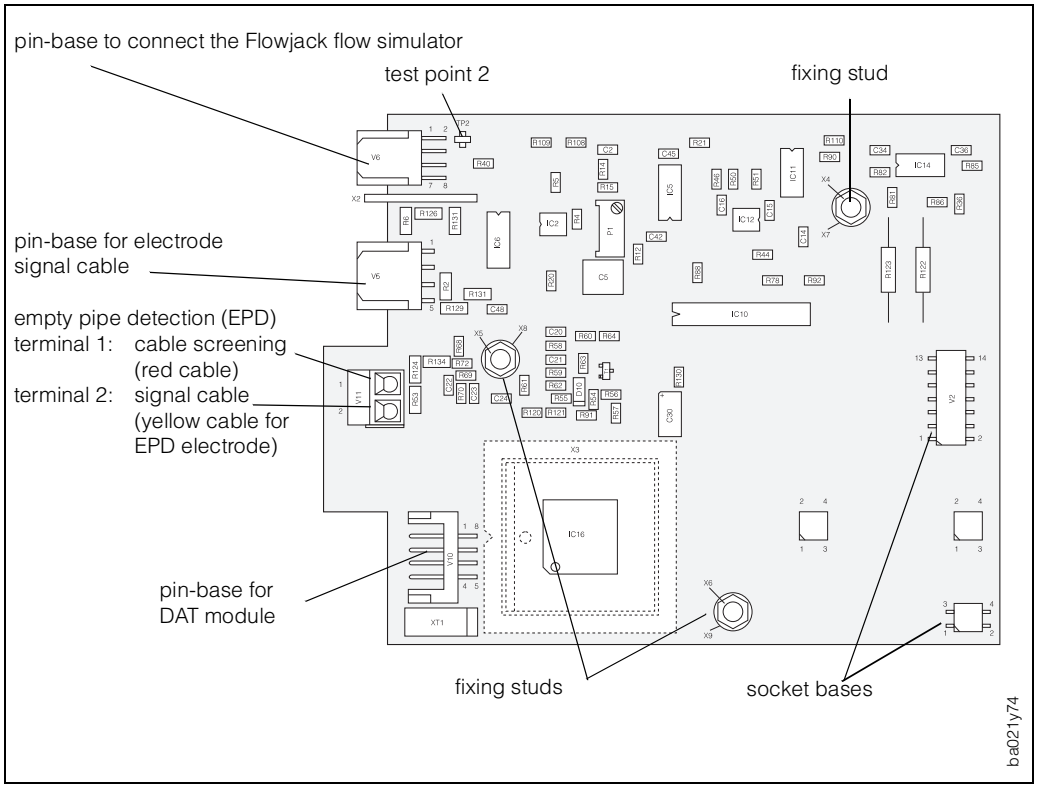
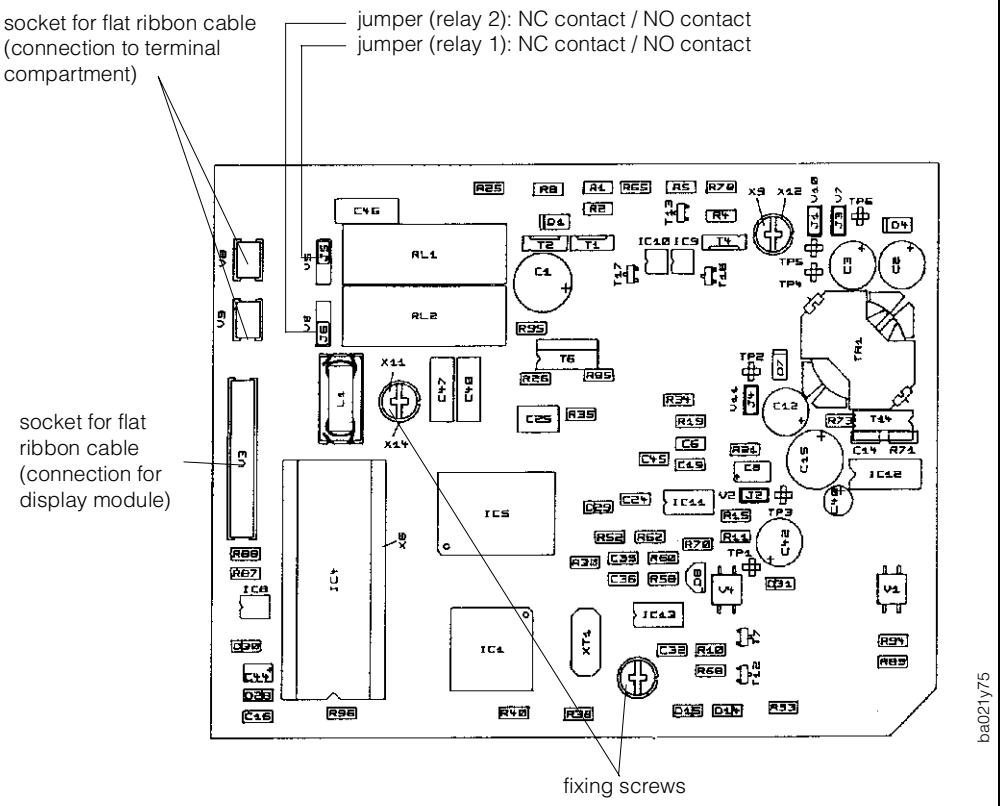
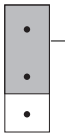
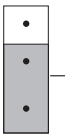


