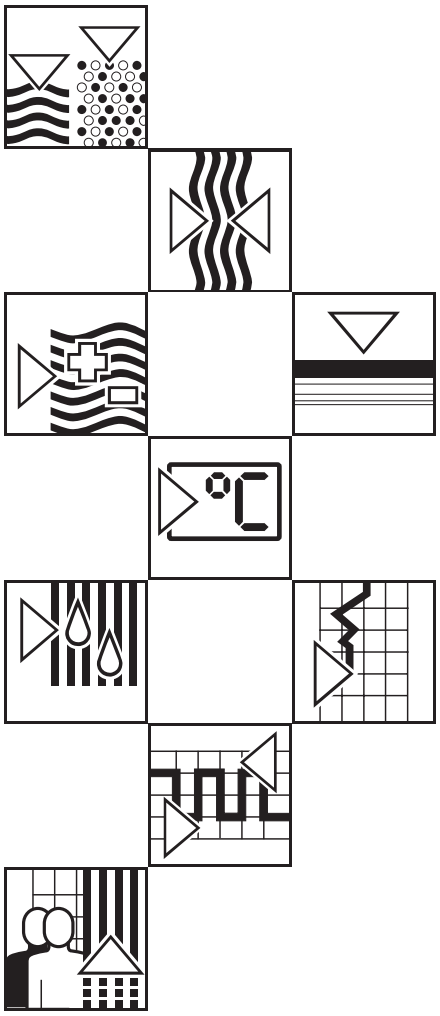
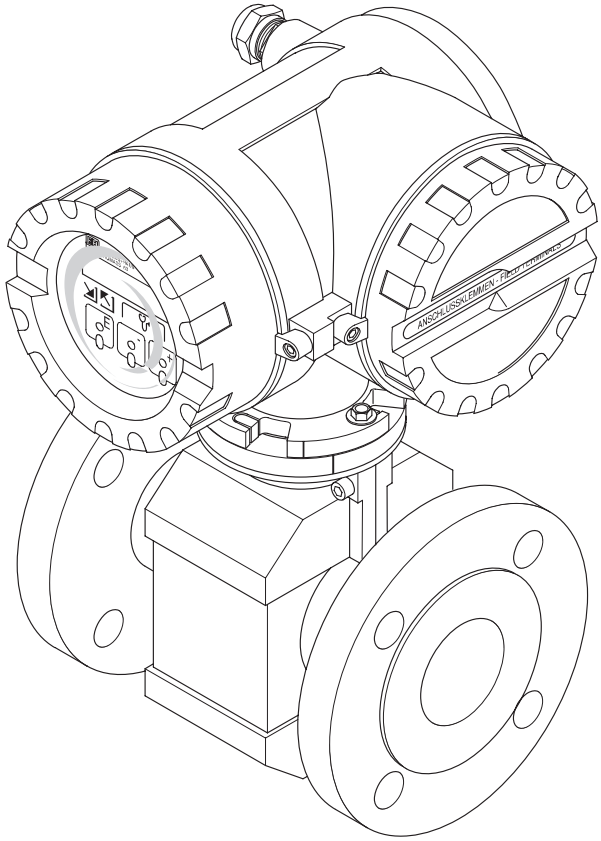
BA 009D/06/en/04.99
No. 50063718
CV 5.0

Valid as of software version
V 3.01.XX (amplifier)
V 2.04.XX (communication)

promag 33
Electromagnetic Flow Measuring System

Operating Manual





Endress+Hauser

Nothing beats know-how

Brief Operating Instructions

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

Safety instructions → see page 5

↓

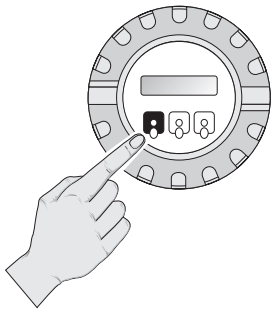
Mounting and electrical connection
- Mounting → see page 9
- Electrical connections → see page 21

↓

Commissioning → see page 34

↓

Operation → see page 35 ff.



ba009y83

↓

Display configuration
- Language → see page 68
- Contrast → see page 68
- Assign line 1 → see page 67
- Assign line 2 → see page 67
- Number of decimal digits → see page 68

continued: next column

Engineering units → see page 47 ff.

↓

Configuration of outputs

Current output
- Full scale values → see page 49, 51
- Current span → see page 51

Pulse / Frequency output
- Operation mode → see page 53
- Pulse value → see page 53
- Pulse width → see page 53
- Full scale frequency → see page 54
- Full scale value → see page 55
- Output signal → see page 56

↓

Relay outputs → see page 58 ff.

↓

More complex applications
require programming of additional functions. The appropriate key works and cross-references are found on the following pages:
- Functions at a Glance → see page 117
- Index → see page 121
- Operating matrix → see page 37

↓

For optimum measuring results
- Creep suppression → see page 72
- Empty Pipe Detection → see page 73

Contents

Registered Trademarks

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

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

1 Safety Instructions

1.1 Correct usage

- The Promag 33 measuring system is only to be used for measuring the flow of conductive fluids. Most liquids can be measured provided they have a minimum conductivity of ≥ 5 µS/cm, e.g.
  – acids, alkalis, pastes, pulps,
  – drinking water, wastewater, sewage sludge,
  – milk, beer, wine, mineral water, yoghurt, molasses, etc.
  A minimum conductivity of ≥ 20 µS/cm is required for measuring demineralised water.
- The manufacturer assumes no liability for damage caused by incorrect use of the instrument.
- Instruments which are used in the explosion hazardous area are supplied with a separate “Ex documentation”, which is an *integral part* of this Operating Manual. The instructions and connected loads provided in this supplement must absolutely be observed. An appropriate icon is shown on the front of this document according to the approval given and the test center (Ex Europe, FM USA, SP Canada).

1.2 Dangers and notes

All instruments are designed to meet state-of-the-art safety requirements, have been tested, and have left the factory in an operational perfectly safe condition.
The devices were developed according to EN 61010 “Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures”.
A hazardous situation may occur if the flowmeter is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information provided in this Operating Manual indicated by the following pictograms:

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


Warning!

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


Caution!

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


Note!

1.3 Personnel for installation, start-up and operation

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorised by the operator of the facility. Personnel must absolutely and without fail read and understand this Operating Manual before carrying out its instructions.
- The instrument may only be operated by personnel who are authorised and trained by the operator of the facility. All instructions in this manual are to be observed without fail.
- With special fluids, incl. those used for cleaning, E+H will be pleased to supply information concerning the chemical resistance properties of wetted parts.
- When welding the piping, the welding machinery must not be grounded through the Promag.
- 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.
- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.


Warning!

Danger of electrical shock!
With the housing cover removed, protection against accidental contact is no longer present.

1.4 Repairs and dangerous substances

The following procedures must be carried out before a Promag 33 is sent to Endress+Hauser for repair:

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

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

An overview of the complete Promag 33 measuring system is shown below.
The technical specifications are stamped on the nameplate and contain the following information:

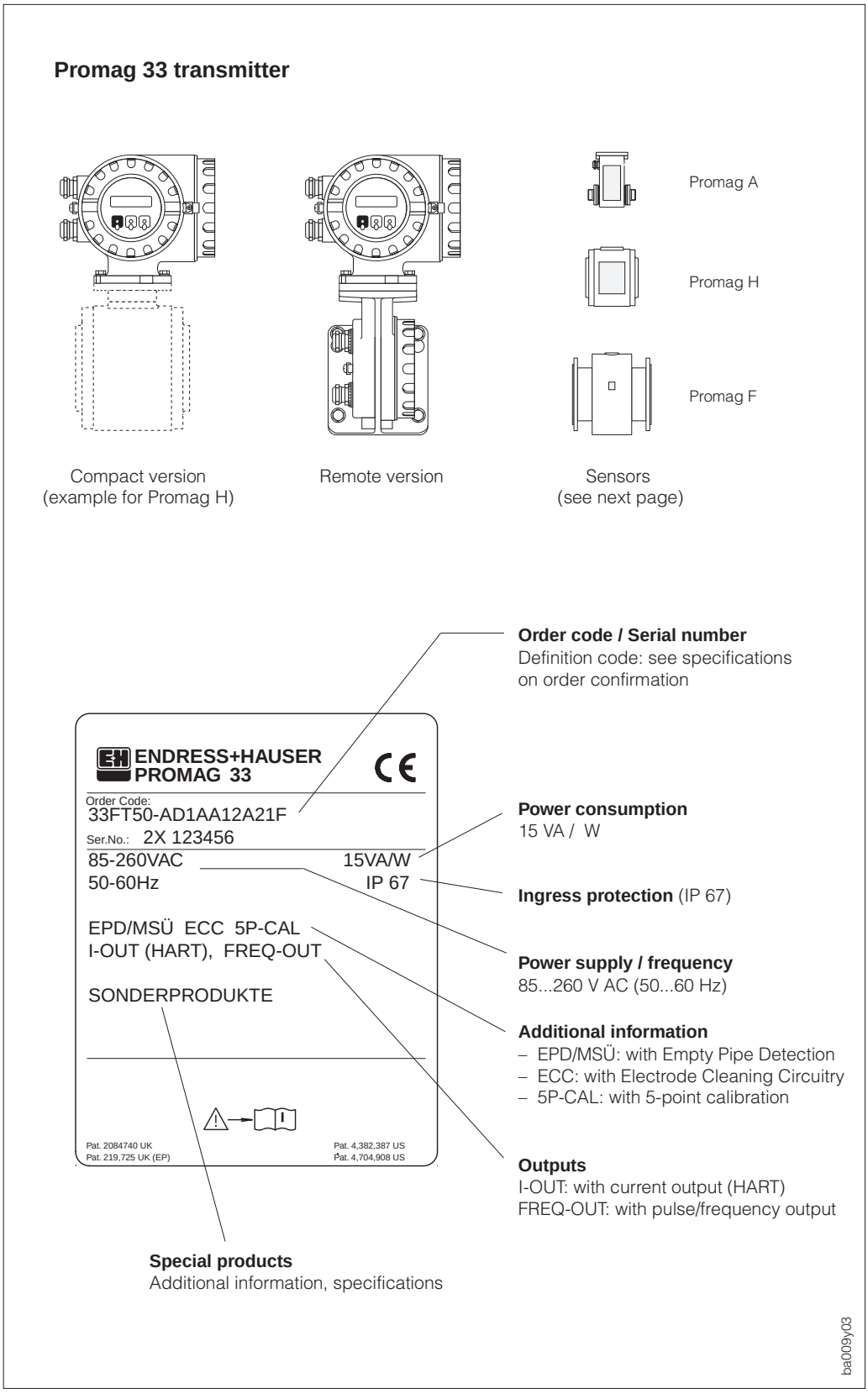
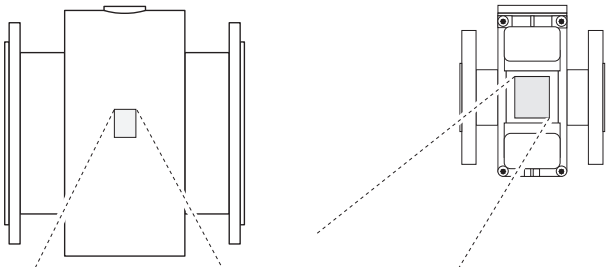
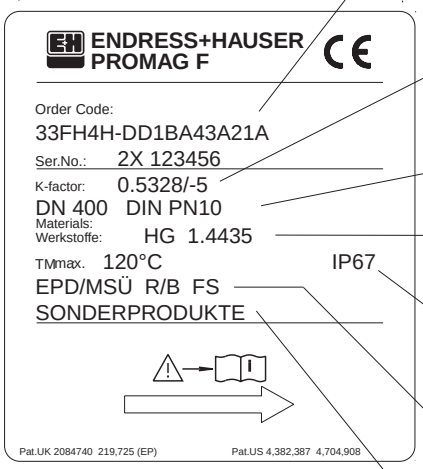


Fig. 1
Promag 33 transmitter
Typical nameplate specifications (example)

Promag A, H and F sensors

Promag F (15...2000) (DN 15...300)





Order code / Serial number
Definition code: see specifications on order confirmation

Calibration factor / Zero point
0.5328 / –5

Nominal diameter (DN 400)
Pressure rating (DIN PN 10 bar)

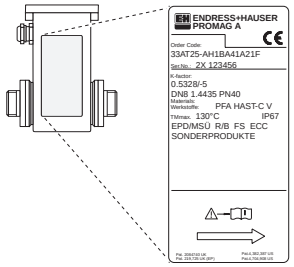
Materials
- Lining: hard rubber (HG)
- Measuring electrodes: stainless steel 1.4435

Ingress protection (IP 67)
Max. fluid temperature (120 °C)

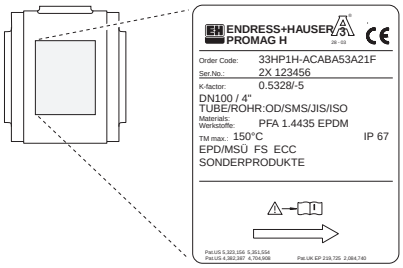
Additional information
- EPD/MSÜ: with Empty Pipe Detection
- R/B: with reference electrode
- FS: remote version (see page 20)

Special product
Additional information, specifications

Promag A (DN 2...25)



Promag H (DN 25...100)



ba009y04

Fig. 2
Promag A, H and F sensors
Typical nameplate specifications (example)

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.
- For explosion protected instruments the mounting regulations and the technical data may differ from those stated here. Please refer to the Ex supplement of this Operating Manual for additional information.

3.1 Transport instructions (DN ≥ 350/14")

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

Transporting to the measuring point
- The sensor must not be lifted by the transmitter housing!
- Use only the grips on the flange for lifting out and mounting the sensor in the piping (from DN 350 or 14").

  Caution!
  The sensor must not be lifted by the metal casing using a fork lift truck! This can buckle the casing and so damage the internal magnetic coils.

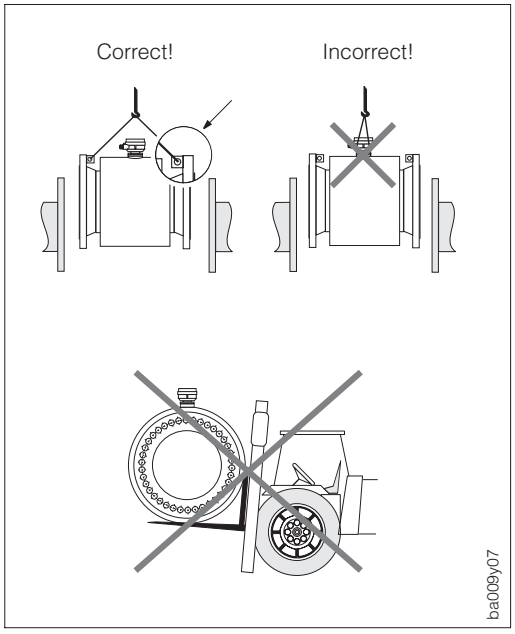


Fig. 3
Transport instructions for large diameter sensors (DN ≥ 350)

Base and supports

The sensor is to be mounted on a base which is sufficiently strong enough to withstand its weight.

Caution!
Do not support the sensor by the sheet casing. The casing may be dented and so damage the magnetic coils inside the sensor.

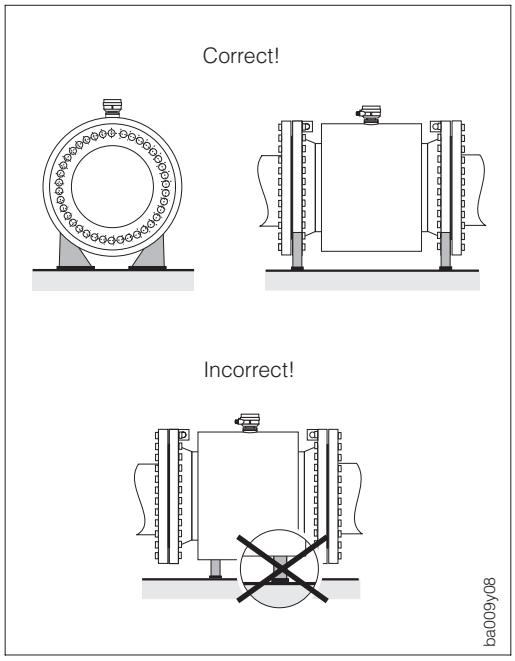


Fig. 4
The proper way to support large diameter sensors (DN ≥ 350)

3.2 Mounting location

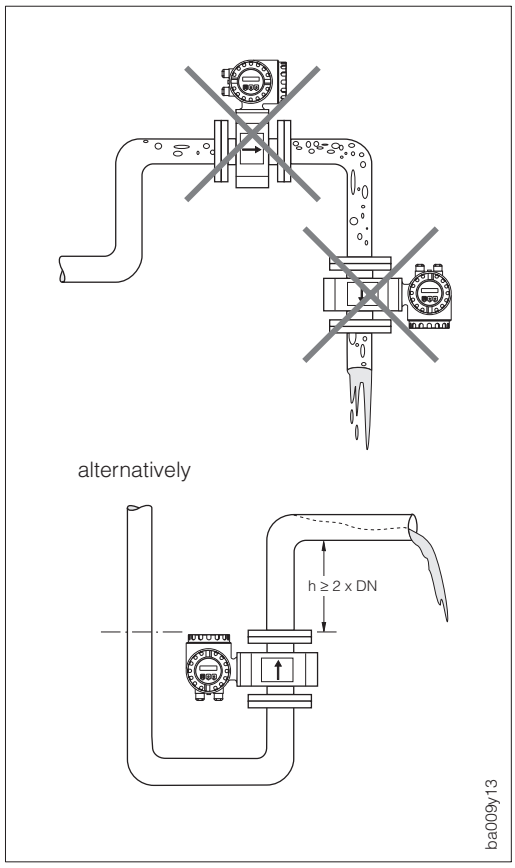
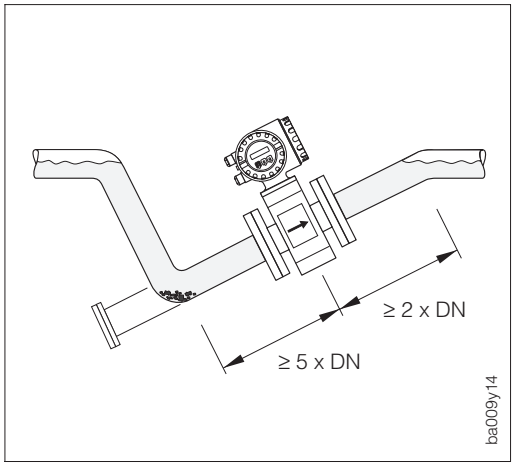


Fig. 5
Mounting location

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

- No installation at the highest point (air accumulation).
- No installation immediately before an open pipe outlet in a downward line.

  The alternative installation, however, enables correct measurement.



Note!

Fig. 6
Mounting with a partly filled pipe

Partly filled pipes

For inclines a mounting similar to a drain should be adopted.
Added security is offered by Empty Pipe Detection in order to detect empty or partly filled pipes (see page 73).

Note!
Danger of solids accumulation!
Do not mount the sensor at the lowest point of the drain. A cleaning valve should also be installed.

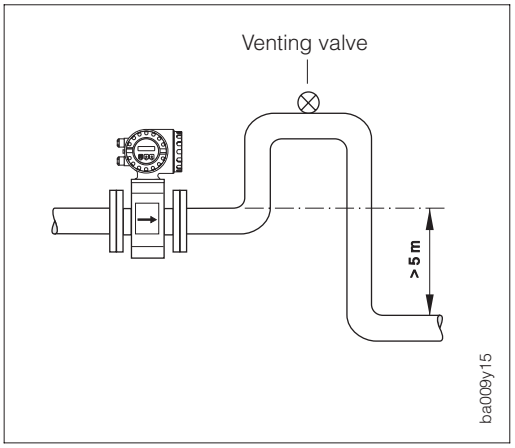


Fig. 7
Installation downward pipe

Downward pipe

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

Installation of pumps
Do not mount the sensors on the suction side of pumps. This prevents low pressure and therefore possible damage to the lining of the measuring tube.
Information on the resistance to vacuum of the flowmeter lining can be found on page 115.

Pulse dampers should be installed when using reciprocal, diaphragm or peristaltic pumps.

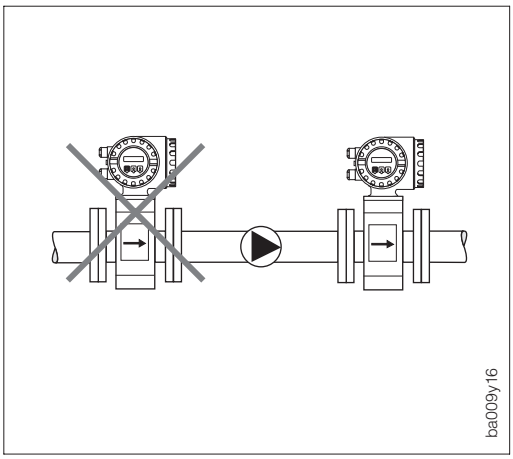
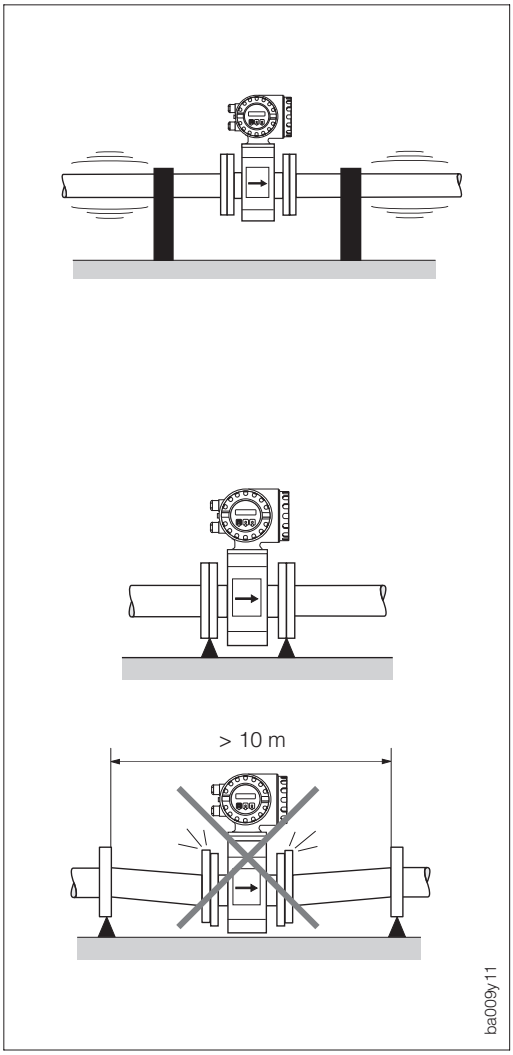


Fig. 8
Installation of pumps

Vibration
The piping before and after the sensor should be securely fastened if there is excessive vibration.
Information on shock and vibration resistance is found on page 110.

Caution!
Excessive vibration necessitates separate mounting of the sensor and transmitter (see pages 20, 109).

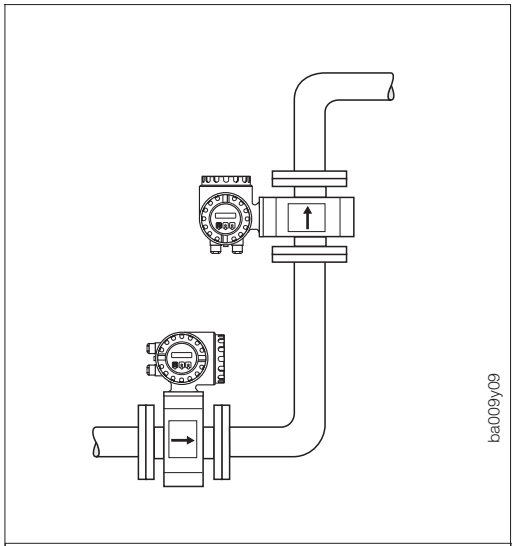
Mechanical support of the sensor is recommended for free runs of piping over 10 m long.



Caution!

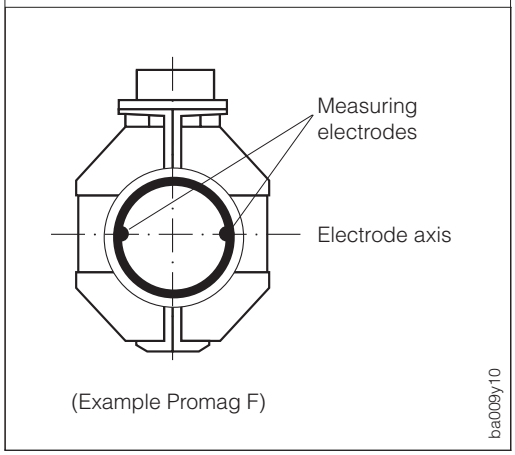
Fig. 9
Ways to avoid vibrations

3.3 Mounting position



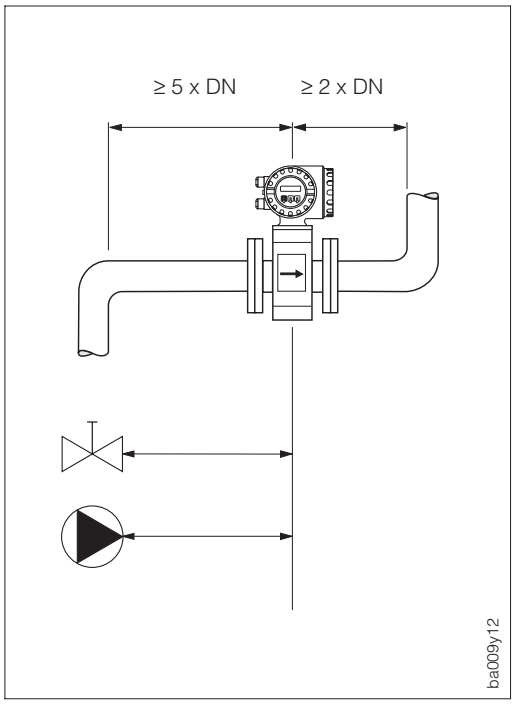
Vertical mounting:
This is the recommended position with the flow upwards. Entrained solid particles sink and fatty components in the stationary fluid rise away from the measuring electrodes. This is the optimal position in empty pipe system and when using Empty Pipe Detection (see page 73).

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



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

Fig. 10
Mounting position (horizontal, vertical)



Inlet and outlet sections
The sensor should by mounted away from fittings such as valves, T-pieces, elbows, etc.

Inlet section: ≥ 5 x DN
Outlet section: ≥ 2 x DN

The inlet and outlet sections must be observed in order to maintain accuracy.

Fig. 11
Inlet and outlet sections

3.4 Nominal diameter and flow rate

The diameter of the pipe usually governs the nominal diameter of the sensor. The optimum flow velocity range is between v = 2...3 m/s. Furthermore, the flow velocity (v) has to be matched to the physical properties of the fluid:

- v < 2 m/s → with abrasive fluids (potter's clay, lime milk, ore slurry)
- v > 2 m/s → with fluids forming coating (wastewater sludge, etc.)

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

DN		Full scale values in [m^3/h]		
[mm]	[inch]	**Minimum value** at v = 0.3 m/s	**Factory setting** at v ~ 2.5 m/s	**Maximum value** at v = 10 m/s
2	1/12"	0.0034	0.0283	0.1131
4	5/32"	0.0136	0.1131	0.4524
8	5/16"	0.0543	0.4524	1.810
15	1/2"	0.1908	1.590	6.362
25	1"	0.5301	4.418	17.67
32	1 1/4"	0.8685	7.238	28.95
40	1 1/2"	1.357	11.31	45.24
50	2"	2.121	17.67	70.69
65	2 1/2"	3.584	29.87	119.5
80	3"	5.429	45.24	181.0
100	4"	8.482	70.69	282.7
125	5"	13.25	110.5	441.8
150	6"	19.09	159.0	636.2
200	8"	33.93	282.7	1130
250	10"	53.01	441.8	1767
300	12"	76.34	636.2	2545
350	14"	103.9	865.9	3464
400	16"	135.7	1131	4524
450	18"	171.8	1431	5726
500	20"	212.1	1767	7069
600	24"	305.4	2545	10179
700	28"	415.6	3464	13854
750	30"	477.1	3976	15904
800	32"	542.9	4524	18096
900	36"	687.1	5726	22902
1000	40"	848.2	7069	28274
1050	42"	935.2	7793	31172
1200	48"	1222	10179	40715
1350	54"	1546	12882	51530
1400	56"	1663	13854	55418
1500	60"	1909	15904	63617
1600	64"	2172	18096	72382
1700	66"	2451	20428	81713
1800	72"	2748	22902	91609
2000	78"	3393	28274	113097

3.5 Adapters

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

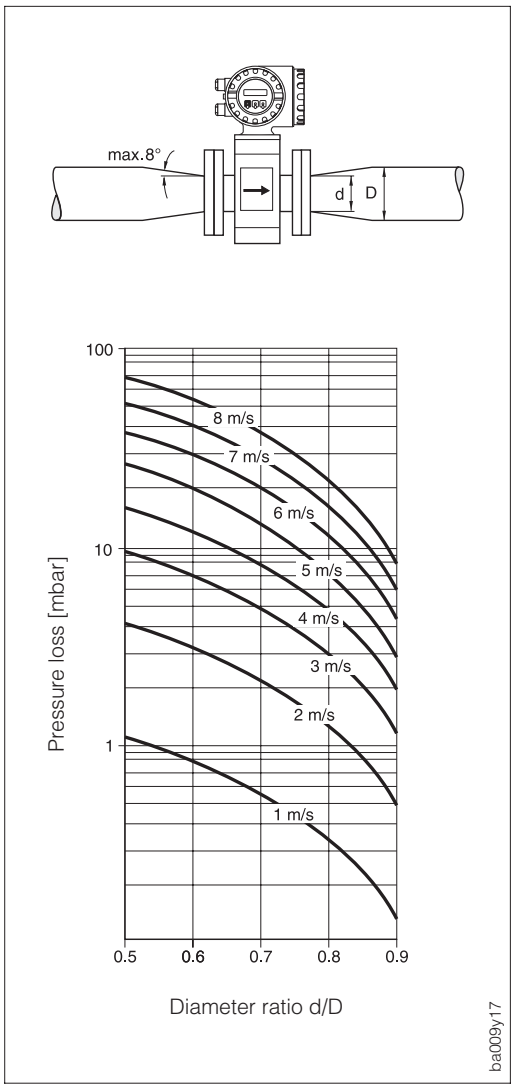


Fig. 12
Pressure loss when using adapters

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

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

Note!

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

3.6 Mounting Promag A sensor

Various process connections are available for the Promag A sensor.
The process connections (adapters) are mounted in two ways:

A. *Coupling nut on a 1" threaded stub (mounting set)*

- Internal thread
- External thread
- PVC adhesive coupling
- Hose connection
- Weld nipples

B. *Screw-in process connections (instead of threaded stub)*

These process connections are mounted as standard in the factory before delivery.
- Flange joints
- Tri-Clamp

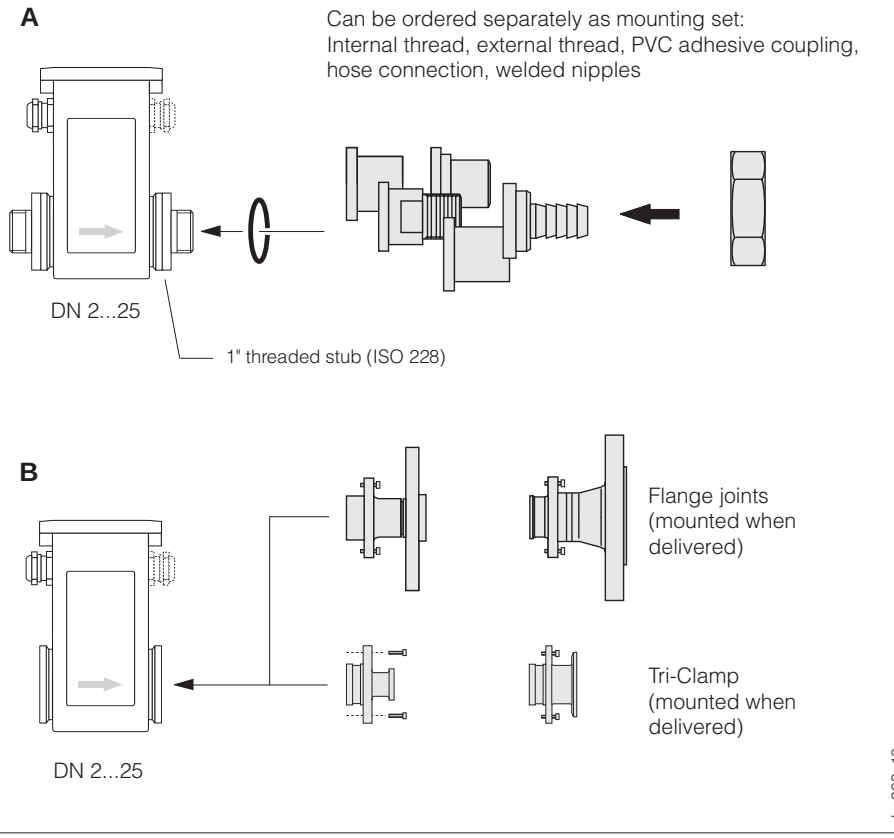


Fig. 13
Process connections
Promag A

Seals / Screw tightening torques (Mounting set)
When fastening the process connections, the O-ring or the flat seal is pressed fully into the seal groove in the threaded stub. The skirted nut thereby comes to a fixed stop.

Length, Dimensions → see pages 99 ff.

3.7 Mounting Promag H sensor

The Promag H sensor is delivered with the process connection already mounted. The various process connections are fastened to the sensor with 4 or 6 screws.

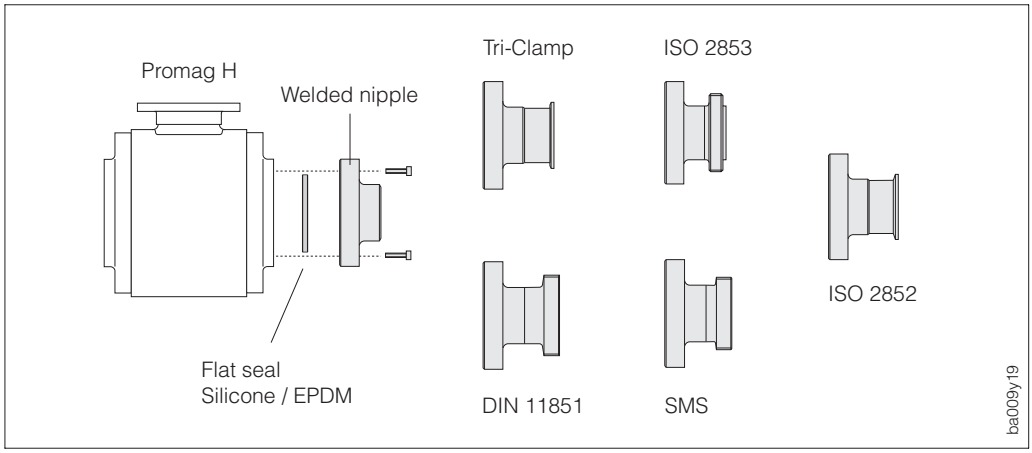


Fig. 14
Process connections
Promag H

Seals / Screw tightening torques
When mounting the process connectors, make sure that the seal is free of dirt and correctly centered. The screws have to be tightened.
The process connector forms a metal connection with the sensor, to guarantee a pre-defined seal compression.

