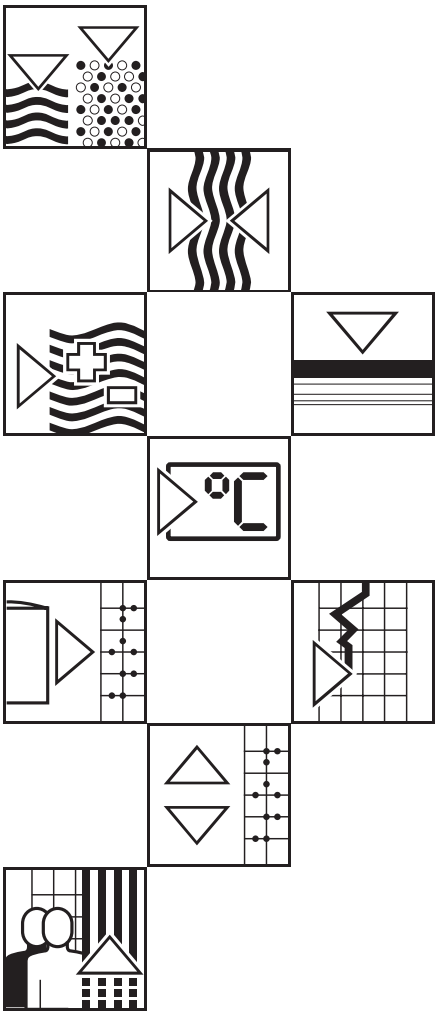
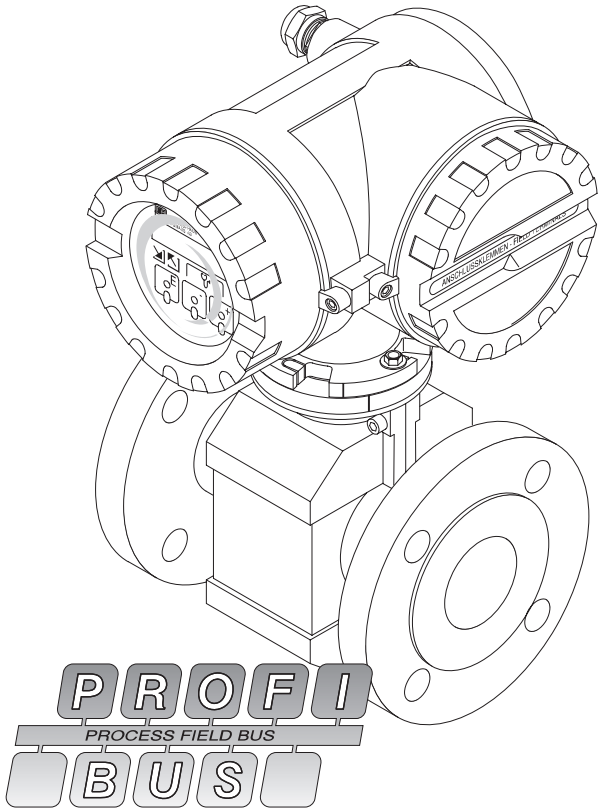
BA 029D/06/en/03.00
No. 50085721
CV 5.0

Valid as of software version
V 3.01.XX (amplifier)
V 2.06.XX (communication)

promag 33 (PROFIBUS-DP/-PA) 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

↓

Communication

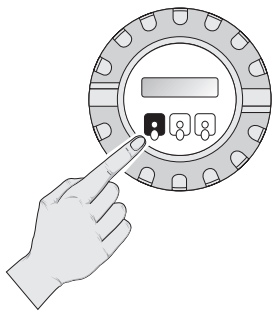
- PROFIBUS-DP interface → see page 31
- PROFIBUS-PA interface → see page 32
- Setting the device address → see page 33
- Cyclic data exchange → see page 36
- Acyclic data exchange → see page 40
- Slot / Index list → see page 44
- Commuwin II operating matrix → see page 50

↓

Commissioning → see page 34

↓

Operation → see page 55 ff.



ba029y83

↓

continued: next column

Display configuration

- Language → see page 67
- Contrast → see page 66
- Assign line 1 → see page 66
- Assign line 2 → see page 66
- Number of decimal digits → see page 66

↓

Engineering units → see page 62

↓

Configuration of outputs

Current output (only with PROFIBUS-PA)

- Full scale values → see page 63
- Current span → see page 63

↓

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 109
- Index → see page 115
- Operating matrix -DP/-PA → see page 57 ff.

↓

For optimum measuring results

- Creep suppression → see page 69
- Empty Pipe Detection / EPD → see page 70

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

PROFIBUS ®
Registered trademarks of the PROFIBUS Trade Organization PTO, Karlsruhe, Germany

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, CSA 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.

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.

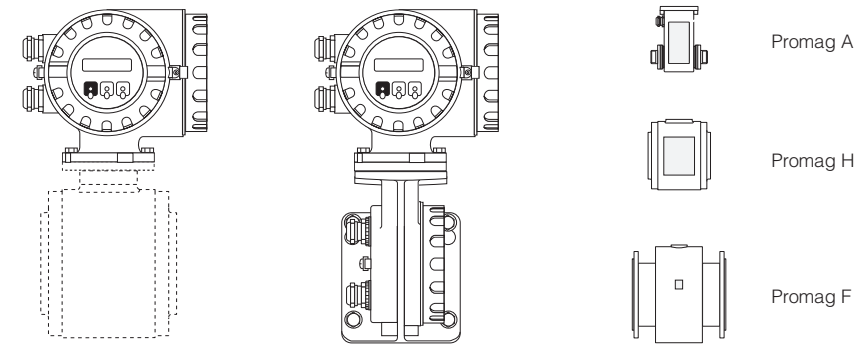
1.5 Technical improvements

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:

Promag 33 transmitter



Compact version (example for Promag H) | Remote version | Sensors (see next page)

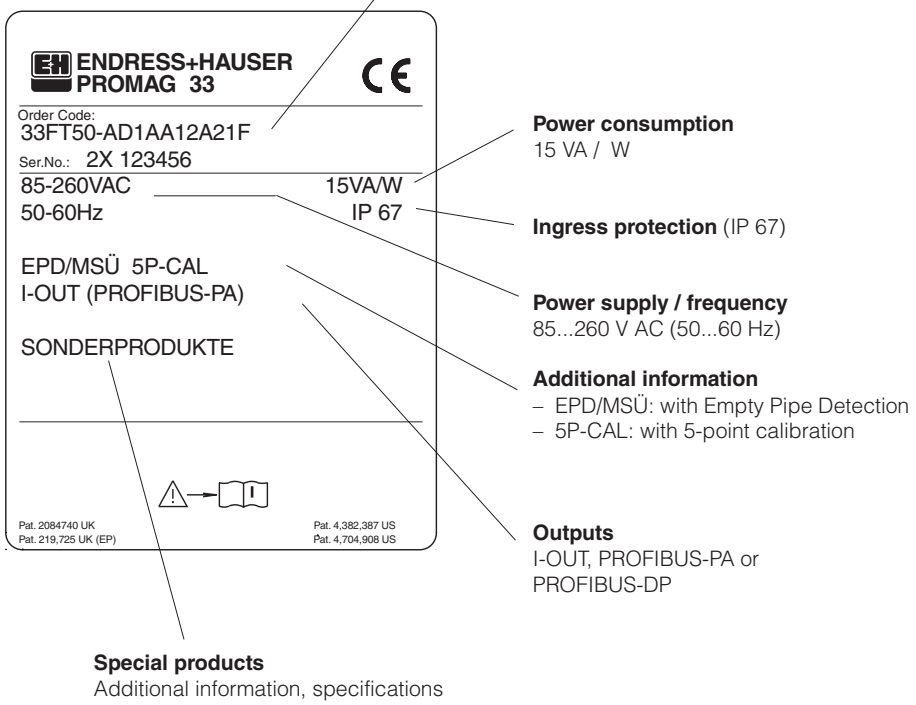
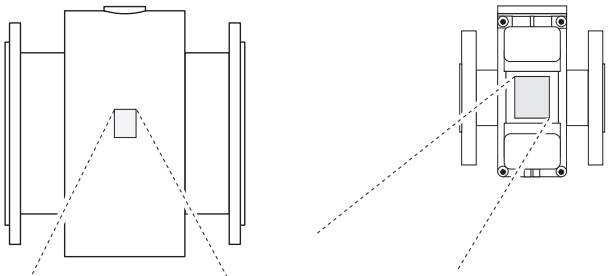
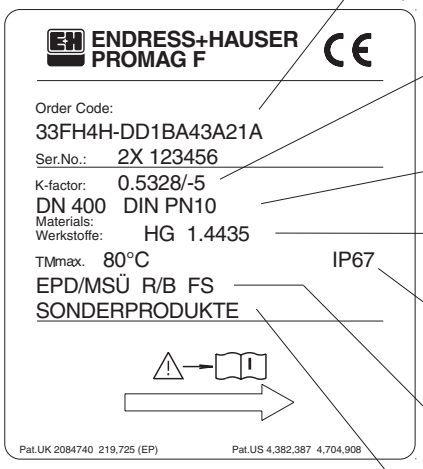


Fig. 1
Promag 33 transmitter
Typical nameplate specifications (example)

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)

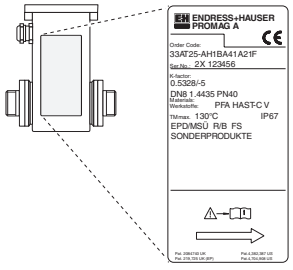
Materials
- Lining: hard rubber (HG)
- Measuring electrodes: stainless steel 1.4435

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

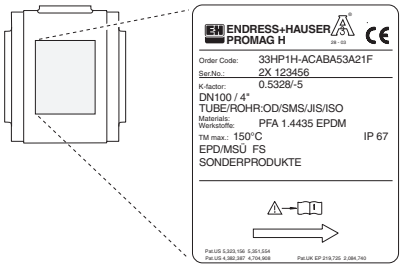
Additional information
- EPD/MSÜ: with Empty Pipe Detection
- R/B: with reference electrode
- FS: remote version (see page 20)

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.

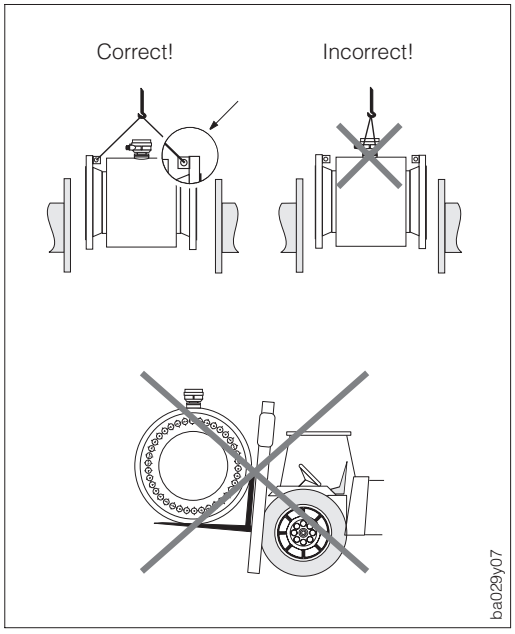
Warning!

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.

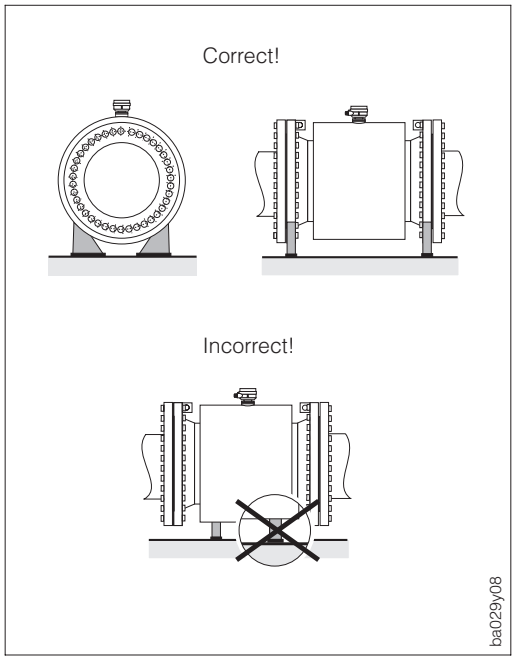


Caution!