Fig. 46

The Promag 35 HART communication board

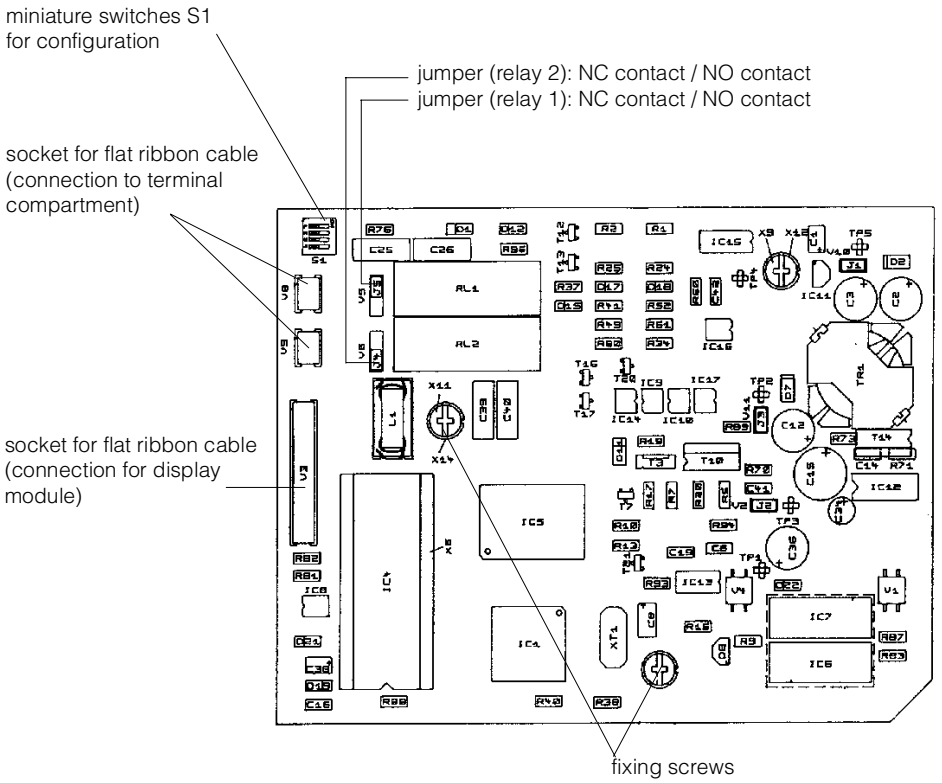


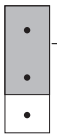
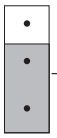
Relay contacts: NC and NO contact settings	
NO contact brought out	NC contact brought out
 jumper J5, J6	 jumper J5, J6
factory setting: relay 1	factory setting: relay 2

Relay 1: error or status output, configurable
Relay 2: status output, configurable

Fig. 47

The Promag 35 RS 485 communication board



Relay contacts: NC and NO contacts setting	
NO contact brought out	NC contact brought out
 jumper J5, J6	 jumper J5, J6
factory setting: relay 1	factory setting: relay 2

Relay 1: error or status output, configurable
Relay 2: status output, configurable

Fig. 48

8.5 Replacing the fuse

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

Caution!
Only use fuses with the specified nominal values.

8.6 Repairs

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

Caution!
The following procedures must be carried out before a Promag 35 S flow meter is sent for repair.

- Remove all residue which may be present.
- This is especially important if the medium 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 through 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 Technical data

9.1 Dimensions and weights

DN 15…200

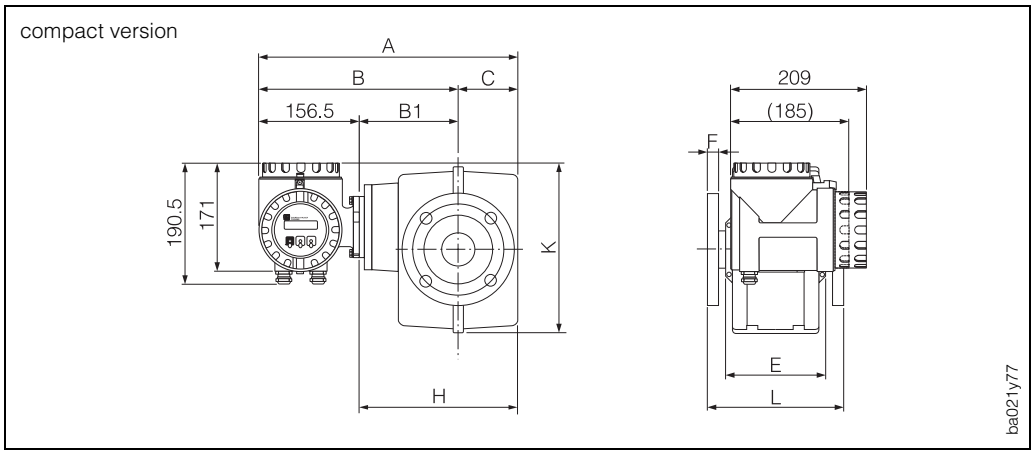


Fig. 49

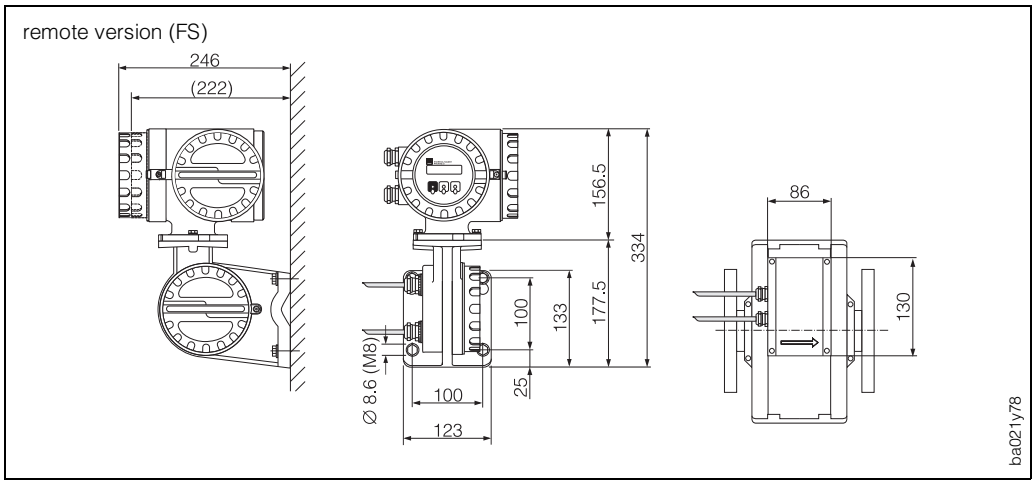


Fig. 50

DN		PN			L		A	B	C	K	E		F			H	B1	Weights*
[mm]	[inch]	DIN [bar]	ANSI [lbs]	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	½"	40	150	–	156/152	–	361	291.5	69.5	200	94.2	–	14	12	–	194.5	125	6
25	1"			20K		228					121.2		14	15	20			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	1½"			20K		228					121.4		16	18	20			11
50	2"			10K		202					121.8		18	20	18			12
65	–			10K							165.9		18	23	18			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"			10K							167.2		22	24	22			27
125	–			10K							205.6		24	24	24			63
150	6"	16	150	10K	332	332	575.5	398.5	177.0	401.8	207.8	202	24	26	24	409	232	66
200	8"			10K							208.0		26	29	26			69