The gaskets must be replaced at frequent intervals!

Diameter		Max. tightening torque
DIN [mm]	ANSI [inch]	[Nm]
25	1"	10
40	$1^1/_2$"	10
50	2"	25
65	$2^1/_2$"	25
80	3"	88
100	4"	88

Length, Dimensions → see pages 102 ff.

Welding the sensor into the pipework (welded nipple)
If the sensor is directly welded into the pipework, we recommend the following procedure:


Caution!

Caution!
The electronics may be destroyed! Take care that the welding ground is not via the Promag 33 H sensor or housing.

1. Fasten the Promag H sensor with some spot welds into the pipe.
2. Loosen the screws at the process-connector flange and remove the sensor from the pipe; make sure that the seal is also removed from the process connector.
3. Weld the process connector into the pipe.
4. Once again install the sensor into the pipe; making sure everything is clean and the seal is correctly positioned.


Note!

Note!
- If the welding process is correctly executed in thin-walled food piping, the seal will not be damaged by the heat, even when mounted. Nevertheless, we recommend removing the sensor and seal first.
- For the disassembly, the pipe has to be spread by about 4 mm.

3.8 Mounting Promag F sensor

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

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

Caution!

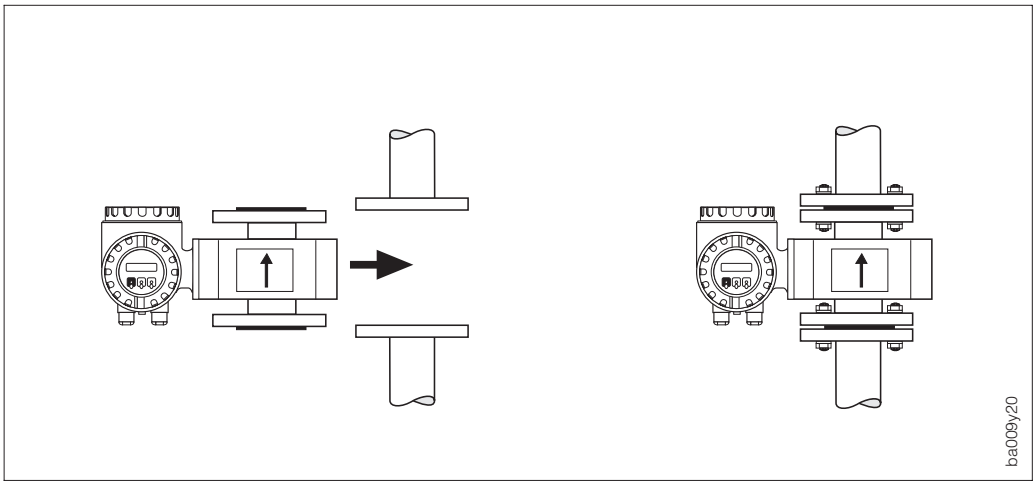


Fig. 15
Mounting Promag 33 F

Seals
- If the measuring tube liner is made of soft rubber or Teflon (PTFE), a flange seal is not required.
- With soft rubber lining the mating flange should have a thin film of non-conductive sealing grease applied.
- Use a seal according to DIN 2690.
- Mounted seals must not protrude into the piping section.

Caution!
Danger of short-circuit! Do not use sealing materials that are electrically conductive, e.g. graphite. This could result in an electrically conductive layer forming on the inside of the measuring tube and therefore short-circuiting the measuring signal.

Caution!

Screw tightening torques → see following page

Length, Dimensions → see pages 104, 105

Screw tightening torques (Promag F)
The tightening torques listed apply to greased threads.
Screws tightened up too tightly deform the sealing surface. Special attention should be paid to soft rubber linings.


Note!

Note!
The tightening torques given here apply only to those pipes which are not subject to mechanical stress.

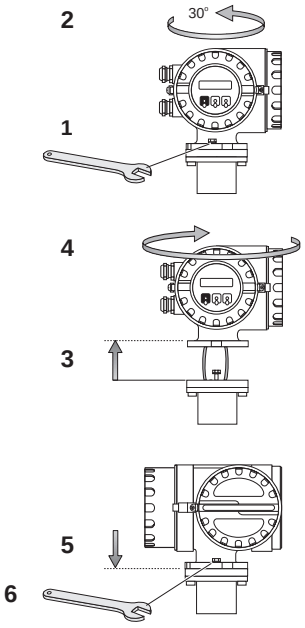
Diameter		Pressure ratings				Screws	Max. tightening torques [Nm]		
[mm]	[inch]	DIN [bar]	ANSI [lbs]	AWWA	JIS		Hard rubber	Soft rubber (EPDM)	PTFE (Teflon)
15	1/2"				20K	4 x M 12	–	–	15
25	1"				20K	4 x M 12	25	5	33
32	–	PN 40	Class	–	20K	4 x M 12	40	8	53
40	1 1/2"		150		20K	4 x M 16	50	11	67
50	2"				10K	4 x M 16	64	15	84
65	–				10K	4 x M 16	87	22	114
80	3"				10K	8 x M 16	53	14	70
100	4"	PN 16	Class	–	10K	8 x M 16	65	22	85
125	–		150		10K	8 x M 16	80	30	103
150	6"				10K	8 x M 20	110	48	140
200	8"				10K	8 x M 20	108	53	137
250	10"	PN 10	Class	–	10K	12 x M 20	104	29	139
300	12"		150		10K	12 x M 20	119	39	159
350	14"					16 x M 20	141/193	39/79	188/258
400	16"	PN	Class	–		16 x M 24	191/245	59/111	255/326
-	18"	10/16	150			20 x M 24	170/251	58/111	227/335
500	20"					20 x M 24	197/347	70/152	262/463
600	24"					20 x M 27	261/529	107/236	348/706
700	28"					24 x M 27	312/355	122/235	–
800	30"	PN	–	Class		24 x M 30	417/471	173/330	–
900	32"	10/16		D		28 x M 30	399/451	183/349	–
1000	36"					28 x M 33	513/644	245/470	–
1200	48"					32 x M 36	720	328	–
–	54"					36 x M 39	840	432	–
1400	–					36 x M 39	840	432	–
–	60"					40 x M 45	1217	592	–
1600	–	PN 6	–	Class		40 x M 45	1217	592	–
–	66"			D		44 x M 45	1238	667	–
1800	72"					44 x M 45	1238	667	–
–	78"					48 x M 45	1347	749	–
2000	–					48 x M 45	1347	749	–

3.9 Turning the transmitter housing and local display

The transmitter housing and local display can be rotated in steps of 90°. This enables the unit to be adapted to different mounting positions in the piping and so simplifying reading and operation.

Warning!
For instruments with EEx d/de or FM/CSA Cl. I Div. 1 approval, the procedure for rotating the instrument is different than that described here and is given in the Ex-supplement to this documentation.

Warning!



Turning the transmitter housing

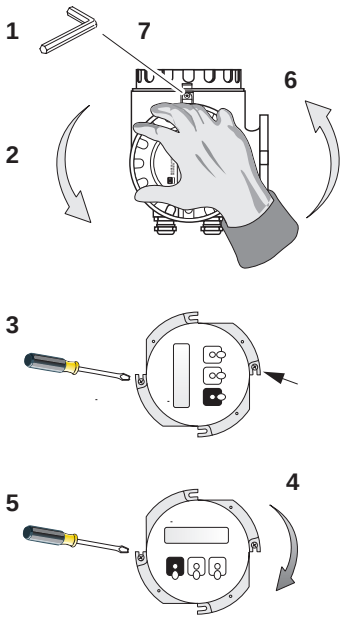
1. Loosen the two fixing screws of the transmitter bayonet catch (approx. two turns)
2. Turn the bayonet catch of the transmitter as far as the screw slits (approx. 15 mm).
3. Carefully lift the transmitter housing to the stop.

   Caution!
   Do not damage the cable between the transmitter and sensor!
4. Turn the transmitter housing to the desired position.
5. Lower the housing and engage the bayonet catch.
6. Retighten the two screws.

ba009y22

Caution!

Fig. 16
Turning the transmitter housing



Turning the local display

ba009y23

Warning!
Danger from electric shock! Switch off the power supply before opening the instrument.

1. Loosen the Allen screw of the safety grip (3 mm Allen key).
2. Unscrew the cover of the electronics area of the transmitter housing.
3. Unscrew the two Phillips screws of the front panel display.
4. Turn the display module to the required position.
5. Securely tighten the Phillips screws.
6. Replace and screw down securely the cover of the electronics area on to the transmitter housing.
7. Securely tighten the Allen screw of the safety grip.

Warning!

Fig. 17
Turning the local display

3.10 Mounting the transmitter (remote version)

The transmitter has to be mounted remote from the sensor when:
- access is difficult,
- space is restricted,
- extreme process and ambient temperatures prevail (for temperature ranges see page 110),
- there is severe vibration (> 2 g/2 h per day; 10...100 Hz).

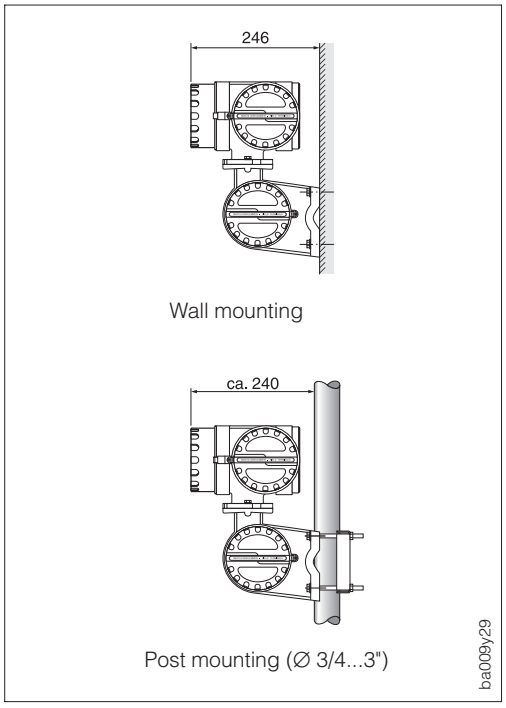


Fig. 18
Wall and post mounting

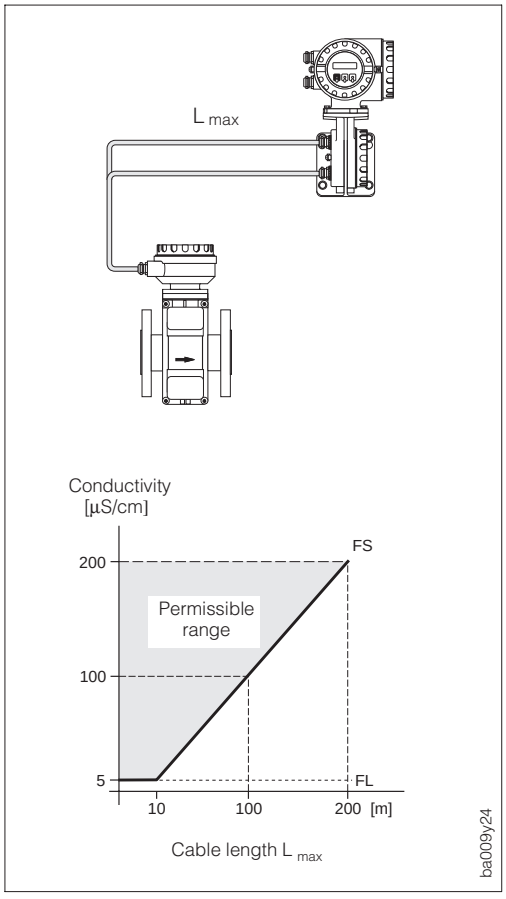


Fig. 19
Fluid conductivity and cable length with the remote version

Wall and post mounting
The remote mounted version is delivered with a wall bracket as standard.
A special mounting set can be supplied for post mounting: Order No. 50076905.

Connecting cable
Two different versions are available for remote versions:

FS version:
- The permissible length of cable L_{max} of more than 10 m is governed by the conductivity of the fluid (see Fig. 19).
- The maximum possible cable length is limited to 10 meter for instruments with Empty Pipe Detection (EPD). This function is only available with the FS version.
- The FS cable is recommended only for distances smaller than 20 m.

FL version:
- All fluids with a minimum conductivity of ≥ 5 µS/cm (demineralised water ≥ 20 µS/cm) can be measured. This is not dependent on the distance between transmitter and sensor (see Fig. 19).
- Empty Pipe Detection (EPD) is *not* available with this version.

Please also note the following for obtaining correct readings:
- Fasten the cable gland or lay it in a conduit. When the fluid conductivity is low, cable movements can cause serious changes in capacitance and thereby falsify the measuring signal.
- Do not run the cable in the vicinity of electrical machines or switching elements.
- Ensure potential equalisation between the transmitter and the sensor.

4 Electrical Connection

Warning!
- When connecting Ex-approved instruments, please observe all instructions and wiring diagrams given in the Ex supplement to this Operating Manual. Your E+H representative will be pleased to provide you with more information.
- When using the remote version, only sensors and transmitters with the same serial number are to be connected together. Measuring errors can occur if this is not the case.

4.1 Degree of protection

The instruments fulfil all the requirements for IP 67. After successful installation in the field or after servicing, the following points must always be observed in order to ensure the degree of protection IP 67:

- Housing seals must be clean and undamaged when inserted in the seal groove. The seals may need to be dried, cleaned or replaced.
- All housing screws and the housing cover must be tightened firmly.
- The cables used for connecting must have the correct outer diameter (see page 27).
- The cable gland must be tightened firmly (see Fig. 20).
- The cable must loop down before entering the cable gland to ensure that no moisture can enter it (see Fig. 20).
  Install the sensor so that the cable glands first hang down and do not first go upwards.
- Any cable gland not used must be replaced with a blind plug.
- The protective bushing should not be removed from the cable gland.

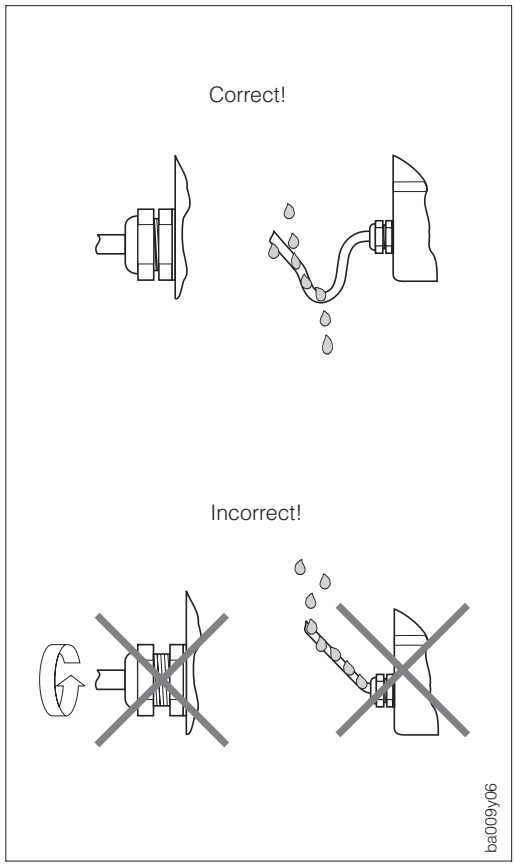


Fig. 20
Mounting cable entries

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

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

4.2 Connecting the transmitter

Warning!

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

Warning!

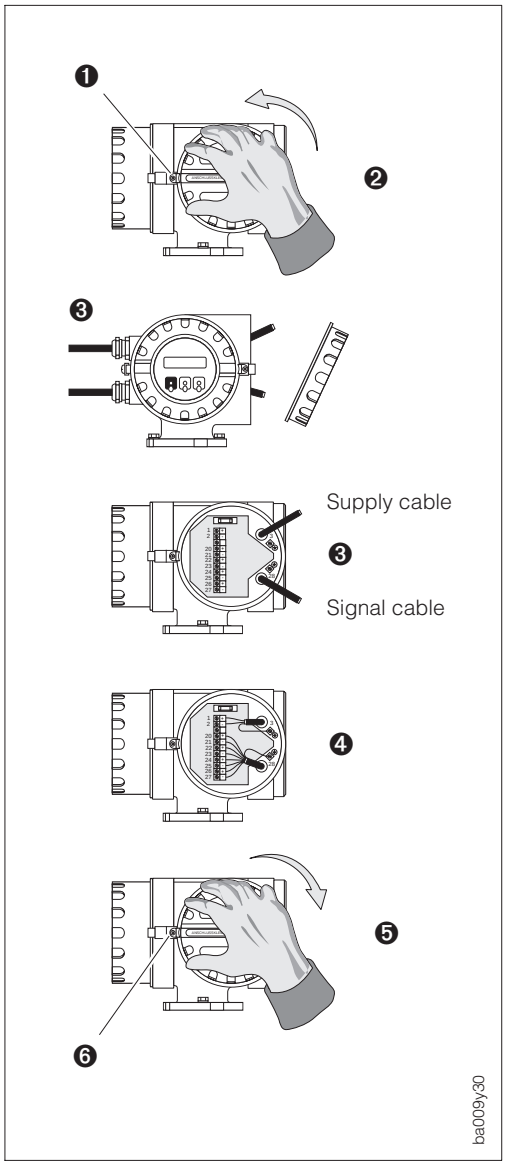


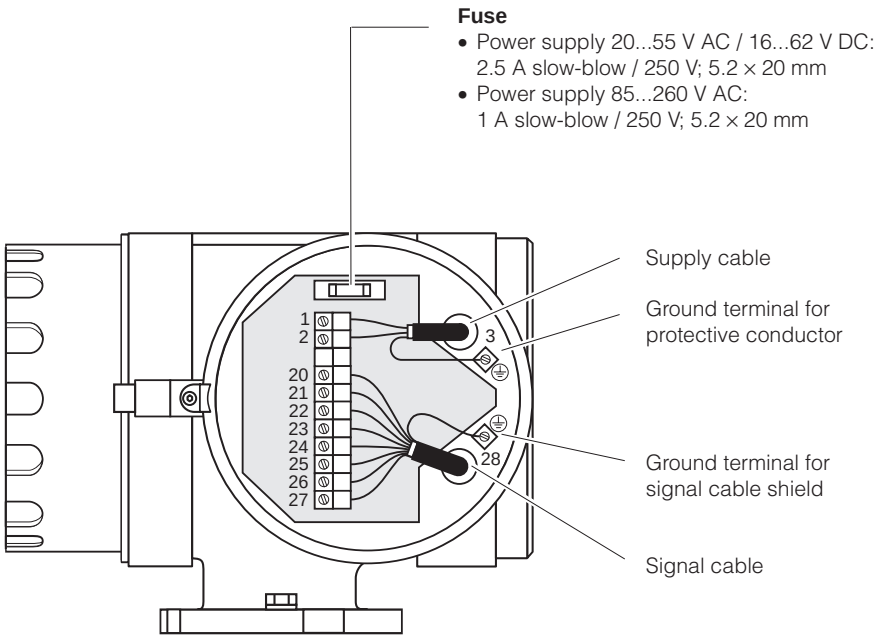
Fig. 21
Connecting the transmitter

1. Loosen the Allen screw of the safety grip using an 3 mm Allen key.
2. Unscrew the wiring compartment cover.
3. Feed the power and signal cables into the appropriate cable glands.
4. Wire up according to the wiring diagrams:
   → see Fig. 22, 23 or
   → Wiring diagram in the screw cover
   - Power supply is connected to terminal 1 (L1, L+), terminal 2 (N, L–) and the ground terminal (3).
   - Fine-wire leads: max. 4 mm^2; put sleeve on the end of the cores. Single-core lead: max. 6 mm^2.
5. Having made the connection, screw the cover tightly again on the transmitter housing.
6. Tighten the Allen screw of the safety grip securely.

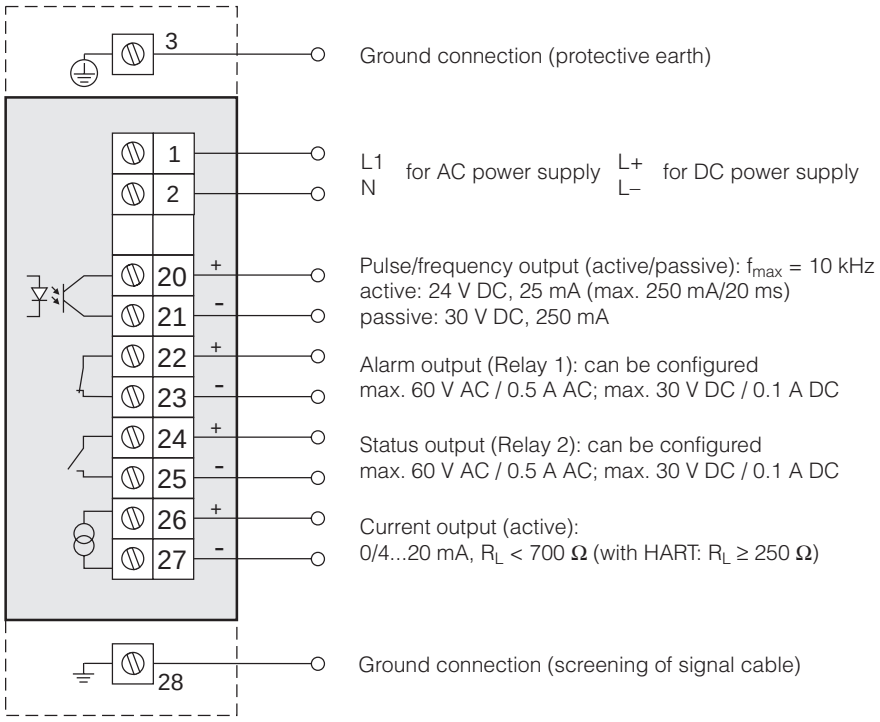
Note!

Note!
For instruments fitted with an “EEx i” communications module, the electrical connection is described in separate Ex documentation.

Connection diagram for the transmitter ("HART")



Version with a "HART" communication module



The input and outputs are galvanically isolated from the power supply and from each other.

ba009y35

Fig. 22
Terminal compartment
Promag 33 (HART)

Connection diagram for the transmitter (“RS 485”)

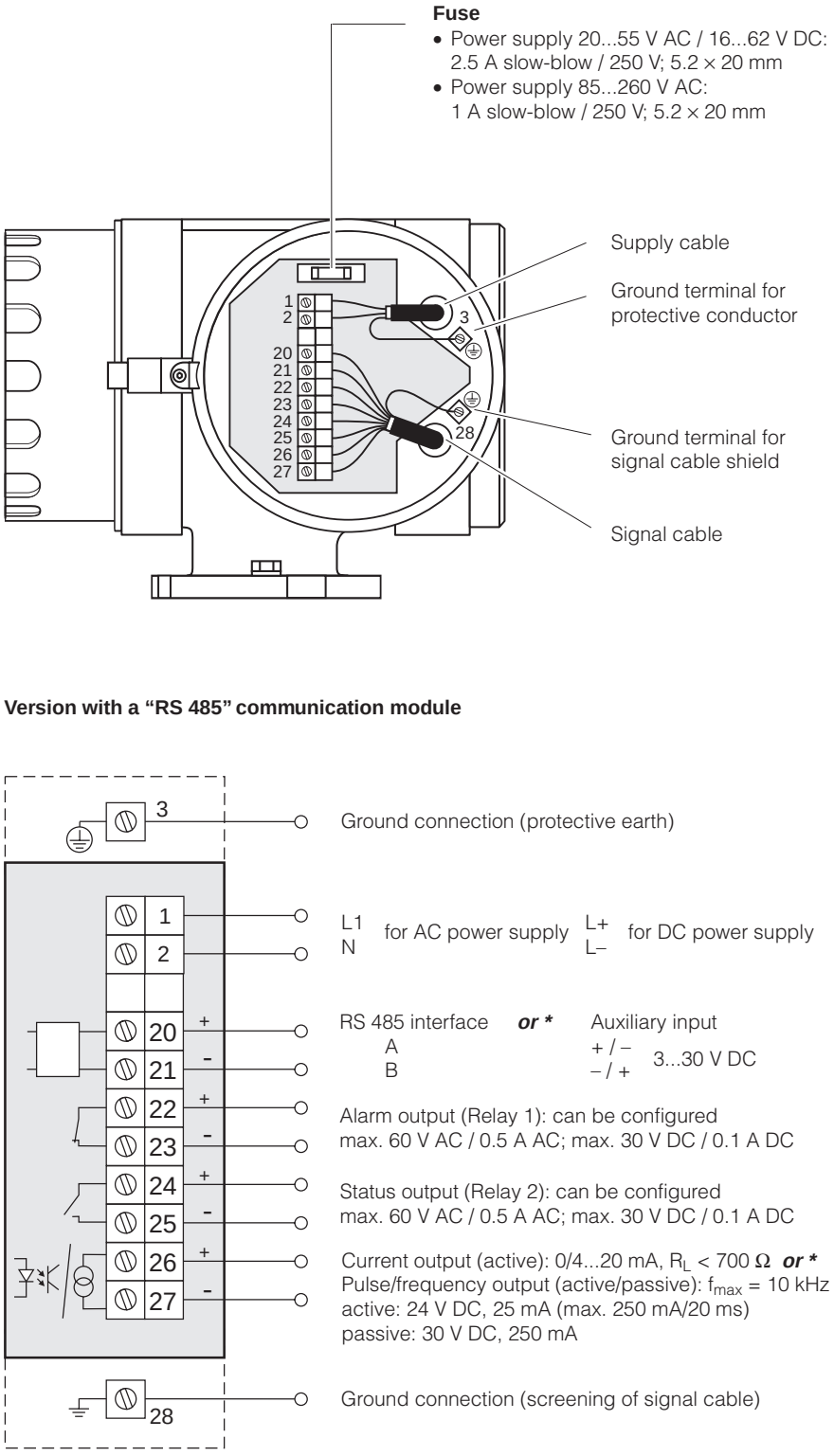


Fig. 23
Terminal compartment
Promag 33 (RS 485)

4.3 Connecting the cable of the remote version

Warning!
Danger from electric shock! Switch off the power supply before opening the instrument.

1. Loosen the safety grip and remove the cover of the *transmitter housing*.

2. Remove the cover from the *connection housing of the sensor*:
   – Promag A, H: Loosen all the Phillips screws
   – Promag F: Loosen the safety grip and unscrew the cover.

3. Feed both signal and coil-current cable into the appropriate cable entries of the connection housings.

   Caution!
   Danger of destroying the coil current control! Only connect or disconnect the coil cable once the power supply to the instrument has been switched off.

4. Connect the sensor / transmitter cable according to the wiring diagrams (see Fig. 25).

5. Retighten the connection housing cover securely.
   With Promag F, the Allen screw of the safety grip also has to be tightened.

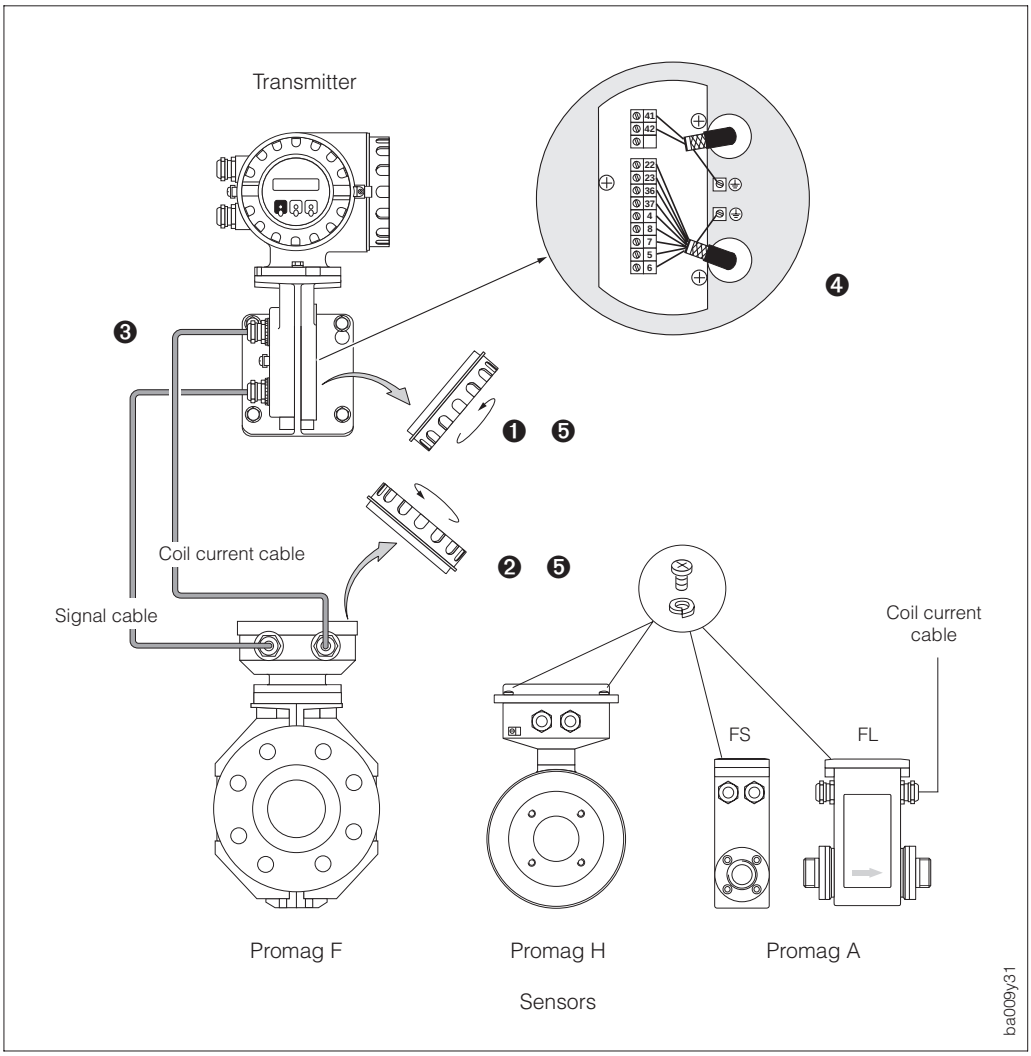
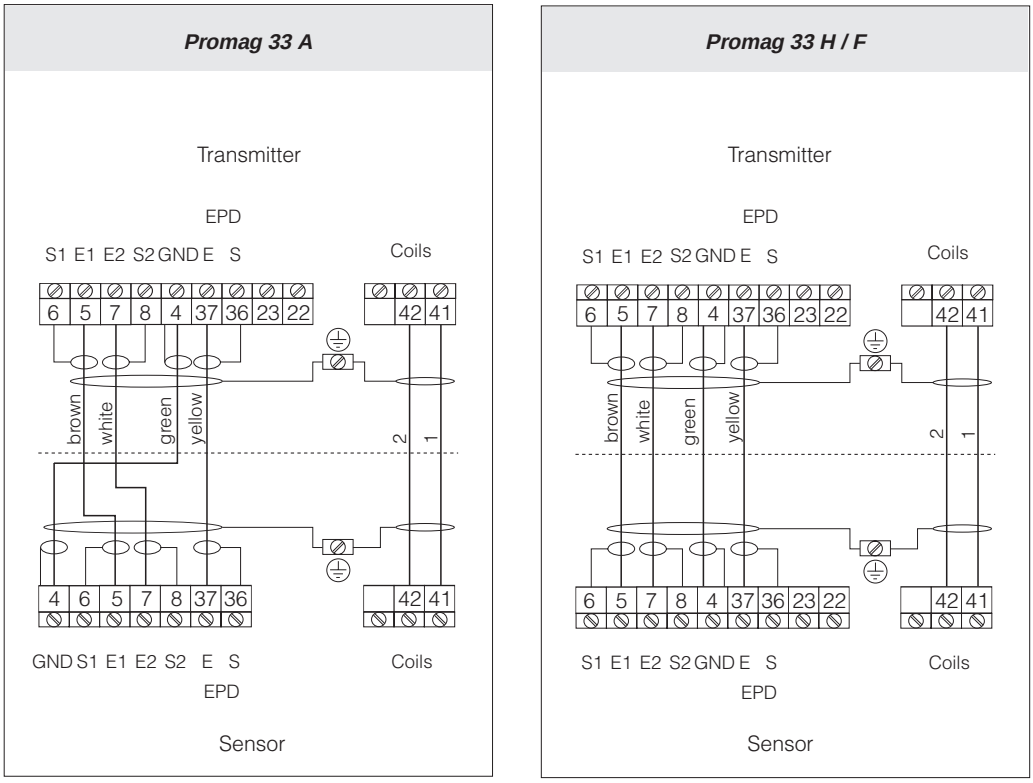


Fig. 24
Connecting the transmitter / sensor cable

Wiring diagrams for the remote version (FS/FL)

Remote version “FS”



Remote version “FL”

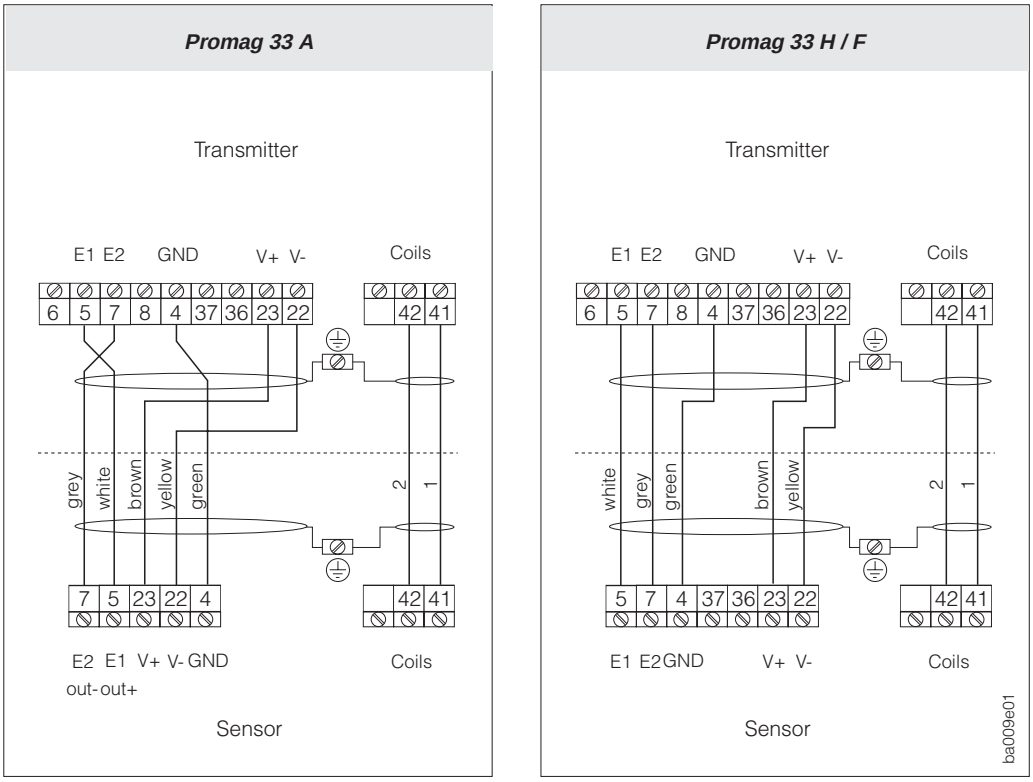


Fig. 25
Wiring diagrams for the remote “FS” and “FL” versions

4.4 Cable specifications

Remote version "FS"

Coil cable:	2 x 0.75 mm^2 PVC cable with common screen *	
	Conductor resistance	≤ 37 Ω/km
	Capacitance: core/core, screen grounded	≤ 120 pF/m
	Permanent operating temperature:	–20...+70 °C
Signal cable:	3 x 0.38 mm^2 PVC cable with common screen * and separately screened cores	
	With EPD (Empty Pipe Detection)	4 x 0.38 mm^2 PVC cable
	Conductor resistance	≤ 50 Ω/km
	Capacitance: core/screen	≤ 420 pF/m
	Permanent operating temperature:	–20...+70 °C

* braided copper screen: ∅ ~ 7 mm

Remote version "FL"

Coil cable:	2 x 0.75 mm^2 PVC cable with common screen *	
	Conductor resistance	≤ 37 Ω/km
	Capacitance: core/core, screen grounded	≤ 120 pF/m
	Permanent operating temperature:	–20...+70 °C
Signal cable:	5 x 0.5 mm^2 PVC cable with common screen *	
	Conductor resistance	≤ 37 Ω/km
	Capacitance: core/core, screen grounded	≤ 120 pF/m
	Permanent operating temperature:	–20...+70 °C

* braided copper screen (coil cable ∅ ~ 7 mm; signal cable ∅ ~ 9 mm)

Operation in areas with severe electrical interference

The Promag 33 measuring system fulfils all general safety requirements according to EN 61010 and electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 when installed in accordance with the NAMUR recommendations.