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.



Caution!

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

3.2 Mounting location

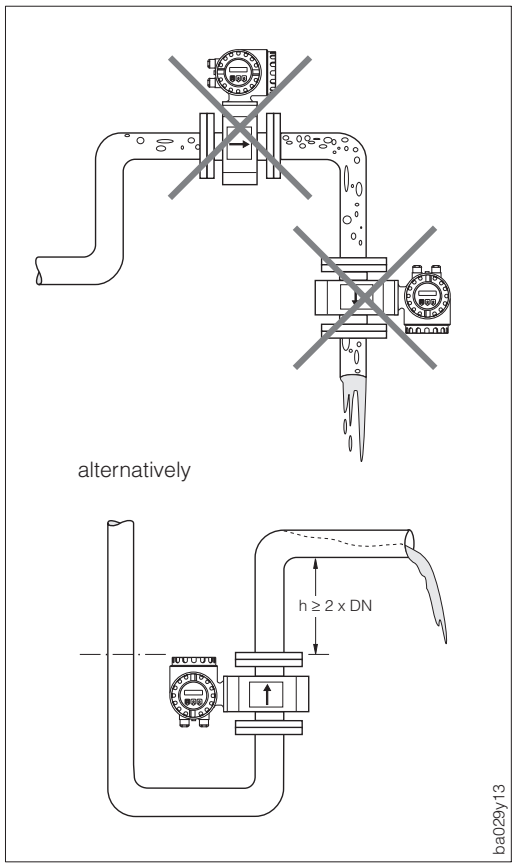
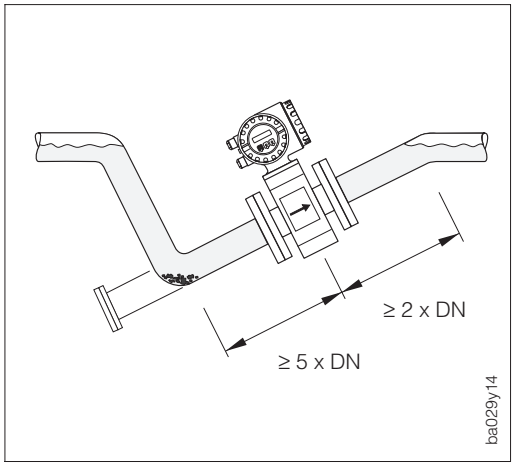


Fig. 5
Mounting location

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 70).

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

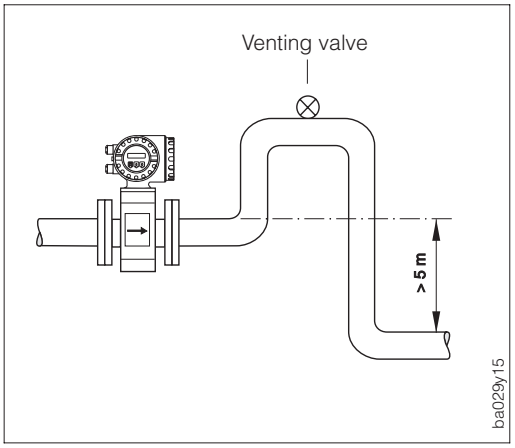


Fig. 7
Installation downward pipe

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 107.

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

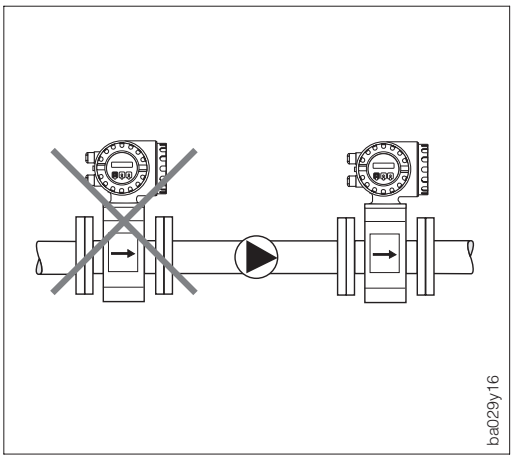
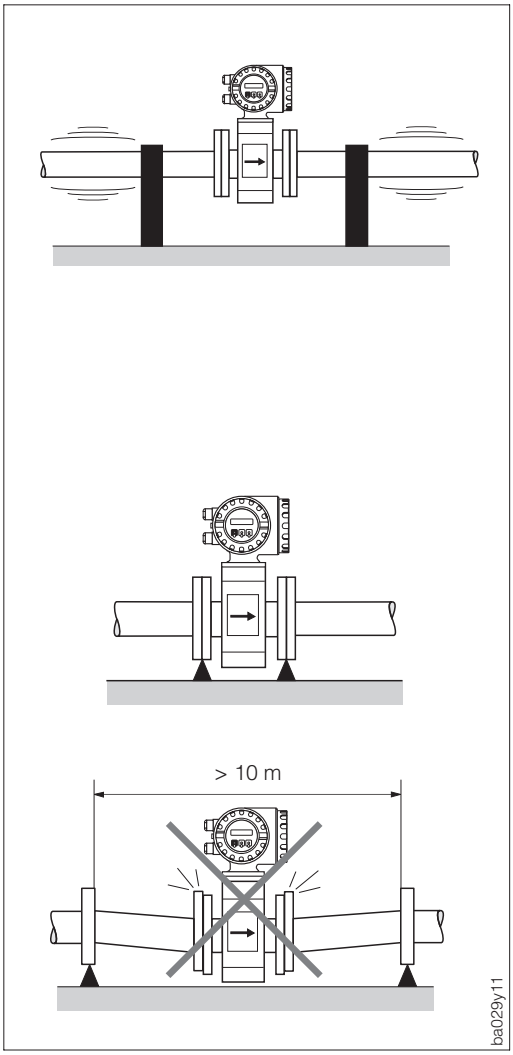


Fig. 8
Installation of pumps

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 102.

Caution!
Excessive vibration necessitates separate mounting of the sensor and transmitter (see pages 20, 102).

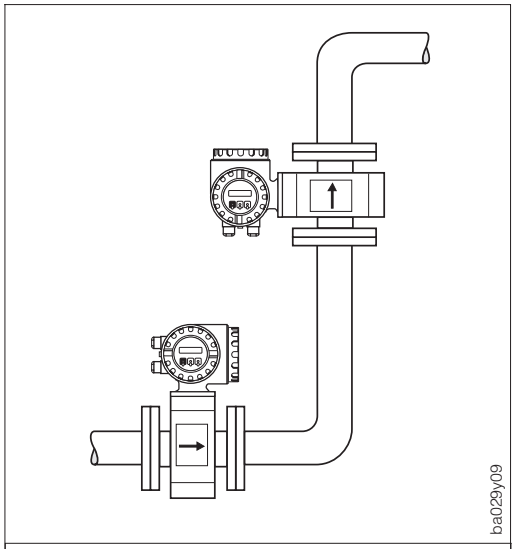
Mechanical support of the sensor is recommended for free runs of piping over 10 m long.



Caution!

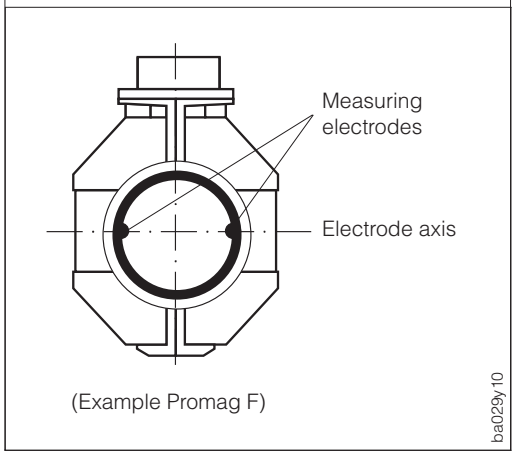
Fig. 9
Ways to avoid vibrations

3.3 Mounting position



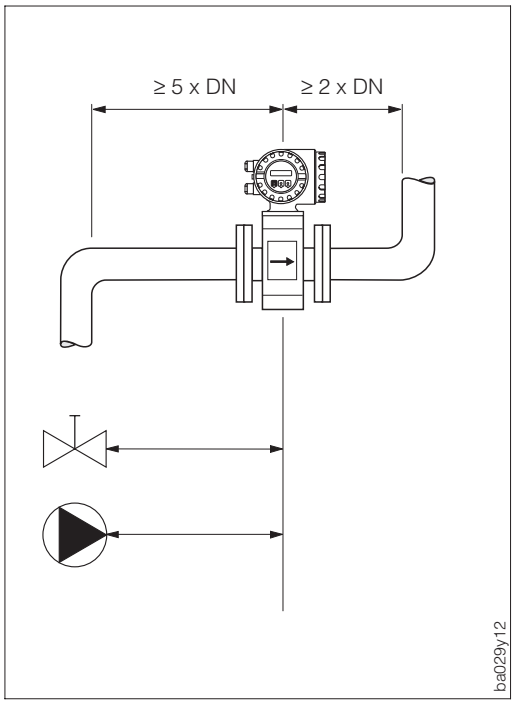
Vertical mounting:
This is the recommended position with the flow upwards. Entrained solid particles sink and fatty components in the stationary fluid rise away from the measuring electrodes. This is the optimal position in empty pipe system and when using Empty Pipe Detection (see page 70).

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 chapter 3.5).

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.