* weights for sensors

Weights transmitter:
Compact version: 3 kg
Remote version with wall mounting: 5 kg

DN 250…600

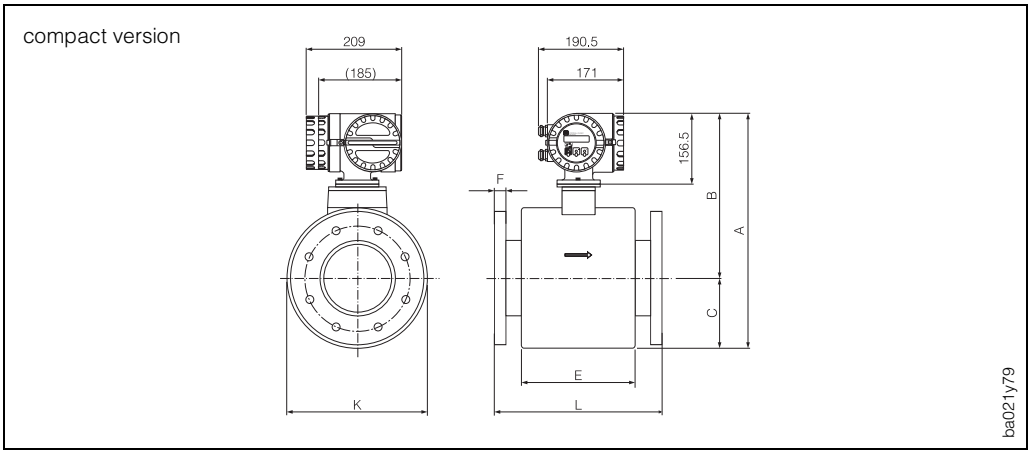


Fig. 51

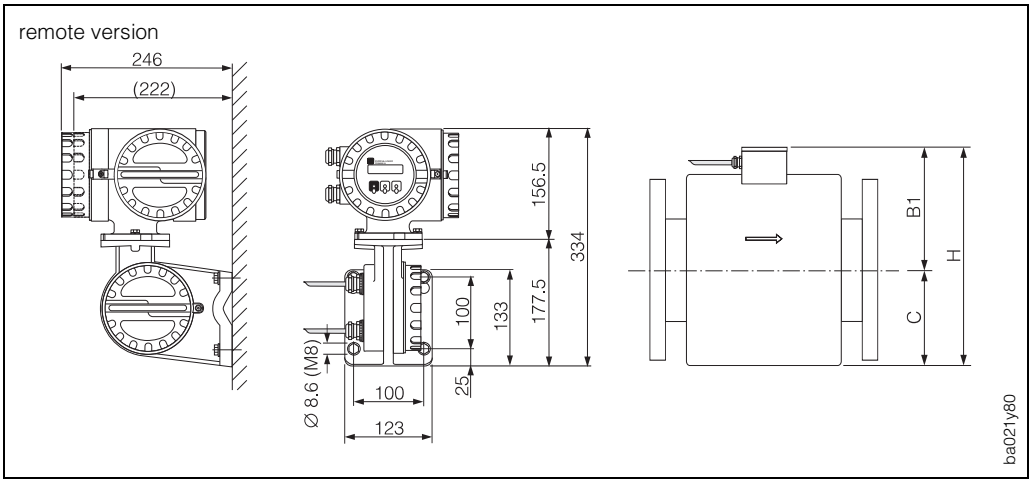


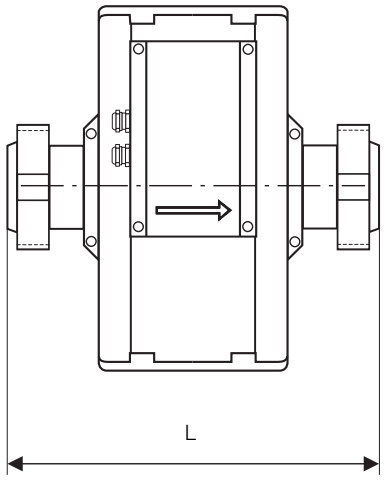
Fig. 52

DN		PN			L		A	B	C	K	E		F			H	B1	Weights*
[mm]	[inch]	DIN [bar]	ANSI [lbs]	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"				450		658.5	446.5	212.0	424	338	338	28	30,5		497	285	73
300	12"				480		709.5	473	236.5	473	358	364	28	32		548	311.5	100
350	14"				530		773.5	505.5	268.0	536	404	410	30	35		612	344	125
400	16"	16	150	–	580	–	837.5	537.6	299.9	598	453	450	32	37	–	676	376.1	150
450	18"				690		870.5	554.5	316.0	632	531	528	32	42		709	393	180
500	20"				690/710		927.5	583.5	344.0	688	531	528	34	43		766	422	200
600	24"				820		1038.5	639.5	399.0	798	665	683	36	45		t877	478	250

* weights for sensors

Weights transmitter:
Compact version: 3 kg
Remote version with wall mounting: 5 kg

Pipe fittings according to DIN 11851 (milk coupling)