Note!

- Remote version:
  To comply with the certificate of conformity, the signal and coil cables between the sensor and transmitter must always be screened and grounded at both ends. Grounding is made using the ground terminals especially for this purpose on the inside of the connection housings. Keep stripped and twisted cable shield section to the ground terminal as short as possible!
- The cable must be resistant to an ambient temperature of max. +80 °C if the Promag H sensor is operated at a process temperature of +150 °C.


Note!

4.5 Potential equalisation

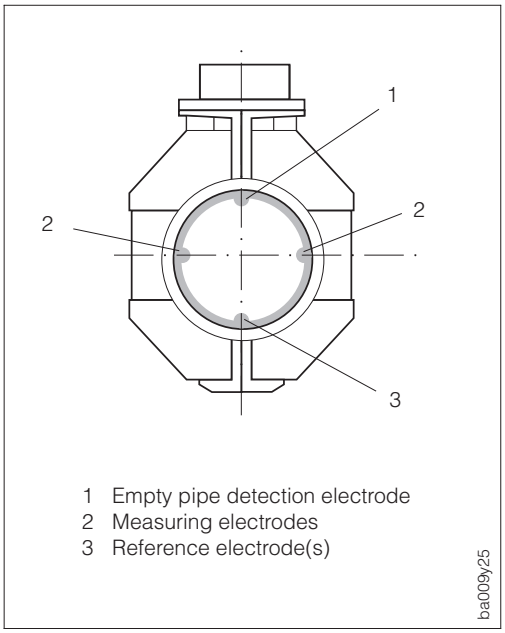


Fig. 26
Position of different electrodes in the measuring tube (Example: Promag 33 F)

The sensor and the fluid must have roughly the same electrical potential to ensure that measurement is accurate and no galvanic corrosion takes place at the electrode. Normally the reference electrode in the sensor or the metal pipe ensures that the potentials are equalised.

Reference electrodes:
- Promag A:
  always with reference electrode
- Promag F:
  optional, depending on material
- Promag H:
  no reference electrode, as there is always a metallic connection to the fluid.

If the reference electrode is correctly grounded and the fluid flows through metallic, non-lined and grounded piping, then it is sufficient to connect the grounding terminal of the Promag 33 transmitter housing to the potential equalisation line in order to prevent corrosion. The connection with the remote-mounted version is made at the ground terminal of the connection housing.

Caution!
Danger of permanent damage to the instrument! If the fluid cannot be grounded for operational reasons, ground disks are to be used.

Potential equalisation for some special cases is described below:

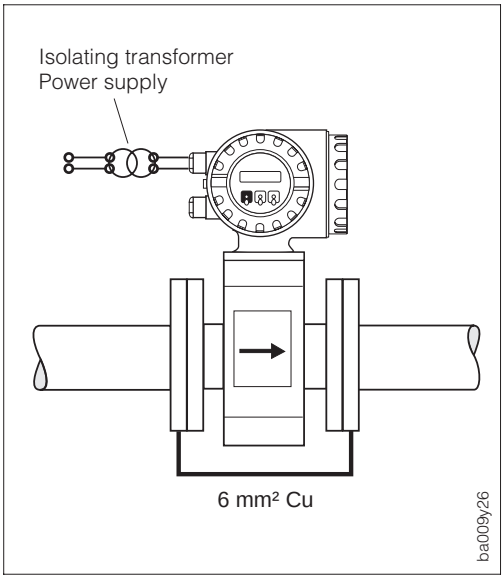


Fig. 27
Potential equalisation for lined pipes with cathodic protection

Potential equalisation for lined pipes with cathodic protection

When the fluid cannot be grounded for operational reasons, the measuring unit must be installed that it is potential-free (Fig. 27). Ensure that components of the piping are connected to one another (copper wire, 6 mm^2).

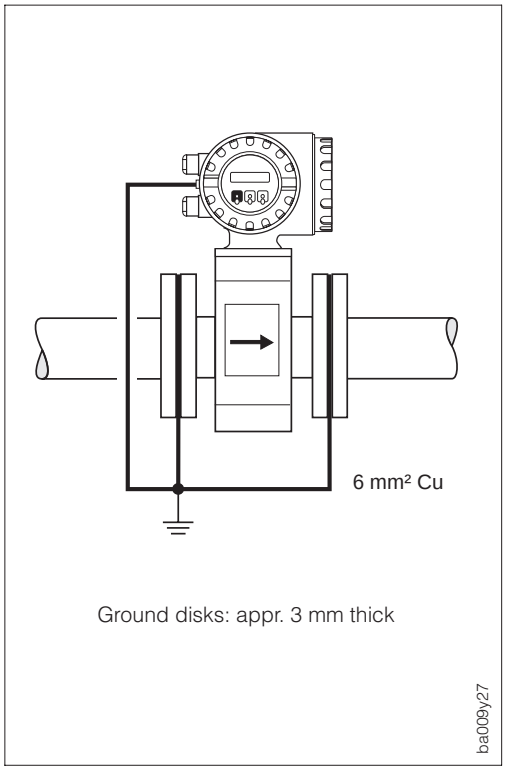
All national regulations regarding potential free installation are to be observed (e.g. VDE 0100).
Ensure that the mounting material used does not result in a conductive bond with the measuring unit and that the material can withstand the tightening torque used.

Plastic or lined piping

Ground disks must always be used with non-conductive piping materials if compensation currents flow through the fluid. They can irreparably damage the reference electrode within a short time due to electrochemical corrosion.

Such conditions occur especially if:
- the piping is insulated with electrically non-conductive materials and
- the piping is made of fibreglass or PVC through which flow highly concentrated acids and alkalis.

Caution!
Danger from damage due to electrochemical corrosion!
- Note the corrosion resistance of the ground disks!
- Note the electrochemical potential series in cases where the ground disks and the measuring electrodes are made of different material.



Caution!

Fig. 28
Potential equalisation with plastic or lined pipings.

Equalising currents in ungrounded metal pipes / Grounding in an area with severe interference

The fluid may be grounded. In order to make the most of the electromagnetic compatibility (EMC) of the Promag 33, it is advisable to provide two flange-to-flange links and to connect them jointly with the transmitter housing to ground potential.

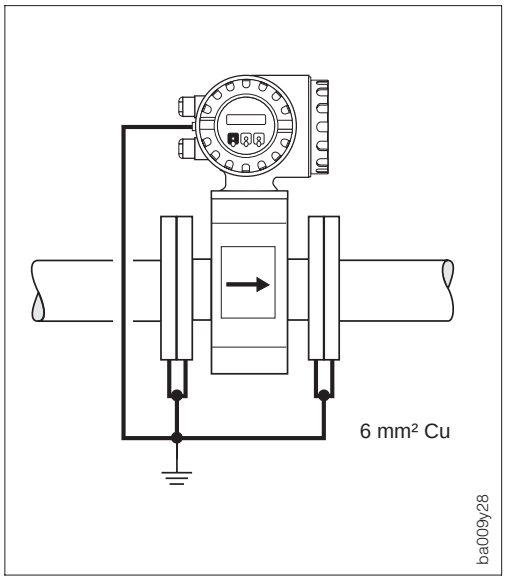


Fig. 29
Potential equalisation with
– equalising currents,
– in areas with severe interference

4.6 Connecting E+H Rackbus and Rackbus RS 485

Promag 33 can be linked to other E+H measuring instruments using an E+H-Rackbus and a Rackbus RS 485 and connected to higher process-control systems such as MODBUS, PROFIBUS, ControlNet etc., with the help of a corresponding gateway (see Fig. 30). A maximum of 64 addresses can be connected to a ZA 672 gateway, including those connected to the FXA 675.

- **E+H Rackbus (19" Racksyst cassette)**
  – For use in a control room up to a max. distance of 15 meters.
  – A maximum of 64 addresses can be integrated into this bus via a ZA 672 gateway.

- **Rackbus RS 485 (field housing)**
  – For use in the field up to a max. distance of 1200 meters.
  – A maximum of 25 measuring instruments can be integrated consecutively with the Rackbus RS 485 via FXA 675.

Commubox FXA 192 allows a direct connection to a PC (see Fig. 31).
Up to 25 Promag transmitters can be connected; however, the actual number depends on the network topology and the application conditions.


Caution!

Caution!
Even if only a single instrument (with Rackbus RS 485) has been installed in hazardous area, not more than ten instruments (with Rackbus RS 485) may be connected to the bus.


Note!

Note!
For the initial installation of a Rackbus network, please refer to the operating instructions of the instruments and software you use, in particular:
- BA 134 F/00/e “Rackbus RS 485 – Topology, Components, Software”
- BA 124 F/00/en “Commuwin II operating program”

Gateway connection to PCs or process-control systems

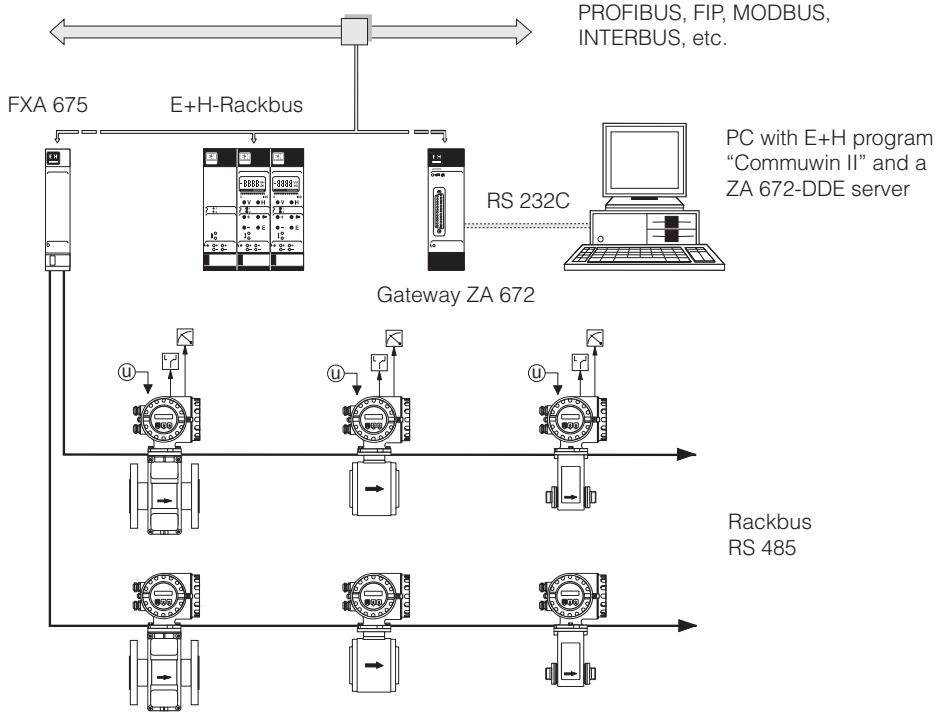


Fig. 30
Connection versions to the Rackbus RS 485 interface

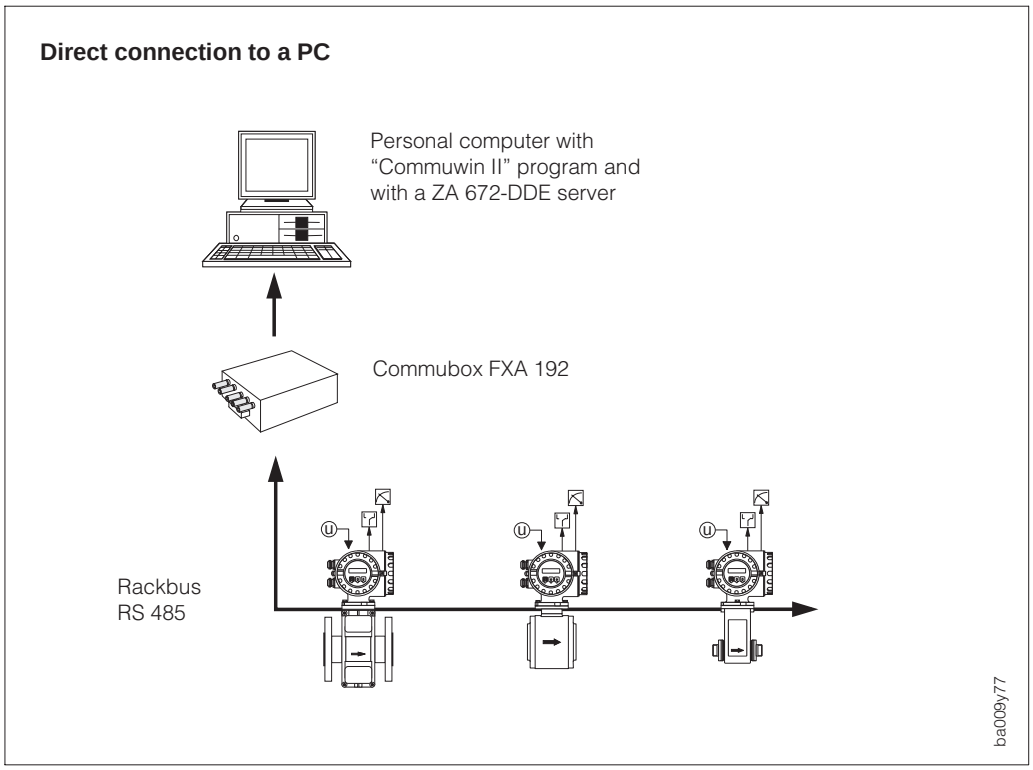


Fig. 31
Direct PC connection to Rackbus RS 485 via Commubox FXA 192

E+H-Rackbus and Rackbus RS 485 wiring

Warning!
When connecting flowmeters with Ex approval, all appropriate instructions and connections diagrams in the seperate Ex documentation to this Operating Manual must be observed.

1. Wire up according to Figure 32.
   The bus is connected using the FXA 675 assembly module or the Commubox FXA 192 (see Fig. 30, 31), which are galvanically isolated.

   Cable specifications for Rackbus RS 485:
   - Connection cable: two-core, twisted, screened
   - Conductor cross-section / cable diameter: ≥ 0.20 mm^2 (24 AWG)
     cable length: max. 1200 m (3900 ft)

2. Set terminating resistors if necessary (see Fig. 33)
   Normally, the corresponding selection switches on the communications board may be left in the factory setting position (all switches = OFF).

3. Subsequent to the bus installation, the following functions of the operating matrix have to be set (see page 69):
   - PROTOCOL → Select “RACKBUS RS 485” protocol (factory setting = OFF)
   - BUS ADDRESS → Set bus address for the respective transmitter (0...63)

Connecting a Promag 33 to a RS 485 Rackbus

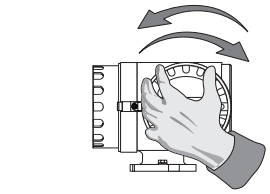
Warning!

Warning!
- Danger from electrical shock! Switch off power supply before opening the transmitter housing.
- If instruments with Ex approvals are used, please observe all instructions and regulations of the Ex supplementary documentation.

1. Loosen the Allen screw of the safety grip (3mm Allen screw).
2. Unscrew the cover of the terminal compartment.
3. Wire up:
   – Terminal 20 → Data A
   – Terminal 21 → Data B
   – Terminal 28 → ground bus screening
4. Screw the cover up tight again on to the terminal compartment.
5. Tighten the Allen screw of the safety grip securely.

Note!

Note!
If the bus is grounded at both sides, then potential equalisation must also be present!



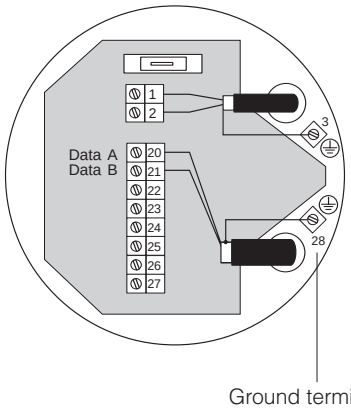


Fig. 32
Electrical connection for the Rackbus RS 485

Setting the termination resistors

Warning!

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

The termination switches are on the RS 485 communication board (see Fig. below).
The termination switches can usually be left at the factory setting (all switches = OFF).

- With the last transmitter on the bus (furthest from the PC), turn on the termination resistor via the selector switches to: OFF – ON – ON – OFF
- If a bus initial voltage is to be provided, then position the selector switches to: ON – ON – ON – ON.

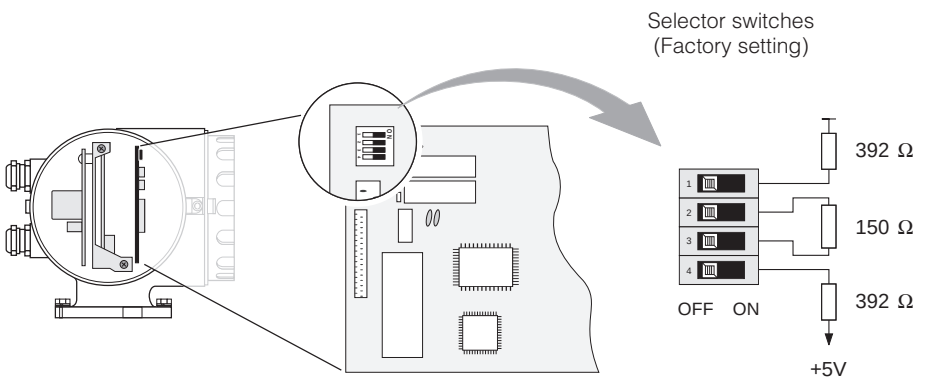


Fig. 33
Setting the termination resistors

4.7 Connecting HART Communicator

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 the current output

Note!
The measuring loop must have a minimum resistance of 250 Ω.

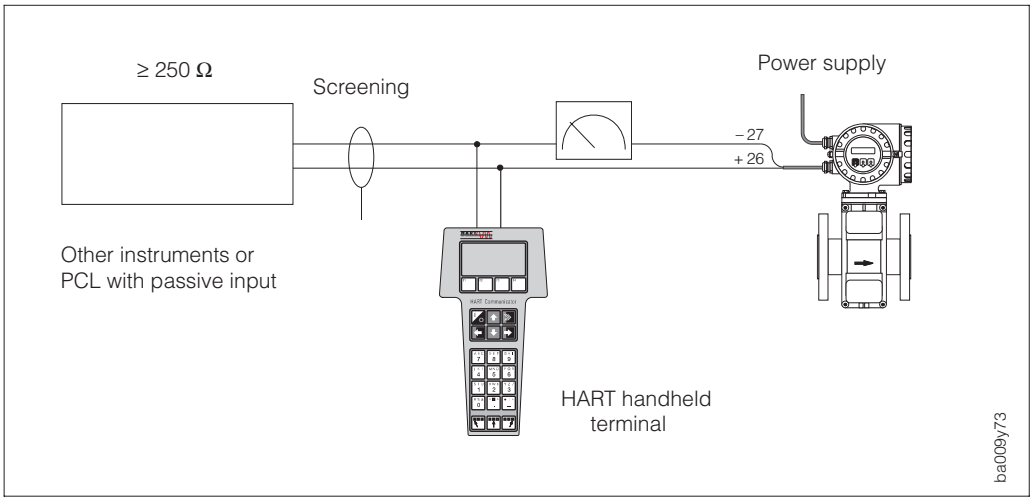


Fig. 34
Electrical connection
HART communicator

4.8 Connecting Commubox FXA 191 (Commuwin II software)

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 the current output

Note!
- The measuring loop must have a minimum resistance of 250 Ω.
- Move the DIP switch on the Commubox to 'HART'.
- Set the function "CURRENT SPAN" to '4–20 mA' (see page 51) and the function "PROTOCOL" to 'HART' (see page 69).
- When connecting up, also take into account the information given in the documentation issued by the HART Communication Foundation.
  This applies especially to HCF LIT 20: "HART, a technical summary".

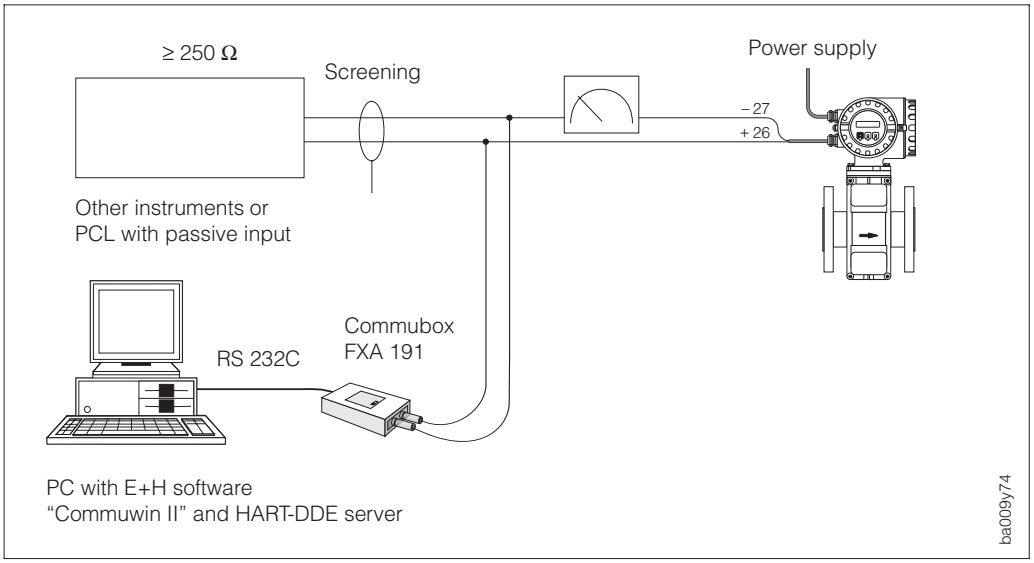


Fig. 35
Electrical connection
Commubox FXA 191

4.9 Commissioning

Before switching on the measuring system, the following checks should be carried out again:
- Check the electrical connections and terminal assignments.
- Compare the data on the nameplate with the local mains voltage and frequency.
- Does the direction of the arrow on the nameplate (sensor) agree with the actual direction of flow in the piping?

If the results of these checks are satisfactory, switch on the supply voltage. The unit is now ready for operation. After switching on, the system performs various self-test routines. During this procedure the following sequence of messages appears on the display:

Display of the communication software version

Promag 33
V2.04.00 HART (or **RS 485)**

Display during start-up

S: START-UP
RUNNING

After successful start-up, normal measurement mode is assumed. The display now shows the flow rate and the totalizer value simultaneously (“HOME” position):

290.82 m^3/h
2.1080 m^3


Note!

Note!
If start-up is not successful, then an error message is shown indicating the cause.
A list with all error messages is given on page 90 ff.

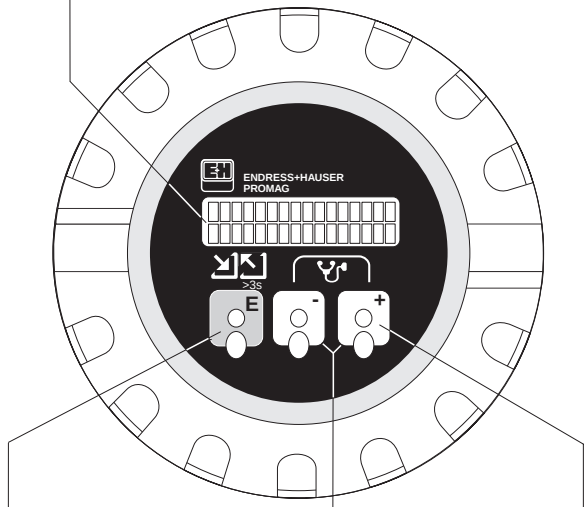
5 Display and Operation

5.1 Display and operating elements

With the Promag 33 display, all important parameters can be read off or configured using the E+H operating matrix.

LC Display

- Illuminated, double-spaced with 16 characters.
- Displayed are menu texts and numerical values as well as error, alarm and status messages
- HOME position (display during normal measuring operation):
  Upper line → freely selectable measured variable (factory setting “FLOW RATE”)
  Bottom line → freely selectable measured variable (factory setting “TOTAL VOLUME”)



3 optical operating elements “Touch-Control”

up: Infrared transmitter diode
down: Infrared receiver diode

+ / – keys

- Select Function Groups
- Enter numerical values (if keys are kept pressed, the numbers displayed will begin changing at accelerated rate)
- Select parameters or settings

Diagnostic and help function (activate +/– keys simultaneously)

Enter key

E HOME position → Access to the operating matrix

>3s E Leave operating matrix → Return to HOME position (activate key for more than 3 seconds)

E Access function
Save entered figures and settings

ba014y34

Fig. 36
Display and operating elements

5.2 Operation (operating matrix)

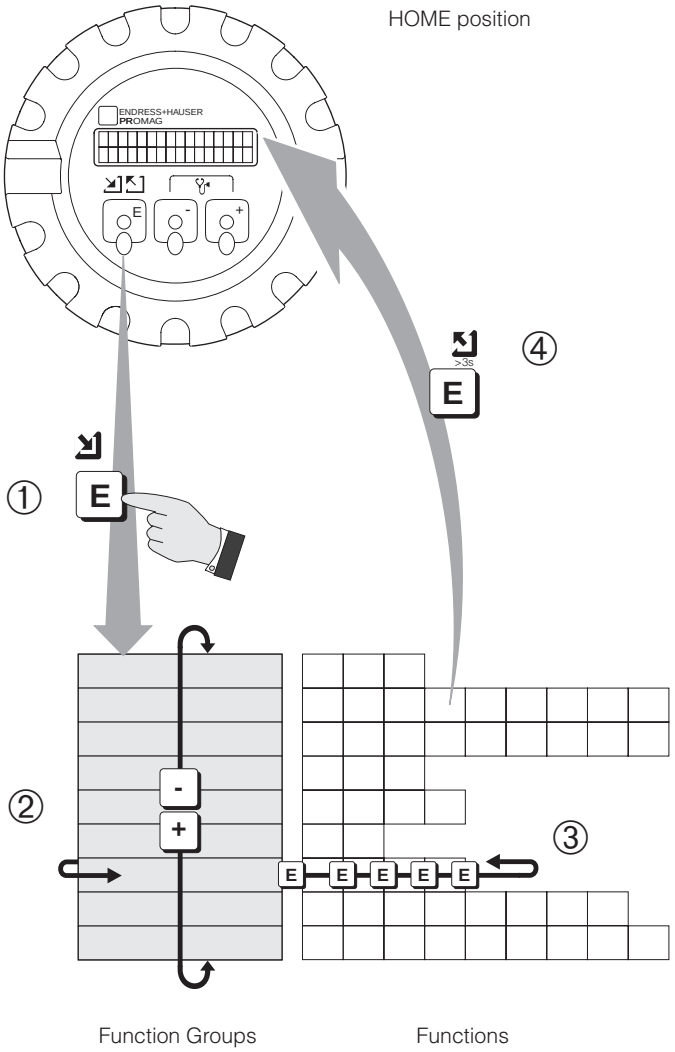
① Access to the operating matrix (from the HOME position)

② Select function group (> GROUP SELECT. <)

③ Select function (enter parameters or numeric values with ± and store with E)

Overview of all functions and parameters → see page 117
Operating example → see page 37
Function description → see page 47 ff.

④ Leave operating matrix → to HOME position (from any matrix position) or
Select other functions

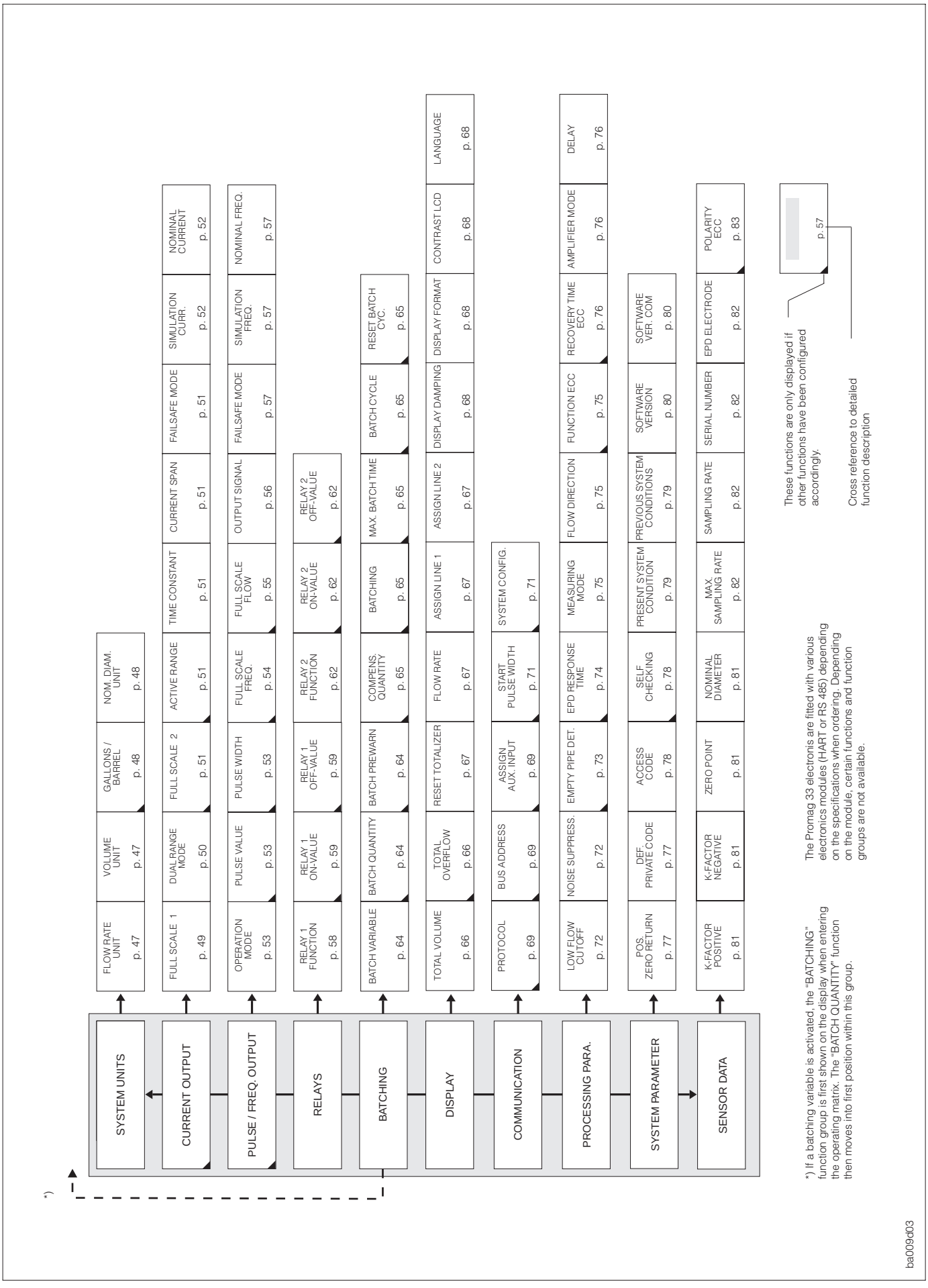


Note!