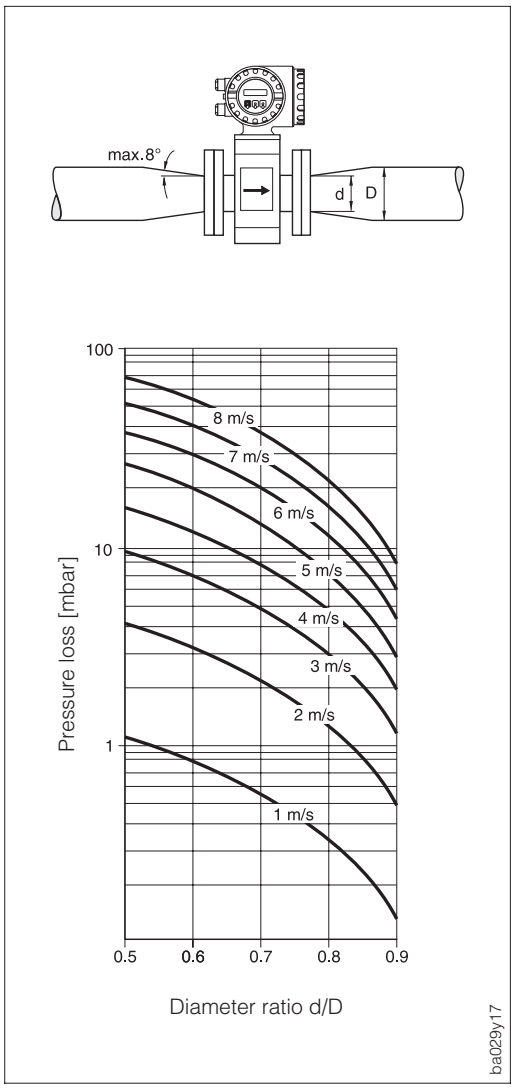


Fig. 12
Pressure loss when using adapters

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

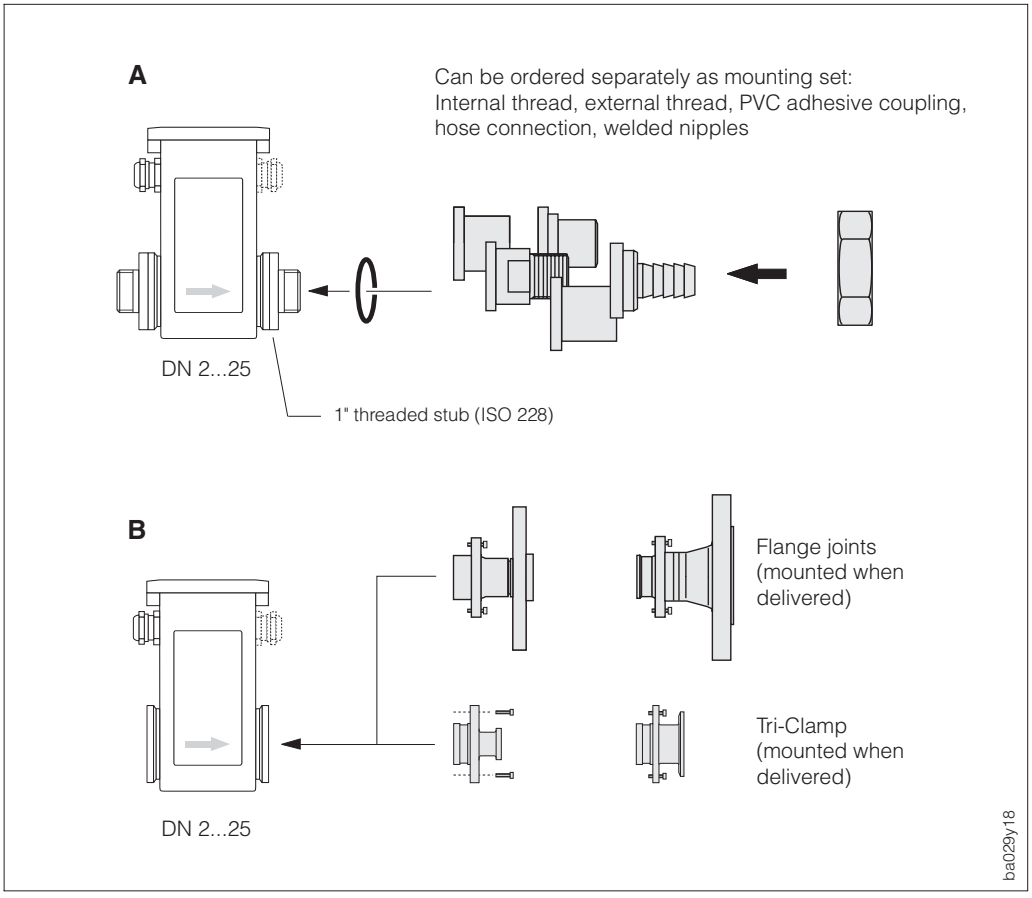


Fig. 13
Process connections
Promag A

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 91 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.

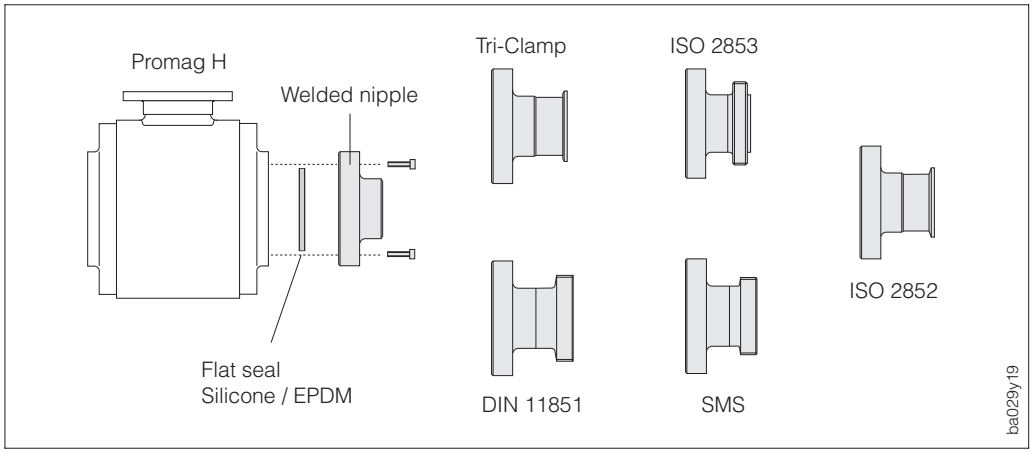


Fig. 14
Process connections
Promag H

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 94 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.

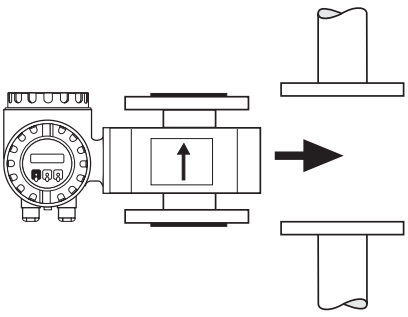


Fig. 15
Mounting Promag 33 F

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.

Screw tightening torques → see following page

Length, Dimensions → see pages 96, 97

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.

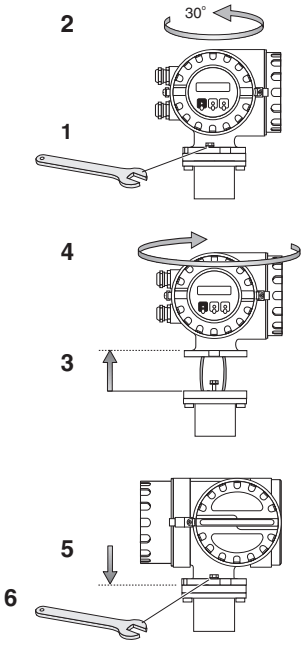
Diameter		Pressure ratings				Screws	Max. tightening torques [Nm]		
[mm]	[inch]	DIN [bar]	ANSI [lbs]	AWWA	JIS		Hard rubber	Soft rubber (EPDM)	PTFE (Teflon)
15	1/2"				20K	4 x M 12	–	–	15
25	1"				20K	4 x M 12	25	5	33
32	–	PN 40	Class	–	20K	4 x M 12	40	8	53
40	1 1/2"		150		20K	4 x M 16	50	11	67
50	2"				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

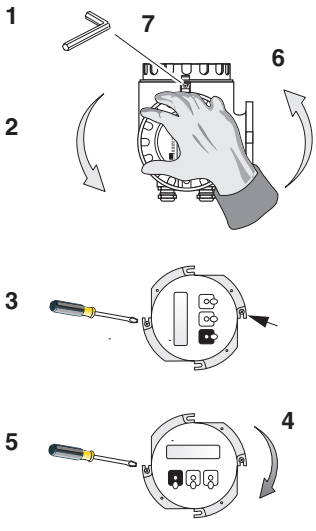
1. Loosen the two fixing screws of the transmitter bayonet catch (approx. two turns)
2. Turn the bayonet catch of the transmitter as far as the screw slits (approx. 15 mm).
3. Carefully lift the transmitter housing to the stop.

   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.

ba029y22

Caution!

Fig. 16
Turning the transmitter housing



Turning the local display

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.

ba029y23

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 102 ff.),
- there is severe vibration (> 2 g/2 h per day; 10...100 Hz).

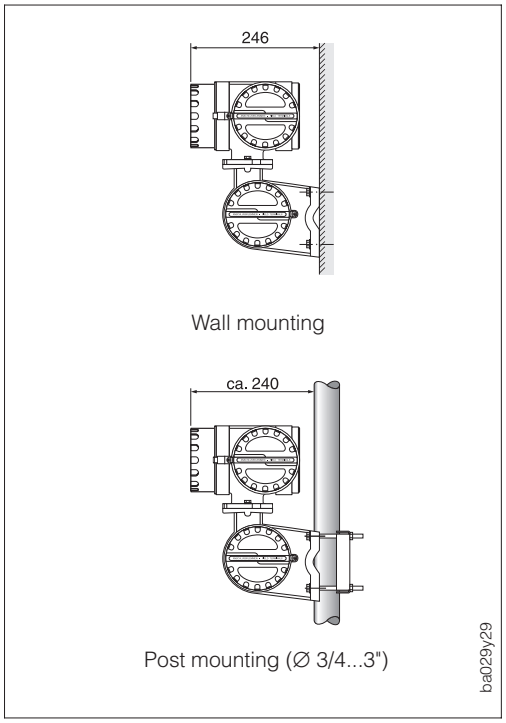


Fig. 18
Wall and post mounting

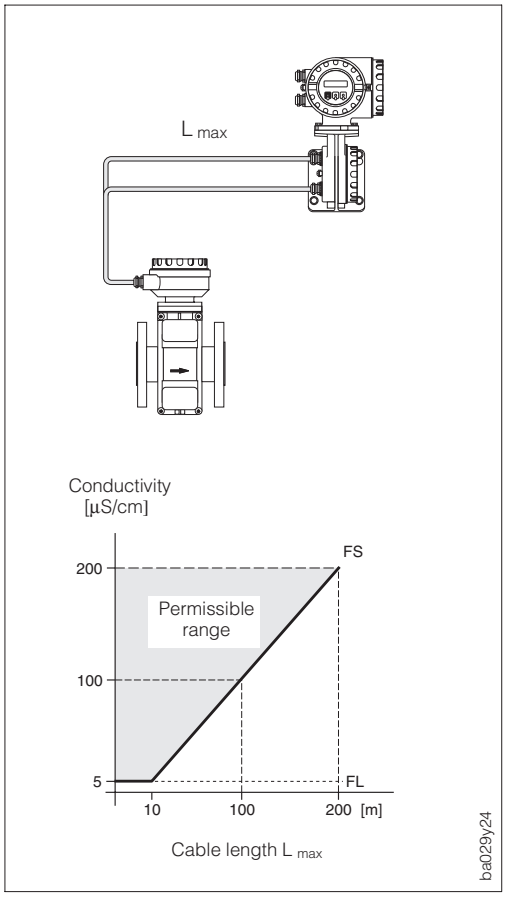


Fig. 19
Fluid conductivity and cable length with the remote version

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.

Warning!

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 28).
- 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.

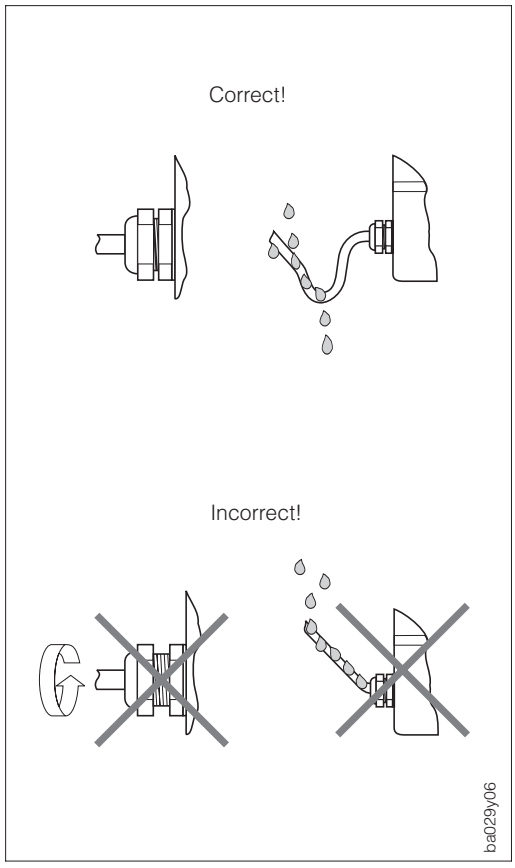


Fig. 20
Mounting cable glands

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.

Caution!

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.

Note!

4.2 Connecting the transmitter

Warning!

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.