DN	PN	L (mm)
25…50	16	210
65…100		310

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Fig. 53

9.2 Technical data: sensor

Sensor Promag S

Nominal diameter	DN 15…600
Nominal pressure	DIN: PN 10 (DN 200…600) PN 16 (DN 25…150) PN 40 (DN 15) PN 25 (DN 200…600), option PN 40 (DN 25…600), option ANSI: Class 150 (½…8") Class 150 (10…24"), option Class 300 (½…24"), option JIS 10K (DN 50…200) 20K (DN 25…40) 20K (DN 50…200), option
Process connection	flange connection (DIN, ANSI; JIS) piping according to DIN 11851 (DN 25…100)
Flange material	DIN: St. 37.2, stainless steel St. 1.4435 ANSI: A 105, 316L JIS: S 20C, SUS 316 L
Fluid temperature range, electrode material	–40…+130 °C PTFE (DN 15…600) –20…+120 °C soft rubber (DN 65…600) 0…+ 80 °C hard rubber (DN 65…600) –40…+ 65 °C NR (option) PU (option)
Ambient temperature range	–10…+50 °C
Electrode material	Hastelloy C-22, tantalum, platinum/rhodium 80/20
Electrodes fitted	DN 15…600: Hastelloy C-22 (measuring/reference and EPD electrodes)
Minimum conductivity	1 µS/cm
Gasket material	—
Housing material	powder-coated die-cast aluminium (DN 15…200) varnished steel (DN 250…600)
Type of protection	IP 65 (IP 67/68 option, at the sensor PG11), EN 60529 NEMA 4X
CIP suitable	yes (note max. temperature)
Power supply	the sensor is supplied by the transmitter
Cable inlets	PG 11 cable glands (5...12 mm) or NPT ½", M20×1.5 (8...15 mm), G ½" threads for cable glands

Inside diameter of measuring pipe (Promag S sensor)

DN		PN			Lining	
[mm]	[inch]	DIN [bar]	ANSI [lbs]	JIS	PTFE (Teflon)	hard rubber, soft rubber (EPDM)
15	½"	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	1½"	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"	16	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)

DN		Measuring pipe lining	Limits for vacuum [mbar absolute] at different temperatures				
[mm]	[inch]		25 °C	80 °C	100 °C	120 °C	130 °C
65…600	3…24"	hard rubber,	✶	0	–	–	–
25…600	1…24"	soft rubber (EPDM)	✶	0	✶	0	–
15…50	½…2"		0	0	0	✶	100
65…80	3"		0	✶	40	✶	130
100	4"		0	✶	135	✶	170
125…150	6"	PTFE	135	✶	240	✶	385
200	8"	(Teflon)	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					
✶ values not available							

Temperature ranges of the sensor
The maximum permissible ambient and medium temperatures must be complied with in all cases. If installed outdoors, a waterproof hood should be provided to protect against direct solar radiation and increase the operational life of the instrument.

- **Promag S**
  Ambient temperature: –10…+ 50 °C
  Medium temperature: –40…+130 °C PTFE
  –20…+120 °C soft rubber (EPDM)
  0…+ 80 °C hard rubber

Caution

Caution!
At high medium and ambient temperatures the sensor Promag S and the transmitter Promag 35 must be mounted separately. Danger of overheating the electronics.

Limits of application in terms of temperature for the compact version Promag 35 S