Note!
- An automatic return to the HOME position will be made if the operating elements are not pressed for 60 seconds (only when the programming is locked).
- If the diagnosis function ± is activated from the HOME position, then an automatic return to HOME position will be made if the operating elements are not pressed within 60 seconds; whether the programming is enabled or locked.

ba009y33

Fig. 37
Selecting functions in the E+H operating matrix


SYSTEM UNITS
FLOW RATE UNIT p. 47
VOLUME UNIT p. 47
GALLONS / BARREL p. 48
NOM. DIAM. UNIT p. 48
CURRENT OUTPUT
FULL SCALE 1 p. 49
DUAL RANGE MODE p. 50
FULL SCALE 2 p. 51
ACTIVE RANGE p. 51
TIME CONSTANT p. 51
CURRENT SPAN p. 51
FAILSAFE MODE p. 51
SIMULATION CURR. p. 52
NOMINAL CURRENT p. 52
PULSE / FREQ. OUTPUT
OPERATION MODE p. 53
PULSE VALUE p. 53
PULSE WIDTH p. 53
FULL SCALE FREQ. p. 54
FULL SCALE FLOW p. 55
OUTPUT SIGNAL p. 56
FAILSAFE MODE p. 57
SIMULATION FREQ. p. 57
NOMINAL FREQ. p. 57
RELAYS
RELAY 1 FUNCTION p. 58
RELAY 1 ON-VALUE p. 59
RELAY 1 OFF-VALUE p. 59
RELAY 2 FUNCTION p. 62
RELAY 2 ON-VALUE p. 62
RELAY 2 OFF-VALUE p. 62
BATCHING
BATCH VARIABLE p. 64
BATCH QUANTITY p. 64
BATCH PREWARN p. 64
COMPENS. QUANTITY p. 65
BATCHING p. 65
MAX. BATCH TIME p. 65
BATCH CYCLE p. 65
RESET BATCH CYC. p. 65
DISPLAY
TOTAL VOLUME p. 66
TOTAL OVERFLOW p. 66
RESET TOTALIZER p. 67
FLOW RATE p. 67
ASSIGN LINE 1 p. 67
ASSIGN LINE 2 p. 67
DISPLAY DAMPING p. 68
DISPLAY FORMAT p. 68
CONTRAST LCD p. 68
LANGUAGE p. 68
COMMUNICATION
PROTOCOL p. 69
BUS ADDRESS p. 69
ASSIGN AUX. INPUT p. 69
START PULSE WIDTH p. 71
SYSTEM CONFIG. p. 71
PROCESSING PARA.
LOW FLOW CUTOFF p. 72
NOISE SUPPRESS. p. 72
EMPTY PIPE DET. p. 73
EPD RESPONSE TIME p. 74
MEASURING MODE p. 75
FLOW DIRECTION p. 75
FUNCTION ECC p. 75
RECOVERY TIME ECC p. 76
AMPLIFIER MODE p. 76
DELAY p. 76
SYSTEM PARAMETER
POS. ZERO RETURN p. 77
DEF. PRIVATE CODE p. 77
ACCESS CODE p. 78
SELF CHECKING p. 78
PRESENT SYSTEM CONDITION p. 79
PREVIOUS SYSTEM CONDITIONS p. 79
SOFTWARE VERSION p. 80
SOFTWARE VER. COM p. 80
SENSOR DATA
K-FACTOR POSITIVE p. 81
K-FACTOR NEGATIVE p. 81
ZERO POINT p. 81
NOMINAL DIAMETER p. 81
MAX. SAMPLING RATE p. 82
SAMPLING RATE p. 82
SERIAL NUMBER p. 82
EPD ELECTRODE p. 82
POLARITY ECC p. 83
*)
*) If a batching variable is activated, the "BATCHING" function group is first shown on the display when entering the operating matrix. The "BATCH QUANTITY" function then moves into first position within this group.
The Promag 33 electronis are fitted with various electronics modules (HART or RS 485) depending on the specifications when ordering. Depending on the module, certain functions and function groups are not available.
These functions are only displayed if other functions have been configured accordingly.
p. 57
Cross reference to detailed function description
ba009d03

Further information on programming
For the Promag 33 measuring system, there is a wide choice of functions and parameters which the user can set individually and adapt to the condition of his process.

The individual functions are allocated to various function groups (see page 37). Selection of these functions within the E+H matrix is carried out as described on page 36. Numerical values or factory settings which may be altered appear flashing on the LC display.

Please note the following:
- If the power supply cuts out, then all calibrated and set values are safely stored in the EEPROM (without requiring batteries).
- Certain functions can be set to "OFF". The appropriate functions in other function groups then no longer appear on the display.
- In certain functions, a prompt is given after entering data for safety reasons. Select "SURE? [YES]" with the ± keys and confirm by pressing E again. The setting is now stored or a function, e.g. an empty pipe adjustment, is activated.


Achtung!

Enable programming (access code)
Normally programming is locked. Any unauthorised changes to the instrument functions, values or factory settings are therefore not possible. Only when a code has been entered (factory setting = 33) parameters can be entered or changed.

The use of a personal code number which can be freely chosen prevents unauthorised personnel from gaining access to data (see page 77).
An exception to this is the function group "BATCHING". In this group only the function "BATCH VARIABLE" is protected by the code number. All other functions in this group can be changed without the code number.

Caution!
- If programming is locked and the ± keys are pressed in a given function, then a prompt to enter the code automatically appears on the display.
- With code "0" (zero) the programming is **always** enabled!
- If the personal code number is no longer available, then please contact the Endress+Hauser service organisation which will pleased to help you.
- Changing certain parameters, e.g. all characteristic data of the sensor, affects a number of functions of the entire measuring system, especially its accuracy. Normally these characteristic data may not be altered and are therefore protected by a special service code only known to E+H service technicians. Please contact your E+H Service organisation for more information.

Locking programming
- After returning to the HOME position, programming is again locked after 60 seconds if no operating element is pressed.
- Programming can also be locked by entering any number (not the customer code number) in the function "ACCESS CODE".

5.3 Operating example

To change the time constant set in the factory at “1.0 s” to “20 s”, then proceed as follows:

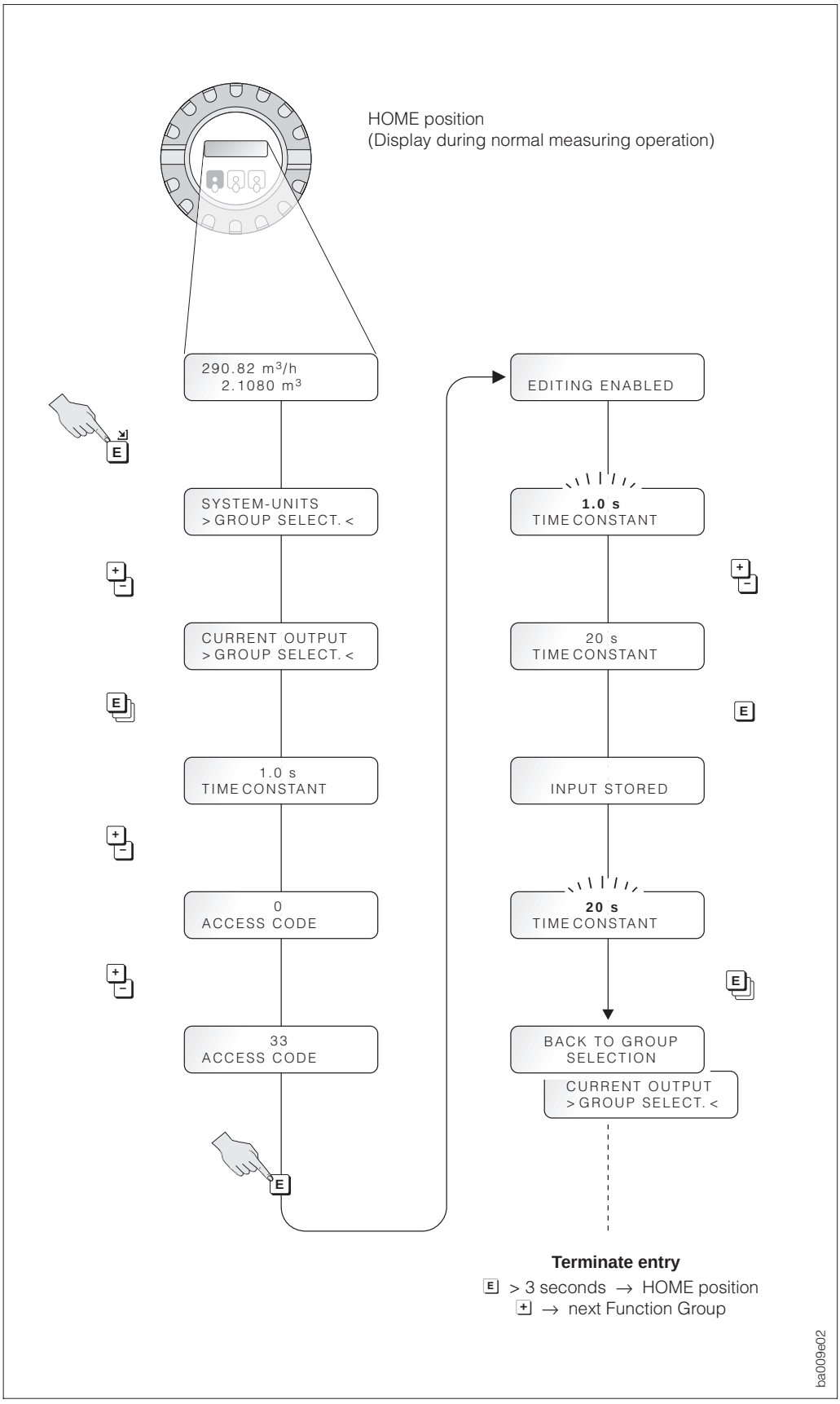


Fig. 38
Operating example
(E+H operating matrix)

5.4 Operation with the HART protocol

Besides local operation, the Promag 33 flowmeter can also be configured 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.

Operating using the “HART Communicator DXR 275”
Promag 33 functions are selected with the HART communicator over a number of menu levels as well as with the aid of a special E+H operating matrix (see Fig. 40).

Note!

Notes!
- The HART protocol requires a “4–20 mA” setting of the current output (see page 51). The “4–20 mA” setting is only selectable if the setting “HART” is switched off in the function “PROTOCOL” (see page 69).
- All functions are accessible at all times with the HART handheld terminal i.e. programming is not locked. The HART operating matrix can, however, be locked by entering the value “–1” in the function “ACCESS CODE”. Data can then no longer be changed. This status remains even after a power failure. The operating matrix can again be enabled by entering the personal code number.
- Further information on the HART Communicator is given in the appropriate operating manual in the carrying case.

Procedure

1. Switch on handheld terminal:
   a. The transmitter is not yet connected → The HART main menu is displayed → Continue with “Online”
   b. The transmitter is already connected → The menu level “Online” is immediately shown.

2. “Online” menu level:
   → Actual measurement data including flow, totaliser sum, etc. are continually shown.
   → Via “Matrix group sel.” you have access to the HART operating matrix (see Fig. 40), then to the function group (e.g. current output) and finally to the desired function, e.g. “Damping PV”.
3. Enter values or change the setting.
4. The field “SEND” is shown by pressing the “F2” function key. By pressing the “F2” key, all values and settings entered with the handheld terminal are registered by the Promag measuring system. Confirm with the “F4” key.
5. Press “F3” HOME function key to return to the “Online” menu level. The actual values measured by the Promag flowmeter with the new settings can now be read off.

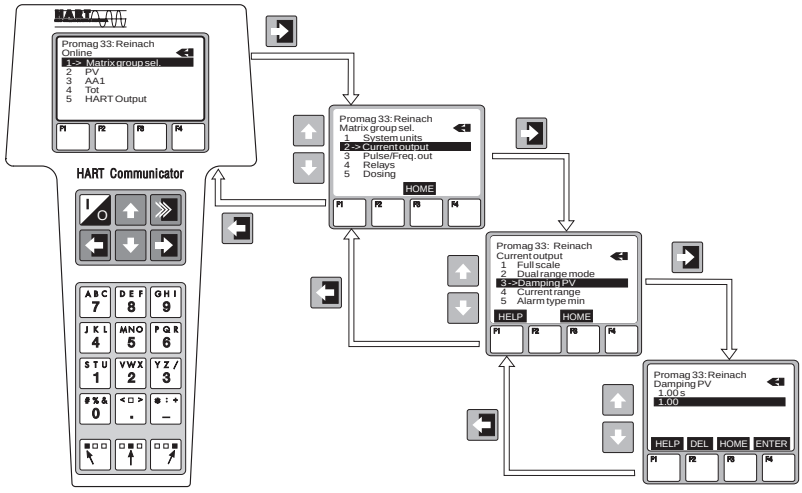


Fig. 39
Operating the HART handheld terminal

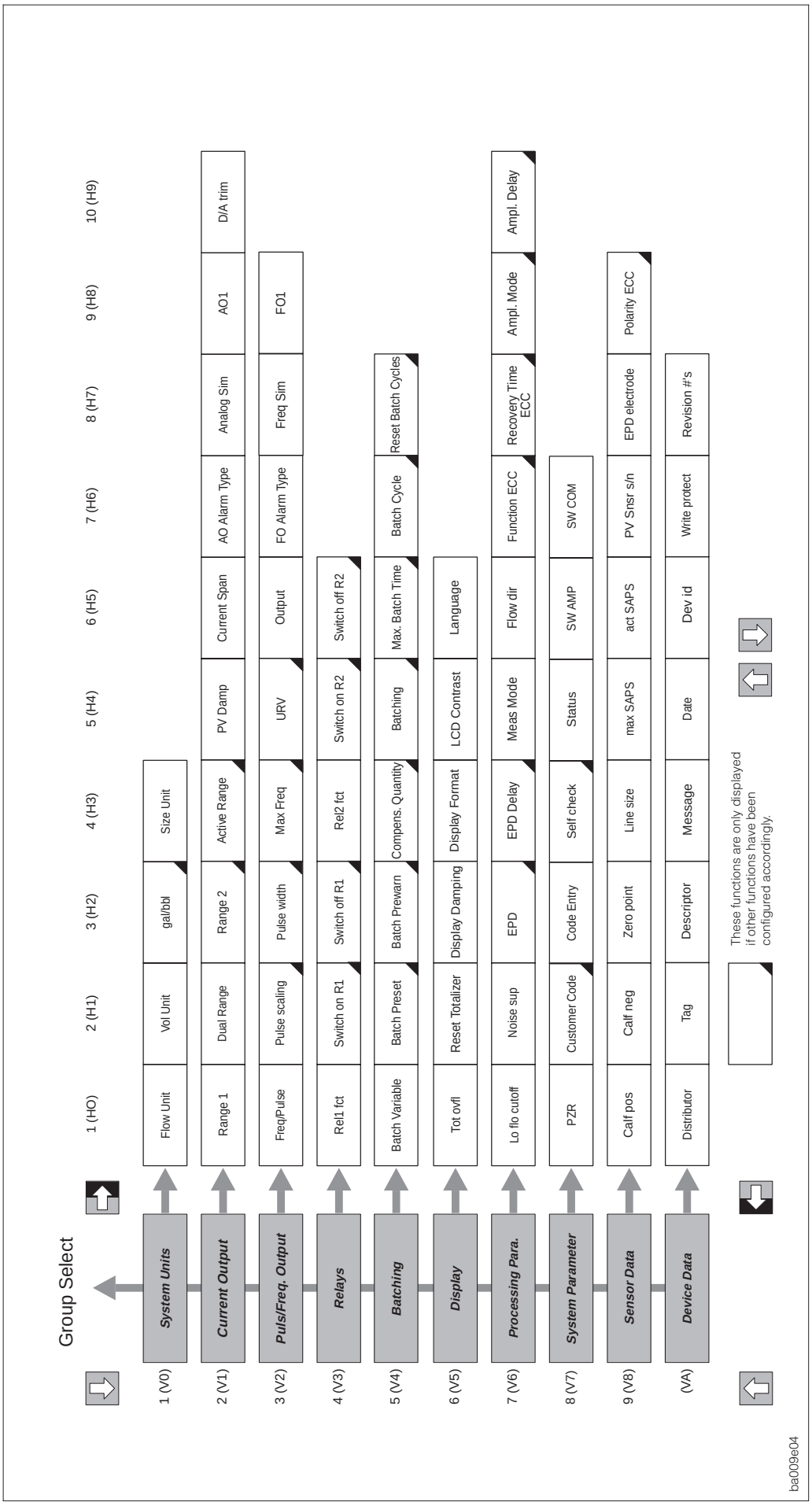


Fig. 40
HART operating matrix
Promag 33

Operating using the "Commuwin II" program
Commuwin II is a universal program for remote operation of field and control-room devices. Use of the Commuwin II operating program is possible independent of the type of instrument or Communication (HART, PROFIBUS, Rackbus RS 485, etc.) chosen.

Commuwin II offers the following functions:
- parameterisation of functions
- visualisation of measuring values
- saving of instrument parameters
- device diagnostics
- measuring point documentation

Commuwin II may also be combined with other software packages to visualise processes.


Note!

Note!
For additional information on Commuwin II, see the following E+H documentation:
- System Information: SI 018F/00/en "Commuwin II"
- Operating Manual: BA124F/00/en "Commuwin II Operating Program"

5.5 Operating Rackbus RS 485

When programming via a Rackbus interface, all Promag instrument functions are arranged and displayed in an E+H operating matrix → see page 44, 45

Operating Matrix for Rackbus RS 485

		H0	H1	H2	H3
V0	MEASURED VALUE	FLOWRATE	TOTALIZED VOL.	FLOW RATE UNITS 0: dm3/s 1: dm3/min 2: dm3/h 3: m3/s 4: m3/min 5: m3/h 6: l/s 7: l/min 8: l/h 9: hl/min 10: hl/h 11: gal/min 12: gal/h 13: gal/day 14: gpm 15: gph 16: gpd 17: mgd 18: bbl/min 19: bbl/h 20: bbl/d 21: ft3/s 22: cc/min	VOLUME UNITS 0: dm3 1: m3 2: l 3: hl 4: gal 5: bbl 6: Kgal 7: ft3
V1	CURRENT OUTPUT	FULL SCALE 1	DUAL RANGE MODE 0: OFF 1: ON	FULL SCALE 2	ACTIVE RANGE 0: RANGE 1 1: RANGE 2
V2	PULSE / FREQ. OUTPUT	OPERATION MODE 0: FREQUENCY 1: PULSE	PULSE VALUE	PULSE WIDTH	FULL-SCALE FREQ.
V3	RELAYS	RELAY 1 FUNCTION 0: ERROR 1: EPD 2: ERROR + EPD 3: DUAL RANGE 4: PRE AL BATCH 5: FLOW DIRECT. 6: LIMIT VALUE K1	SWITCH-ON PT. RE 1	SWITCH-OFF PT. RE 1	RELAY 2 FUNCTION 0: – 1: EPD 2: – 3: DUAL RANGE MODE 4: BATCHING 5: FLOW DIRECT. 6: LIMIT VALUE K2
V4	BATCHING	BATCH MODE 0: OFF 1: VOLUME	BATCH QUANTITY	PRE BATCH QTY	COMPENSATION QTY
V5	DISPLAY	TOTAL OVERFLOW	RESET TOTALIZER 0: NO 1: YES	DISPLAY LINE 1 0: – 1: FLOWRATE 2: TOTALIZER 3: – 4: BATCH QUANTITY 5: BATCH UPWARDS 6: BATCH DOWNWARD 7: BATCH COUNTER	DISPLAY LINE 2 0: OFF 1: FLOWRATE 2: TOTALIZER 3: TOT. 1 OVERFL. 4: BATCH QUANTITY 5: BATCH UPWARDS 6: BATCH DOWNWARD 7: BATCH COUNTER
V6	COMMUNICATION	INTERFACE RS 485	RACKBUS ADDRESS		
V7	SYSTEM PARAMETER	POS. ZERO RETURN 0: OFF 1: ON		ACCESS CODE	SELF CHECK 0: OFF 1: ON
V8	PROCESSING PARA.	LOW FLOW CUTOFF	NOISE SUPPRESSION 0: OFF 1: MODERATE 2: MEDIUM 3: HIGH	EMPTY PIPE DET. 0: OFF 1: ON 2: EMPTY 3: FULL	EPD RESPONSE TIME 0: 1 s 1: 2 s 2: 5 s 3: 10 s 4: 30 s 5: 1 min
V9	SENSOR DATA	K-FACTOR POS.	K-FACTOR NEG.	ZERO POINT	NOMINAL DIAMETER
V10	SETUP	TAG NUMBER CHA. 1			

Operating Matrix for Rackbus RS 485					
H4	**H5**	**H6**	**H7**	**H8**	**H9**
GALLON / BARREL 0: 31 gal 1: 31.5 gal 2: 42 gal 3: 55 gal 4: 36 ImpGal 5: 42 ImpGal	**PIPE SIZE UNIT** 0: mm 1: inch				
TIME CONSTANT	**CURRENT RANGE** 0: 0...20 mA 1: 4...20 mA 2: 0...20 mA NAMUR 3: 4...20 mA NAMUR	**FAILSAFE MODE** 0: MINIMUM 1: MAXIMUM 2: HOLD 3: GO	**SIMULATION CURR.** 0: OFF 5: 12 mA 1: 0 mA 6: 20 mA 2: 2 mA 7: 22 mA 3: 4 mA 8: 25 mA 4: 10 mA	**ACTUAL CURRENT**	
FULL-SCALE FLOW	**OUTPUT SIGNAL** 0: NORMALLY CLOSED 1: NORMALLY OPENED 2: ACTIVE POS. 3: ACTIVE NEG.	**FAILSAFE MODE** 0: LOGIC VALUE 0 1: HOLD 2: GO	**SIMULATION FREQ.** 0: OFF 1: 0 Hz 2: 2 Hz 3: 10 Hz 4: 1 kHz 5: 10 kHz	**ACTUAL FREQUENCY**	
SWITCH-ON PT. RE 2	**SWITCH-OFF PT. RE 2**				
BATCHING 0: CANCEL 1: EXECUTE 2: CANCEL	**BATCH TIME LIMIT**	**BATCH COUNTER**	**BATCH COUNT RESET** 0: NO 1: YES		
DISPLAY DAMPING	**SIGNIFICANT DIGIT** 0: – 1: 5 2: 4 3: 3	**LCD CONTRAST**	**LANGUAGE** 0: ENGLISH 1: DEUTSCH 2: FRANCAIS 3: ESPANOL 4: ITALIANO 5: NEDERLANDS 6: DANSK 7: NORSK 8: SVENSK 9: SUOMI 10: BAHASA 11: JAPANESE		
SYSTEM CONFIG. 0: RS 485 / 4–20 mA 1: RS 485 / FREQ.					
DIAGNOSTIC CODE		**SOFTWARE VERSION**	**SOFTWARE VER COM**		
DEVICE MODE 0: UNIDIRECTIONAL 1: BIDIRECTIONAL	**FLOW DIRECTION** 0: FORWARD 1: REVERSE	**FUNCTION ECC** 0: OFF 1: ON	**RECOVERY TIME ECC**	**GAIN RANGE** 0: AUTOMATIC 1: 1 2: 2 3: 3 4: 4	**DELAY**
MAX. SAMPLE RATE	**SAMPLE RATE**	**SERIAL NUMBER**	**EPD ELECTRODE** 0: NO 1: YES	**POLARITY ECC** 0: POSITIVE 1: NEGATIVE	

6 Description of Functions

This section is an in-depth description of the individual functions and specifications of Promag 33. Factory settings are indicated in ***bold italics***. On request, Promag 33 measuring instruments are also available with customised parameterisation. In such cases, values or settings may differ from the factory settings shown here.

Function group **SYSTEM UNITS**	
FLOW RATE UNIT	Selection of the required units for the flow rate (volume/time). The units selected here also define those for: • Creepage • Relay switching points • Full scale values for current and frequency dm³/s – dm³/min – dm³/h – m³/s – m³/min – ***m³/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 The actual flow rate appears on the display.
VOLUME UNIT	Selection of the required units for the volume flow. The units selected here also define those for: • Pulse value (e.g. m³ → m³/p) • Totalizer • Batch quantity, batch precontact quantity, compensation quantity dm³ – ***m³*** – l – hl – gal – bbl – 10³ gal – ft³

Function group **SYSTEM UNITS**	
GALLONS / BARREL	In the USA and UK, the ratio of barrels (bbl) to gallons (gal) is defined according to the fluid used and the specific industry. Therefore the following definitions have to be selected: • US or imperial gallons • Ratio gallons/barrel Note! This function is only available if barrel or gallon is selected as "FLOW RATE UNIT" or "VOLUME UNIT". US: 31.0 gal/bbl → for beer ***US: 31.5 gal/bbl*** → for liquids (used in normal cases) US: 42.0 gal/bbl → for petrochemicals US: 55.0 gal/bbl → for filling tanks Imp: 36.0 gal/bbl → for beer and similar liquids Imp: 42.0 gal/bbl → for petrochemicals
NOM. DIAM. UNIT	Selection of the required unit for the nominal diameter of the sensor. The unit selected here also defines those for the display in the "NOMINAL DIAMETER" function (see page 81). ***mm*** – inch Display of the actual set nominal diameter (in the units selected).

Note!

Function group
CURRENT OUTPUT

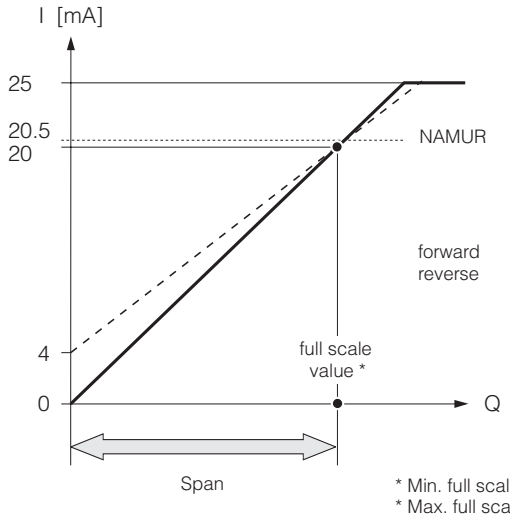
This function group is not available when the setting “RS 485 / FREQUENCY” or “AUX. INPUT / FREQ.” is shown in the function “SYSTEM CONFIG.” for the communication module RS 485 (see page 71).

FULL SCALE 1

Enter the desired full scale value for the flowrate at 20 mA. The max. possible overload of the scaled full scale value depends on the setting in the function “CURRENT SPAN” (see page 51).

Note!
- Scaling always applies to both directions of flow (bidirectional), but with the unidirectional mode, no signal is shown for a negative flow.
- When programming according to NAMUR, the measuring range is reduced from 12.5 m/s to 10.25 m/s.
- Dual range mode and flow direction can be given by both relays (see page 60, 61).

Note!



5-digit number with floating decimal point (e.g. 520.00 dm^3/min)
Factory setting: ***dependent*** on nominal diameter

UNIT ==> FLOW RATE UNIT
Unit selection → see “FLOW RATE UNIT” function

Note!

Function group
CURRENT OUTPUT

DUAL RANGE MODE

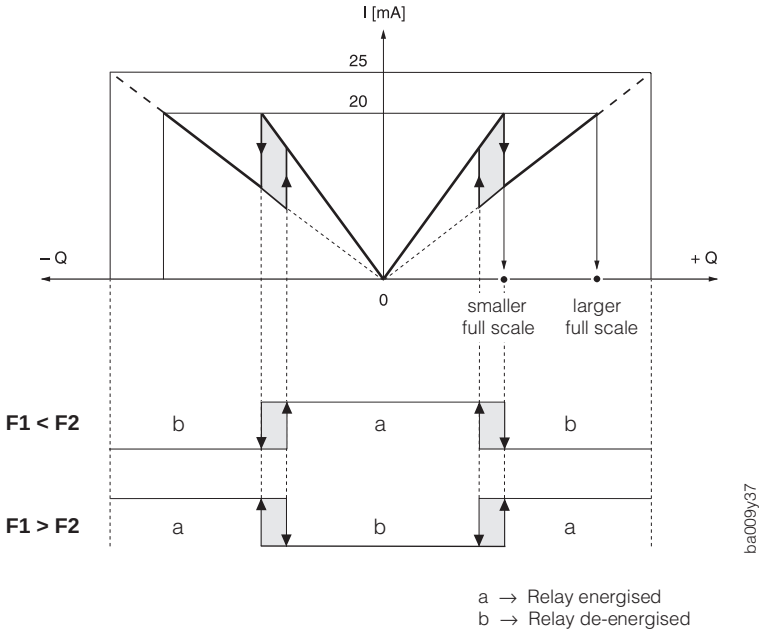
For specific applications the scaling of a second end value is useful or possibly required, e.g. for a higher resolution of the measuring signal with very small flow velocities.

By activating the dual range mode, the system automatically changes between full scale value 1 and 2 during normal measuring operation. Full scale value 1 and 2 are freely selectable.

Note!
- The appropriate configuration enables the actual full scale value to be supplied or signalled via both relays (see following Figure and page 61). In this case the following applies:
  – Full scale value 1 active → Relay 1 or 2 energised (live)
  – Full scale value 2 active → Relay 1 or 2 de-energised (dead)
- If the Promag 33 measuring electronics are fitted with a communication module "RS 485", then the full scale values 1/2 can also be activated using the auxiliary input (see page 69).

OFF – ON

Example (0...20 mA; Full scale 1 < Full scale 2)



a → Relay energised
b → Relay de-energised

Function group **CURRENT OUTPUT**	
FULL SCALE 2	Description of function → see function "FULL SCALE 1" (page 49) Note! This function is only available if the "DUAL RANGE MODE" function is activated (see page 50).
ACTIVE RANGE	Display of the actual full scale value (if the dual range mode is active): ***FULL SCALE 1*** – FULL SCALE 2
TIME CONSTANT	Selecting the time constant determines whether the current output signal reacts quickly (small time constant) to rapidly fluctuating flow or delayed (long time constant). Note! The time constant does not influence the behaviour of the display. max. 3-digit number with floating decimal point: 0.01...100 s Factory setting: ***1.0 s***
CURRENT SPAN	Selection of the current range 0/4...20 mA. The current for the scaled full scale value (100%) is always 20 mA. A choice can be made between the current output corresponding to NAMUR recommendations (max. 20.5 mA) or the current output with maximum 25 mA. Note! The "0–20 mA" current output can only be selected if the HART protocol is inactivated (see page 69). 0–20 mA (25 mA) → maximum 25 mA 4–20 mA (25 mA) → maximum 25 mA 0–20 mA → maximum 20.5 mA (NAMUR) ***4–20 mA*** → maximum 20.5 mA (NAMUR)
FAILSAFE MODE	In cases of an instrument error it is advisable for safety reasons that the current output assumes a previously defined status which can be set in this function. The setting chosen only affects the current output. Other outputs or the display (e.g. totalizer) are not affected. ***MIN. CURRENT*** – When a fault occurs (or with EPD) the current signal is set to the following value: for 0–20 mA → 0 mA; for 4–20 mA → 2 mA MAX. CURRENT – When a fault occurs (or with EPD) the current signal is set to the following value: for 0/4–20 mA (25 mA) → 25 mA; for 0/4–20 mA → 22 mA HOLD VALUE – Last valid measured value is held. ACTUAL VALUE – Normal measured output despite fault.

Note!

Note!

Note!

Function group **CURRENT OUTPUT**	
SIMULATION CURRENT	In this function, the output current can be simulated to correspond to 0%, 50% or 100% of the set current range. The 'error values' 2 mA (for 4...20 mA) and 25 mA (maximum possible value) or 22 mA for NAMUR can also be simulated. After activating the simulation mode, the message "S: CURRENT OUTP. SIMUL. ACTIVE" appears on the display in the HOME position. *Application example:* – checking instruments connected – checking the adjustment of the internal current signal Note! • No simulation is possible if "Positive zero return" is activated. • The selected simulation mode affects only the current output. The flowmeter remains fully operational for measurement, i.e. totalizer, flow display etc. are operating normally. • Positive zero return interrupts any simulation being carried out and sets the output current to 0 mA or 4 mA. *For 0–20 mA:* ***OFF*** – 0 mA – 10 mA – 20 mA – 22 mA *For 0–20 mA (25 mA):* ***OFF*** – 0 mA – 10 mA – 20 mA – 25 mA *For 4–20 mA:* ***OFF*** – 2 mA – 4 mA – 12 mA – 20 mA – 22 mA *For 4–20 mA (25 mA):* ***OFF*** – 2 mA – 4 mA – 12 mA – 20 mA – 25 mA
NOMINAL CURRENT	In this function, the current and calculated target value of the output current is shown (0.00...25.00 mA). The effective current can vary slightly due to external effects such as temperature. Display of the actual flow rate.

Note!

Function group
PULSE / FREQ. OUTPUT

This function group is not available when the setting “RS 485 / CURRENT” or “AUX. INPUT / CURRENT” is shown in the function “SYSTEM CONFIG.” for the communication module RS 485 (see page 71).

OPERATION MODE

Select operation as pulse or frequency output. Depending on the selection (pulse or frequency), different functions are available in this function group.

PULSE – FREQUENCY

PULSE VALUE

In this function, define the freely selectable flow quantity which the output pulse is to deliver. By means of an external counter the sum of these pulses can be totalised and the total quantity determined since the start of measurement.

Note!
This function is only available if the setting “PULSE” is selected in the function “OPERATION MODE”.

Note!

5-digit number with floating decimal point (e.g. 75.000 dm^3/p)
Factory setting: ***dependent*** on nominal diameter

UNIT ==> VOLUME UNIT
Unit selection → see “VOLUME UNIT” function

PULSE WIDTH

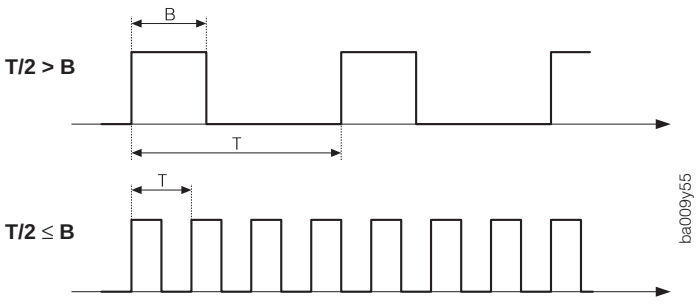
In this function, the maximum pulse width can be set for example for external counters with a max. possible input frequency. The pulse width is limited to the set value.

Note!
This function is only available if the setting “PULSE” is selected in the function “OPERATION MODE”.

Note!

3-digit number with fixed decimal point: 0.05...2.00 s
Factory setting: ***2.00 s***

T/2 < PULSE ==> PULSE/PAUSE = 1:1
If the frequency resulting from the selected pulse weighting and current flowrate is too high (T/2 < selected pulse width B), the pulses emitted are automatically reduced to half a cycle. The pulse/pause ratio is then 1:1.



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

Note!

Function group
PULSE / FREQ. OUTPUT

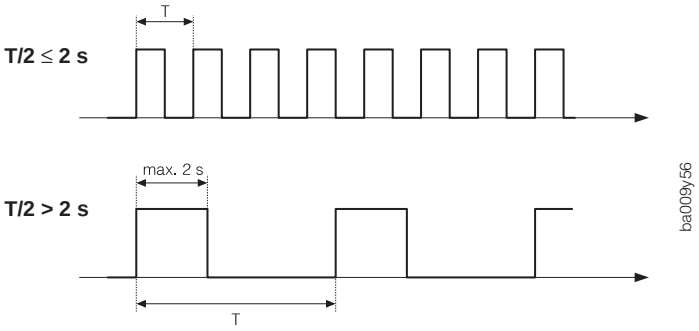
FULL SCALE FREQ.

Enter the full scale frequency (2...10000 Hz) for the max. flow rate required. The corresponding full scale value is defined in the function “FULL SCALE FLOW” (see page 55).

Note!
- This function is only available if the setting “FREQUENCY” is selected in the function “OPERATION MODE” (see page 53).
- An extension up to 163% of the selected full scale frequency is possible.
- With unidirectional mode, no signal is given for negative flow (reverse).

max. 5-digit number: 2...10000 Hz
Factory setting: ***10000 Hz***

T/2 < 2s ==> PULSE/PAUSE = 1:1
In the “FREQUENCY” mode the output signal is symmetrical (pulse/pause ratio = 1:1). At low frequencies, the pulse duration is limited to max. 2 seconds (see Figure below), i.e. the pulse/pause ratio is no longer symmetrical.



The above figure applies to positive pulses.