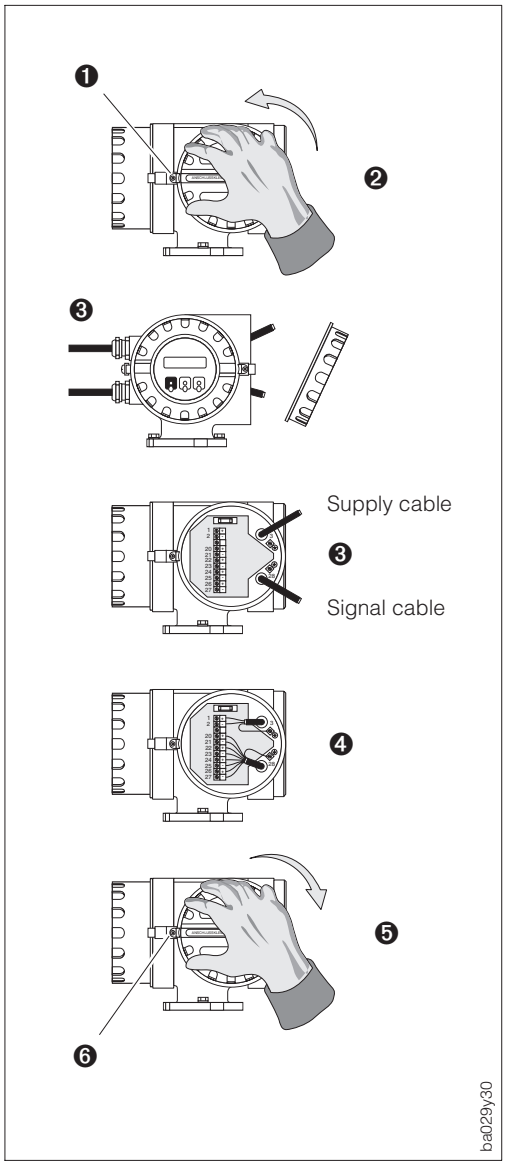


Fig. 21
Connecting the transmitter

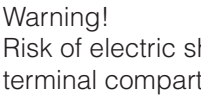
1. Loosen the Allen screw of the safety grip using an 3 mm Allen key.
2. Unscrew the wiring compartment cover.
3. Feed the power and signal cables into the appropriate cable glands.
4. Wire up according to the wiring diagrams:
   → see Fig. on page 23 resp. 25 or
   → Wiring diagram in the screw cover
   - 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.

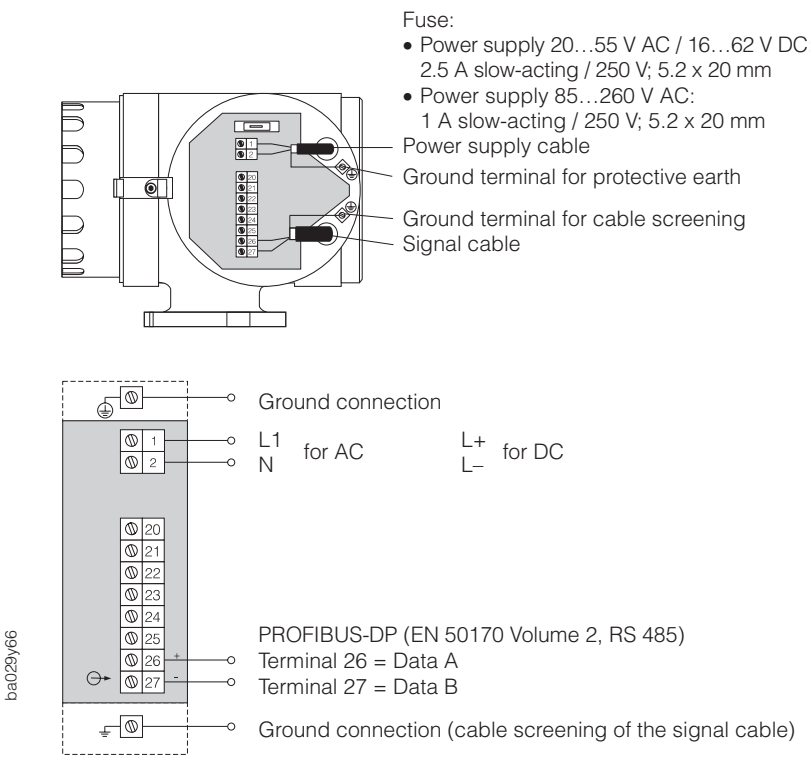
Note!

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

4.3 Connection diagram PROFIBUS-DP

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





Note!

- The grounding design of the plant is to be considered.
  The bus cable shield should always be connected to ground at both ends!

- Select bus address by: a) local operation (see page 68)
  b) miniature switches on the communication board (see page 33)

- Spur networks
  Length of spur cables up to 1.5 MBaud < 6.6 m.
  No spur cables should be used for transmission rates > 1.5 MBaud

  The cable between a distribution box and the bus driver in the field transmitter is called a spur cable. Experience with plants has shown that the planning of spur cables should be carried out very carefully. It cannot be assumed that the total lengths of all spur cables are always less than < 6.6 m for a transmission rate up to 1.5 MBaud. The actual layout of the field transmitters plays a significant role. It is thus recommended that, if possible, no spur cables are used for transmission rates > 1.5 MBaud. If spur cables must be used, then these should not have bus terminator.

Fig. 22
Electrical connection
Promag 33 PROFIBUS-DP

Setting the end-of-line resistors of the bus cable
Because incorrect adjustments of impedance lead to reflections along the cabling, and can thus cause faulty communication, it is important to have the correct end-of-line resistors on the cabling.

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

The switches (termination switches SW1) are on the communication board RS 485 (see Fig. below).
For transmission rates up to 1.5 MBaud, the end-of-line resistor on the last transmitter on the bus is set by the termination switch SW1 to: ON – ON – ON – ON.

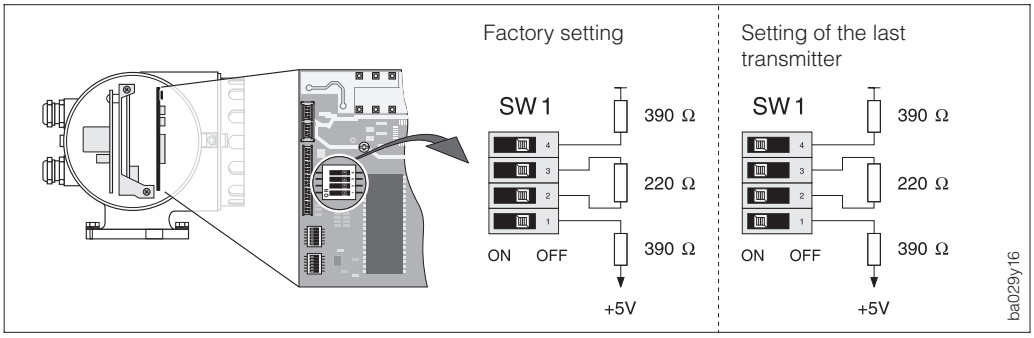


Fig. 23
Setting termination ressistors

If the transmitter is to operate at a baud rate greater than 1.5 MBaud, then because of reflections along the cabling caused by the capacitive load of the peripherals, an external end-of-line connector is to be used, e.g. with a 9-pole Sub D connector with integrated inductance.

Transmission cabling
The maximum permissible cable length (segment length) of a PROFIBUS system depends on the speed of transmission. Only 32 transmitters, according to the field-bus standard PROFIBUS-DP, may be operated within any one segment.

Maximum length of segment as a function of the baud rate:

Baud rate [kBit/s]	9.6 – 187.5	500	1500	12000
Length of segment [m]	1000	400	200	100

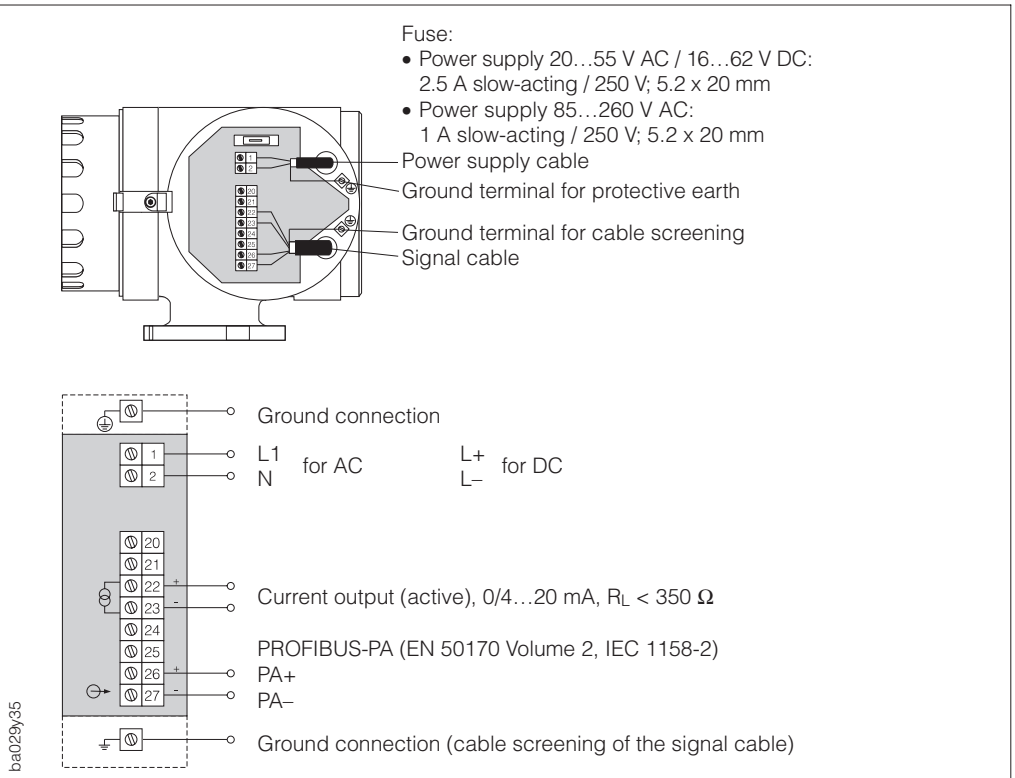
The specifications on the maximum segment length in the table above refer to cable Type A specified in the PROFIBUS standard given in the table below with the following parameters:

Specifications of the PROFIBUS RS 485 cable Type A:

Characteristic impedance	135 to 165 Ω, at a measurement from 3 to 20 MHz
Cable capacitance	< 30 pF per meter
Cross section area	> 0.34 mm^2, to AWG 22
Cable type	Twisted pairs, 1 x 2, 2 x 2 or 1 x 4 cable
Loop resistance	110 Ω per km
Signal attenuation	max. 9 dB over the entire lenght of the cable section
Screening	Braided copper screening, or braided and film screening

4.4 Connection diagram PROFIBUS-PA

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



Note!
- The grounding design of the plant is to be considered.
  The bus cable shield should always be connected to ground at both ends!
- Select bus address by: a) local operation (see page 68)
  b) miniature switches on the communication board (see page 33)
- Additional specification details about PROFIBUS-PA Profile 2.0 fieldbus can be found in Operating Manual BA 198F/00/en “Field Communication PROFIBUS-DP/-PA: Guidelines for planning and commissioning”.

Fig. 24
Electrical connection
Promag 33 PROFIBUS-PA

4.5 Connecting the cable of the remote version

Warning!

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!

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. 26).