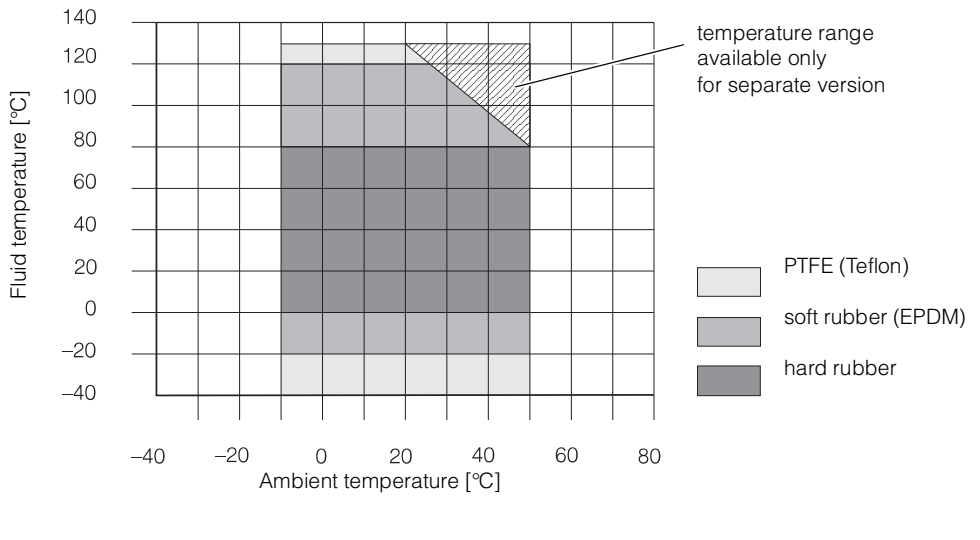


Fig. 54

Sensor Promag S

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

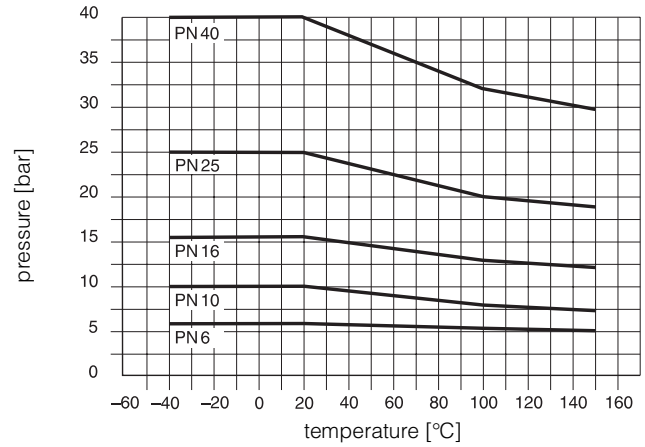


Fig. 55

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

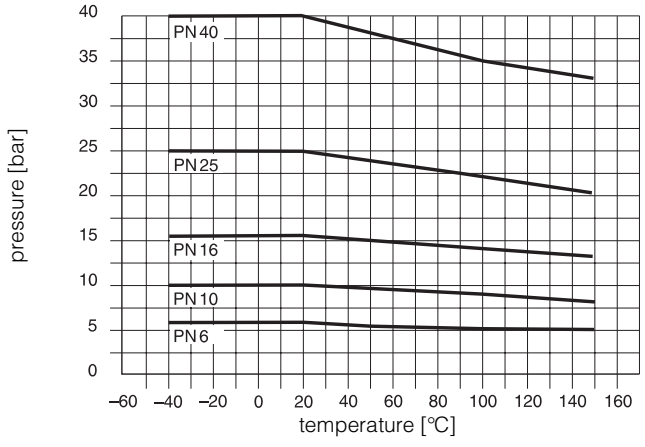


Fig. 56

Pressure limitation due to fluid temperature (ANSI B 16.5)
Flange material: steel A 105

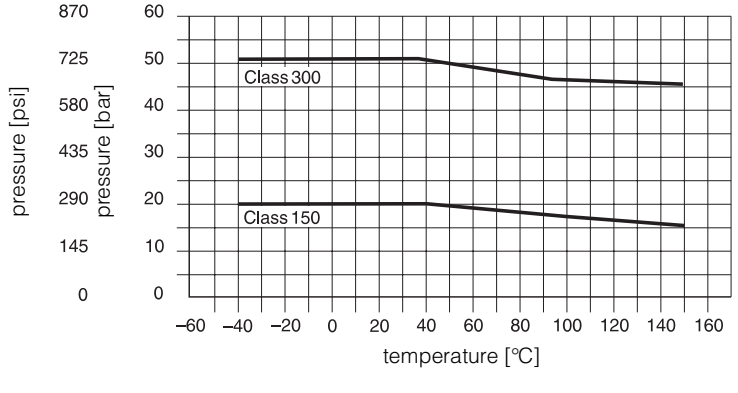


Fig. 57

Sensor Promag S

Pressure limitation due to fluid temperature (ANSI B 16.5)
Flange material: steel 316L

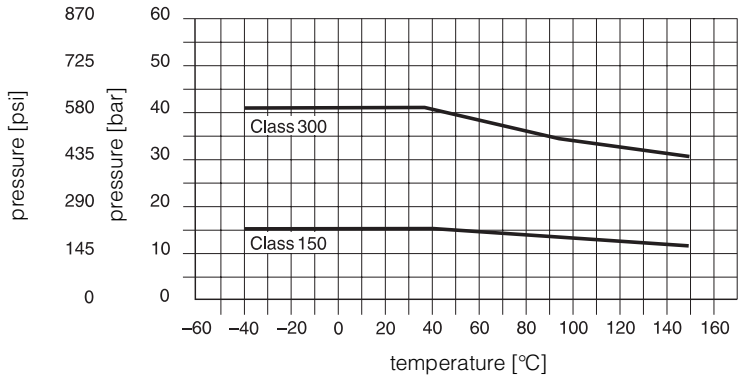


Fig. 58

9.3 Technical data: transmitter

Promag 35 transmitter/measuring system

Housing material	powder-coated die-cast aluminium
Type of protection	IP 67 (EN 60529), NEMA 4X
Ambient temperature	–20…+60 °C –20…+50 °C (with 20…55 V AC; 16…62 V DC)
Resistance to shock and vibration	tested to EN 61010 and IEC 68-2-6 (complete measuring system)
Cable entries	power supply cable and signal cable (outputs) PG 13.5 cable glands (5…12 mm) or NPT ½" M20×1.5 (8…15 mm), G ½" threads for cable glands
Power supply	180…260 V AC, 45…65 Hz 85…130 V AC, 45…65 Hz 20…55 V AC, 16…62 V DC Installation Category: II power supply failure: bridging at least 1 main cycle (≤22 ms)
Power consumption	AC: <35 VA (incl. sensor) DC: <35 W (incl. sensor)
Galvanical isolation	input and outputs galvanically isolated from the supply, from the sensor and one another
Full-scale value scaling	0.3…10 m/s
Current output	0/4…20 mA adjustable, galvanically isolated, R_L <700 Ω (with HART at least 250 Ω), time constant can be chosen, scaleable full-scale value, temperature coefficient type: 0.005% o.r./°C
Pulse/frequency output	choice of active/passive, galvanically isolated, active: 24 V DC, 25 mA (250 mA for 20 ms), R_L >100 Ω passive: open collector, 30 V DC, 25 mA (250 mA for 20 ms) frequency output: f_{End} = selectable to 10 kHz, pulse/pause ratio 1:1, pulse width max. 2 s pulse output: choice of value per pulse, pulse polarity selectable, pulse width adjustable (50 ms…2 s); above a frequency of 1/(2× pulse width) the pulse/pause ratio is 1:1.
Alarm output	relay 1, either NC or NO contact available, factory setting: NO contact brought out max. 60 V AC/30 V DC, max. 0.5 A AC/0.1 A DC, galvanically isolated, programmable for error, error + EPD, limit value 1, empty pipe detection (EPD), exceeding measure range (v≥12.5 m/s), dual range mode, batching or direction of flow
Status output	relay 2, either NC or NO contact available, factory setting: NC contact brought out max. 60 V AC/30 V DC, max. 0.5 A AC/0.1 A DC, galvanically isolated, programmable for limit value 2, exceeding measuring range (v ≥12.5 m/s), dual range mode, batching, EPD (empty pipe detection) or direction of flow
Communication	RS 485 interface (Rackbus protocol) or SMART (HART protocol via current output)
Data backup	EEPROM saves data of measuring system (without battery required) in the event of a power failure
Display	LCD, illuminated, two lines (16 characters each)
Compatibility with interference (EMC)	according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as to NAMUR recommendations (complete measuring system)

9.4 Nominal diameter and flow rate

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

If it should be necessary to increase the flow rate, this can be done by reducing the nominal diameter of the sensor (see page 17 "Adapters").