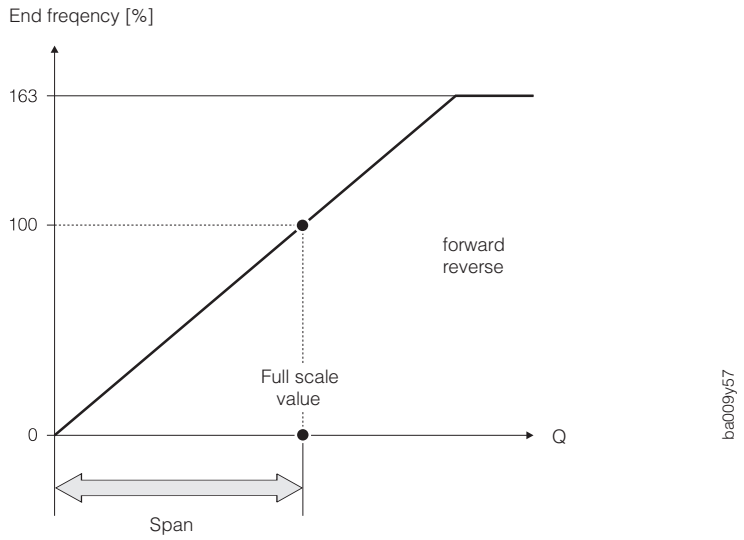
Function group
PULSE / FREQ. OUTPUT

FULL SCALE FLOW

Entry of the required full scale value for the flow rate.
Scaling always applies to both directions of flow (bidirectional), but with the unidirectional mode, no signal is given for a negative flow.

Note!
This function is only available if the setting “FREQUENCY” is selected in the function “OPERATION MODE” (see page 53).

Note!



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

UNIT ==> FLOW RATE UNIT
Unit selection → see “FLOW RATE UNIT” function

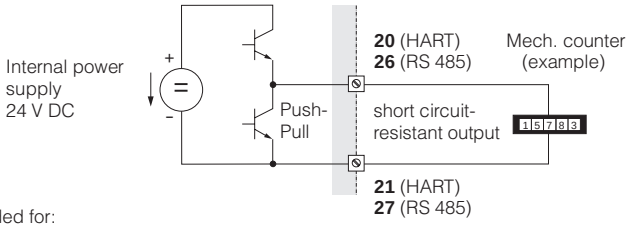
Function group
PULSE / FREQ. OUTPUT

OUTPUT SIGNAL

With this function the pulse/frequency output can be configured as required, for example for an external counter.

ACTIVE → Internal power supply used (+24 V)
PASSIVE → External power supply required

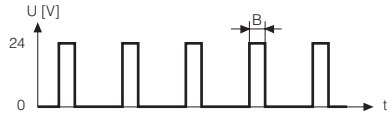
ACTIVE



ba009y64

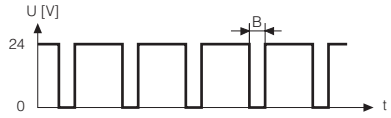
Recommended for:
– high output frequencies
– continuous currents up to 25 mA (I_{max} = 250 mA for 20

ACTIVE / POSITIVE pulses

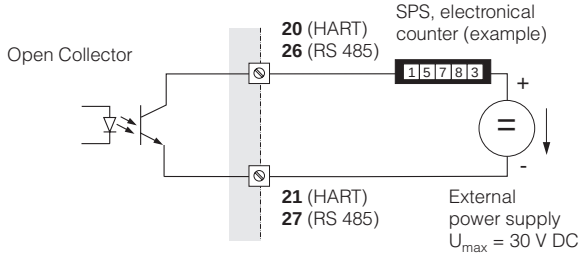


ba009y65

ACTIVE / NEGATIVE pulses



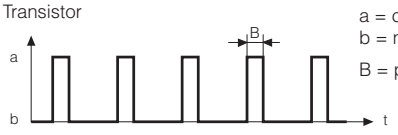
PASSIVE



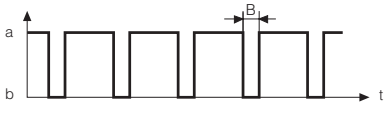
ba009y66

Recommended for:
– low output frequencies
– continuous currents up to 25 mA (I_{max} = 250 mA for 20 ms)

PASSIVE / NEGATIVE pulses



PASSIVE / POSITIVE pulses



ba009y67

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

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

Function group **PULSE / FREQ. OUTPUT**	
FAILSAFE MODE	In cases of an instrument error it is advisable for safety reasons that the pulse/frequency output assumes a previously defined status which can be set in this function. Notes! The setting chosen only affects the pulse/frequency output and the totaliser. Other outputs or displays, e.g. current output, are not affected. ***FALLBACK VALUE*** In event of fault or EPD, the signal is set to the fall-back value (0 Hz). The totalizer stops operating. LAST VALUE Last valid measured value is held. The totalizer operates with this value. ACTUAL VALUE Normal measured value is given despite fault, also with totalizer.
SIMULATION FREQ.	With this function preset frequency signals can be simulated in order to check, for example, any instruments connected. The simulated signals are always symmetrical (pulse/pause ratio = 1:1). After activating the simulation mode, the display shows the message “S: FREQ. OUTPUT SIMUL. ACTIVE”. Notes! • No simulation is possible if “Positive zero return” is activated. • The flowmeter is fully capable of measuring during simulation, i.e. totalizer, flow display etc. continue to operate normally. • Positive zero return interrupts a simulation in progress and sets the output signal to the fall-back value. ***OFF*** – 0 Hz (fallback value) – 2 Hz – 10 Hz – 1 kHz – 10 kHz
NOMINAL FREQ.	With this function the calculated target value of the output frequency is shown (0.00...16383 Hz). Note! In the “PULSE” operation mode, this display does not operate at very low frequencies. Display of the actual flow rate.

Note!

Note!

Note!

Note!

Function group
RELAYS

RELAY 1 FUNCTION

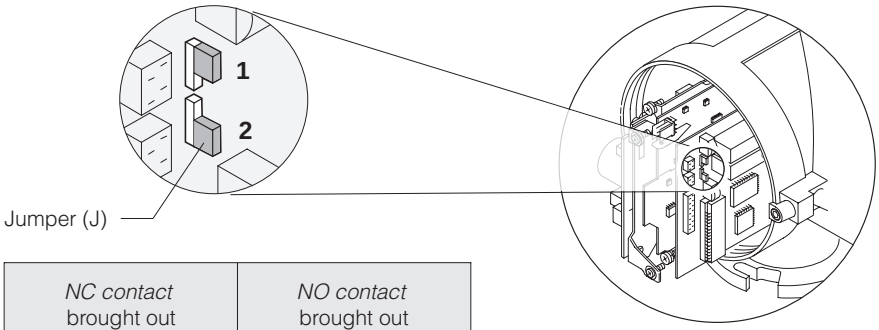
Selection of the relay function. The setting “FAILURE” can only be assigned to relay 1, not to relay 2!.

Notes!
- Note page 60 and 61 for the switching response of relay 1.
- For safety reasons we recommend configuring relay 1 as the alarm output and to define the failsafe mode of the outputs (see pages 51 and 57).
- As standard the normally open contact of relay 1 is brought out. However, the normally closed contact is also available by plugging a jumper on the communications board (see Figure below).

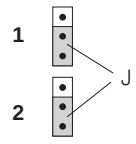
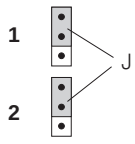
FAILURE	Indicating system errors (list of error messages → see page 90)
EPD *	Empty pipe detection (indicating an empty or partly filled measuring tube)
ERROR + EPD *	Indicating system errors or an empty/partly filled measuring tube
DUAL RANGE MODE *	Indicating active full scale value (1 or 2)
BATCH PRECONTACT *	Indicating reached prebatch quantity
FLOW DIRECTION	Indicating direction of flow (forward/reverse). On unidirectional measurement, relay 1 also switches in the negative flow direction.
LIMIT FLOWRATE 1	Indicating if preset limit value is outside range or Indicating an overflow (v ≥ 12,5 m/s).

* These parameters only appear on the display if the appropriate function has already been activated.

Configuring of relay contacts (Relay 1 / 2)
Factory setting relay 1 → NO contact
Factory setting relay 2 → NC contact



ba009y68

NC contact brought out	*NO contact* brought out
	

ba009y81...82

Warning!

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

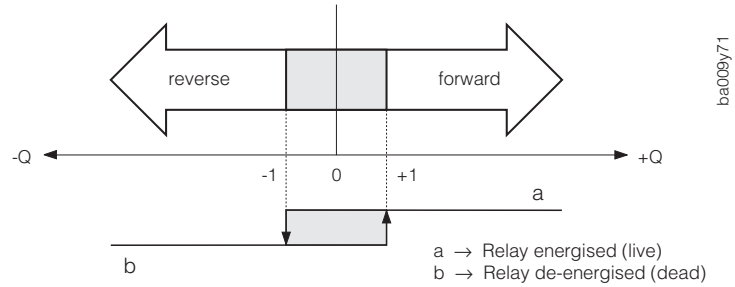
Function group
RELAYS

RELAY 1 ON-VALUE

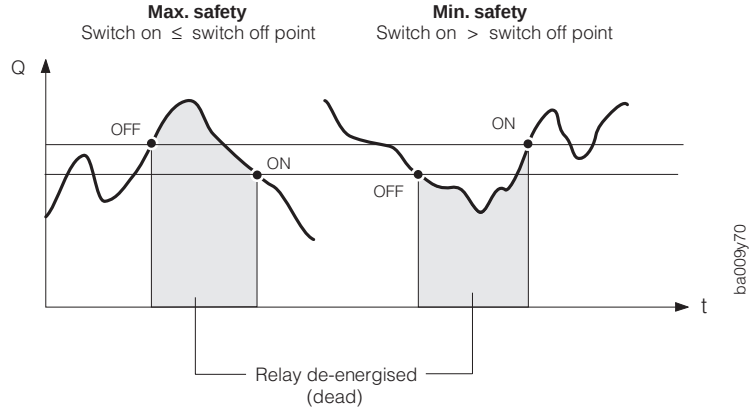
If you have configured Relay 1 for “FLOW DIRECTION” or “LIMIT FLOWRATE”, you may determine the necessary switching points in these functions.

RELAY 1 OFF-VALUE

Relay 1 → “FLOW DIRECTION”
The value entered in this function defines the switch-on point for the positive *and* negative flow direction.
Detection of the flow direction operates with a hysteresis determined by the switch point. If the switch point entered is for example = 1 dm^3/min, then the relay de-energises at –1 dm^3/min and energises again at +1 dm^3/min.
If a direct switchover is required (no hysteresis), then set the switch point to the value “0”.
If creep suppression is activated, then it is recommended that the hysteresis is set to a value larger or the same as the low flow cutoff.



Relay 1 → “LIMIT FLOWRATE 1”
The relay switches over as soon as the actual flow rate is above or below a defined switch point (see Figure).

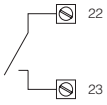
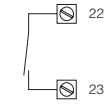
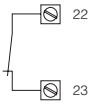
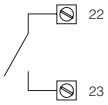
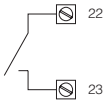
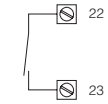
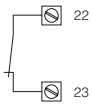
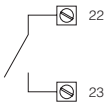
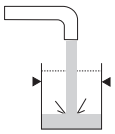
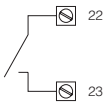
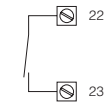
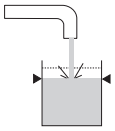
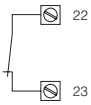
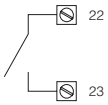
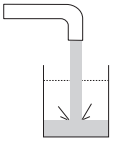
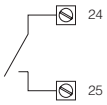
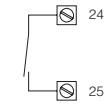
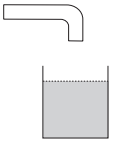
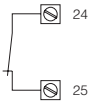
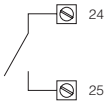


Note!
If you intend to use the limit function to detect when the measuring range has been exceeded (v ≥ 12,5 m/s), then proceed as follows:
→ Set the switch on and switch off point to the maximum possible value.
→ Press the ⊞ key until the message “LIMIT REACHED” appears on the display. The relay is dead as soon as the max. permissible measuring range is exceeded.

Note!

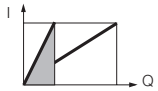
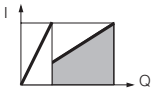
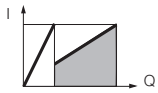
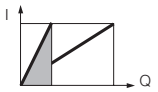
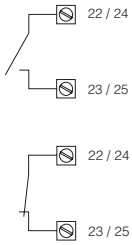
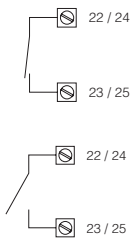
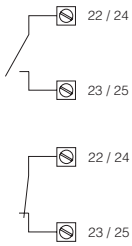
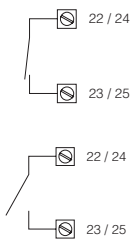
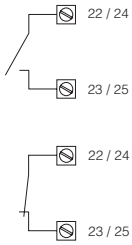
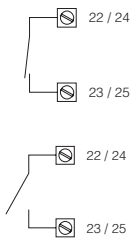
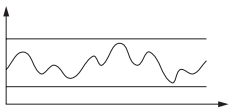
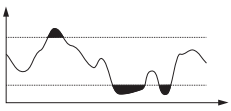
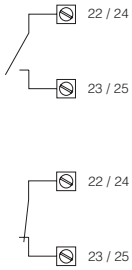
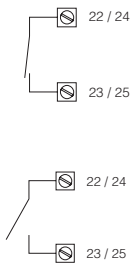
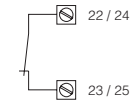
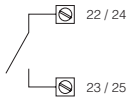
5-digit number with floating decimal point (e.g. 1.0000 dm^3/min)

UNIT ==> FLOW RATE UNIT
Unit selection → see “FLOW RATE UNIT” function

Functions Relay 1	State	Relay	Relay contact *	
			NC contact *	NO contact *
FAILURE	System OK 	energised		
	Failure (system error) 	de-energised		
ERROR + EPD (EPD = Empty Pipe Detection)	System OK and pipe full 	energised		
	Failure (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				
BATCH CONTACT	Batching cycle running and batch quantity *not* reached yet. 	energised		
	Batch quantity reached (batch cycle stopped). 	de-energised		

y80-01...23

Fig. 41
Relay functions and switching response

Common Functions Relay 1 and 2	State	Relay	Relay contact *	
			NC contact *	NO contact *
DUAL RANGE MODE	Full scale value 1 < 2  Full scale 1 active Full scale value 1 > 2  Full scale 1 active (larger span)  Full scale 2 active (larger span)  Full scale 2 active	energised de-energised		
EPD (EPD = Empty Pipe Detection)	Measuring tube full  Measuring tube partly full 	energised de-energised		
FLOW DIRECTION	forward  reverse 	energised de-energised		
LIMIT FLOWRATE 1 **LIMIT FLOWRATE 2**	Flow rate not above or below limit  Flow rate either above or below limit 	energised de-energised		
Supply failure		de-energised		

y80-01...23

* A jumper on the communications board allows either the NC or NO contact to be selected (see page 58):
- Factory setting Relay 1 → Normally open contact (NO)
- Factory setting Relay 2 → Normally closed contact (NC)

Fig. 42
Relay functions and switching response


Note!

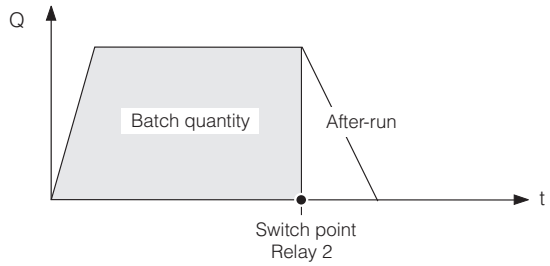
Function group **RELAYS**	
RELAY 2 FUNCTION	Selection of the relay function (Relay 2). Notes! • Note page 60 and 61 for the switching response of relay 2. • As standard the normally closed contact of relay 2 is brought out. However, the normally open contact is also available by plugging a jumper on the communications board (see page 58). EPD * — Empty pipe detection (indicating an empty or partly filled measuring tube) DUAL RANGE MODE * — Indicating active full scale value (1 or 2) BATCH CONTACT * — Indicating reached batch quantity FLOW DIRECTION — Indicating direction of flow (forward/reverse). On unidirectional measurement, relay 2 also switches in the negative flow direction. ***LIMIT FLOWRATE 2*** — Indicating if preset limit value is outside range or Indicating an overflow (v ≥ 12,5 m/s). * These parameters only appear on the display if the appropriate function has already been activated.
RELAY 2 ON-VALUE **RELAY 2 OFF-VALUE**	Description of function → see function “RELAY 1 ON-VALUE” resp. “RELAY 1 OFF-VALUE” (page 59)

Function group
BATCHING

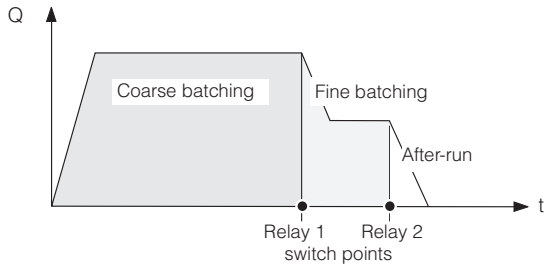
Introduction

The “BATCHING” function group together with the preset totalizer enables simple batching cycles to be controlled. The Promag 33 transmitter has two relays which can be used for controlling single or two-stage batching cycles:

Single-stage batching cycle



Two-stage batching cycle (with pre-batch contact of relay 1)



ba009y72

Entering a compensation quantity can compensate for ***plant-specific but constant*** errors in volume e.g. caused by after-runs of pumps, closing time of valves, etc.

Note!
- For short-cycle batching (filling time < 20 s) → see function “SELF CHECKING” (page 78)
- If a system error (failure) occurs during a batching cycle or an empty pipe is detected (EPD) the filling procedure is immediately stopped.

Note!

Starting / Stopping a Batching Cycle

The batching cycle can be started and stopped in four different ways:
- via the HART interface or Rackbus 485
- via the auxiliary input (with the “RS 485” communications module only)
- via the function “BATCHING”
- from the HOME position. Starting the batching cycle from the HOME position is always possible if the “BATCH VARIABLE” function is set to “VOLUME” (see next page):

START – STOP – CANCEL
(E confirms the selection)

Note!
If a batching variable is activated, the “BATCHING” function group is first shown on the display when entering the operating matrix. The function “BATCH QUANTITY” then moves into the first position within this function group. This makes using the matrix much easier for the user. In addition all batching functions can be changed without entering a code number.

Note!

Function group **BATCHING**	
BATCH VARIABLE	In this function, the batching mode can be activated or switched off. Note! If the batching mode is activated, the “BATCHING” Function group is first shown on the display when entering the operating matrix. The “BATCH VARIABLE” function then moves into first position within this group. ***OFF*** – VOLUME
BATCH QUANTITY	This function is used to set the required batching quantity. Note! Relay 2 can be assigned as a “BATCH CONTACT” (see page 62). 5-digit number with floating decimal point (e.g. 240.00 l) Unit selection → see function “VOLUME UNIT” Factory setting: ***0.0000*** [unit] Dispay showing which function is assigned to Relay 2.
BATCH PREWARN	In this function a *pre-batch* quantity can be defined which is used for two-stage batching cycles (see page 63). Note! Relay 1 can be assigned as a “PREBATCH CONTACT” (see page 58). 5-digit number with floating decimal point (e.g. 200.00 l) Unit selection → see function “VOLUME UNIT” Factory setting: ***0.0000*** [unit] Dispay showing which function is assigned to Relay 1.

Function group **BATCHING**	
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 → a negative correction factor is to be set • Underfilling → a positive correction factor is to be set *Example:* Batching quantity = 100 l; pre-batch quantity = 90 l → maximum positive correction factor = +100 l → maximum negative correction factor = –10 l Note! If no sufficiently large negative correction factor can be set, then the initial switch-off quantity may have to be lowered. 5-digit number with floating decimal point and arithmetical sign (e.g. –10.000 l) Factory setting: ***0.0000*** [unit] UNIT ==> VOLUME UNIT Unit selection → see "VOLUME UNIT" function
BATCHING	This function is used to manually start a batching cycle or to stop a batching cycle already running. A running batching cycle can be stopped at any time. Starting or stopping a batching cycle has a direct influence on relay 1 and 2, if configured for "BATCH PRECONTACT" and/or "BATCH CONTACT". START – STOP – ***CANCEL*** (E activates START or STOP)
MAX. BATCH TIME	Set the maximum filling period according to which Relay 2 (BATCH CONTACT) is to switch (de-energised), e.g. for safety reasons in case of a plant failure. max. 5-digit number: 0...30000 s Factory setting: ***0 s*** (= switched off)
BATCH CYCLE	In this function the number of batching cycles executed is shown: Max. 7-digit number: 0...9999999 Factory setting: ***0***
RESET BATCH CYC.	With this function the batching totalizer can be reset. ***NO*** – YES Display showing the number of successfully executed batching cycles.

Note!

Function group DISPLAY	
TOTAL VOLUME	Display of the totalised flow quantity from when measurement began. This value is either positive or negative depending on the direction of flow. Notes! • If the count has more figures than can be displayed, e.g. with overflow, then the symbol “>” is shown before the value. • If the function “MEASURING MODE” is set to “UNIDIRECTIONAL” (see page 75), then the totaliser only registers flow in the positive direction. • In cases of error the totaliser is coupled to the error response of the pulse/frequency output (see page 57, 85). For transmitters with an RS 485 communications module, this is only the case if the function “SYSTEM CONFIG.” is set to “AUX.INPUT/FREQ.” or “RS485 / FREQ.” (see page 71). With the setting “...../CURRENT”, the totalizer always stops totalizing in case of a failure. Display: max. 7-digit number Factory setting: ***0.0000*** [unit] UNIT ==> VOLUME UNIT Unit selection → see “VOLUME UNIT” function
TOTAL OVERFLOW	Display of totalizer overflows. On the display the totalised flow is shown as a max. 7-digit number with floating decimal point. Larger numbers (>9,999,999) can be read off in this function as overflows. The effective amount is thus the sum of the overflow and the value shown in the HOME position resp. in the function “TOTAL VOLUME”. Example: Display of 2 overruns: **2 e7 dm^3** = 2 · 10^7 dm^3 = 20,000,000 dm^3 The actual displayed totalizer value is 196,845.7 dm^3. Total amount since measurement started = 20,196,845.7 dm^3 Note! • This function is displayed only if overruns have occurred. In addition, in the HOME position an overflow is made visible by optically inverting the “>” sign. • The totalizer value may have a positive or negative sign as a result of the bidirectional measurement. Display of the actual totalizer value (HOME position).

Note!

Note!

Function group **DISPLAY**	
RESET TOTALIZER	The totalizer can be reset to "Zero" in this function. Note! • The overflow as well as the totalizer value in the HOME position are reset to zero. • If the Promag 33 measuring electronics are fitted with a communications module "RS 485", then the totalizer reset can also be carried out with the auxiliary input (see page 69). + / − ***NO*** – YES + / − Display of the actual totalizer value (HOME position).
FLOW RATE	Display of the actual flow rate. This is particularly advantageous if the HOME position is already assigned to other measuring variables, e.g. to a batching function. Display: max. 5-digit number: –99999...+99999 + / − UNIT ==> FLOW RATE UNIT Unit selection → see "FLOW RATE UNIT" function
ASSIGN LINE 1	With this function the variable is defined which should be displayed on the *upper* display line during normal operation (HOME position). + / − ***FLOW RATE*** – TOTAL VOLUME – BATCH QUANTITY * – BATCH UPWARDS * – BATCH DOWNWARDS * – BATCH CYCLE * * These parameters only appear if the function "BATCH VARIABLE" is set to "VOLUME" (see page 64).
ASSIGN LINE 2	With this function the variable is defined which should be displayed on the *lower* display line during normal operation (HOME position). + / − OFF – FLOW RATE – ***TOTAL VOLUME*** – TOTAL OVERFLOW – BATCH QUANTITY * – BATCH UPWARDS * – BATCH DOWNWARDS * BATCH CYCLE * * These parameters only appear if the function "BATCH VARIABLE" is set to "VOLUME" (see page 64).

Note!

Function group DISPLAY	
DISPLAY DAMPING	Selecting a time constant determines whether the display reacts quickly (small time constant) or slowly (large time constant) to widely changing flow. Note! • Damping is inactivated when set to “zero”. • The time constant does not affect the response of the current output. max. 2-digit number: 0...99 s Factory setting: ***1 s***
DISPLAY FORMAT	In this function you can determine how many significant digits are shown on the display for the flow rate. Along with the function “DISPLAY DAMPING”, this serves to stabilize the display with strongly fluctuating flows. Notes! • Non-significant digits *in front* of the decimal point are shown as “0”. • Non-significant digits *after* the decimal point are not shown, while the last digit displayed is rounded. • The setting carried out here affects the display only. It does not affect the accuracy of calculations within the system itself. ***x.xxxx*** (5 significant digits) x.xxx (4 significant digits) x.xx (3 significant digits)
LCD CONTRAST	The display contrast can be optimally adjusted to match prevailing operating conditions on site (e.g. ambient temperature). Caution! At minus temperatures (< 0 °C) the visibility of the LCD is no longer assured. The display contrast is at a maximum if the ± keys are simultaneously pressed when starting up the flowmeter. **IIIIIIIIIII**..... Any change in contrast is immediately seen with the adjustable bar graph.
LANGUAGE	In this function the appropriate language is selected in which all text, parameters and operating messages are to be displayed. Note! English is selected if the ± keys are simultaneously pressed when starting up the flowmeter. ENGLISH – DEUTSCH – FRANCAIS – ESPANOL – ITALIANO NEDERLANDS – DANSK – NORSK – SVENSKA – SUOMI – BAHASA INDONESIA – JAPANESE (in original alphabet)

Function group
COMMUNICATION

In this function group, the interfaces provided by the Promag 33 can be appropriately configured and/or activated (Rackbus RS 485, HART protocol):
- The Promag 33 electronics are fitted either with the communications module “HART” or “RS 485” according to the order specifications.
- Further information on the HART protocol is found on → page 33, 40
- Further information on the Rackbus RS 485 is found on → page 30, 42

PROTOCOL

For communication via a serial interface, various data transmission protocols are available which can be activated or switched off in this function.

Note!
For instruments with no local operation (blind version), the appropriate protocol is always switched on.

Note!

With “HART” communications module
OFF – HART

With “RS 485” communications module
OFF – RACKBUS RS 485

BUS ADDRESS

In this function, the bus address can be set for carrying out data transfer via the HART protocol or RS 485.

Note!
The following applies for HART:
– The 4...20 mA analogue output is only active with the address “0” (→ ‘point-to-point network’).
– If the address is not “0”, then the current output is set to 4 mA (→ ‘multidrop network’).

Note!

2-digit number: ***0***...15 (HART), ***0***...63 (RS 485)

ASSIGN AUX. INPUT

In this function, 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 71).

The functions of the auxiliary input are started or activated by applying an external voltage. Two types of activating are to be disginguished:
- Pulsed mode (enter start pulse width → see page 71)
- Level mode

Note!
- Please refer to the table on page 70. 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 communications module is used, then this function is blanked out.

Note!

With “Pulsed mode”
RESET TOTALIZER
BATCHING *

With “Level mode”
DUAL RANGE MODE *
POS. ZERO RETURN

* This parameter is only shown on the display if the appropriate function has already been activated.

Functions of the auxiliary input

With "PULSED MODE"

Assignment	Pulse at auxiliary input	Function	Remarks
RESET TOTALIZER	• No pulse • Pulse between 3...30 V DC; at least for the duration of the set start pulse width.	No function Totalizer (incl. overflows) is reset	–
BATCHING	• No pulse • Pulse between 3...30 V DC; at least for the duration of the set start pulse width. • Another pulse during the filling procedure (at least for the duration of the set start pulse width).	No function Batching cycle is started. Batching cycle is stopped.	The "BATCHING" option is only available, if the function "BATCH VARIABLE" is set to "VOLUME" (see page 64). By deactivating the batching function, the auxiliary input is automatically set to "POS. ZERO RETURN".

With "LEVEL MODE"

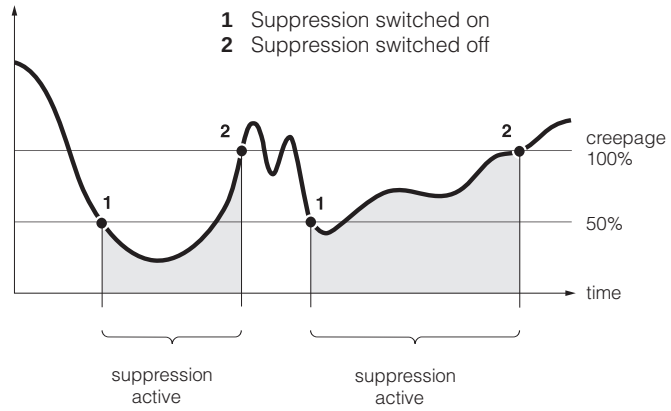
Assignment	Voltage at auxiliary input	Function	Remarks
DUAL RANGE MODE	• No voltage • Voltage of 3...30 V DC	Current output operates with FULL SCALE 1 Current output operates with FULL SCALE 2	The "DUAL RANGE MODE" option is only available, if the current output is switched on and the dual range mode is activated. If the current output is switched off or the dual range mode deactivated, then the auxiliary input is automatically set to "POS. ZERO RETURN".
POS. ZERO RETURN	• No voltage • Voltage of 3...30 V DC	Instrument operates normally. All output signals are set to "0" (corresponds to no flow).	No simulation of current or frequency signals is possible when "Positive zero return" is activated.

Function group COMMUNICATION	
START PULSE WIDTH	Certain functions of the auxiliary input are only started via a pulsed voltage (see page 70). In this function, you enter the minimum pulse width to be reached by the input pulse in order that the appropriate function is activated. This ensures that the function is not activated by transient voltage peaks (interference pulses). Note! This function is only available if the Promag electronics are fitted with the communications module “RS 485” and if the auxiliary input is activated as well as appropriately configured. max. 3-digit number: 20...100 ms Factory setting: ***20 ms***
SYSTEM CONFIG.	In this function, the actual configuration of the communications module “RS 485” is shown: Note! • This function is only available, if the transmitter electronics are fitted with a RS 485 communication module. • This function can only be reconfigured after entering a special service code. If you have problems with the existing configuration, then please contact your E+H Service organisation. **Display:** 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.

Note!

Note!

Note!

Function group **PROCESSING PARAMETERS**	
LOW FLOW CUTOFF	Set the required switch point for the creepage (low flow cutoff). The creep suppression prevents the flowrate being registered in the lower part of the measuring range, e.g. by a variable column of liquid at standstill. Note! • When creep suppression is active, the sign of the flow appears optically inverted on the display. • The max. creepage depends on the nominal diameter of the sensor currently being used and corresponds to a flow velocity v = 1 m/s. Q [Vol/time] **1** Suppression switched on **2** Suppression switched off  ba009y38 5-digit number with floating decimal point (e.g. 15.000 dm^3/min) Unit selection → see function “FLOW RATE UNIT” Factory setting: ***dependent*** on the nominal diameter HYSTERESIS = 50% Creep suppression operates with a negative hysteresis of 50%.
NOISE SUPPRESS.	Using the interference blanking (= software filter) the sensitivity of the flow measurement signal can be reduced with respect to transient flows and interference peaks; e.g. with fluids containing solids or gas bubbles. OFF – LOW – ***MEDIUM*** – HIGH

Function group
PROCESSING PARAMETERS

EMPTY PIPE DET.

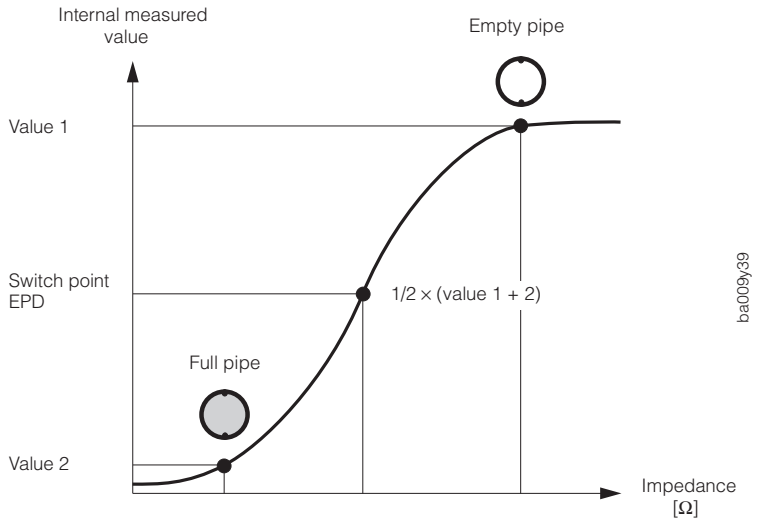
With this function (EPD = Empty Pipe Detection), two procedures can always be activated:
– Carrying out the empty and full pipe adjustment (**before** switching on EPD!).
– Switching on/off Empty Pipe Detection.

Note!
- This function is only available if the sensor is fitted with an extra EPD electrode.
- The EPD function is not available with the remote "FL" version.
- The connection cable with the remote "FS" version may only be a maximum of 10 m long. Only then can correct functioning of the EPD be guaranteed!
- The EPD function is switched off when the flowmeter is delivered and must be switched on manually when required.
- EPD has the same effect on the outputs as if there was a fault. A corresponding alarm message can be indicated via both relay outputs (1 or 2) if configured accordingly.

Note!

OFF	EPD switched off
ON	EPD switched on
EMPTY PIPE ADJ.	Start empty pipe adjustment (confirm with E)
FULL PIPE ADJUST	Start full pipe adjustment (confirm with E)

Remarks on Empty Pipe Detection (EPD)
Only a completely full measuring tube enables correct readings to be obtained. This can be continuously checked by Empty Pipe Detection. EPD is based on measuring the impedance between reference and EPD electrode (see Figure).



Response when partially full
If the EPD is active and responds due to a partially filled or empty pipe, then the alarm message "A: EMPTY PIPE DETECTED" is shown on the display. The outputs respond in such cases as described on page 85.