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

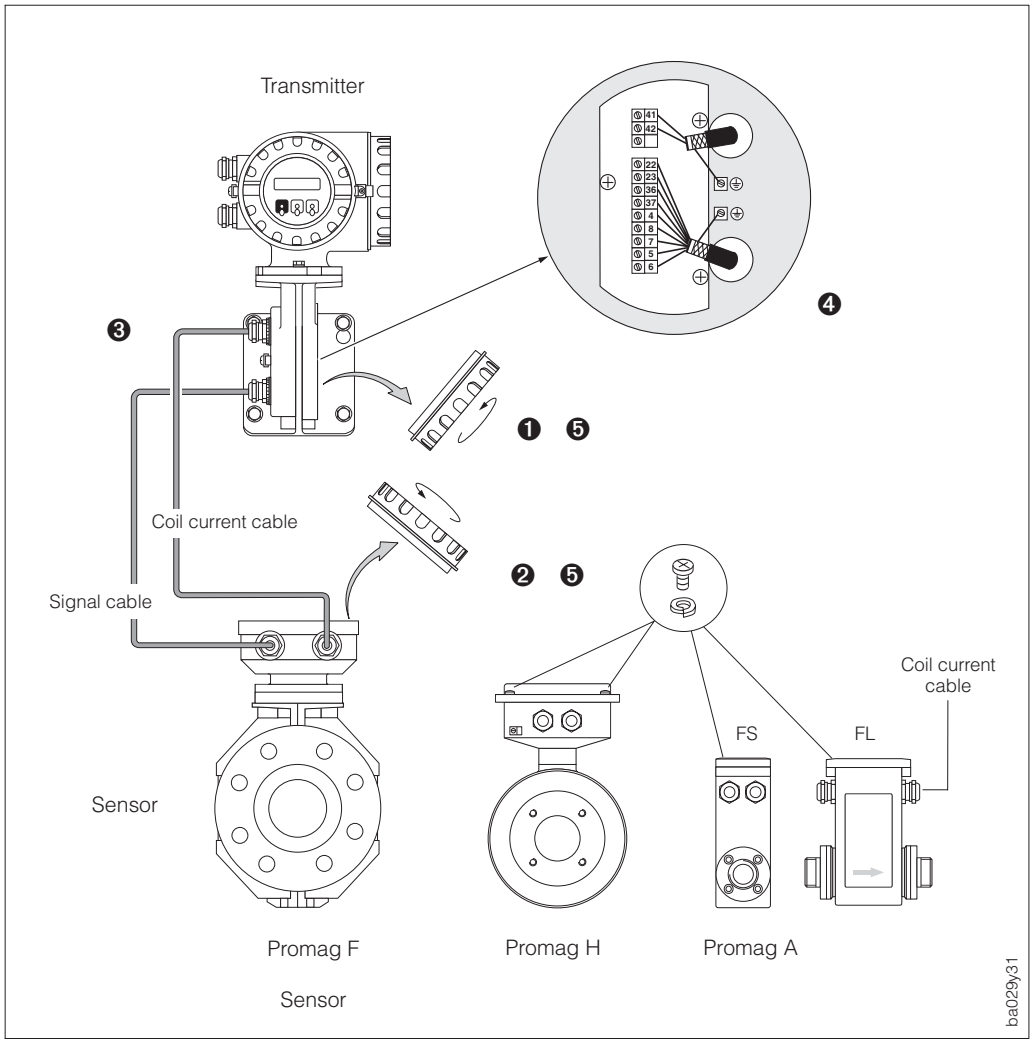
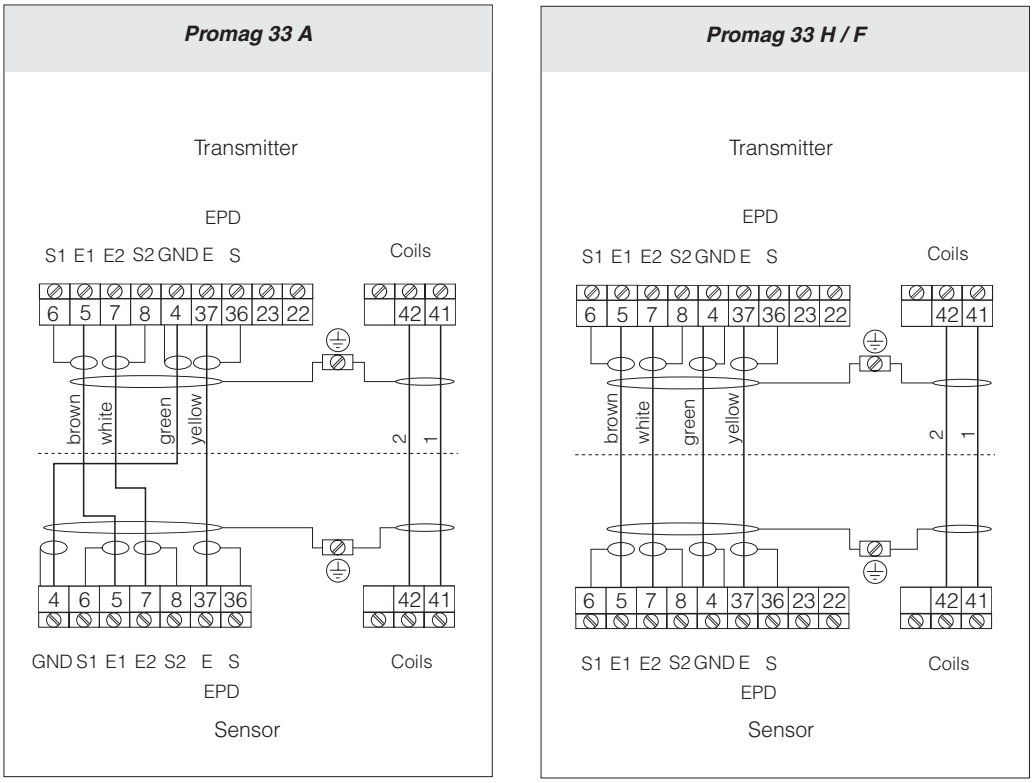


Fig. 25
Connecting the remote version

Wiring diagrams for the remote version (FS/FL)

Remote version “FS”



Remote version “FL”

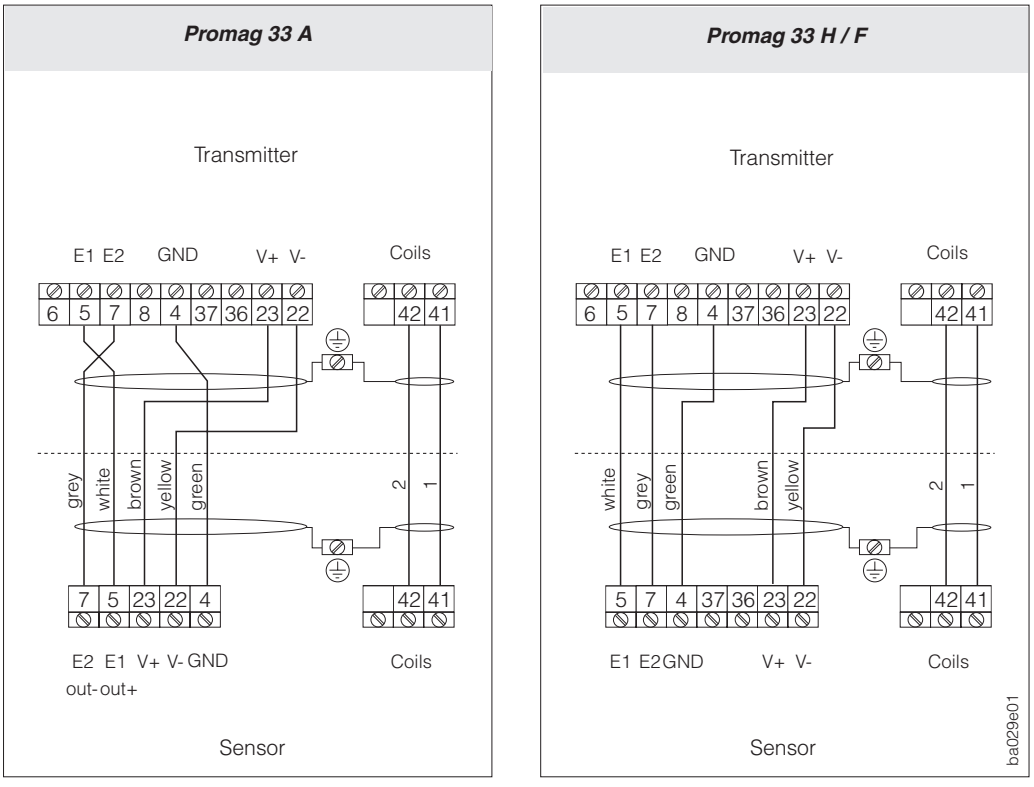


Fig. 26
Wiring diagramms of the remote versions “FS” and “FL”

4.6 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!

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.

4.7 Potential equalisation

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.

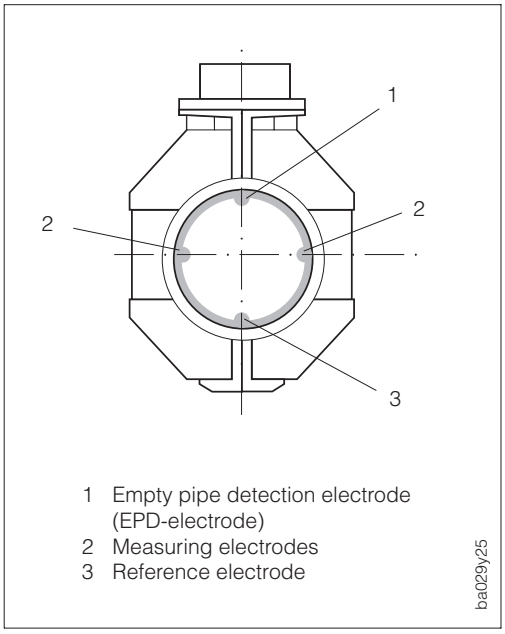


Fig. 27
Positions of the different electrodes (Promag 33 F)

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:

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. 28). 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.

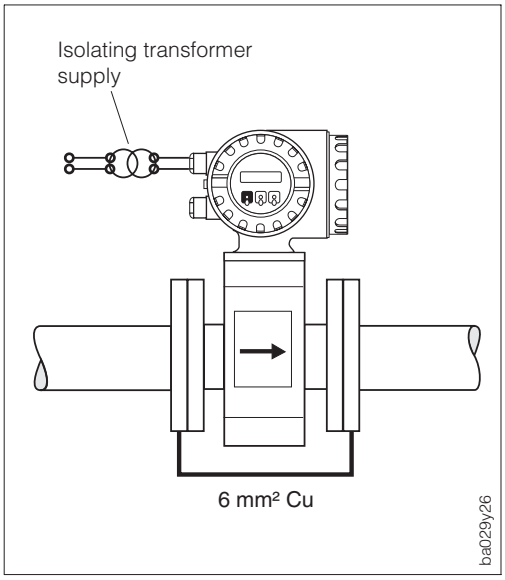


Fig. 28
Potential equalization for lined pipes and cathodic protection

Plastic or lined piping

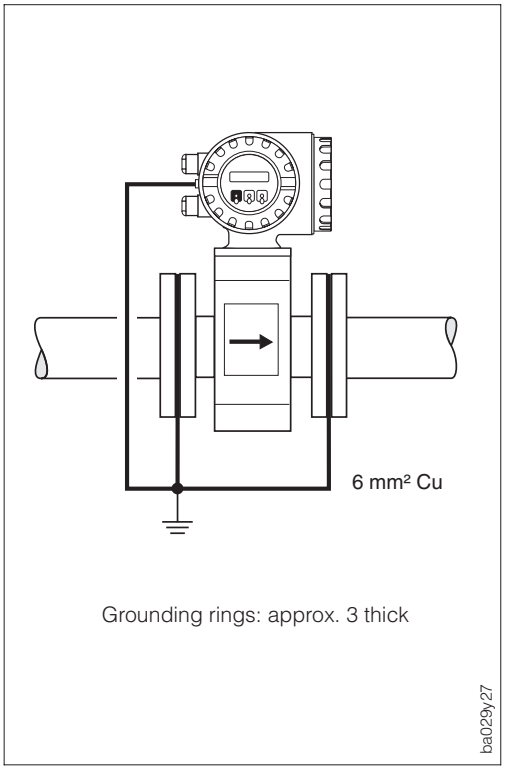


Fig. 29
Plastic or lined piping

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.

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

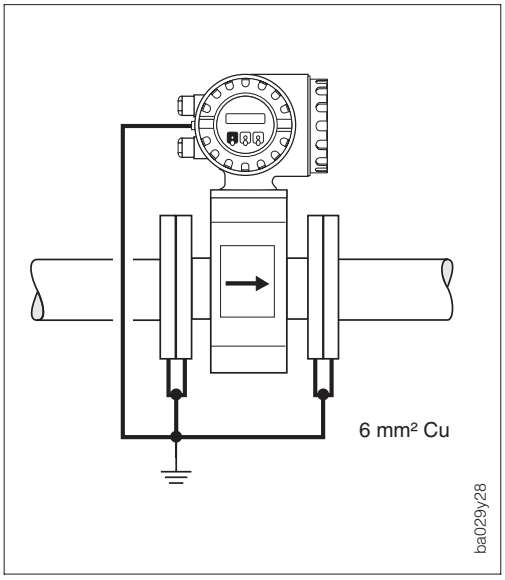


Fig. 30
Equalization currents in undergrounded metal pipes

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.