The table below shows the scaleable minimum and maximum full-scale values incl. factory settings.

DN		**Minimum full-scale value**	**Full-scale value set in works**	**Maximum full-scale value**
[mm]	[inch]	(Scaling at v ~0.3 m/s)	(Scaling at v ~2.5 m/s)	(Scaling at v ~10 m/s)
15	½"	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	1¼"	0.8686 m^3/h	7.2382 m^3/h	28.953 m^3/h
40	1½"	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	2½"	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

9.5 Error limits

Measuring uncertainty under reference conditions

Pulse output	±0.5% o.r. ±0.01% o.f.s. (f.s. = 10 m/s);
Current output	plus ±5 µA
Repeatability	±0.1% o.r. ±0.005% o.f.s.
Options	±0.2% o.r. ±0.05% of Q_k Q_k = desired reference flow rate for the calibration (v = 2…10 m/s), state Q_k if ordering
Power supply voltage	within the specified range, supply fluctuation exert no influence.

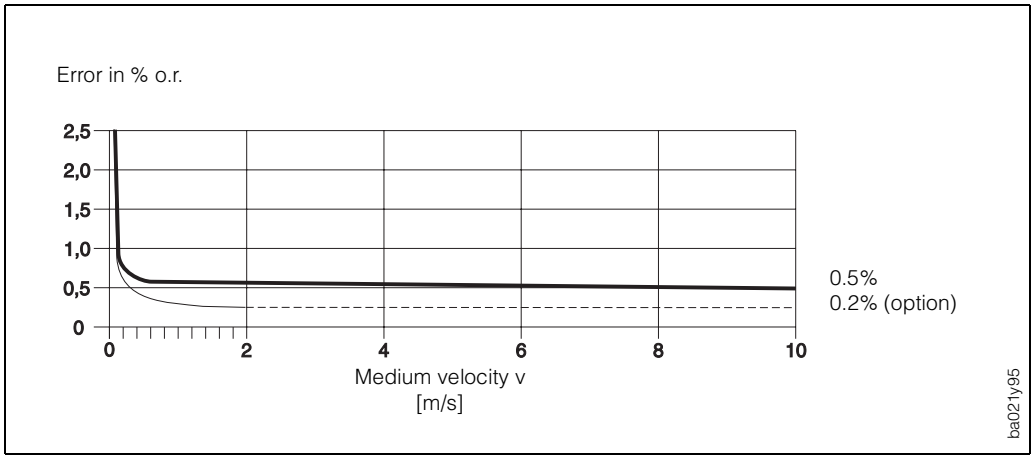


Fig. 59

Reference condition (DIN 19200 and VDI/VDE 2641)

Medium temperature	+28 °C ±2 K
Ambient temperature	+22 °C ±2 K
Warm-up time	30 minutes
Installation at reference conditions	inlet length >10× DN outlet length >5× DN sensor and transmitter grounded sensor centered in the piping

Programming at a Glance

Operating procedure

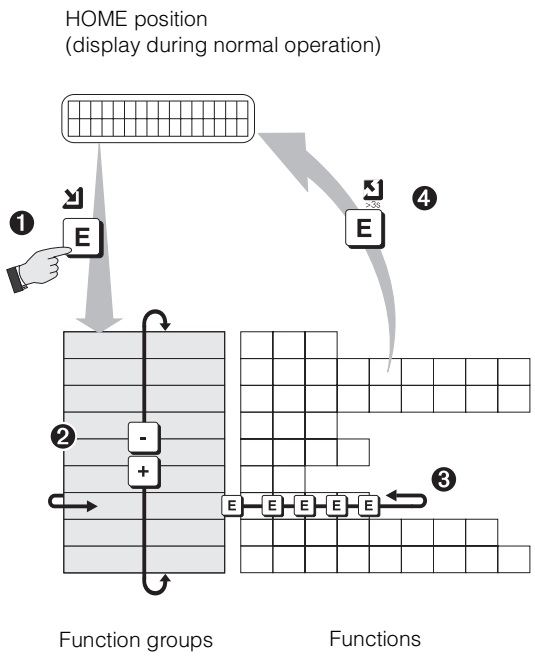
❶ access to programming matrix >GROUP SELECTION<

❷ select function group

❸ select function

❹ return tor HOME position from every position (after programming)

Programming example → see page 32
Function description → see page 33f.



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Functions of the operating elements

E — Access the programming matrix or function groups from the HOME position.

E — Return to the HOME position by pressing E for more than 3 seconds.

E — Select individual functions within the function group in the forward direction or save the data entered.

\+ / − — Select different function groups or set the parameters or numerical values. If **+** or **–** is held down, the number on the display will change at increasing speed.

\+ + − — On pressing simultanously + / −: The diagnostic function or help function during programming is shown. Display of important additional information.

Note

Note!
If the user is momentarily accessing a function, an automatic return to the HOME position will be made if the operating elements are not activated for 1 minute (only when the programming is locked).

FUNCTION GROUPS Functions	Possible settings *Factory setting*
SYSTEM UNITS	
FLOW RATE UNIT p. 33	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, cc/min
VOLUME UNIT p. 33	dm^3, ***m^3***, l, hl, gal, bbl 10^3 gal, ft^3
GALLONS/ BARREL p. 34	US: 31.0 gal/bbl ***US: 31.5 gal/bbl*** US: 42.0 gal/bbl US: 55.0 gal/bbl Imp: 36.0 gal/bbl Imp: 42.0 gal/bbl
NOM. DIAM. UNIT p. 34	***mm***, inch
CURRENT OUTPUT	
FULL SCALE 1 p. 35	5-digit number with floating decimal point (e.g. 250.00 m^3/h)
DUAL RANGE MODE p. 36	***OFF*** (only full-scale value 1 active) ON
FULL SCALE 2 p. 37	5-digit number with floating decimal point (e.g. 3600.0 m^3/h)
ACTIVE RANGE p. 37	Only displayed value: ***FULL SCALE 1*** or FULL SCALE 2
TIME CONSTANT p. 37	Max. 3-digit number: with 2 decimal places (0.01…100 s), ***1 s***
CURRENT SPAN p. 38	0–20 mA ***4–20 mA*** 0–20 mA (25 mA) 4–20 mA (25 mA)
FAILSAFE MODE p. 38	***MIN. CURRENT*** (0 mA at 0–20 mA; 2 mA at 4–20 mA) MAX. CURRENT (22/25 mA) HOLD VALUE (last valid measured value is held) ACTUAL VALUE (normal measured value output despite fault)