When the pipe is partially filled and the EPD is not activated, then the response may be different for identical plants:
– varying flow display
– zero flow
– excess flow values

(continued on next page)

Function group **PROCESSING PARAMETERS**	
EPD (continued)	**Procedure for empty and full pipe adjustment** Note! If Promag 33 is fitted with an EPD electrode, then the unit is already calibrated in the factory with drinking water (500 µS/cm). A new empty pipe and full pipe adjustment is to be carried out on site when liquids having different conductivities are used. 1. Empty the piping. For the emtpy pipe adjustment to be carried out now, the walls of the measuring tube should be wetted with liquid. 2. Start the empty pipe adjustment: – Select “EMPTY PIPE ADJ.” and confirm with E. – Set the safety prompt “PIPE EMPTY? [NO]” with ± to [YES] and confirm with E. Empty pipe adjustment is now started and the message “EPD ADJUSTMENT RUNNING” is shown on the display. 3. Fill the piping with fluid. 4. Start the full pipe adjustment with the fluid stationary: – Select “FULL PIPE ADJUST” and confirm with E. – Set the safety prompt “PIPE FULL? [NO]” with ± to [YES] and confirm with E. Full pipe adjustment is now started and the message “EPD ADJUSTMENT RUNNING” is shown on the display. 5. Switch on the Empty Pipe Detection after the adjustment → Select “ON” and confirm with E. Note! The EPD function can only be switched on if an empty or full pipe adjustment has been successfully carried out. If the adjustment is not successful then the following alarm messages can appear on the display: – A: EPD ADJUSTMENT VALUES MISSING: The EPD function is switched on, but an empty resp. a full pipe adjustment has not been carried out yet. – A: EPD ADJUSTMENT FULL = EMPTY: The EPD function is switched on, but the values for full and empty pipe are identical. – A: EPD ADJUSTMENT FULL <=> EMPTY: The EPD function is switched on, but the adjustment did not take place with full or empty pipe. – A: EPD ADJUSTMENT NOT POSSIBLE: An empty pipe adjustment is not possible because the conductivity of the fluid is outside the permissible range. In such cases the empty or full pipe adjustment ***must again*** be carried out!
EPD RESPONSE TIME	The response time of Empty Pipe Detection can be selected by the user to suit his process conditons. An alarm is not given until this response time has expired. Momentary air bubbles in the measuring tube are then not interpreted as a partial filling of the pipe. Note! This function is only available if the Empty Pipe Detection is switched on (EPD → ON). ± ***1 s*** – 2 s – 5 s – 10 s – 30 s – 60 s

Function group **PROCESSING PARAMETERS**	
MEASURING MODE	With this function the flow direction for measurement is specified for the signal output: • *Unidirectional:* Signal output in the positive direction only (forward). Flows in a negative direction (backwards) are not included or totalised by the Promag measuring system. • *Bidirectional:* Signal output in both directions (forward and reverse). Note! The flow display always operates in both flow directions independent of the setting in this function. UNIDIRECTIONAL – ***BIDIRECTIONAL***
FLOW DIRECTION	In special cases it is possible that the arrow marked on the sensor nameplate does not agree with the actual flow direction of the fluid (Example: the sensor is operated "upside down"). In this function you have the option to change the arithmetical sign of the flow variable. ***FORWARD **** – REVERSE ** * Positive flow according to the arrow on the nameplate. ** Positive flow in the opposite direction to the arrow on the nameplate.
FUNCTION ECC	Switching on and off the Electrode Cleaning Circuitry (ECC). Note! • This function is only available if the Promag 33 is fitted with an electrode cleaning function (optional). • The ECC function is not available with the remote "FL" version. ***ON*** ECC switched on OFF ECC switched off **Remarks on ECC:** Conductive build-up on the electrodes and the measuring tube walls (e.g. magnetite) can cause measurement errors. The ECC has been developed in order to prevent build-up occurring. The cleaning cycle of 3 seconds is dependent on the tracking frequency and repeats itself every 30 minutes. The ECC works in the way described for all electrode materials available except tantalum. If the electrode material is tantalum then the ECC only protects the electrode surface from oxidation. Caution! If the ECC is switched off for a long period of time in an application where there is a conductive build-up in the measuring tube, then this can lead to errors. If there is a large concentration of build-up at one point, then, under certain circumstances, switching on the ECC may not remove it. In such cases the flowmeter is to be cleaned and the build-up removed.

Note!

Note!

Caution!

Function group **PROCESSING PARAMETERS**	
RECOVERY TIME ECC	After the electrode cleaning procedure is completed, the signal outputs may be unsteady for a little while. This is due to electrochemical potentials caused by electrostatic charging of the fluid during the cleaning cycle. If this is the case, then the recovery time can be extended using this function. Caution! During the recovery time (max. 255 s) the last value registered before cleaning is given. If a very long time has been set, then the system will not detect any possible change in flow (e.g. standstill) during this time. max. 3-digit number: 1...255 s Factory setting: ***5 s***
AMPLIFIER MODE	Selection of the amplifier mode, e.g. for strongly fluctuating flow rates. The Promag 33 amplifier has an automatic amplifier booster controller. This ensure that the amplifier always operates at optimum amplification according to the flow velocity of the fluid. High accuracy is thus maintained over the wide dynamic range of 1000:1. Applications with rapid and strongly fluctuating flow rates 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. Caution! With the settings “MODE 3” and “MODE 4”, ensure that the actual flow velocity does not exceed the preset flow spans. If these are exceeded, then the flowrate is not recognised as an error by the measuring system and faulty measurement may result. ***NORMAL*** automatic amplifier booster controller MODE 1 for flow rates 0...>12 m/s MODE 2 for flow rates 0...12 m/s MODE 3 for flow rates 0...4 m/s MODE 4 for flow rates 0...1 m/s
DELAY	Within the measuring amplifier, the delay of the automatic amplification switchover (see function “AMPLIFIER MODE” → NORMAL) 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. with piston pumps). The entered number thus corresponds to the number of measuring events (samples) to be ignored before a switch-over of the amplifier booster is necessary. max. 4-digit number: ***10***...1000

Function group **SYSTEM PARAMETERS**	
POS. ZERO RETURN	With this function the signals of current and pulse/frequency output can be set to the fallback value, e.g. for interrupting the measurement for cleaning the piping. After positive zero return is activated, the display shows the message “S: POS. ZERO-RET. ACTIVE”. Measured value suppression is equivalent to zero flow. During this time the following applies: • Current output → set to 0 mA or 4 mA • Pulse/frequency output → at the fallback value • Display flow = 0 • The totalizer remains at the last applicable value. Note! • This function has top priority above all other functions of the instrument. Simulations are suppressed for example. • During positive zero return both relays (1 and 2) are live, i.e. energised. Any error messages occurring, e.g. fault or alarm, can then only be called up using the diagnosis function (E) or via the function “PRESENT SYSTEM CONDITION”. These errors do not, however, affect the outputs. • If the Promag 33 measuring electronics are fitted with a communications module “RS 485”, then positive zero return can also be activated using the auxiliary input (see page 69). + / − ***OFF*** – ON
DEF. PRIVATE CODE	This function enables a personal code number to be selected with which programming can be enabled. Note! • Programming is always enabled with the code number “0”. • When programming is locked this function is not available and access to the personal code number by third parties is not possible. The code number can only be altered when programming has been enabled. + / − max. 4-digit number: 0...9999 Factory setting: ***33***

Note!

Note!

Function group **SYSTEM PARAMETERS**	
ACCESS CODE	All data of the Promag 33 measuring system are protected against unauthorised access. Only by first entering a code number in this function programming is enabled and the settings of the instrument can then be altered. If, in any function, the ± operating elements are touched, then the measuring system jumps automatically into this function and the display shows the prompt to enter the code number (if programming is locked): → Enter code number 33 (factory setting) or → Enter personal code number (see "DEF. PRIVATE CODE", page 77) Note! • After jumping to the HOME position programming is again locked after 60 seconds if no operating element is touched during this time. • Programming can also be locked by entering any number (not the customer code number) in this function. • If you can no longer find your personal code number, then the Endress+Hauser service organisation will be pleased to help you. • Certain functions can only be modified by entering a special service code number. This is known to your E+H Service organisation. Please contact your E+H Service for any further information you may require. ± max. 4-digit number: 0...9999 Factory setting: ***0***
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 "BATCH VARIABLE" (see page 64) is set to "VOLUME". In this case no periodic self check is carried out. ± OFF – ***ON***

Function group **SYSTEM PARAMETERS**	
PRESENT SYSTEM CONDITION	With this function system/process errors as well as status messages which occur while measurement is in progress can be called up according to their priority. Error and status messages are displayed in the HOME position alternately with the actual measurement variable. On activating the diagnosis function (⊞) there is automatically a jump to this function. With error-free measurement the message “S: SYSTEM WORKS NORMALLY” will appear on the display. Note! • This function can also be selected directly through the function group “SYSTEM PARAMETERS”. • A complete listing of all possible system/process errors and status messages is found on page 90 ff. ⊞ Calling up other current errors or status messages “+” → message with higher display priority “–” → message with lower display priority ⊞ By pressing the diagnosis function again when a system error occurs you can also call up error descriptions. In such cases a diagnosis symbol (stethoscope) is shown on the display.
PREVIOUS SYSTEM CONDITIONS	In this function, all system/process errors and status messages that have occurred so far are listed in chronological order (error history with max. 10 entries). Note! • A complete list of all possible system/process errors and status messages is given on page 90 ff. • If no error or status messages have occurred since the measuring system was last started up then the display shows the message “S: NO ENTRY EXISTING”. • With more than 10 entries the oldest is overwritten. • Storage of this list is volatile and is lost if there is a power supply failure. ⊞ Calling up other system/process errors and status messages “+” Listing is done chronologically with the oldest, second oldest ...etc. message. “–” Listing is done chronologically with the latest, second latest ... etc. message.


Note!


Note!

Function group
SYSTEM PARAMETERS

SOFTWARE VERSION

Display of the current software version installed on the amplifier board.
The numbers of the software version have the following meaning:

PRO 33 V 3. 01 . 00

- Number changes if minor alterations are made to the new software. This also applies to special versions of software.
- Number changes if the new software contains additional functions.
- Number changes if basic alterations have to be made to the software, e.g. owing to technical modifications to the instrument.

SOFTWARE VER. COM

Display of the current software version installed on the communication board.
The numbers of the software version have the following meaning:

V 2 . 04. 00 HART / RS 485

- Communication interface
- Number changes if minor alterations are made to the new software. This also applies to special versions of software.
- Number changes if the new software contains additional functions.
- Number changes if basic alterations have to be made to the software, e.g. owing to technical modifications to the instrument.

Function group
SENSOR DATA

Sensor data, such as nominal diameter, calibration factor, etc., are set in the factory. All characteristic values of the sensor are stored in the DAT memory.

Caution!
Normally these characteristic sensor data may not be altered. A change to the sensor data affects a number of functions of the whole measuring system, especially its accuracy. The following functions of this group can therefore only be changed after entering a ***service code*** and cannot be altered using the personal code.


Caution!

Please contact your E+H Service organisation for more information.

K-FACTOR POS.

Display of the actual calibration factor of the sensor for positive flow direction. The calibration factor is determined and set in the factory:


5-digit number with fixed decimal point: 0.5000...2.0000
Factory setting: ***dependent*** on nominal diameter and calibration

Caution!
Under normal operating conditions the calibration factor is not to be changed. The service code number required for this is known to your E+H Service organisation. Please contact E+H Service for any problems or questions that have occurred.


Caution!

K-FACTOR NEG.

Display of the actual calibration factor of the sensor for negative flow direction. The calibration factor is determined and set in the factory:


5-digit number with fixed decimal point: 0.5000...2.0000
Factory setting: ***dependent*** on nominal diameter and calibration

Caution!
Under normal operating conditions the calibration factor is not to be changed. The service code number required for this is known to your E+H Service organisation. Please contact E+H Service for any problems or questions that have occurred.


Caution!

ZERO POINT

Display of the zero point correction of the sensor. This value is determined and set in the factory:


max. 4-digit number: –1000...+1000
Factory setting: ***dependent*** on nominal diameter and calibration

Caution!
Under normal circumstances the zero point correction is not to be altered. The service code number required for this is known to your E+H Service organisation. Please contact E+H Service for any problems or questions that have occurred.


Caution!

NOMINAL DIAMETER

Display of the actual nominal diameter of the sensor.

Caution!
The nominal diameter given may, in general, not be altered. Numerous functions depend directly on the nominal diameter (technical units, full-scale values, switch points, creepage, etc.). When the nominal diameter is changed, all dependent parameters are set to a **new** plausible value!


Caution!


Value between 2...2000 mm or 1/12... 78“
Factory setting: ***dependent*** on the sensor diameter


UNIT ==> NOM. DIAM. UNIT
Unit selection → see function “NOM. DIAM. UNIT”

Function group SENSOR DATA	
MAX. SAMPLING RATE	Display of the maximum sampling rate (= SAPS). It depends on the particular sensor being used and is set in the factory. Caution! Under normal circumstances, the max. sampling rate should not be altered. The service code number required for this is known to your E+H Service organisation. Please contact E+H Service for any problems or questions that have occurred. max. 3-digit number with fixed decimal point: 1.0...60.0 /s (per second) Factory setting: ***dependent*** on the sensor
SAMPLING RATE	Display of the sampling rate (= SAPS). The following standard values apply for the flowmeters: • Promag A, F → 16.7 / s • Promag H → 25.0 / s Note! • The sampling rate is usually set to the MAX. SAMPLING RATE. It should only be altered in special cases. The service code number required for this is known to your E+H Service organisation. Please contact E+H Service for any problems or questions that have occurred. • The Promag 33 measuring system is synchronised with the main power supply. Therefore, the sampling rate entered is set to the nearest possible value or rounded off to it. max. 3-digit number with fixed decimal point: – upper limit = depending on nominal diameter (max. 60.0 / s) – lower limit = 1.0 / s
SERIAL NUMBER	Display ot the serial number of the sensor. The serial number is normally entered in the factory. max. 6-digit number: 1...999999
EPD ELECTRODE	This function indicates whether the sensor is equipped with an electrode for Empty Pipe Detection (EPD). This setting is made in the factory to suit the sensor installed. Note! Empty Pipe Detection can only be activated when an EPD electrode is fitted. YES – NO Factory setting: – With an EPD electrode as standard → YES – Sensors without an EPD electrode → NO

Function group **SENSOR DATA**	
POLARITY ECC	Display of the actual current polarity for the Electrode Cleaning Circuitry (ECC). Depending on the material of the electrode, electrode cleaning is carried out with a positive or negative current. An incorrect current at the electrode can damage the material. Using the material data for the electrode stored in the DAT, the Promag automatically selects the appropriate polarity. Note! • This function is not available with the FL version. • The ECC function is described in detail on page 75. Caution! If, for any reason, it is necessary to change the polarity (e.g. after a loss of the DAT), then it is possible to do so with this function. This function is, however, still protected by a special service code and cannot be changed with the personal code. Please contact your E+H Service organisation for more information. + POSITIVE with electrodes in 1.4435, Hastelloy C or platinum − NEGATIVE with electrodes in tantalum


Note!


Caution!

7 Trouble-shooting, Maintenance and Repairs

7.1 Response of the measuring system on faults or alarm

The Promag 33 distinguishes between two kinds of error:
- System error (failure): instrument failure, power failure
- Process error (alarm): empty pipe, measuring range exceeded

Errors which occur during normal operation are indicated on the display (see page 90).
The error response of the outputs is described in the following table.

Positive Zero Return *not* activated			
	Current output	**Pulse / Frequency output**	**Relay outputs 1 / 2**
No System / process error present	Measurement OK	Measurement OK	Switching response → see page 60, 61
System or process error present	Failsafe mode selectable (see page 51): MIN. CURRENT 0–20 mA → 0 mA 4–20 mA → 2 mA MAX. CURRENT 0/4–20 mA (25 mA) → 25 mA 0/4–20 mA → 22 mA HOLD VALUE Last valid measured value is held. ACTUAL VALUE Normal measured value output despite fault.	Failsafe mode selectable (see page 57): FALLBACK VALUE Signal → 0 Hz Totalizer stops operating. LAST VALUE Last valid measured value is held. The totalizer operates with this value. ACTUAL VALUE Normal measured value is given despite fault, also with totalizer.	Switching response → see page 60, 61

Positive Zero Return *activated*			
	Current output	**Pulse / Frequency output**	**Relay outputs 1 / 2**
No system and process errors present	For 0–20 mA → 0 mA For 4–20 mA → 4 mA	Signal at the fallback value: → no signal output (0 Hz)	Relays 1 and 2 are live, i.e. energised
System error only present			
Process error only present			
System and process error present			

Positive Zero Return and Simulation


Caution!

Caution!
Note the following points when 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 asked for and displayed with the aid of the diagnostic function.
- Measured value suppression sets all signal outputs to zero (corresponding to zero flow).
- Both relays are live, i.e. energised.

Simulation:
- This function has second highest priority, likewise the corresponding status message. Any error messages which occur during this time can only be asked for and displayed with the aid of the diagnostic function.
- Normal output of system errors via the alarm output (relay 1).
- Normal functioning of relay 1 or 2 as per configuration (see pages 60 and 61).

7.2 Trouble-shooting and remedy

All instruments undergo various stages of quality control during production. The last of these stages is the wet calibration carried out on state-of-the-art calibration rigs. The following summary helps to identify possible causes of error during normal measurement.

Warning!
This error diagnosis cannot be carried out with Ex instruments as they must be opened and thus the ignition protection type is no longer present.

Type of error	Remedy (Step 1 → 2 → ...)
Does a message indicating error, alarm or status appear on the display?	Appropriate measures can be carried out for every message: – Error messages **F: ....** → see page 90 – Alarm messages **A: ....** → see page 92 – Status messages **S: ....** → see page 93 For error messages it is possible to call up further sources of error via the diagnosis function (⊞).
No display and no output signal.	**1** Check the power supply → Terminals 1, 2 **2** Check the fuse → see page 23, 24 85...260 V AC: 1 A slow-blow 20...55 V AC and 16...62 V DC: 2.5 A slow-blow **3** Replace electronics → see page 96
The display is blank, with outputs still functioning.	**1** Check the ribbon cable connector of the display module → see page 96 (No. 3b) **2** Replace display module → see page 96 **3** Replace electronics → see page 96
Display text is shown in a foreign or a language that is not understood.	Switch off the power supply. Switch on the instrument again while simultaneously pressing the ⊞ keys. The display text is then shown in English at maximum contrast.
No current or pulse output signals despite display showing measured values?	**1** Check the ribbon cable connector to the terminal compartment → see page 96 (No. 8) **2** Replace electronics → see page 96
Does the instrument show negative flow values although the fluid in the piping is flowing forward?	**1** Remote version → switch off the power supply, check the wiring (see page 26) and if necessary change round Terminals 41 and 42. **2** Change the setting in the function “FLOW DIRECTION” accordingly → see page 75
Is the display unsettled despite continuous flow?	**1** Check ground and potential equalisation → see page 28 **2** Check to see if air bubbles are in the fluid. **3** Increase the time constant for the current output → see page 51 **4** Increase the display damping for flow → see page 68

continued on next page

Type of error	Remedy (Step 1 → 2 → ...)
The display is pulsing or unstable, e.g. due to piston, hose or diaphragm pumps or those pumps with similar characteristics.	Carry out the following settings in the operating matrix: **1** Function DISPLAY DAMPING >10 seconds page 68 **2** Function TIME CONSTANT > 5 seconds page 51 **3** Function LOW FLOW CUTOFF = 0 page 72 **4** Function NOISE SUPPRESSION = OFF page 72 **5** Function MEASURING MODE = BIDIRECTIONAL page 75 **6** Function AMPLIFIER MODE = MODE 2 page 76 If this does not produce satisfactory results, then, a pulse damper must be installed between the pump and the Promag.
Is there is a difference between the internal totalizer of Promag and the external counter?	This error occurs especially with back flows in the piping as the pulse output cannot "subtract" such flows. The following solutions are available: **Solution 1:** Negative flows are ignored, i.e. the display of the Promag or external counter show identical values → set function "MEASURING MODE" to "UNIDIRECTIONAL" (see page 75). **Solution 2:** Flows in both directions are registered. This requires an external counter or other evaluating unit to add or subtract the appropriate pulses (forward/reverse). Proceed as follows: **1** Fct. MEASURING MODE → BIDIRECTIONAL page 75 **2** Fct. RELAY 2 FUNCTION → FLOW DIRECTION page 62 **3** Connect the pulse output (Terminals 20/21 with HART; Terminals 26/27 with RS 485) to the input of the external counter. **4** Connect relay 2 (Terminal 24/25) to the flow direction input of the external counter. **5** *Negative flow direction* → The external counter is to be set so that the appropriate pulses are subtracted for negative flow (relay 2 is then de-energised). **6** *Positive flow direction* → The external counter is to be set so that the appropriate pulses are added with positive flow (relay 2 is then energised).
Is a low flow indicated despite standstill of the fluid and filled measuring tube?	**1** Check ground and potential equalisation → see page 28 **2** Check to see if air bubbles are in the fluid. **3** Activate "LOW FLOW CUTOFF" function, i.e. enter or increase the switch point value → see page 72
Is a measured value shown despite an empty pipe?	**1** Carry out an empty or full pipe adjustment and then switch on the empty pipe detection function → see page 73 ff. **2** Check the following terminal connections: • Electronics: EPD cable → see page 96 (No. 5c) • Remote version: EPD cable → see page 26 (Terminals 36 and 37) **3** Fill the measuring tube.
The current output cannot be set to "0–20 mA".	In the function group COMMUNICATION, the function "PROTOCOL" must be set to "OFF" → see page 69

continued on next page

Type of error	Remedy (Step 1 → 2 → ...)
The current output signal is always 4 mA, whatever the flow signal.	In the function group COMMUNICATION, the function "BUS ADDRESS" must be set to "0" → see page 69
The error cannot be remedied or else there is another type of error. In such cases please contact your local E+H Service organisation.	The following solutions are possible: **Request an E+H service technician** The following information is required when contacting a customer service technician: – brief description of the error – order code given on the nameplate → see page 7, 8 **Repair** Note the procedures on page 97 ("Repairs") before returning the instrument for repair. Please state a brief description of the error on the delivery note. **Replacing the electronics** If a new electronic plug-in board is ordered, we require the full order code which can be taken from the instrument order structure: *Order structure (Promag 33)* **33** _ _ _ _ – _ _ _ _ _ _ _ _ _ _ _ _ **33 X MOD** – □ □ □ □ *Order code Electronic plug-in board* The last four places correspond to the order code on the nameplate of the transmitter → see page 7.

7.3 Error, alarm and status messages

Error message (Failure)	Code	Cause (Call up by ⊞)	Remedy
	0	No system error present	–
F: SYSTEM ERROR POWER SUPPLY	**4**	**: LOW VOLTAGE DETECTED** The voltage from the power supply board is too low.	1. Check the power supply. 2. Replace electronics (see page 89, 96)
	5	**: COIL CURRENT CONTROL** Coil current out of tolerance.	1. Remote version: Switch off the power supply before the coil cable (Terminals 41/42) is connected or removed. 2. Remote version: Switch power supply off and check the wiring of terminals 41/42 (see page 26). 3. Switch off power supply and check the coil current cable (see page 96, No. 7). 4. Replace electronics (see page 89, 96)
F: SYSTEM ERROR AMPLIFIER	**6**	**: DAT FAILURE** Error when accessing DAT data (adjusted values of the sensor).	1. Check whether the DAT is plugged onto the amplifier board (see page 96, No. 5b). 2. After replacing the electronics, check whether the amplifier operates with an old software version. The first number of the software version must be the same or greater (see page 80). 3. Replace electronics (see page 89, 96) 4. Order a DAT, giving the serial number and order code (see page 7, 8) and replace (see page 96).
	7	**: EEPROM FAILURE** Error when accessing EEPROM data (adjusted values of the amplifier).	Replace electronics (see page 89, 96)
	8	**: ROM / RAM FAILURE** Error when accessing program memory (ROM) or main memory (RAM) of the processor.	Replace electronics (see page 89, 96)
	9	**: GAIN ERROR AMPLIFIER** Gain error of the amplifier.	1. Check ground and potential equalisation (see page 28). 2. Switch the power supply off and on again. 3. Replace electronics (see page 89, 96)

Error message (Failure)	Code	Cause (Call up by ⊞)	Remedy
F: SYSTEM ERROR AMPLIFIER	**10**	**: NO AMPLIFIER RESPONSE** Faulty data transmission between communication module and amplifier.	Replace electronics (see page 89, 96)
F: VALUE NOT ACCEPTED	**17**	The value entered was not correctly accepted by the amplifier.	1. Re-enter the parameter again. 2. Switch the power supply off and on again. 3. Replace electronics (see page 89, 96)
F: SYSTEM ERROR COM-MODULE	**11**	**: MODULE NOT COMPATIBLE** Communication module and amplifier are not compatible.	Replace electronics (see page 89, 96)
	12	**: EEPROM FAILURE** Error when accessing EEPROM data (process and adjustment data of the communication module).	Replace electronics (see page 89, 96)
	13	**: RAM ERROR** Error when accessing the main memory (RAM).	Replace electronics (see page 89, 96)
	14	**: ROM ERROR** Error when accessing the program memory (ROM).	Replace electronics (see page 89, 96)
	15	**: LOW VOLTAGE DETECTED** The voltage supplied by the DC/DC converter on the communication module is too low.	1. Check the power supply. 2. Replace electronics (see page 89, 96)
	16	**: VOLTAGE REFERENCE** Voltage reference of the communication module is out of tolerance, i.e. correct functioning of the current output is not assured.	Replace electronics (see page 89, 96)

Alarm message	Code	Cause	Remedy
A: EPD ADJUSTMENT VALUES MISSING	**18**	EPD is switched on, but no adjustment has taken place.	Carry out an EPD adjustment as per page 73 ff.
A: EPD ADJUSTMENT NOT POSSIBLE	**19**	EPD is switched on, but an adjustment is not possible because the conductivity of the fluid is outside the permissible range (too high or too low).	With such fluids, the EPD function cannot be used!
A: EPD ADJUSTMENT FULL = EMPTY	**20**	EPD is switched on, but an alarm message is displayed because the adjustment values for full and empty pipe are identical.	Repeat the EPD adjustment as per page 73 ff.
A: EPD ADJUSTMENT FULL <=> EMPTY	**21**	EPD is switched on, but an alarm message is displayed because the adjustment did not take place with full or empty pipe.	Repeat the EPD adjustment as per page 73 ff.
A: EMPTY PIPE DETECTED	**22**	The measuring tube is not completely full or may be empty.	Check the process conditions of your installation.
A: FLOW TOO HIGH	**23**	The fluid velocity in the measuring tube is larger than 12.5 m/s. The measuring range of the transmitter electronics is exceeded.	Reduce the flow rate.
A: CURRENT OUTP. TOO HIGH	**24**	The actual flow rate is too high for the scaled full scale value (I_{max} = 25 mA resp. 20,5 mA with NAMUR).	1. Scale higher full scale values (see page 49, 51) or 2. Reduce flow rate.
A: FREQ. OUTPUT OVERFLOW	**25**	The actual flow rate is too high for the scaled full scale value (f_{max} = approx. 163 % of f_{End}).	1. Scale a higher full scale value (see page 55) or 2. Reduce flow rate.
A: BATCH TIME EXCEEDED	**26**	The maximum time for a batching cycle has been exceeded.	1. Identify the cause for exceeding the time provided, e.g. a possible plant error (defective or blocked valve). 2. It may be necessary to increase the maximum batching time or to switch off the “MAX. BATCH TIME” function (see page 65).

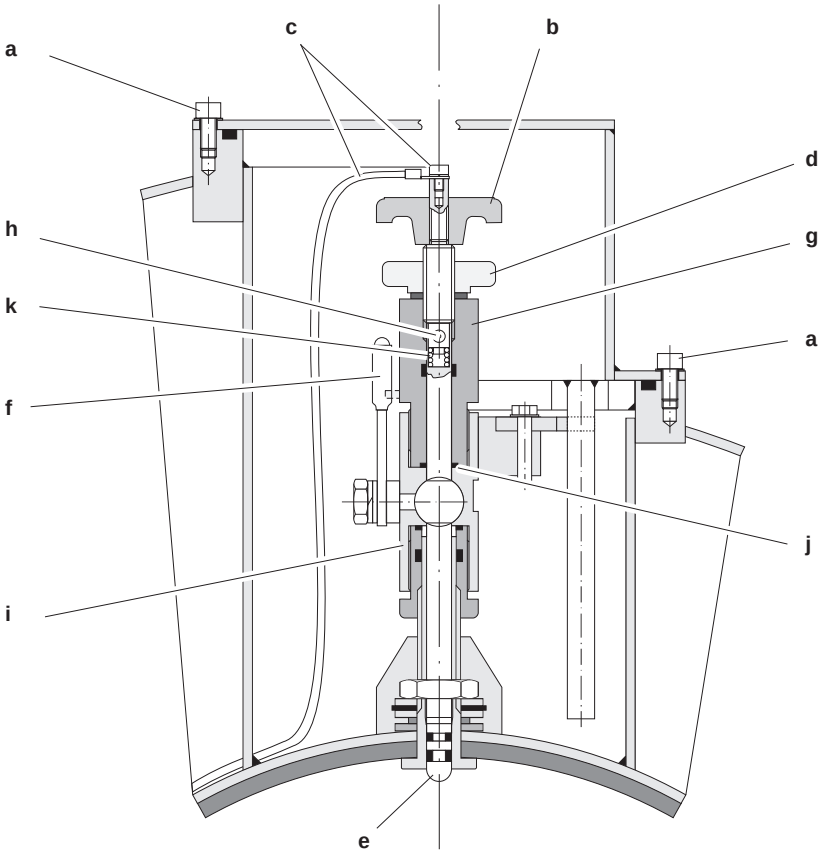
Status message	Code	Cause	Remedy
S: POS. ZERO RET. ACTIVE	**1**	Measured value suppression active. This message has top priority for Promag 33.	–
S: CURRENT OUTP. SIMUL. ACTIVE	**2**	Current simulation active	–
S: FREQ. OUTPUT SIMUL. ACTIVE	**3**	Frequency simulation active	–
S: EPD ADJUSTMENT RUNNING	**27**	EPD adjustment in progress (full / empty pipe adjustment).	–
S: BATCHING IS RUNNINING	**28**	Batching in progress until the selected quantity has been discharged.	–

7.4 Replacing the measuring electrodes

The Promag F (DN 350...2000) is available with replacement electrodes as an option. This version enables the measuring electrodes to be cleaned or replaced under process conditions.

Type DN 1200...2000
left side

Type DN 350...1050
right side



a	Allen screw	g	Holding cylinder
b	Rotary arm	h	Locking pins (rotary arm)
c	Electrode cable	i	Ball valve housing
d	Knurled nut (counter nut)	j	Gasket (holding cylinder)
e	Measuring electrode	k	Coil spring
f	Shut-off valve (ball valve)		

ba009y21

Fig. 43
Replacement unit for changing electrodes

Dismantling the electrode

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

   Warning!
   Danger of injury! Under process condition (piping under pressure) the electrode can spring back to the stop. Keep pressing against it while loosening.

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

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

   
   Warning!
6. Unscrew the entire electrode along with the holding cylinder (g).
7. Remove the rotary arm (b) from the electrode (e), while pressing to remove the locking pin (h). Take care not to lose the coil spring (k).
8. Replace the old electrode with a new electrode.
   A set of replacement electrodes can be ordered from Endress+Hauser.

Assembling the electrode

1. Slide the new electrode (e) into the holding cylinder (g) from below. Ensure that gaskets at the tip of the electrode are clean.
2. Put the rotary arm (b) on the electrode and secure with the locking pin (h).

   Caution!
   Ensure that the coil spring (k) is in place. This ensures close electrical contact and thus reliable measuring signals.

   
   Caution!
3. Pull back the electrode as far as possible so that the tip does not protrude out from the holding cylinder (g).
4. Screw the holding cylinder onto the shut-off unit (i) and thighten by hand. Gasket (j) on the holding cylinder must be in place and clean.

   Note!
   Ensure that the rubber tubes on the holding cylinder (g) and shut-off valve (f) have the same colour (red or blue)

   
   Note!
5. Open the shut-off valve (f) and screw in the electrode using the rotary arm (b) until the stop.
6. Screw the knurled nut (d) onto the holding cylinder. This clamps the electrode tight.
7. Screw the electrode cable (c) to the rotary arm (b) using the Allen screw.

   Caution!
   Ensure that the Allen screw of the electrode cable is tight. This ensures close electrical contact and thus reliable measuring signals.

   
   Caution!
8. Replace the cover and tighten the Allen screw (a).

7.5 Replacing the transmitter electronics

Warning!
- Danger from electric shock! Switch off the power supply before opening the transmitter housing.
- When using Ex instruments, they must first cool down for at least 10 minutes before opening.
- The local power supply voltage and frequency must be the same as the technical specifications of the power supply boards.
- Ensure that the new electronics board is the same as the old one before replacing it (power supply, version of amplifier and software).

1. Loosen the Allen screws of the safety grip (3-mm Allen key).
2. Unscrew the cover of the electronics area of the transmitter housing.
3. Remove the local display as follows:
   a. Loosen the mounting screws of the display module.
   b. Unplug the ribbon cable of the display from the communications board.
4. Unplug the 2-pole plug of the power supply cable (by pressing down the catch) from the power supply board.
5. Remove the electrode signal cable from the amplifier board:
   a. Remove the cable board.
   b. Remove the blue DAT module.
   c. Loosen the EPD cable from the screw terminals.
6. Loosen the two Phillips screws of the board support plate. Carefully remove the support plate approx. 4...5 cm out of the transmitter housing.
7. Remove the coil current cable plug from the power supply board.
8. Remove the ribbon cable plug (connection cable to the terminal area) from the communications board.
9. The entire transmitter electronics, together with the board support plate, can now be completely removed from the housing.
10. Replace the old transmitter electronics with new transmitter electronics.
11. Reassemble in reverse sequence.

Replacing the DAT module (see 5b):
- Procedure for replacing the transmitter electronics → plug the old DAT onto the new amplifier board.
- Procedure for replacing a defective DAT → plug the new DAT onto the old amplifier board.

DAT = Replaceable data module in which the basic data of the sensor are stored (see page 113).