5 Communication

5.1 PROFIBUS-DP interface

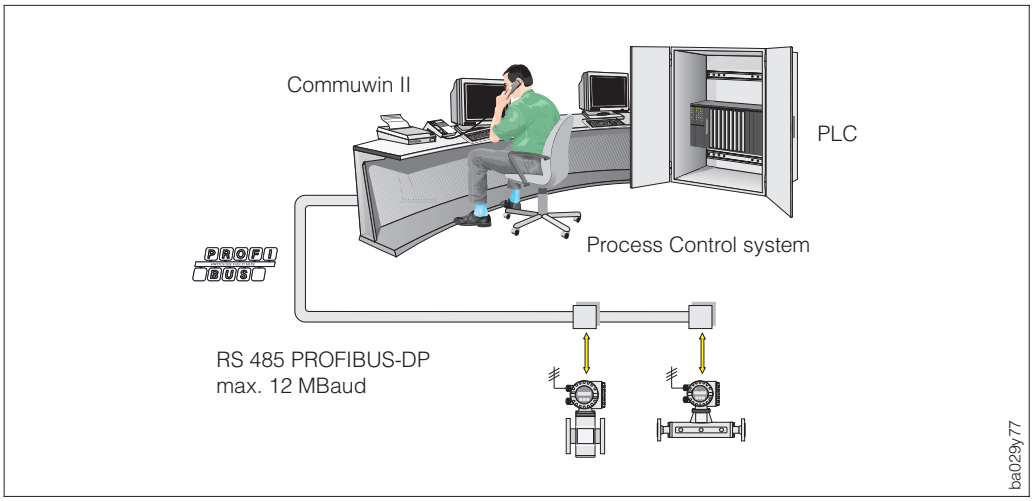


Fig. 31
General layout of the PROFIBUS-DP

General
The Promag 33 can be equipped with a PROFIBUS-DP (Decentralised Peripheral) interface according to the fieldbus standard PROFIBUS-DP, EN 50170 Volume 2. This enables the exchange of data with process control systems which comply with this standard. Integration into a control system must be performed in accordance with the specifications for PROFIBUS-PA profiles 2.0.

Transmission speed
The maximum PROFIBUS-**DP** bus speed of the Promag 33 is 12 Mbaud.

Note!
- The Promag 33 can automatically identify the speed of data transmission.
- Information on bus end-of-line resistors is given on page 24.

Note!

Communication partner
The Promag 33 always acts as a slave in a control system and, depending on the type of application, can therefore exchange data with one or several masters. The master can be a process control system, a PLC or a PC with a PROFIBUS-DP plug-in communication board.

Batching function
The internal batching procedure is not integrated into PROFIBUS-DP functions as the instrument has no relay function. However, for certain applications, it is possible to have a batching procedure using the function of the totaliser.

Note!
Additional specification details about PROFIBUS-PA Profile 2.0 fieldbus can be found in Operating Manual BA 198F/00/en “Field Communication PROFIBUS-DP/-PA: Guidelines for planning and commissioning”.

Note!

5.2 PROFIBUS-PA interface

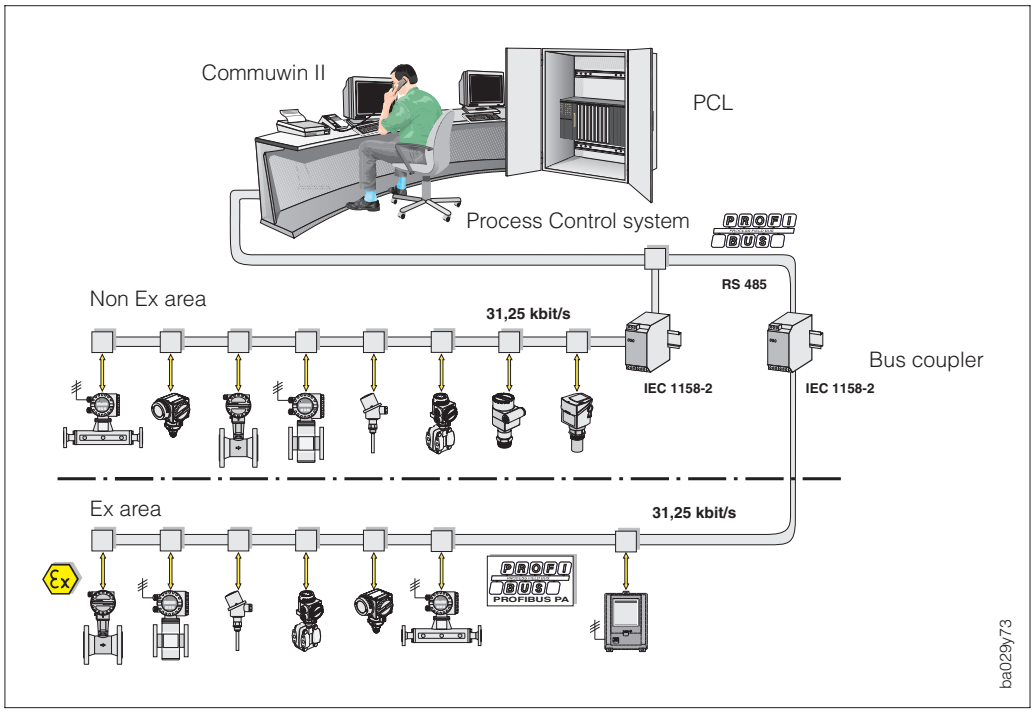


Fig. 32
General layout of the PROFIBUS-PA

General

The Promag 33 can be equipped with a PROFIBUS-PA (EN 50170) interface according to the fieldbus standard PROFIBUS-DP, EN 50170 Volume 2. This enables the exchange of data with process control systems which comply to this standard. Integrating into a control system must be in accordance with the specifications for PROFIBUS-PA profiles 2.0.

Communication partner

The Promag 33 always acts as a slave in a control system and, depending on the type of application, can therefore exchange data with one or several masters. The master can be a process control system, a PLC or a PC with a PROFIBUS-DP plug-in communication board.

Note!

Note!
In project management, note that the current consumption of the Promag 33 is 12 mA.

Caution!

Caution!
In order to protect the PROFIBUS-PA segment from the effects of any serious faults occurring in the instrument (e.g. short circuiting), the IEC 1158-2 interface is equipped with a safety fuse. When the fuse blows, the instrument is permanently separated from the bus. The COM module must then be replaced (see also page 89).

Batching function

The internal batching procedure is not integrated into PROFIBUS-PA functions as the instrument has no relay function. However, for certain applications, it is possible to have a batching procedure using the function of the totaliser.

Note!

Note!
Additional specification details about PROFIBUS-PA Profile 2.0 fieldbus can be found in Operating Manual BA 198F/00/en “Field Communication PROFIBUS-DP/-PA: Guidelines for planning and commissioning”.

5.3 Setting the device addresses of the PROFIBUS-DP/-PA

- Adressing:
  The address must always be set for PROFIBUS-DP/-PA transmitters.
  Valid addresses are 0...125. Every address can only be assigned once in a PROFIBUS-DP/-PA network. If an address is not correctly set, then the transmitter is not recognised by the master.
  The address 126 is reserved for the initial start-up and for service purposes.
- Setting when delivered:
  All transmitters are sent from the factory with the address 126 and software addressing. In the function group “COMMUNICATION” the option <local> is activated in the function “SYSTEM CONFIG.”. In this setting, the transmitter can be addressed either locally via local operation.

Note!

PROFIBUS-DP/-PA addressing through local operation
See page 68, Function “BUS ADDRESS”.

PROFIBUS-DP/-PA addressing using the DIP switches

Procedure

Warning!
Risk of electric shock! Switch off the power supply before unscrewing the cover of the transmitter housing.

❶ Loosen the safety claw Allen screws (3 mm Allen key).
❷ Unscrew the cover of the transmitter electronics compartment.
❸ Remove the local display unit (if present) by unscrewing the mounting screws of the display module.
❹ Configure the position of the DIP switches on the communication board.
❺ Re-assemble in reverse sequence

Warning!

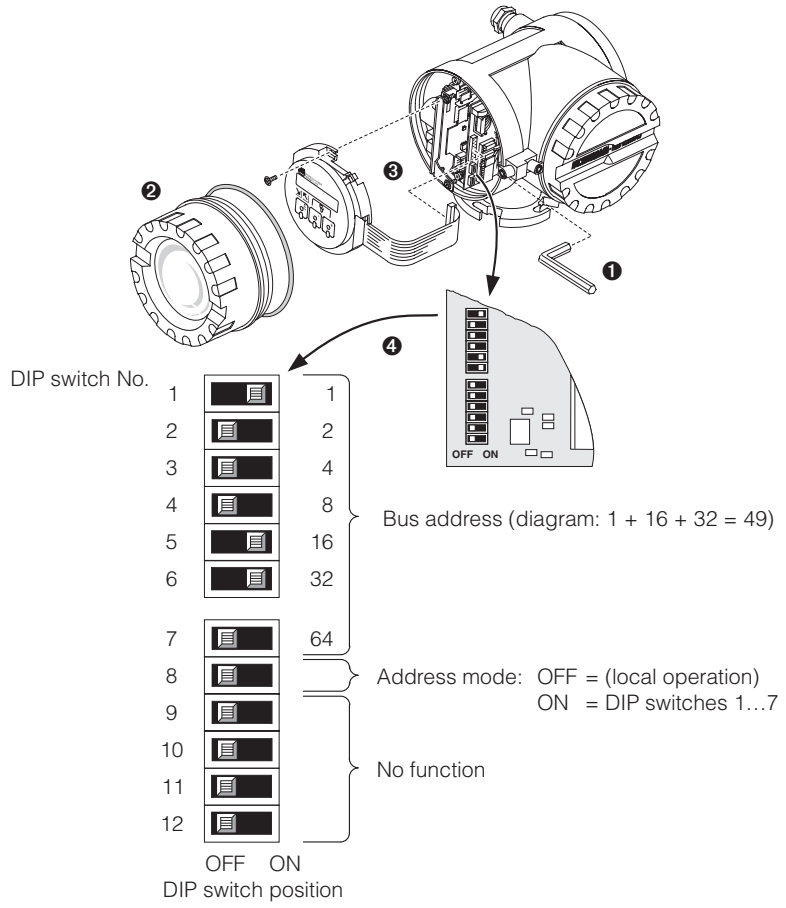


Fig. 33
Addressing using the DIP switches on the communications board

5.4 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:

P	R	O	M	A	G		3	3					
V	2	.	0	6	.	0	0		P	B	U	S	

Disply of the currently installed software version on the communication board and the identification of the communication board. The PROFIBUS communication board can be identified by the display “PBUS”.

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

Having started up successfully, normal operation begins. On the the display two freely selectable measured variables appear simultaniously.

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

Communication with a PROFIBUS master is displayed in the “Home-Position” by an alternatively flashing double arrow. During configuration and in case of error reports, the double arrow is masked out.


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 83 ff.


Caution!

Caution!
The type of access to the instrument is set in the function “SYSTEM CONFIG.”, within the function group “COMMUNICATION”.

Operation
- In mode **<local>**, the instrument is operated on site.
- In mode **<remote>**, the instrument is operated via the PROFIBUS network using an acyclic Class II master such as Commuwin II.

Switching between <local> and <remote> modes does not affect the cyclic exchange of measured values. When switching over, only the value of the status, the 5th byte of the actual measured value block, is changed (see Table on page 39).

5.5 System integration

The device specific data file (GSD) is required for engineering a PROFIBUS-DP network. The GSD (plain text file) contains, for example, a description of the speed the instrument used to transmit data and in which format the PLC is to receive the digital information from the transmitter.

Each instrument is given an identification number (ID No.) by the PROFIBUS Trade Organization (PTO). The name of the device master file (GSD) is derived from this. For Endress+Hauser, this ID No. always starts with "15XX".

Name of the instrument	ID-No.:	GSD	File type	Bitmaps
Promag 33 PROFIBUS-PA	1505 (hex)	EH_1505.gsd	EH_1505.200	EH_1505_d.bmp EH_1505_n.bmp EH_1505_s.bmp
Promag 33 PROFIBUS-DP	1511 (hex)	EH_1511.gsd	EH_1511.200	EH_1511_d.bmp EH_1511_n.bmp EH_1511_s.bmp

The GSD-Files of all Endress+Hauser data can be obtained as follows:

- Internet: Endress+Hauser → http://www.endress.com
  (Product Avenue → Downloadstreet → Field Communication St.)
  PTO → http://www.profibus.com
  (GSD libary)
- As a diskette from Endress+Hauser: Order number 943157-0000

Contents of the download file from the internet and on the diskette:
- All Endress+Hauser GSDs
- Endress+Hauser type files
- Endress+Hauser bitmap files
- Comprehensive information on the instruments

Handling GSD/type files
GSD files must be loaded in a specific subdirectory of the PROFIBUS-DP project management software of your PLC.