Factory settings are indicated in ***bold italics***

FUNCTION GROUPS Functions	Possible settings *Factory setting*
SIMULATION CURR. p. 39	***OFF*** 0 mA (0% at 0…20 mA) 2 mA (error at 4…20 mA) 4 mA (0% at 4…20 mA) 10 mA (50% at 0…20 mA) 12 mA (50% at 4…20 mA) 20 mA (100%) 22 mA (max. value with NAMUR) 25 mA (max. value)
NOMINAL CURRENT p. 39	Only displayed value: 0.00…25.00 mA
PULSE/FREQ. OUTPUT	
OPERATION MODE p. 40	***PULSE*** FREQUENCY
PULSE VALUE p. 40	5-digit number with variable decimal point (e.g. 75.000 dm^3/p)
PULSE WIDTH p. 41	3-digit number with fixed decimal point (0.05…***2.00 s***)
FULL SCALE FREQ. p. 42	max. 5-digit number (2…***10,000 Hz***)
FULL SCALE FLOW p. 43	5-digit number with variable decimal point (e.g. 6.400 dm^3/min)
OUTPUT SIGNAL p. 44	***PASSIVE/POSITIVE*** (open-collector/ active-high) PASSIVE/NEGATIVE (open-collector/ active-low) ACTIVE/POSITIVE (push-pull/active-high) ACTIVE/NEGATIVE (push-pull/active-low)
FAILSAFE MODE p. 45	***FALLBACK VALUE*** (corresponding to zero flow) LAST VALUE (last valid measured value is held) ACTUAL VALUE (normal measured value output despite fault)
SIMULATION FREQ. p. 45	***OFF*** 0 Hz (zero flow) 2 Hz 10 Hz 1 kHz 10 kHz
NOMINAL FREQ. p. 45	Only displayed value: 0.0…16,383 Hz

FUNCTION GROUPS Functions	Possible settings *Factory setting*
RELAYS	
RELAY 1 FUNCTION p. 46	***FAILURE*** EPD ERROR + EPD DUAL RANGE MODE BATCH PRECONTACT FLOW DIRECTION LIMIT FLOWRATE 1
RELAY 1 ON-VALUE p. 47	5-digit number with floating decimal point (any value which ***agrees*** with a nominal diameter set between 0...12.5 m/s fluid velocity)
RELAY 1 OFF-VALUE p. 49	5-digit number with floating decimal point (any value which ***agrees*** with a nominal diameter set between 0...12.5 m/s fluid velocity)
RELAY 2 FUNCTION p. 49	EPD DUAL RANGE MODE BATCH CONTACT FLOW DIRECTION ***LIMIT FLOWRATE 2***
RELAY 2 ON-VALUE p. 49	5-digit number with floating decimal point (any value which ***agrees*** with a nominal diameter set between 0...12.5 m/s fluid velocity)
RELAY 2 OFF-VALUE p. 49	5-digit number with floating decimal point (any value which ***agrees*** with a nominal diameter set between 0...12.5 m/s fluid velocity)
BATCHING	
BATCH QUANTITY p. 53	5-digit number with variable decimal point (e.g. 240.00 l)
BATCH PREWARN p. 53	5-digit number with variable decimal point (e.g. 200.00 l)
COMPENS. QUANTITY p. 53	5-digit number with variable decimal point (e.g. 10,000 l)
BATCHING p. 54	START – STOP – ***CANCEL***
MAX. BATCH TIME p. 54	Max. 5-digit number: 0…30 000 s
BATCH CYCLE p. 54	Max. 7-digit number: 0…9 999 999
RESET BATCH CYC. p. 54	***NO*** YES

FUNCTION GROUPS Functions	Possible settings *Factory setting*
BATCH VARIABLE p. 54	***OFF*** VOLUME
DISPLAY	
TOTAL VOLUME p. 55	Max. 7-digit number: ***0.000000***…9 999 999 with appropriate unit
TOTAL OVERFLOW p. 55	Display: (e.g. 74e7 dm^3 = 740,000,000 dm^3)
RESET TOTALIZER p. 55	***NO*** YES
FLOW RATE p. 56	Only displayed value: max. 5-digit number (0.0000…99 999) with appropriate unit
ASSIGN LINE 1 p. 56	***FLOW RATE*** TOTAL VOLUME BATCH QUANTITY BATCH UPWARDS BATCH DOWNWARDS BATCH CYCLE
ASSIGN LINE 2 p. 56	OFF FLOW RATE ***TOTAL VOLUME*** TOTAL OVERFLOW BATCH QUANTITY BATCH UPWARDS BATCH DOWNWARDS BATCH CYCLE
DISPLAY DAMPING p. 56	Max. 2 digit number 0…99 s ***1 s***
DISPLAY FORMAT p. 57	***X.XXXX*** (5 signif. digits) X.XXX (4 signif. digits) X.XX (3 signif. digits)
LCD CONTRAST p. 57	IIIIIII..... A change in contrast is immediately seen on the bar graph
LANGUAGE p. 57	ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS DANSK NORSK SVENSKA SUOMI BAHASA INDONESIA JAPANESE Factory setting: ***according*** to the respective country