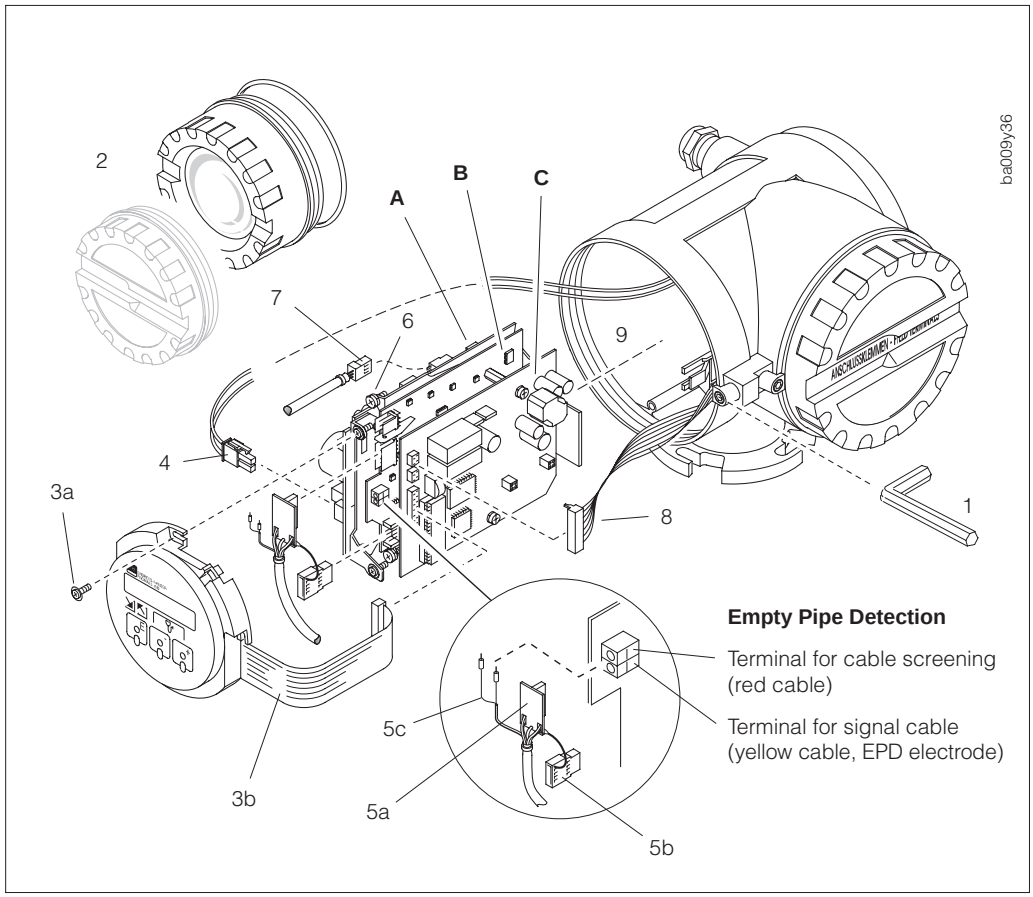


Fig. 44
Replacing the transmitter electronics:

A *Power supply board*
B *Amplifier board*
C *Communications board*

7.6 Replacing the fuse

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

The instrument fuse can be found in the terminal compartment → see page 23, 24

Exclusively use the following types of fuses:
- Power supply 20...55 V AC / 16...62 V DC → 2.5 A slow-blow / 250 V; 5.2 × 20 mm
- Power supply 85...260 V AC → 1 A slow-blow / 250 V; 5.2 × 20 mm

7.7 Repairs

Please carry out the following procedure before returning the Promag 33 for repair to Endress+Hauser:
- A note must always be enclosed with the instrument, giving the following information:
  – Brief description of the error
  – Description of the application
  – Chemical and physical properties of the fluid
- 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.

Warning!
We must request you not to return a unit if it is not completely certain that harmful substances can be removed e.g. cracks have been penetrated or substances have diffused through plastics.
Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the operator of the instrument.

7.8 Spare parts

The electronics plug-in module of the Promag 33 can be ordered separately as a spare part:
- Replacement → see page 96
- Order code → see page 89

7.9 Maintenance

No special maintenance is necessary for the Promag 33 measuring system.

8 Dimensions

8.1 Dimensions Promag 33 A

Note!
The dimensions and weights of explosion protected versions may differ from the specifications given here. Please refer to the Ex supplement.

Note!

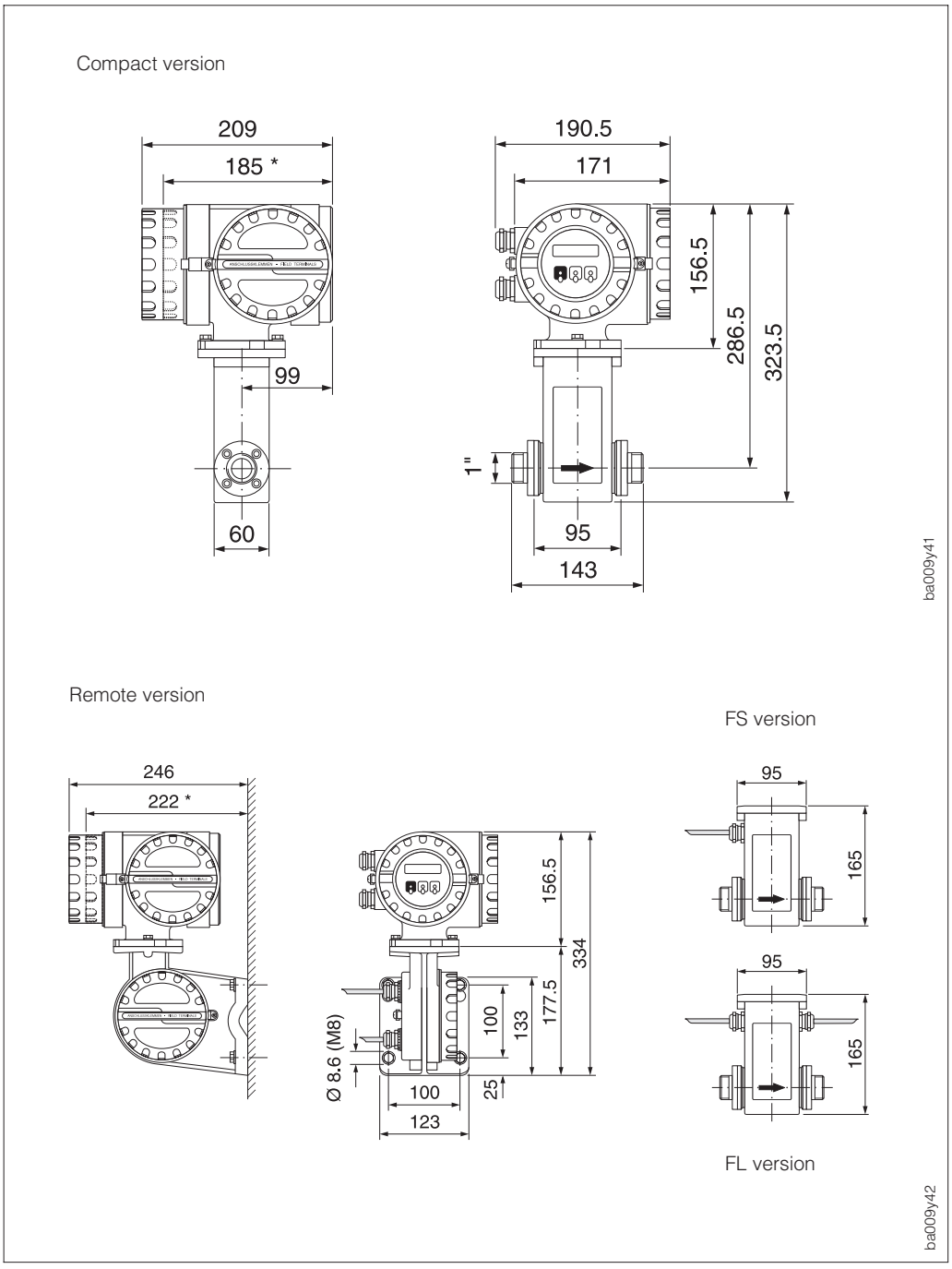


Fig. 45
Dimensions Promag 33 A

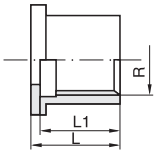
** with blind version*

Weights:

Compact version	5 kg (without process connections)
Promag 33 transmitter	3 kg (5 kg for wall mounted version)
Promag A sensor	2 kg

Dimensions of the process connections for Promag A

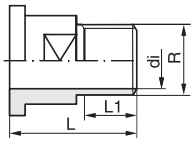
Internal thread
standard thread:
ISO 228/DIN 2999



y43-01...08

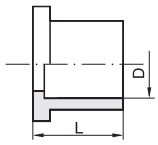
DN	L	L1	Thread
2...15	20	18	1/2"
2...15	20	18	1/2" NPT
25	45	22	1"
25	45	22	1" NPT

External thread
standard thread:
ISO 228/DIN 2999



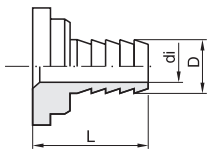
DN	L	L1	di	Thread
2...15	35	13.2	16.1	1/2"
2...15	42	20.0	16.1	1/2" NPT
25	50	16.8	22.0	1"
25	60	25.0	22.0	1" NPT

PVC adhesive coupling



DN	L	D	Pipe connection
2...15	19	20.0	20 · 2
2...15	20	21.5	1/2"
25	66	25.0	25 · 2
25	69	32.0	32 · 2.5
25	69	33.5	1"

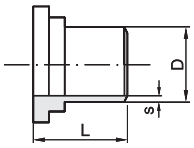
Hose connection



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

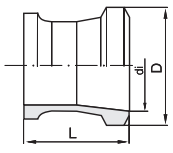
LW = Internal diameter hose

Welded nipple
DN 2...15



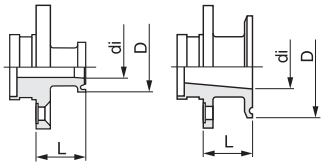
DN	L	D	s	Pipe connection
2...15	20	21.3	2.6	1/2"
2...15	20	21.3	2.6	18 · 1

Welded nipple
DN 25



DN	L	D	di	Pipe connection
25	30	33.7	26.0	1"
25	30	33.7	26.0	28 · 1
25	20	25.4	22.1	25.4 · 1.6 / 1"

Tri-Clamp
Stainless steel
1.4404/316L



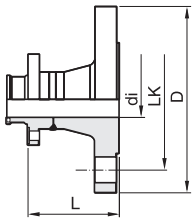
DN	L	D	di	Pipe connection
2...8	24	25.0	9.5	1/2"
15	24	25.0	16.0	3/4"
2...8	24	50.4	22.1	1"
15	24	50.4	22.1	1"
25	24	50.4	22.1	1"

All dimensions in [mm]

Flange
Stainless steel 1.4404/316L
with joint dimensions to
DIN 2501/ANSI B16.5/JIS B2210

DN 2...15:
with DN 15 or $^1/_2$" flanges

DN 25:
with DN 25 or 1" flanges



Flange to DIN 2501, PN 40

DN	L	D	di	LK
2...8	51.8	95	17.3	65
15	51.8	95	17.3	65
25	51.8	115	28.5	85

Flange to ANSI B16.5

	Class 150				Class 300		
DN	L	D	LK	di	L	D	LK
2...8	61.6	88.9	60.5	15.8	61.6	95.2	66.5
15	61.6	88.9	60.5	15.8	61.6	95.2	66.5
25	67.4	108.0	79.2	26.6	73.8	123.9	88.9

Flange to JIS B2210

DN	L	D	di	LK
2...8	62.5	95	15	70
15	62.5	95	16	70
25	62.5	115	25	90

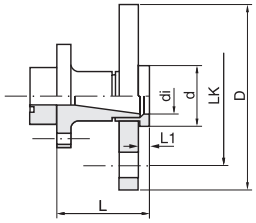
Face-to-face length to DVGW (200 mm)

Flange
PVDF with joint dimensions to
DIN 2501/ANSI B16.5/JIS B2210

DN 2...15:
with DN 15 or $^1/_2$" flanges

DN 25:
with DN 25 or 1" flanges

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



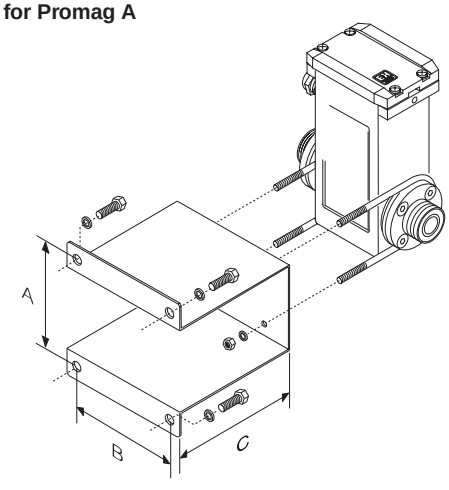
Flange as per DIN 2501/ANSI B16.5/JIS B2210
PN 16/Class 150/10K

DN	L	L1	D	d	di	DIN LK	ANSI LK	JIS LK
2...8	52.7	6	95	34	16.2	65	60.5	70
15	52.7	6	95	34	16.2	65	60.5	70
25	52.7	7	115	50	27.2	85	79.2	90

Face-to-face length as per DVGW (200 mm)

All dimensions in [mm]

Wall mounting kit for Promag A



A = 105 mm
B = 105 mm
C = 115 mm

ba009y59

Fig. 46
Dimensions
Wall mounting kit for Promag A

8.2 Dimensions Promag 33 H

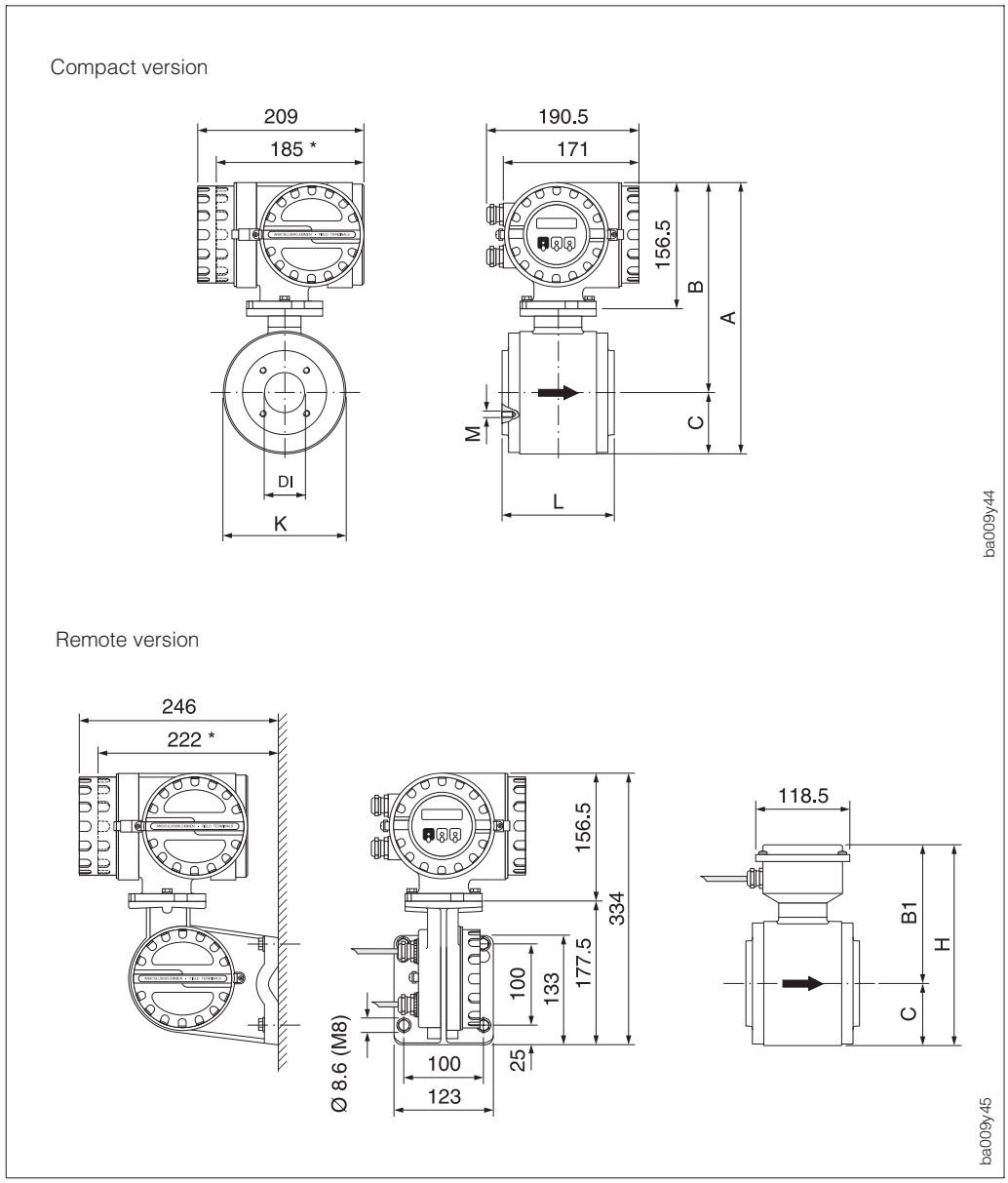


Fig. 47
Dimensions Promag 33 H

** with blind version*

DN		DI [1]	PN	L	A	B	B1	C	K	H	M	Weight [2]
[mm]	[inch]	[mm]	DIN [bar]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
25 DIN	–	26.0	16	140	318	254.0	158.5	64.0	128	222.5	M 6x4	6.0
25	1"	22.6	16	140	318	254.0	158.5	64.0	128	222.5	M 6x4	6.0
40	$1^1/_2$"	35.3	16	140	318	254.0	158.5	64.0	128	222.5	M 6x4	6.5
50	2"	48.1	16	140	343	266.5	171.0	76.5	153	247.5	M 8x4	9.0
65	$2^1/_2$"	59.9	16	140	343	266.5	171.0	76.5	153	247.5	M 8x4	9.0
80	3"	72.6	16	200	393	291.5	196.0	101.5	203	297.5	M 12x4	19.0
100	4"	97.5	16	200	393	291.5	196.0	101.5	203	297.5	M 12x4	18.5

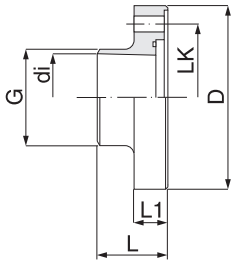
[1] Internal diameter of tube [2] Weight of compact version

Weight:

Compact version [2]	see table above
Promag 33 transmitter	3 kg (5 kg for wall mounted version)
Sensor connection housing	approx. 1 kg

Process connections (Promag H sensor)

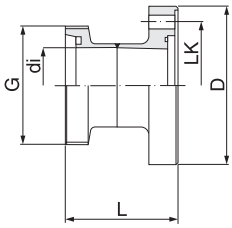
Welded nipple



y46-01...06

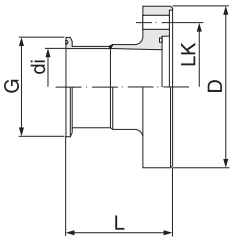
DN	D	G	di 1)	L	L1	LK
25	75	27	22.6	42	19	56.0
25 DIN	79	31	26.0	42	19	60.0
40	92	40	35.3	42	19	71.0
40 DIN	92	43	38.0	42	19	71.0
50	105	55	48.1	42	19	83.5
50 DIN	105	55	50.0	42	19	83.5
65	121	66	59.9	42	21	100.0
65 DIN	121	72	66.0	42	21	100.0
80	147	79	72.6	42	24	121.0
80 DIN	147	87	81.0	42	24	121.0
100	168	104	97.5	42	24	141.5
100 DIN	168	106	100.0	42	24	141.5

DIN 11851



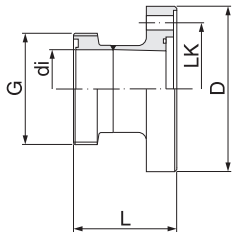
DN	di 1)	G	D	L	LK
25	26	52 x 1/6"	79	68	60.0
40	38	65 x 1/6"	92	72	71.0
50	50	78 x 1/6"	105	74	83.5
65	66	95 x 1/6"	121	78	100.0
80	81	110 x 1/4"	147	83	121.0
100	100	130 x 1/4"	168	92	141.5

Tri-Clamp



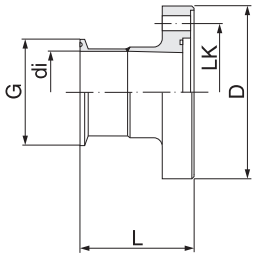
DN	ANSI	di 1)	G	D	L	LK
25	1"	22.1	50.4	75	68.6	56.0
40	1 1/2"	34.8	50.4	92	68.6	71.0
50	2"	47.5	63.9	105	68.6	83.5
65	–	60.2	77.4	121	68.6	100.0
80	3"	72.9	90.9	147	68.6	121.0
100	4"	97.4	118.9	168	68.6	141.5

SMS 1145



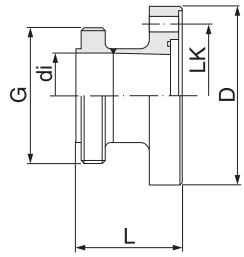
DN	di 1)	G	D	L	LK
25	22.5	40 x 1/6"	75	60	56.0
40	35.5	60 x 1/6"	92	63	71.0
50	48.5	70 x 1/6"	105	65	83.5
65	60.5	85 x 1/6"	121	70	100.0
80	72.0	98 x 1/6"	147	75	121.0
100	97.6	132 x 1/6"	168	70	141.5

ISO 2852



DN	di 1)	G	D	L	LK
25	22.6	50.5	75	68.5	56.0
40	35.6	50.5	92	68.5	71.0
50	48.6	64.0	105	68.5	83.5
65	60.3	77.5	121	68.5	100.0
80	72.9	91.0	147	68.5	121.0
100	97.6	119.0	168	68.5	141.5

ISO 2853



DN	di 1)	G	D	L	LK
25	22.6	37.1	75	61.5	56.0
40	35.6	50.6	92	61.5	71.0
50	48.6	64.1	105	61.5	83.5
65	60.3	77.6	121	61.5	100.0
80	72.9	91.1	147	61.5	121.0
100	97.6	118.1	168	61.5	141.5

Length:
DN 25... 65 = 2 x L + 136 mm
DN 80...100 = 2 x L + 196 mm

1) Please note the internal diameter (di, DI) when cleaning the piping with a scraper!

8.3 Dimensions Promag 33 F (DN 15...300)

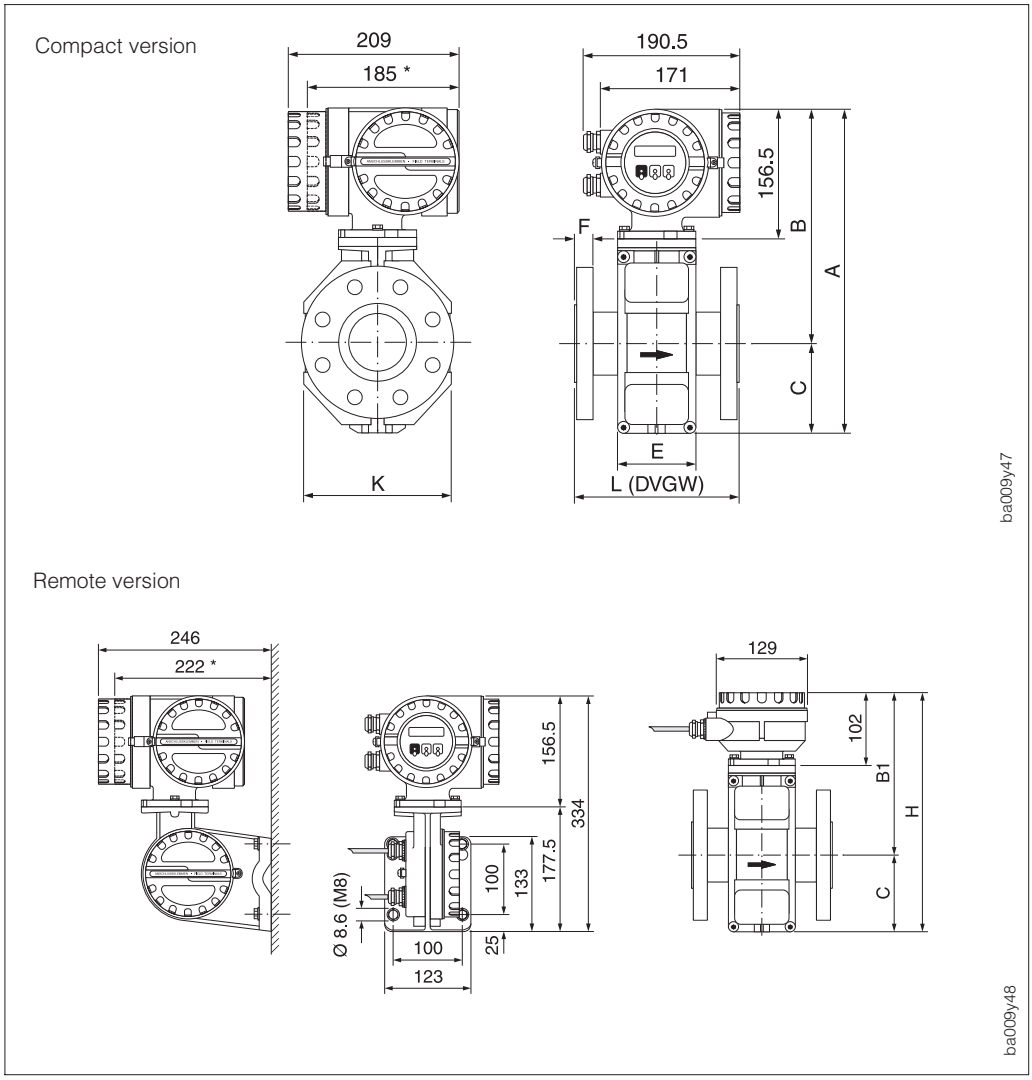


Fig. 48
Dimensions
Promag 33 F (DN 15...300)

** with blind version*

DN		PN			L[1]	A	B	C	K	E	F		H	B1	Weight[2]
[mm]	[inch]	DIN	ANSI Class	JIS	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	DIN [mm]	ANSI [mm]	[mm]	[mm]	[kg]
15	1/2"	40	150	20K	200	340.5	256.5	84	120	94	14	11.2	286	202	6.5
25	1"	40	150	20K	200	340.5	256.5	84	120	94	16	14.2	286	202	7.3
32	–	40	–	20K	200	340.5	256.5	84	120	94	18	–	286	202	8.0
40	1 1/2"	40	150	20K	200	340.5	256.5	84	120	94	18	17.5	286	202	9.4
50	2"	40	150	10K	200	340.5	256.5	84	120	94	20	19.1	286	202	10.6
65	–	16	–	10K	200	390.5	281.5	109	180	94	18	–	336	227	12.0
80	3"	16	150	10K	200	390.5	281.5	109	180	94	20	23.9	336	227	14.0
100	4"	16	150	10K	250	390.5	281.5	109	180	94	22	23.9	336	227	16.0
125	–	16	–	10K	250	471.5	321.5	150	260	140	24	–	417	267	21.5
150	6"	16	150	10K	300	471.5	321.5	150	260	140	24	25.4	417	267	25.5
200	8"	10	150	10K	350	526.5	346.5	180	324	156	26	28.4	472	292	35.3
250	10"	10	150	10K	450	576.5	371.5	205	400	156	28	30.2	522	317	48.5
300	12"	10	150	10K	500	626.5	396.5	230	460	166	28	31.8	572	342	57.5

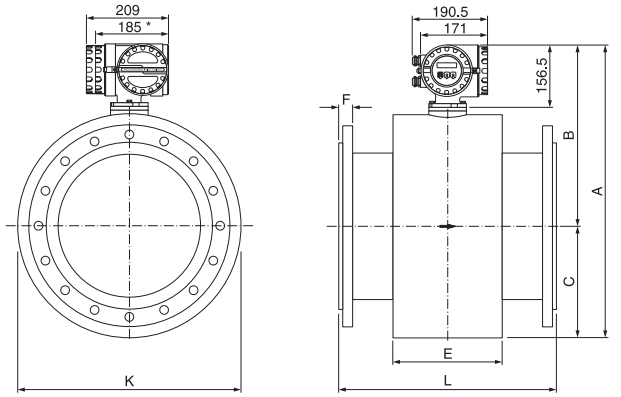
[1] The length is always identical independent of the chosen pressure rating.
[2] Weights for compact version only.

Weight:

Compact version [2]	see table above
Promag 33 transmitter	3 kg (5 kg for wall mounted version)
Sensor connection housing	approx. 1 kg

8.4 Dimensions Promag 33 F (DN 350...2000)

Compact version



Remote version

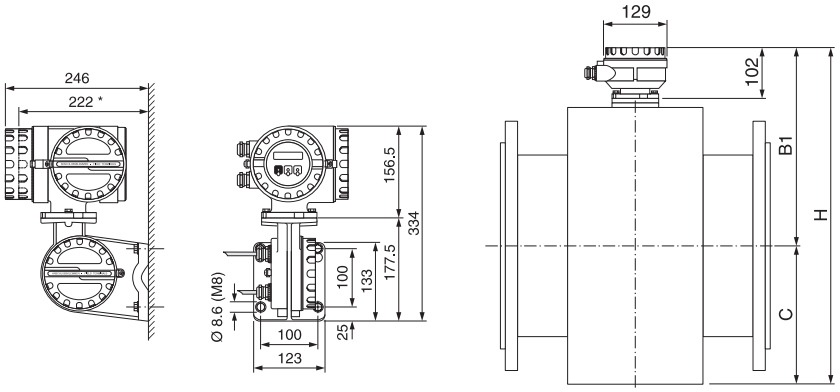


Fig. 49
Dimensions
Promag 33 F (DN 350...2000)

** with blind version*

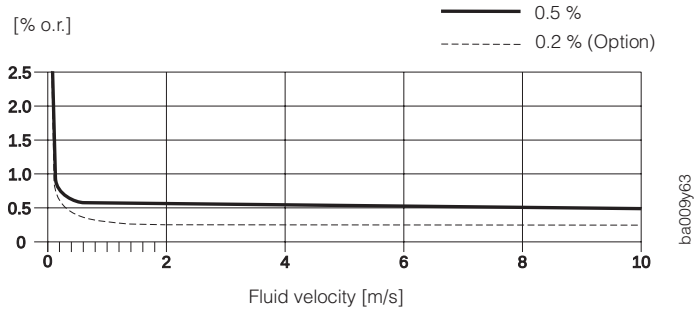
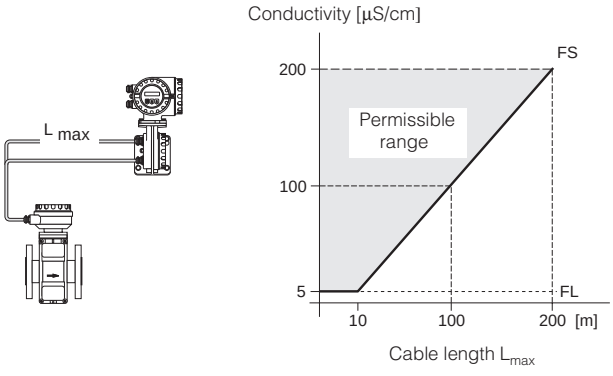
DN		PN			L [1]	A	B	C	K	E	F			H	B1	Weight [2]
[mm]	[inch]	DIN [bar]	ANSI [Class]	AWWA [Class]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	DIN [mm]	ANSI [mm]	AWWA [mm]	[mm]	[mm]	[kg]
350	14"	10	150	–	550	738	456.0	282.0	564	276	26	34.9	–	683.5	401.5	110
400	16"	10	150	–	600	790	482.0	308.0	616	276	26	36.5	–	735.5	427.5	130
450	18"	–	150	–	650	840	507.0	333.0	666	292	–	39.7	–	785.5	452.5	240
500	20"	10	150	–	650	891	532.5	358.5	717	292	28	42.9	–	836.5	478.0	170
600	24"	10	150	–	780	995	584.5	410.5	821	402	28	47.6	–	940.5	530.0	230
700	28"	10	–	D	910	1198	686.0	512.0	1024	589	30	–	33.3	1143.5	631.5	350
750	30"	–	–	D	975	1198	686.0	512.0	1024	626	–	–	34.9	1143.5	631.5	450
800	32"	10	–	D	1040	1241	707.5	533.5	1067	647	32	–	38.1	1186.5	653.0	450
900	36"	10	–	D	1170	1394	784.0	610.0	1220	785	34	–	41.3	1339.5	729.5	600
1000	40"	10	–	D	1300	1546	860.0	686.0	1372	862	34	–	41.3	1491.5	805.5	720
1050	42"	–	–	D	1365	1598	886.0	712.0	1424	912	–	–	44.5	1543.5	831.5	1050
1200	48"	6	–	D	1560	1796	985.0	811.0	1622	992	28	–	44.5	1741.5	930.5	1200
1350	54"	–	–	D	1755	1998	1086.0	912.0	1824	1252	–	–	54.0	1943.5	1031.5	2150
1400	–	6	–	–	1820	2148	1161.0	987.0	1974	1252	32	–	–	2093.5	1106.5	1800
1500	60"	–	–	D	1950	2196	1185.0	1011.0	2022	1392	–	–	57.2	2141.5	1130.5	2600
1600	–	6	–	–	2080	2286	1230.0	1056.0	2112	1482	34	–	–	2231.5	1175.5	2500
1650	66"	–	–	D	2145	2360	1267.0	1093.0	2186	1482	–	–	63.5	2305.5	1212.5	3700
1800	72"	6	–	D	2340	2550	1362.0	1188.0	2376	1632	36	–	66.7	2495.5	1307.5	3300
2000	78"	6	–	D	2600	2650	1412.0	1238.0	2476	1732	38	–	69.9	2595.5	1357.5	4100

[1] Thickness of the flange face includes sealing strip. The length is always identical independent of the chosen pressure rating.
[2] Weights of compact DIN PN 10 version. Weights for transmitter: see previous page

9 Technical Data

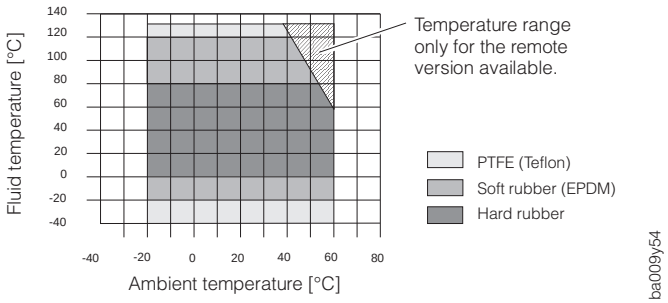
Application	
Instrument name	Flow measuring system “Promag 33”
Instrument function	Flow measurement of liquids in closed piping. Applications in measurement, control and regulation processes, for e.g. batching and dosing (> 10 s), etc.
Function and system design	
Measuring principle	Electromagnetic flow measurement according to Faraday’s law (Generation of a voltage by induction in a magnetic field).
Measuring system	Instrument family “Promag 33” consisting of: • Transmitter: Promag 33 (with a HART or a RS 485 communications module) • Sensor: Promag A (DN 2, 4, 8, 15, 25) Promag H (DN 25, 40, 50, 65, 80, 100) Promag F (DN 15...2000) Two versions are available: • Compact version • Remote version (FS or FL version)
Input variables	
Measured variable	Flow velocity (proportional to induced voltage, measured by two electrodes in the measuring tube)
Measuring range	Measuring range of electronics within v = 0...12.5 m/s The full scale value for the current output can be selected within the following limits: – Minimum full scale value at v = 0.3 m/s – Maximum full scale value at v = 10 m/s
Operable flow range	Over 1000 : 1 When the flow is pulsating, the amplifier is not overloaded above its set full scale value even with peak velocities of 12.5 m/s. Flow is measured between 0.01...>10 m/s at the stated accuracy.
Auxiliary input	The auxiliary input is only available with a “RS 485” communications module. U = 3...30 V DC, R_i = 1.8 kΩ, galvanically isolated Configurable for: Positive zero return, totalizer reset, starting a batch cycle or dual range mode.