Example 1
The project management software Siemens STEP 7 of the Siemens PLC S7-300/400 is in the subdirectory ...\siemens\step7\s7data\gsd.
Bitmap files also belong to the GSD files. The measuring point is shown graphically using these bitmap files. These files must be loaded into the subdirectory ...\siemens\step7\s7data\nsbmp.

Example 2
Type files (x.200 files) are required if a Siemens S5 PLC is being used and the PROFIBUS-PA network is being designed with the project management software COM ET 200.

Example 3
There is a subdirectory in the GSD directory containing GSD files with a standard DP identification code (0 x 94). These files are to be used with, e.g. a PLC 5 from Allen-Bradley.

For other project management software, please contact the manufacturer of your PLC for the correct subdirectory.

5.6 Cyclic data exchange

Structure of a cyclic file telegram
Using Data_Exchange, a PLC can send the output data to a Promag 33 and read the input files in an answer telegram. For optimum configuration of the Promag 33, the cyclic file telegram has the following structure:

PLC → Promag 33 (Output-Data)

Byte	Data	Access	Data format	Units
0	Control	write	Every time this byte is changed from 00h to another digit, a binary control is carried out by the cyclic service. Changing from any digit to 00h has no effect. 0 → 1: Reset Totalizer 0 → 2: Reserved 0 → 3: Reserved 0 → 4: Reserved 0 → 5: Activate positive zero return 0 → 6: Deactivate positive zero return 0 → 7...255: Reserved	—

Promag 33 → PLC (Input-Data)

Byte	Data	Access	Data format	Units
0, 1, 2, 3	Volumeflow	read	32-digit floating point number (IEEE-754)	l/s
4	Status Volumeflow	read	see the status code on page 39	—
5, 6, 7, 8	Totalizer	read	32-digit floating point number (IEEE-754)	default: m^3
9	Status Totalizer	read	see the status code on page 39	—

General Information
When the instrument is delivered, the data blocks Volumeflow and Totalizer are activated.

If not all output variables of the Promag 33 are used, then individual data blocks can be deactivated using the "FREE PLACE" block in the project management software (Class I master). In order to achieve the appropriate structures for the cyclic data telegram, the specification FREE PLACE (00h) must be sent to the transmitter for these non-activated blocks (see also the example for constructing a data telegram on page 38).
The FREE PLACE block is contained in the GSD.

Note!
The status 08 hexadecimal (hex) in Class I master is shown for those data blocks which are not activated.


Note!

Only those data blocks should be activated which are to be processed in the control system. This increases the data rate in a PROFIBUS-DP/-PA network. The cyclic exchange of data to the Class I master (e.g. PLC) is shown on the local display by a flashing double arrow.

Caution!
- When data blocks are activated, their place in the sequence must be noted.
- The instrument must be reset before loading a new device configuration by switching off the power for a short time and then switching on again.


Caution!

Note!
The measured values are transmitted to the Class I master in the system units as shown in the table on page 36 using the cyclic data exchange. If the unit of a measured value is changed by local operation, then this has no effect on the unit of this measured value in Class I master communication. Only after activating the function “UNIT TO BUS” in the function group “COMMUNICATION” is the modified system of units of the measured value transmitted to the Class I master.


Note!

IEEE floating point numbers
For converting a hex value into an IEEE floating point number for processing measured values. Measured values are transmitted to the Class I master in the IEEE-754 number format as shown below:

Byte n			**Byte n + 1**			**Byte n + 2**			**Byte n + 3**		
Bit 7	Bit 6	Bit 0	Bit 7	Bit 6	Bit 0	Bit 7		Bit 0	Bit 7		Bit 0
VZ	2^7 2^6 2^5 2^4 2^3 2^2 2^1		2^0	2^{-1} 2^{-2} 2^{-3} 2^{-4} 2^{-5} 2^{-6} 2^{-7}		2^{-8} 2^{-9} 2^{-10} 2^{-11} 2^{-12} 2^{-13} 2^{-14} 2^{-15}			2^{-16} 2^{-17} 2^{-18} 2^{-19} 2^{-20} 2^{-21} 2^{-22} 2^{-23}		
	Index			**Mantissa**			**Mantissa**			**Mantissa**	

Formula = $(-1)^{VZ} * 2^{(Index\ -127)} * (1 + Mantissa)$

Example: 40 F0 00 00 hex = 0100 0000 1111 0000 0000 0000 0000 0000 binary

$$\text{Value} = (-1)^0 * 2^{(129-127)} * (1 + 2^{-1} + 2^{-2} + 2^{-3})$$
$$= 1 * 2^2 * (1 + 0.5 + 0.25 + 0.125)$$
$$= 1 * 4 * 1.875 = 7.5$$

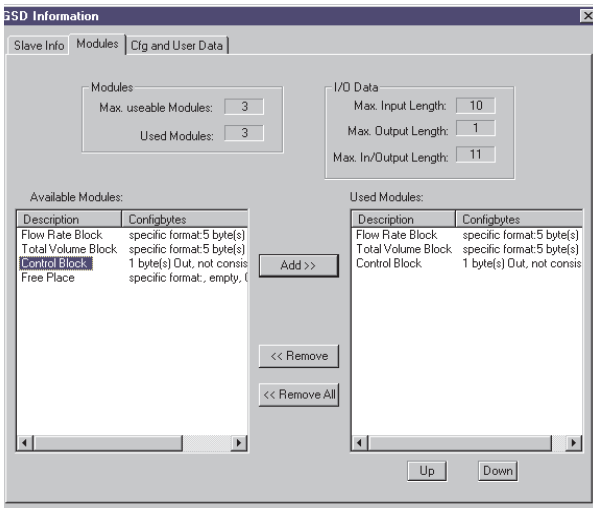
Example for construction a data telegram

The configuration data (CHK_CFG) used in this example are:
[42h, 84h, 08h, 05h]; [42h, 84h, 08h, 05h]; [20h]

The cyclic data telegram contains 11 bytes device data with 3 active blocks.

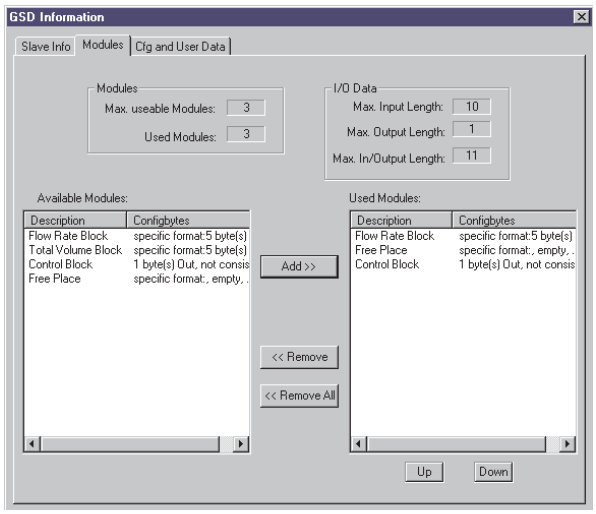
Byte Length	Data blocks	Status	Access	GSD block name	Configuration data (dependent on the PROFIBUS Master)
0 ..4	Volumeflow + Status	active	read	Flow Rate Block	42h, 84h, 08h, 05h
5.. 9	Totalizer + Status	active	read	Total Volume Block	42h, 84h, 08h, 05h
0	Control	active	write	Control Block	20h

Example in an engineering software:



Example 1:
With this configuration, the following blocks will be transmitted to the DP master, with a data length of 10 input bytes and 1 output byte:
– Volumeflow + Status
– Totalizer + Status
– Control

FREE PLACE is to be selected for blocks which are not required:



Example 2:
With this configuration, the following blocks will be transmitted to the DP master, with a data length of 5 input bytes and 1 output byte:
– Volumeflow + Status
– Control

Status code
Encoding the status according to PROFIBUS profiles “PROFIBUS-PA Profiles for Process Control Devices - General Requirements” V 2.0:

Status Code	Meaning	Condition of the instrument
00 Hex	non-specific	BAD
04 Hex	configuration-error	BAD
08 Hex	not connected	BAD
0C Hex	device failure	BAD
10 Hex	sensor failure	BAD
14 Hex	no communication (last usable value)	BAD
18 Hex	no communication (no usable value)	BAD
1C Hex	out of service	BAD
20 Hex	configuration error, variable not supported	BAD
40 Hex	non-specific	UNCERTAIN
44 Hex	last usable value	UNCERTAIN
48 Hex	substitute-set	UNCERTAIN
4C Hex	initial value	UNCERTAIN
50 Hex	sensor conversion not accurate	UNCERTAIN
54 Hex	engineering unit range violation	UNCERTAIN
58 Hex	sub-normal	UNCERTAIN
5C Hex	configuration error, value adapted	UNCERTAIN
64 Hex	empty pipe detection	UNCERTAIN
68 Hex	pos. zero return active	UNCERTAIN
80 Hex	ok	GOOD
81 Hex	LO_LIM (Alarm active)	GOOD
82 Hex	HI_LIM (Alarm active)	GOOD
83 Hex	low and high limit bit set value constant	GOOD
84 Hex	active block alarm	GOOD
88 Hex	active advisory alarm	GOOD
8C Hex	active critical alarm	GOOD
90 Hex	unacknowleged block alarm	GOOD
94 Hex	unacknowleged advisory alarm	GOOD
98 Hex	unacknowleged critical alarm	GOOD
9C Hex	good-local operating possible	GOOD
9D Hex	LO_LIM (Alarm active)	GOOD
9E Hex	HI_LIM (Alarm active)	GOOD
9F Hex	good-local operating possible low and high limit bit set value constant	GOOD
AC Hex	initiate fail safe	GOOD

Note!


Note!

- If the instrument detects the process error EPD (Empty Pipe Detection), in the mode **>remote<** (80 Hex) or in the mode **>local<** (9C Hex), the status of the measured value will be set to 64 Hex.
- If the zero point return is be activated in the mode **>remote<** (80 Hex) or in the mode **>local<** (9C Hex), the status of the measured value will be set to 68 Hex.
- To optimize a subsequent control process, it is recommended that the status of the measured value be analyzed.

5.7 Acyclic data exchange

Using acyclic functions, the Class II master is able to change the parameters in the blocks shown below, e.g. time constant of flow rate, type of function, reset of the totaliser, etc.

The Promag 33 software consists of four different blocks corresponding to PROFIBUS-PA profile definitions:

- 1 *Physical* block
  The physical block contains device-specific information such as measuring point ID, software version, etc.

- 1 *Transducer* block for flow rate, temperature and density.
  The transducer block contains sensor data such as the calibration factor or nominal diameter.

- 1 *Function* block for totalizer
  The totaliser blocks enable the control system direct access to the totaliser of the Promag 33.

- 1 *AI* block (AI = Analogue Input)
  This universal function block makes available to the control system all parameters required for the processing of measured variables given below (filtering, scaling, mode and status handling).