FUNCTION GROUPS Functions	Possible settings *Factory setting*
COMMUNICATION	
PROTOCOL p. 58	***OFF*** HART or Rackbus RS 485
BUS ADDRESS p. 58	2-digit number: ***0***…63 (RS 485) ***0***…15 (HART)
ASSIGN AUX. INPUT p. 58	RESET TOTALIZER BATCHING DUAL RANGE MODE ***POS. ZERO RETURN***
START PULSE WIDTH p. 60	Max. 3-digit number ***20***…100 ms
SYSTEM CONFIG. p. 60	RS 485/CURRENT RS 485/FREQUENCY ***AUX. INPUT/CURRENT*** AUX. INPUT/ FREQ.
PROCESSING PARAMETERS	
LOW FLOW CUTOFF p. 61	5-digit number with variable decimal point (e.g. 15.000 dm^3/min)
NOISE SUPPRESS. p. 61	OFF LOW ***MEDIUM*** HIGH
EMPTY PIPE DET. p. 62	***OFF*** ON EMPTY PIPE ADJ. FULL PIPE ADJUS.
EPD RESPONSE TIME p. 62	60 s, 30 s, 10 s, 5 s, 2 s, ***1 s***
MEASURING MODE p. 63	UNIDIRECTIONAL ***BIDIRECTIONAL***
FLOW DIRECTION p. 63	***FORWARD*** REVERSE
AMPLIFIER MODE p. 63	***NORMAL*** (aut. control) Mode 1 (v=0>12 m/s) Mode 2 (v=0...12 m/s) Mode 3 (v=0...4 m/s) Mode 4 (v=0...1 m/s)
DELAY p. 63	Max. 4-digit number ***10***...1000
SYSTEM PARAMETERS	
POS. ZERO RETURN p. 64	***OFF*** ON
DEF. PRIVATE CODE p. 64	Max. 4-digit number (0…9999), ***35***

FUNCTION GROUPS Functions	Possible settings *Factory setting*
ACCESS CODE p. 65	Max. 4-digit number (***0***…9999)
SELF CHECKING p. 65	OFF ***ON***
PRESENT SYSTEM CONDITION p. 66	Display only (entries chronological): F ⇒ Error message (system error) A ⇒ Alarm message (process error) S ⇒ Status message
PREVIOUS SYSTEM CONDITIONS p. 66	Display only (entries chronological): F ⇒ Error message (system error) A ⇒ Alarm message (process error) S ⇒ Status message
SOFTWARE VERSION p. 67	Display only
SOFTWARE VER. COM p. 67	Display only
SENSOR DATA	
Factory settings: ***dependent on*** the sensor (nominal diameter) and its calibration.	
K-FACTOR POS. p. 68	5-digit number with fixed decimal point (0.5000…2.0000)
K-FACTOR NEG. p. 68	5-digit number with fixed decimal point (0.5000…2.0000)
ZERO POINT p. 68	Max. 4-digit number (–1000…+1000)
NOMINAL DIAMETER p. 69	Select from fixed table: 15…600 mm or ½…24 inch
MAX. SAMPLE RATE p. 73	2- or 3-digit number with fixed decimal point (1.0…60.0/s)
SAMPLING RATE p. 69	Number with fixed decimal point and 1 decimal place (upper limit as for MAX. SAMPLE RATE)
SERIAL NUMBER p. 69	Max. 6-digit serial number (1…999 999)
EPD ELECTRODE p. 70	YES NO
COIL SLOPE p. 70	Max. 3-digit number (0…255)

Programming Matrix / Clients Settings

Note

Note!
After commissioning and configuring the measuring point, please fill in the adjacent matrix with the values and settings you have selected.

Group selection

SYSTEM UNITS	FLOW RATE UNIT	VOLUME UNIT	GALLONS/BARREL	NOM. DIAM. UNIT						
CURRENT OUTPUT	FULL SCALE 1	DUAL RANGE MODE	FULL SCALE 2	ACTIVE RANGE	TIME CONSTANT	CURRENT SPAN	FAILSAFE MODE	SIMULATION CURR.	NOMINAL CURRENT	
PULSE/FREQ. OUTPUT	OPERATION MODE	PULSE VALUE	PULSE WIDTH	FULL SCALE FREQ.	FULL SCALE FLOW	OUTPUT SIGNAL	FAILSAFE MODE	SIMULATION FREQ.	NOMINAL FREQ.	
RELAYS	RELAY 1 FUNCTION	RELAY 1 ON-VALUE	RELAY 1 OFF-VALUE	RELAY 2 FUNCTION	RELAY 2 ON-VALUE	RELAY 2 OFF-VALUE				
BATCHING 1)	BATCH QUANTITY	BATCH PREWARN	COMPENS. QUANTITY	BATCHING	MAX. BATCH TIME	BATCH CYCLE	RESET BATCH CYC.	BATCH VARIABLE		
DISPLAY	TOTAL VOLUME	TOTAL OVERFLOW	RESET TOTALIZER	FLOW RATE	ASSIGN LINE 1	ASSIGN LINE 2	DISPLAY DAMPING	DISPLAY FORMAT	LCD CONTRAST	LANGUAGE
COMMUNICATION	PROTOCOL	BUS ADDRESS	ASSIGN AUX. INPUT	START PULSE WIDTH	SYSTEM CONFIG. *					
PROCESSING PARAMETERS	LOW FLOW CUTOFF	NOISE SUPPRESS.	EMPTY PIPE DET.	EPD RESPONSE TIME	MEASURING MODE	FLOW DIRECTION	AMPLIFIER MODE	DELAY		
SYSTEM PARAMETERS	POS. ZERO RETURN	DEF. PRIVATE CODE	ACCESS CODE	SELF CHECKING	PRESENT SYSTEM CONDITION	PREVIOUS SYSTEM CONDITIONS	SOFTWARE VERSION	SOFTWARE VER. COM		
SENSOR DATA	K-FACTOR POS. *	K-FACTOR NEG. *	ZERO POINT *	NOMINAL DIAMETER *	MAX. SAMPLE RATE *	SAMPLING RATE *	SERIAL NUMBER *	EPD ELECTRODE *	COIL SLOPE *	

1) If a batching variable is activated, the "BATCHING" Function group is first shown on the display when entering the programming matrix.

* Fields are protected by a special code (service code).

These functions are only shown on the display with corresponding selection/adjustment

BA021E39

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