Output variables	
Output signal	• *Current output:* active, 0/4...20 mA, galvanically isolated, R_L < 700 Ω (with HART: R_L ≥ 250 Ω), time constant selectable (0.01...100 s), full scale value freely selectable, temperature coefficient: typical 0.005 % o.r./°C; resolution: 10 µA • *Pulse / frequency output:* active/passive selectable, galvanically isolated active: 24 V DC, 25 mA (max. 250 mA during 20 ms), R_L > 100 Ω passive: Open Collector, 30 V DC, 250 mA Frequency output: Full scale frequency 2...10000 Hz, pulse/pause ratio 1:1, pulse width max. 2 s Pulse output: Pulse value and pulse polarity selectable Pulse width adjustable (0.05...2 s) Above a frequency of 1 / (2 x pulse width) the pulse/pause ratio is 1:1 • *Alarm output (Relay 1):* Either NC or NO via a jumper available (factory setting: NO contact) max. 60 V AC / 30 V DC; max. 0.5 A AC / 0.1 A DC, galvanically isolated. Configurable for: error message (failure), empty pipe detection (EPD), failure + EPD, full scale switching, batch precontact, direction of flow, limit value 1 and overflow (v > 12.5 m/s) • *Status output (Relay 2):* Either NC or NO via a jumper available (factory setting: NC contact) max. 60 V AC / 30 V DC; max. 0.5 A AC / 0.1 A DC, galvanically isolated. Configurable for: empty pipe detection (EPD), full scale switching, batch contact, direction of flow, limit value 2 and overflow (v > 12.5 m/s)
Signal on alarm	• Current output → failsafe mode selectable (see page 51) • Pulse/frequency output → failsafe mode selectable (see page 57) • Relay 1 output → de-energised on “FAILURE” or power failure • Relay 2 output → de-energised on power failure Error response of outputs (detailed description) → see page 85
Load	R_L < 700 Ω (current output)
Creep suppression	• Switching points selectable (see page 72) • Max. creepage depends on the nominal diameter at v = 1 m/s • Hysteresis: 50% of set creepage
Accuracy	
Reference conditions	According to DIN 19200 and VDI/VDE 2641: Fluid temperature +28 °C ± 2 K Ambient temperature +22 °C ± 2 K Warm up period 30 minutes Mounting – Inlet section > 10 x DN – Outlet section > 5 x DN – Transmitter and sensor are grounded. – The sensor is built-in centered into the piping.

Accuracy (continued)	
Measured error	Pulse output: ± 0.5% o.r. ± 0.01% o.f.s. (full scale value = 10 m/s) Current output: additionally ± 5 µA (typical) o.r. = of reading o.f.s. = of max. full scale value  *Option:* Promag 33 A and F: ± 0.2% o.r. ± 0.005% of Q_k Q_k = desired reference flow quantity for calibration (v = 2...10 m/s). Q_k has to be noted for ordering. Deviations in power supply voltage have no influence on the specified ranges.
Repeatability	± 0.1% o.r. ± 0.005% o.f.s. o.r. = of reading o.f.s. = of max. full scale value
Operating conditions	
Installation conditions	
Installation instructions	Orientation: vertical or horizontal Restrictions and other recommendations → see page 10 ff.
Inlet and outlet sections	Inlet section: ≥ 5 x DN Outlet section: ≥ 2 x DN
Connection cable length (remote version)	*FS version:* 0... 10 m → min. conductivity ≥ 5 µS/cm (for liquids in general) 0... 10 m → min. conductivity ≥ 20 µS/cm (for demineralised water) 10...200 m → min. conductivity = f (L_{max}) *FL version:* 0...200 m → min. conductivity ≥ 5 µS/cm (for liquids in general) 0...200 m → min. conductivity ≥ 20 µS/cm (for demineralised water) *Instrument equipped with empty pipe detection (EPD):* max. cable length = 10 m 

Operating conditions (continued)

Ambient conditions

Ambient temperature	–25...+60 °C (Transmitter and sensor) • An all-weather cover should be used to protect the housing from direct sunlight when mounting in the open. This is especially important in warmer climates and with high ambient temperatures. • Due to the danger of the transmitter electronics overheating, the transmitter and sensor are to be mounted separately with high ambient and fluid temperatures (see Figure). 
Storage temperature	–10...+50 °C (preferably at +20 °C)
CIP cleanable	Promag A, H, F → Yes (observe maximum temperature)
SIP cleanable	Promag A No Promag H Yes (observe maximum temperature) Promag F No
Degree of protection (EN 60529)	IP 67 (NEMA 4X) Option: IP 68 (NEMA 6P) for sensor A and F
Shock and vibration resistance	Accelleration up to 2 g / 2 h per day; 10...100 Hz
Electromagnetic compatibility (EMC)	According to EN 50081 Part 1 and 2 (interference emission) / EN 50082 Part 1 and 2 (interference immunity) as well as to NAMUR recommendations

Process conditions

Fluid temperature	The fluid temperature range depends on the sensor lining: *Promag A* –20...+130 °C PFA *Promag H* –20...+130 °C PFA with EPDM gasket –20...+150 °C PFA with Silicone gasket *Promag F* –40...+130 °C PTFE (Teflon), DN 15...600 –20...+120 °C Soft rubber (EPDM), DN 25...2000 0...+ 80 °C Hard rubber, DN 65...2000 (see also Figure *"Ambient temperature"*)

(continued on next page)

Operating conditions (continued)	
Process conditions	
Nominal pressure	*Promag A* PN 16 for Tri-Clamp and PVC couplings PN 40 for all other connections *Promag H* PN 16 *Promag F* DIN PN 6 (DN 1200...2000) PN 10 (DN 200...1000) PN 16 (DN 65...150) PN 40 (DN 15...50) PN 10 (DN 1200...2000, optional) PN 16/25 (DN 200...1000, optional) PN 40 (DN 65...150, optional) ANSI Class 150 ($^1/_2$...24") Class 300 ($^1/_2$...6", optional) AWWA Class D (28...48") JIS 10K (DN 50...300) 20K (DN 15...40) 20K (DN 50...300, optional) The material load curves (p-T-load diagrams) for all process connections can be found in the Technical Information TI 027D/06/en "Promag 33"
Conductivity	Minimum conductivity: ≥ 5 µS/cm (for liquids in general) ≥ 20 µS/cm (for demineralised water) With the remote "FS" version the conductivity required also depends on the length of the cable → see page 109 *"Connection cable length"*
Pressure loss	• No pressure loss if sensor and piping have the same nominal diameter. • Pressure loss specifications when using adapters e.g. reducers or expanders → see page 14. • Vacuum resistance of measuring tube lining → see page 115
Mechanical construction	
Design / Dimensions	Dimensions → see pages 99–105 Internal diameter of measuring tube → see page 114
Weight	See pages 99–105
Materials	*Transmitter housing:* Powder-coated die-cast aluminium *Sensor housing:* Promag A 1.4435 incl. threaded stub Promag H 1.4301 Promag F DN 15...300: Powder-coated die-cast aluminium DN 350...2000: Coated steel (continued on next page)

Mechanical construction (continued)	
Materials (continued)	*Process connections*: Promag A DIN → Stainless steel 1.4404, PVDF ANSI → 316L, PVDF JIS → 316L, PVDF Threaded stub: 1.4435, PVC Promag H 1.4404 / 316L Promag F DIN → Stainless steel 1.4571, St. 37-2 ANSI → A 105, 316L AWWA → A 105, A 36 JIS → S20C, SUS 316L *Electrodes:* Promag A 1.4435; Platinum/Rhodium 80/20; Titanium; Hastelloy C-22; Tantalum Promag H 1.4435 Promag F 1.4435; Platinum/Rhodium 80/20; Hastelloy C-22; Tantalum *Gasket material:* Promag A Viton, Kalrez (optional), Silicone (aseptic version) Promag H EPDM, Silicone Promag F no gaskets (Lining = 'gasket')
Electrodes fitted	Promag A Measuring, reference and empty pipe detection electrodes. As standard with: 1.4435, Hastelloy C-22, Tantalum Optional with: Platinum/Rhodium Promag H Measuring and empty pipe detection electrodes Promag F Measuring, reference and empty pipe detection electrodes. As standard with: 1.4435, Hastelloy C-22, Tantalum
Process connections	*Promag A:* Internal and external thread, PVC adhesive coupling, hose connection, welded nipple, aseptic welded nipples for pipelines according to DIN 11850, Tri-Clamp, flange connection (DIN, ANSI, JIS). *Promag H:* Welded nipples for OD tube, SMS, JIS, ISO and DIN 11850 tubes, DIN 11851 thread, SMS thread, ISO 2853 thread, Tri-Clamp, ISO 2852 connection. *Promag F:* Flange connection (DIN, ANSI, JIS)
Electrical connection	• Wiring diagrams: see page 23 ff. • Cable specifications: see page 27 • Galvanic isolation: All circuits for inputs, outputs, power supply and sensors are galvanically isolated from one another.
Cable entries	*Power supply and signal cable (outputs):* Cable glands PG 13.5 (5...15 mm) or threads for cable glands $^1/_2$" NPT, M20 x 1.5 (8...15 mm), G $^1/_2$" *Coil current cable and signal cable (remote version)* Promag A: Cable glands PG 11 (5...12 mm) or threads for cable glands $^1/_2$" NPT, M20 x 1.5 (8...15 mm), G $^1/_2$" Promag H: Cable glands PG 13.5 (5...15 mm) or threads for cable glands $^1/_2$" NPT, M20 x 1.5 (8...15 mm), G $^1/_2$" Promag F: Cable glands PG 13.5 (5...15 mm) or threads for cable glands $^1/_2$" NPT, M20 x 1.5 (8...15 mm), G $^1/_2$"

User interface	
Operation	• On-site operation with three optical keypads (E, –, +) • Operation via HART protocol or RS 485 interface • E+H operating matrix for all instrument functions
Display	• LC display: illuminated, double-spaced with 16 characters each • Damping of flow display can be adjusted: 0...99 s
Communication	• Rackbus RS 485 interface (Rackbus protocol) • SMART protocol (HART protocol via current output) • PROFIBUS-PA / PROFIBUS-DP
Power supply	
Supply voltage / Frequency	85...260 V AC, 45...65 Hz 20... 55 V AC, 45...65 Hz 16... 62 V DC
Power consumption	AC: <15 VA (incl. sensor) DC: <15 W (incl. sensor) Current at make (Promag 33 X / 24 V DC): – max. 13.5 A (< 100 µs) – max. 6 A (< 5 ms)
Power supply failure	Bridges minimum 1 power cycle (22 ms) • EEPROM saves measuring system data on power failure (no batteries required). • DAT = replaceable data memory in which basic data of the sensor are stored: nominal diameter, SAPS (actual values), serial number, calibration factor, zero point, status EPD (yes/no), EPD calibration values.
Certificates and approvals	
Ex approvals	Information on Ex versions (e.g. ATEX/CENELEC, FM, CSA) can be supplied by your E+H sales center on request. All explosion protection data are given in separate documentation available on request.
Sanitary version	– Sensor Promag A: 3A approval – Sensor Promag H (hygienic version): 3A approval and EHEDG tested
CE mark	By attaching the CE mark, Endress+Hauser confirms that the Promag 33 measurement system has been successfully tested and fulfils all legal requirements of the relevant CE directives.
Order information	
Accessories	• Post mounting set for transmitter (remote version): Order No. 50076905 • Wall mounting kit for Promag A sensor: Order No. 50064550 • Spare parts: see page 97
Supplementary documentation	System Information Promag (SI 010D/06/en) Technical Information Promag 33 (TI 027D/06/en) Supplementary Ex documentation: ATEX/CENELEC, FM, CSA
Other standards and guidelines	
EN 60529	Degree of protection by housing (IP code)
EN 61010	Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures
EN 50081	Part 1 and 2 (interference emission)
EN 50082	Part 1 and 2 (interference immunity)
NAMUR	Association of Standards for Control and Regulation in the Chemical Industry

Internal diameter of the measuring tube

Sensor	DN		PN			AWWA	Internal diameter		
	[mm]	[inch]	DIN [bar]	ANSI [lbs]	JIS		PFA	PTFE (Teflon)	Hard rubber Soft rubber (EPDM)
Promag A	2	1/12"		-	-	-	2.2	-	-
	4	5/32"		-	-	-	4.6	-	-
	8	5/16"	40	-	-	-	8.6	-	-
	15	1/2"		-	-	-	16.1	-	-
	25	1"		-	-	-	22.0	-	-
Promag H	25 DIN	-		-	-	-	*	-	-
	25	1"		-	-	-	*	-	-
	40	1 1/2"		-	-	-	*	-	-
	50	2"	16	-	-	-	*	-	-
	65	2 1/2"		-	-	-	*	-	-
	80	3"		-	-	-	*	-	-
	100	4"		-	-	-	*	-	-
							* For details see page 103		
Promag F	15	1/2"	40	Class 150	20K		-	15	-
	25	1"	40	Class 150	20K		-	26	-
	32	-	40	Class 150	20K		-	35	-
	40	1 1/2"	40	Class 150	20K		-	41	-
	50	2"	40	Class 150	10K		-	52	-
	65	-	16	Class 150	10K		-	68	65
	80	3"	16	Class 150	10K		-	80	78
	100	4"	16	Class 150	10K		-	105	100
	125	-	16	Class 150	10K		-	130	126
	150	6"	16	Class 150	10K		-	156	154
	200	8"	10	Class 150	10K		-	207	205
	250	10"	10	Class 150	10K		-	259	259
	300	12"	10	Class 150	10K		-	309	310
	350	14"	10	Class 150			-	337	341
	400	16"	10	Class 150			-	387	391
	-	18"	-	Class 150			-	-	436
	500	20"	10	Class 150			-	487	491
	600	24"	10	Class 150			-	593	593
	700	28"	10			Class D	-	-	692
	-	30"	-			Class D	-	-	741
	800	32"	10			Class D	-	-	794
	900	36"	10			Class D	-	-	893
	1000	40"	10			Class D	-	-	995
	-	42"	-			Class D	-	-	1042
	1200	48"	6			Class D	-	-	1195
	-	54"	-			Class D	-	-	1338
	1400	-	6			-	-	-	1401
	-	60"	-			Class D	-	-	1491
	1600	-	6			-	-	-	1599
	-	66"	-			Class D	-	-	1637
	1800	72"	6			Class D	-	-	1799
	-	78"	-			Class D	-	-	1981
	2000	-	6			-	-	-	1995

Resistance of the lining to vacuum (standard version)

Sensor	DN		Measuring tube lining	Limits for vacuum [mbar] at different fluid temperatures					
	[mm]	[inch]		25 °C	80 °C	100 °C	120 °C	130 °C	150 °C
Promag A	2...25	1/12...1"	PFA	0	0	0	0		
Promag H	25...100	1...4"	PFA	0	0	0	0	0	0
Promag F	65...2000 25...2000	3...78" 1...78"	Hard rubber Soft rubber (EPDM)	0 0	0 0	0	0		
	15...50 65...80 100 125...150 200 250 300 350 400	1/2...2" 3" 4" 6" 8" 10" 12" 14" 16"	PTFE (Teflon)	0 0 0 135 200 330 400 470 540	0 * * * * * * * *	0 40 135 240 290 400 500 600 670	* * * * * * * * *	100 130 170 385 410 530 630 730 800	
	450...600	18...24"		Vacuum not permitted!					

* No values available

10 Functions at a Glance

SYSTEM UNITS	
FLOW RATE UNIT (p. 47)	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 Your setting: .....
VOLUME UNIT (p. 47)	dm^3 – ***m^3*** – l – hl – gal – bbl – 10^3 gal – ft^3 Your setting: .....
GALLONS / BARREL (p. 48)	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 Your setting: .....
NOM. DIAM. UNIT (p. 48)	***mm*** – inch Your setting: .....
CURRENT OUTPUT	
FULL SCALE 1 (p. 49)	5-digit floating point (e.g. 250.00 m^3/h) Factory setting: ***dependent*** on diameter Your setting: .....
DUAL RANGE MODE (p. 50)	***OFF*** (only full scale value 1 active) ON (full scale value 1 or 2 active) Your setting: .....
FULL SCALE 2 (p. 51)	5-digit floating point (e.g. 3600.0 m^3/h) Factory setting: ***dependent*** on diameter Your setting: .....
ACTIVE RANGE (p. 51)	Display: ***FULL SCALE 1*** or FULL SCALE 2
TIME CONSTANT (p. 51)	Floating point: 0.01...100 s Factory setting: ***1.0 s*** Your setting: .....
CURRENT SPAN (p. 51)	0–20 mA ***4–20 mA*** 0–20 mA (25 mA) 4–20 mA (25 mA) Your setting: .....

CURRENT OUTPUT (continued)	
FAILSAFE MODE (p. 51)	***MIN. CURRENT*** Signal is set to the following value: → 0 mA (with 0–20 mA) → 2 mA (with 4–20 mA) MAX. CURRENT Signal is set to the following value: → 22 mA (with 4–20 mA) → 25 mA (with 0/4–20 mA [25 mA]) HOLD VALUE Last valid measured value is held. ACTUAL VALUE Normal measured value output despite fault. Your setting: .....
SIMULATION CURR. (p. 52)	*With "0–20 mA":* ***OFF*** – 0 mA – 10 mA – 20 mA – 22 mA *With "0–20 mA (25 mA)":* ***OFF*** – 0 mA – 10 mA – 20 mA – 25 mA *With "4–20 mA":* ***OFF*** – 2 mA – 4 mA – 12 mA – 20 mA – 22 mA *With "4–20 mA (25 mA)":* ***OFF*** – 2 mA – 4 mA – 12 mA – 20 mA – 25 mA Your setting: .....
NOMINAL CURRENT (p. 52)	Displayed value: 0.00...25.00 mA
PULSE / FREQ. OUTPUT	
OPERATION MODE (p. 53)	***PULSE*** – FREQUENCY Your setting: .....
PULSE VALUE (p. 53)	5-digit floating point (e.g. 240.00 m^3/p) Factory setting: ***dependent*** on diameter Your setting: .....
PULSE WIDTH (p. 53)	3-digit fixed point: 0.05...2.00 s Factory setting: ***2.00 s*** Your setting: .....
FULL SCALE FREQ. (p. 54)	max. 5-digit number: 2...10000 Hz Factory setting: ***10000 Hz*** Your setting: .....
FULL SCALE FLOW (p. 55)	5-digit floating point: e.g. 7.2500 m^3/h Your setting: .....

PULSE / FREQ. OUTPUT (continued)	
OUTPUT SIGNAL (p. 56)	***PASSIVE / POSITIVE*** (open collector / active-high) PASSIVE / NEGATIVE (open collector / active-low) AKTIVE / POSITIVE (push-pull / active-high) AKTIVE / NEGATIVE (push-pull / active-low) Your setting: .....
FAILSAFE MODE (p. 57)	***FALLBACK VALUE*** (corresponding to zero flow) LAST VALUE (last valid measured value is held) ACTUAL VALUE (normal measured output despite fault) Your setting: .....
SIMULATION FREQ. (p. 57)	***OFF*** – 0 Hz (fallback value) – 2 Hz – 10 Hz – 1 kHz – 10 kHz Your setting: .....
NOMINAL FREQ. (p. 57)	Displayed value: 0.00...16383 Hz
RELAYS	
RELAY 1 FUNCTION (p. 58)	***FAILURE*** EPD ERROR + EPD DUAL RANGE MODE BATCH PRECONTACT FLOW DIRECTION LIMIT FLOWRATE 1 Your setting: .....
RELAY 1 ON-VALUE (p. 59)	5-digit floating point: e.g. 1.0000 dm^3/min Your setting: .....
RELAY 1 OFF-VALUE (p. 59)	5-digit floating point: e.g. 10.000 dm^3/min Your setting: .....
RELAY 2 FUNCTION (p. 62)	EPD DUAL RANGE MODE BATCH CONTACT FLOW DIRECTION ***LIMIT FLOWRATE 2*** Your setting: .....

RELAYS (continued)	
RELAY 2 ON-VALUE (p. 62)	5-digit floating point: e.g. 1.000 dm^3/min Your setting: .....
RELAY 2 OFF-VALUE (p. 62)	5-digit floating point: e.g. 10.000 dm^3/min Your setting: .....
BATCHING	
BATCH VARIABLE (p. 64)	***OFF*** – VOLUME Your setting: .....
BATCH QUANTITY (p. 64)	5-digit floating point: e.g. 240.00 l Factory setting: ***0.0000*** [unit] Your setting: .....
BATCH PREWARN (p. 64)	5-digit floating point: e.g. 200.00 l Factory setting: ***0.0000*** [unit] Your setting: .....
COMPENS. QUANTITY (p. 65)	5-digit floating point: e.g. –10.00 l Factory setting: ***0.0000*** [unit] Your setting: .....
BATCHING (p. 65)	START – STOP – ***CANCEL*** (E activates START or STOP)
MAX. BATCH TIME (p. 65)	max. 5-digit number: 0...30000 s Factory setting: ***0 s*** Your setting: .....
BATCH CYCLE (p. 65)	Display: max. 7-digit number (0...9999999) Factory setting: ***0***
RESET BATCH CYCLE (p. 65)	***NO*** – YES
DISPLAY	
TOTAL VOLUME (p. 66)	Display: max. 7-digit floating point 0,0000...9999999 [unit] Factory setting: ***0.0000*** [unit]
TOTAL OVERFLOW (p. 66)	Display: e.g. 74 e7 dm^3 = 74,000,000 dm^3 Factory setting: ***0***
RESET TOTALIZER (p. 67)	***NO*** – YES
FLOW RATE (p. 67)	Display: max. 5-digit number –99999...+99999 [unit]

DISPLAY (continued)	
ASSIGN LINE 1 (p. 67)	***FLOW RATE*** – TOTAL VOLUME – BATCH QUANTITY – BATCH UPWARDS – BATCH DOWNWARDS – BATCH CYCLE Your setting: .....
ASSIGN LINE 2 (p. 67)	OFF FLOW RATE ***TOTAL VOLUME*** TOTAL OVERFLOW BATCH QUANTITY BATCH UPWARDS BATCH DOWNWARDS BATCH CYCLE Your setting: .....
DISPLAY DAMPING (p. 68)	max. 2-digit number: 0...99 s Factory setting: ***1 s*** Your setting: .....
DISPLAY FORMAT (p. 68)	***x.xxxx*** 5 significant digits x.xxx 4 significant digits x.xx 3 significant digits Your setting: .....
LCD CONTRAST (p. 68)	**IIIIIIIIIII** ..... A change in contrast is immediately seen on the bar graph
LANGUAGE (p. 68)	ENGLISH – DEUTSCH – FRANCAIS – ESPANOL – ITALIANO – NEDERLANDS – DANSK – NORSK – SVENSKA – SUOMI – BAHASA INDONESIA – JAPANESE (in original alphabet) Your setting: .....
COMMUNICATION	
PROTOCOL (p. 69)	With “HART” communication module: ***OFF*** – HART With “RS 485” communication module: ***OFF*** – RACKBUS RS 485 Communication module: ..... Your setting: .....
BUS ADDRESS (p. 69)	max. 2-digit number: ***0***...15 (HART); ***0***...63 (RS 485) Your setting: .....
ASSIGN AUX. INPUT (S. 69)	*For “Pulsed mode”:* RESET TOTALIZER BATCHING *For “Level mode”:* DUAL RANGE MODE ***POS. ZERO RETURN*** Your setting: .....

COMMUNICATION (continued)	
START PULSE WIDTH (S. 71)	max. 3-digit number: ***20***...100 ms Your setting: .....
SYSTEM CONFIG. (p. 71)	Display (only with “RS 485” communication module) RS 485 / CURRENT RS 485 / FREQUENCY AUX. INPUT / CURRENT AUX. INPUT / FREQ.
PROCESSING PARAMETERS	
LOW FLOW CUTOFF (p. 72)	5-digit floating point: e.g. 15.000 dm^3/min Factory setting: ***dependent*** on diameter Your setting: .....
NOISE SUPPRESS. (p. 72)	OFF – LOW – ***MEDIUM*** – HIGH Your setting: .....
EMPTY PIPE DET. (p. 73)	Two functions: – Switching on/off “Empty pipe detection” – Start empty or full pipe adjustment ***OFF*** – ON – EMPTY PIPE ADJ. – FULL PIPE ADJUST Your setting: .....
EPD RESPONSE TIME (p. 74)	***1 s*** – 2 s – 5 s – 10 s – 30 s – 60 s Your setting: .....
MEASURING MODE (p. 75)	UNIDIRECTIONAL – ***BIDIRECTIONAL*** Your setting: .....
FLOW DIRECTION (p. 75)	***FORWARD*** [1] – REVERSE [2] [1] Positive flow according to the arrow on the nameplate [2] Positive flow in the opposite direction to the arrow on the nameplate Your setting: .....
FUNCTION ECC (p. 75)	***ON*** – OFF Your setting: .....
RECOVERY TIME ECC (p. 76)	max. 3-digit number: 1...255 s Factory setting: ***5 s*** Your setting: .....
AMPLIFIER MODE (p. 76)	***NORMAL*** (automatic 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) Your setting: .....
DELAY (p. 76)	max. 4-digit number: 10...1000 Factory setting: ***10*** Your setting: .....

SYSTEM PARAMETERS	
POS. ZERO RETURN (p. 77)	***OFF*** – ON
DEF. PRIVATE CODE (p. 77)	max. 4-digit number: 0...9999 Factory setting: ***33*** Your setting: .....
ACCESS CODE (p. 78)	max. 4-digit number: 0...9999 Factory setting: ***0***
SELF CHECKING (p. 78)	OFF – ***ON*** Your setting: .....
PRESENT SYSTEM CONDITION (p. 79)	Display (entries chronological): F: ... = Error message (system error) A: ... = Alarm message (process error) S: ... = Status message ***S: SYSTEM WORKS NORMALLY***
PREVIOUS SYSTEM CONDITIONS (p. 79)	Display (chronological, max. 10 entries): F: ... = Error message (system error) A: ... = Alarm message (process error) S: ... = Status message ***S: NO ENTRY EXISTING***
SOFTWARE VERSION (p. 80)	Display: e.g. PRO 33 V3.01.00
SOFTWARE VER. COM (p. 80)	Display: e.g. V3.02.00 HART; V3.02.00 RS 485
SENSOR DATA	
Normally these characteristic sensor data may not be altered. A change to the sensor data affects a number of functions of the whole measuring system, especially its accuracy! The following functions of this group can therefore only be changed after entering a ***service code*** and cannot be altered using the personal code. Please contact your E+H Service organisation for more information.	
K-FACTOR POS. (p. 81)	max. 5-digit fixed point: 0.5000...2.0000 Factory setting: ***dependent*** on the sensor (DN) and its calibration Setting: .....
K-FACTOR NEG. (p. 81)	max. 5-digit fixed point: 0.5000...2.0000 Factory setting: ***dependent*** on the sensor (DN) and its calibration Setting: .....

SENSOR DATA (continued)	
ZERO POINT (p. 81)	max. 4-digit number: –1000...+1000 Factory setting: ***dependent*** on the sensor (DN) and its calibration Setting: .....
NOMINAL DIAMETER (p. 81)	Selected from fixed table: 2...2000 mm or 1/12...78 inch Factory setting: ***dependent*** on the sensor (DN) Setting: .....
MAX. SAMPLING RATE (p. 82)	max. 3-digit fixed point: 1.0...60.0 / s (per second) Factory setting: ***dependent*** on the sensor (DN) Setting: .....
SAMPLING RATE (p. 82)	max. 3-digit fixed point: 1.0...60.0 /s (upper limit as for MAX. SAMPLING RATE) Factory setting: ***dependent*** on the sensor (DN) Setting: .....
SERIAL NUMBER (p. 82)	max. 6-digit number: 1...999999 Setting: .....
EPD ELECTRODE (p. 82)	***YES**** – NO * with EPD electrode as standard Setting: .....
POLARITY ECC (p. 83)	POSITIVE – NEGATIVE Factory setting (Electrode material): Positive → 1.4435, Hastelloy-C, Platinum Negative → Tantalum Setting: .....

11 Index

Europe

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

Belarus
❑ Belorgsintez
Minsk
Tel. (0172) 508473, Fax (0172) 508583

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

Bulgaria
INTERTECH-AUTOMATION
Sofia
Tel. (02) 664869, Fax (02) 9631389

Croatia
❑ Endress+Hauser GmbH+Co.
Zagreb
Tel. (01) 6637785, Fax (01) 6637823

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

Czech Republic
❑ Endress+Hauser GmbH+Co.
Praha
Tel. (026) 6784200, Fax (026) 6784179

Denmark
❑ Endress+Hauser A/S
Søborg
Tel. (70) 131132, Fax (70) 132133

Estonia
ELVI-Aqua
Tartu
Tel. (7) 441638, Fax (7) 441582

Finland
❑ Endress+Hauser Oy
Helsinki
Tel. (0204) 83160, Fax (0204) 83161

France
❑ Endress+Hauser S.A.
Huningue
Tel. (389) 696768, Fax (389) 694802

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

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

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

Hungary
Mile Ipari-Elektro
Budapest
Tel. (01) 4319800, Fax (01) 4319817

Iceland
BIL ehf
Reykjavik
Tel. (05) 619616, Fax (05) 619617

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

Italy
❑ Endress+Hauser S.p.A.
Cernusco s/N Milano
Tel. (02) 921921, Fax (02) 92107153

Latvia
Rino TK
Riga
Tel. (07) 315087, Fax (07) 315084

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

Netherland
❑ Endress+Hauser B.V.
Naarden
Tel. (035) 6958611, Fax (035) 6958825

Norway
❑ Endress+Hauser A/S
Tranby
Tel. (032) 859850, Fax (032) 859851

Poland
❑ Endress+Hauser Polska Sp. z o.o.
Warszawy
Tel. (022) 7201090, Fax (022) 7201085

Portugal
Tecnisis, Lda
Cacém
Tel. (21) 4267290, Fax (21) 4267299

Romania
Romconseng S.R.L.
Bucharest
Tel. (01) 4101634, Fax (01) 4112501

Russia
❑ Endress+Hauser Moscow Office
Moscow
Tel. (095) 1587564, Fax (095) 1589871

Slovakia
Transcom Technik s.r.o.
Bratislava
Tel. (7) 44888684, Fax (7) 44887112

Slovenia
❑ Endress+Hauser D.O.O.
Ljubljana
Tel. (061) 5192217, Fax (061) 5192298

Spain
❑ Endress+Hauser S.A.
Sant Just Desvern
Tel. (93) 4803366, Fax (93) 4733839

Sweden
❑ Endress+Hauser AB
Sollentuna
Tel. (08) 55511600, Fax (08) 55511655

Switzerland
❑ Endress+Hauser AG
Reinach/BL 1
Tel. (061) 7157575, Fax (061) 7111650

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

Ukraine
Photonika GmbH
Kiev
Tel. (44) 26881, Fax (44) 26908

Yugoslavia Rep.
Meris d.o.o.
Beograd
Tel. (11) 4441966, Fax (11) 4441966

Africa

Egypt
Anasia
Heliopolis/Cairo
Tel. (02) 4179007, Fax (02) 4179008

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

South Africa
❑ Endress+Hauser Pty. Ltd.
Sandton
Tel. (011) 4441386, Fax (011) 4441977

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

America

Argentina
❑ Endress+Hauser Argentina S.A.
Buenos Aires
Tel. (01) 145227970, Fax (01) 145227909

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

Brazil
❑ Samson Endress+Hauser Ltda.
Sao Paulo
Tel. (011) 50313455, Fax (011) 50313067

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

Chile
❑ Endress+Hauser Chile Ltd.
Santiago
Tel. (02) 3213009, Fax (02) 3213025

Colombia
Colsein Ltda.
Bogota D.C.
Tel. (01) 2367659, Fax (01) 6104186

Costa Rica
EURO-TEC S.A.
San Jose
Tel. (02) 961542, Fax (02) 961542

Ecuador
Insetec Cia. Ltda.
Quito
Tel. (02) 269148, Fax (02) 461833

Guatemala
ACISA Automatizacion Y Control Industrial S.A.
Ciudad de Guatemala, C.A.
Tel. (03) 345985, Fax (03) 327431

Mexico
❑ Endress+Hauser S.A. de C.V.
Mexico City
Tel. (5) 5682405, Fax (5) 5687459

Paraguay
Incoel S.R.L.
Asuncion
Tel. (021) 213989, Fax (021) 226583

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

USA
❑ Endress+Hauser Inc.
Greenwood, Indiana
Tel. (317) 535-7138, Fax (317) 535-8498

Venezuela
Controval C.A.
Caracas
Tel. (02) 9440966, Fax (02) 9444554

Asia

China
❑ Endress+Hauser Shanghai Instrumentation Co. Ltd.
Shanghai
Tel. (021) 54902300, Fax (021) 54902303

❑ Endress+Hauser Beijing Office
Beijing
Tel. (010) 68344058, Fax (010) 68344068

Hong Kong
❑ Endress+Hauser HK Ltd.
Hong Kong
Tel. 25283120, Fax 28654171

India
❑ Endress+Hauser (India) Pvt Ltd.
Mumbai
Tel. (022) 8521458, Fax (022) 8521927

Indonesia
PT Grama Bazita
Jakarta
Tel. (21) 7975083, Fax (21) 7975089

Japan
❑ Sakura Endress Co. Ltd.
Tokyo
Tel. (0422) 540613, Fax (0422) 550275

Malaysia
❑ Endress+Hauser (M) Sdn. Bhd.
Petaling Jaya, Selangor Darul Ehsan
Tel. (03) 7334848, Fax (03) 7338800

Pakistan
Speedy Automation
Karachi
Tel. (021) 7722953, Fax (021) 7736884

Papua-Neuguinea
SBS Electrical Pty Limited
Port Moresby
Tel. 3251188, Fax 3259556

Philippines
❑ Endress+Hauser Philippines Inc.
Metro Manila
Tel. (2) 3723601-05, Fax (2) 4121944

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

South Korea
❑ Endress+Hauser (Korea) Co., Ltd.
Seoul
Tel. (02) 6587200, Fax (02) 6592838

Taiwan
Kingjarl Corporation
Taipei R.O.C.
Tel. (02) 27183938, Fax (02) 27134190

Thailand
❑ Endress+Hauser Ltd.
Bangkok
Tel. (2) 9967811-20, Fax (2) 9967810

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

Iran
PATSA Co.
Tehran
Tel. (021) 8754748, Fax (021) 8747761

Israel
Instrumetrics Industrial Control Ltd.
Netanya
Tel. (09) 8357090, Fax (09) 8350619

Jordan
A.P. Parpas Engineering S.A.
Amman
Tel. (06) 4643246, Fax (06) 4645707

Kingdom of Saudi Arabia
Anasia Ind. Agencies
Jeddah
Tel. (02) 6710014, Fax (02) 6725929

Lebanon
Network Engineering
Jbeil
Tel. (3) 944080, Fax (9) 548038

Sultanate of Oman
Mustafa Sultan Science & Industry Co. LLC.
Ruwi
Tel. 602009, Fax 607066

United Arab Emirates
Descon Trading EST.
Dubai
Tel. (04) 2653651, Fax (04) 2653264

Yemen
Yemen Company for Ghee and Soap Industry
Taiz
Tel. (04) 230664, Fax (04) 212338

Australia + New Zealand

Australia
ALSTOM Australia Limited
Milperra
Tel. (02) 97747444, Fax (02) 97744667

New Zealand
EMC Industrial Group Limited
Auckland
Tel. (09) 4155110, Fax (09) 4155115

All other countries

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