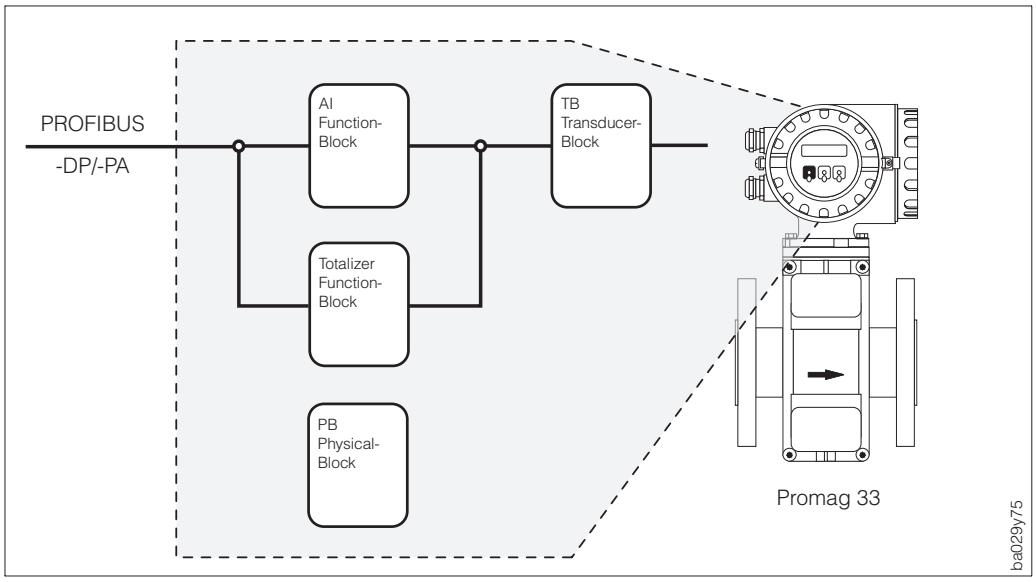
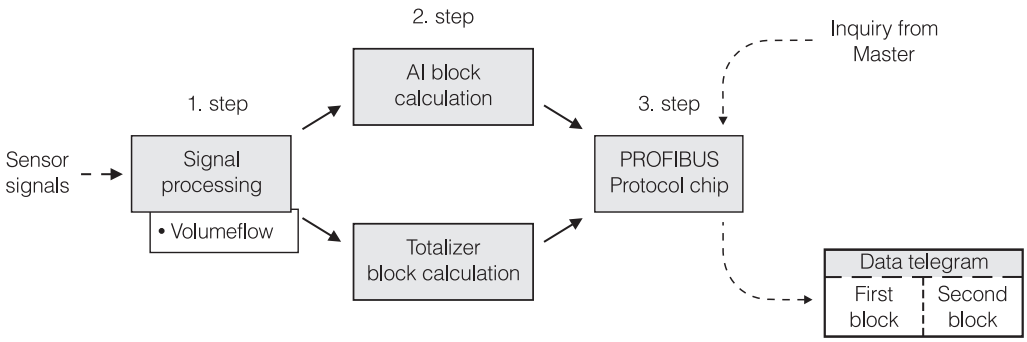


Fig. 34
Function block model of the Promag 33 PROFIBUS-PA

5.8 Cycle times

Processing of the internal measured value and data communication of the Promag 33 is carried out in three steps:



- **1st step: Signal processing**
  During signal processing, the primary measured variable volume flow is computed, from the sensor signals.
  The length of the sampling interval depends on the type of sensor, the nominal diameter and the power supply. For typical sample values see table on page 42.

- **2nd step: AI block calculation**
  With the measured values calculated from the signal processing, the output values of the AI blocks and the totalisers are calculated and written into a cyclic data telegram.
  The AI block evaluation has a delay of max. 3 ms per block.

  Note!
  Only one AI block or totaliser is calculated per cycle. Only the AI blocks or totaliser block are calculated (see page 38). By deactivating parameters not required in the cyclic data telegram, the real time response of the measurement unit is improved.

- **3rd step: PROFIBUS protocol chip**
  The cyclic data telegram is transfered to the protocol chip and sent on request to the master at the appropriate data transmission speed.

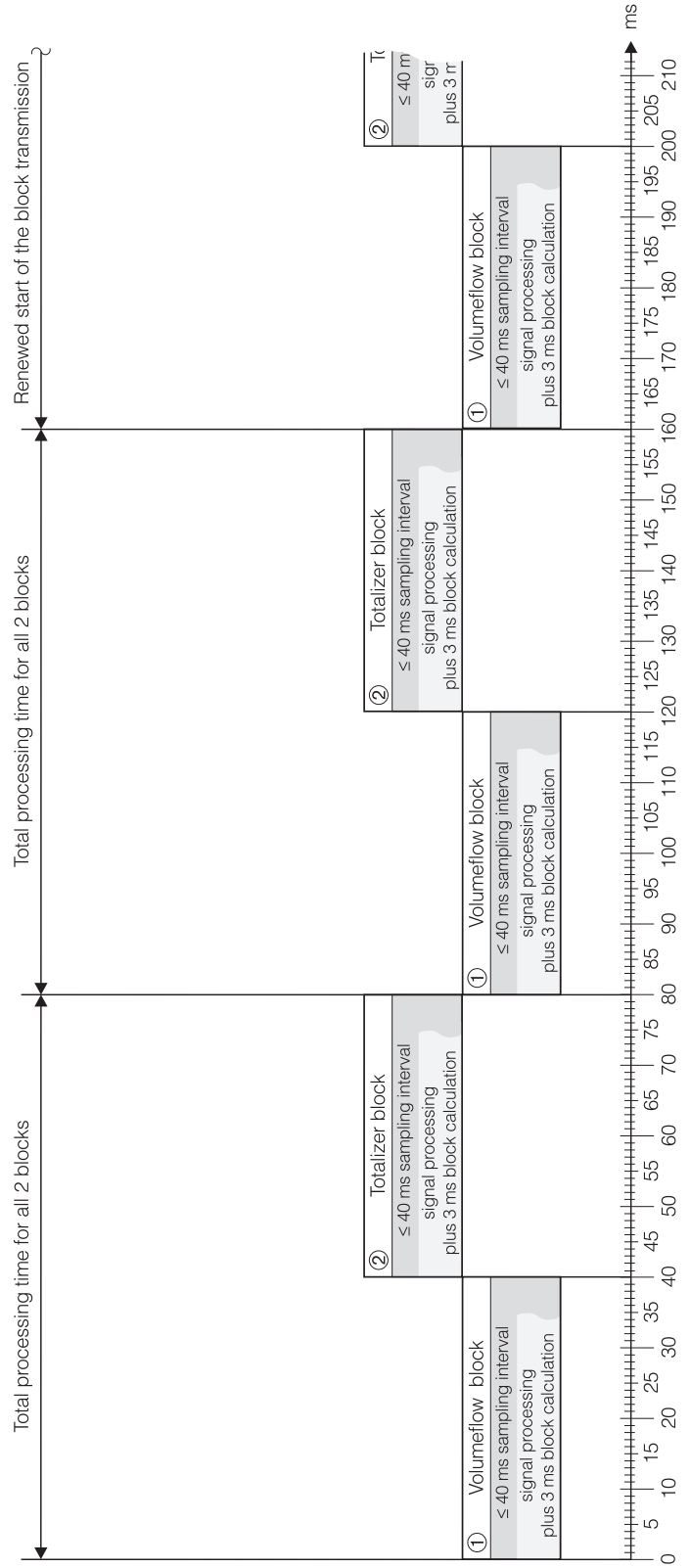
Typical processing time of Promag 33:

Sensor	Nominal diameter	Scanning interval [ms]		
	[mm]	50 Hz	60 Hz	DC
Promag A	2	80	83	73
Promag A	4...25	60	67	55
Promag H	25...100	40	50	36
Promag H - DIN	25	40	50	36
Promag F	15...50	60	67	55
Promag F	65...100	60	67	75
Promag F	125...200	100	100	109
Promag F	250...400	120	133	127
Promag F	450...500	140	150	145
Promag F	600	160	167	164
Promag F	700...750	200	200	200
Promag F	800...900	240	233	217
Promag F	1000...1050	260	267	256
Promag F	1200	300	300	294
Promag F	1350...1400	340	350	323
Promag F	1500	380	400	370
Promag F	1600...1700	420	400	400
Promag F	1800	480	450	435
Promag F	2000	500	500	436

Example for the timing of the block calculation and signal processing (see also Table on page 38)**:**

- Promag 33 H
- DN 25, 50 Hz
- 2 active blocks:
  ① Volumeflow
  ② Totalizer

= Scanning interval ≤ 40 ms
= AI block calculation / Totalizer block calculation: 3 ms per block



5.9 Slot / Index list

The PTO profile is used as the basis for the definition. All parameters in **Slot 1**, the index are derived from the following tables:

Name	E+H Matrix	Index	Read	Write	Object typ	* Parameter	Data type	Size bytes	Storage class
Device Management									
Directory_Header/ Composite_Directory_Entries		0	X		Record	M	Unsigned 16	12	C
Composite_Directory_Entry/ Composite_Directory_Entries		1	X		Record	M	Unsigned 16	28	C
not used		2							
not used		3							
not used		4							
not used		5							
not used		6							
not used		7							
not used		8							
not used		9							
not used		10							
not used		11							
not used		12							
not used		13							

* Parameter: O = Optional
M = Mandatory

Name	E+H Matrix	Index	Read	Write	Object typ	* Parameter	Data type	Size bytes	Storage class
Physical Block									
BLOCK OBJECT		14	X		Record	M	DS-32	20	C
ST_REV	V8H1	15	X		Simple	M	Unsigned16	2	N
TAG_DESC	V8H0	16	X	X	Simple	M	Octet String	32	S
STRATEGY		17	X	X	Simple	M	Unsigned 16	2	S
ALERT_KEY		18	X	X	Simple	M	Unsigned 8	1	S
TARGET_MODE		19	X	X	Simple	M	Unsigned 8	1	S
MODE_BLK		20	X		Record	M	DS-37	3	
ALARM_SUM	V7H0/1	21	X		Record	M	DS-42	8	D
SOFTWARE_REVISION	V9H6	22	X		Simple	M	Octet String	16	Cst
HARDWARE_REVISION	V9H7	23	X		Simple	M	Octet String	16	Cst
DEVICE_MAN_ID	VAH1	24	X		Simple	M	Unsigned 16	2	Cst
DEVICE_ID	VAH2	25	X		Simple	M	Octet String	16	Cst
DEVICE_SER_Num	VAH3	26	X		Simple	M	Octet String	16	Cst
DIAGNOSIS	V9H0	27	X		Simple	M	Octet String	4	D
DIAGNOSIS_EXTENSION	V9H8	28	X		Simple	O	Octet String	6	D
DIAGNOSIS_MASK	V9H3	29	X		Simple	M	Octet String	4	Cst
DIAGNOSIS_MASK_ EXTENSION	V9H9	30	X		Simple	O	Octet String	6	Cst
DEVICE_CERTIFICATION	V9H6	31	X	X	Simple	O	Octet String	16	N
SECURITY_LOCKING	V9H7	32	X	X	Simple	O	Unsigned16	2	N
FACTORY_SETTING	V9H8	33		X	Simple	O	Unsigned16	2	S
not used		34							
not used		35							

* Parameter: O = Optional
M = Mandatory

Name	E+H Matrix	Index	Read	Write	Object typ	* Parameter	Data type	Size bytes	Storage class
Physical Block (continued)									
not used		36							
not used		37							
not used		38							
not used		39							
not used		40							
not used		41							
not used		42							
not used		43							
DESCRIPTOR	VAH0	44	X	X	Simple	M	Octet String	32	S
DEVICE_MESSAGE	VAH5	45	X	X	Simple	M	Octet String	32	S
DEVICE_INSTAL_DATE	VAH4	46	X	X	Simple	M	Octet String	8	S
not used		47							
not used		48							
not used		49							
not used		50							
not used		51							
Actual Error		52	X		Simple	O	Unsigned 16	2	D
not used		53							
UpDownFeaturesSupported		54	X		Simple	M	Octet String	1	Cst
UpDownCtrl parameter		55		X	Simple	O	Unsigned 8	1	D
UpDown parameter		56	X	X	Record	O	UpDownData	20	D
Device Bus Address		57	X		Simple	O	Unsigned 8	1	D
not used		58							
not used		59							
not used		60							
not used		61							
not used		62							
not used		63							
not used		64							

* Parameter: O = Optional
M = Mandatory

Name	E+H Matrix	Index	Read	Write	Object typ	* Para-meter	Data type	Size bytes	Storage class
Transducer Block									
BLOCK OBJECT		65	X		Record	M	DS-32	20	C
ST_REV	VAH1	66	X		Simple	M	Unsigned 16	2	N
TAG_DESC	VAH0	67	X	X	Simple	M	Octet String	32	S
STRATEGY		68	X	X	Simple	M	Unsigned 16	2	S
ALERT_KEY		69	X	X	Simple	M	Unsigned 8	1	S
TARGET_MODE		70	X	X	Simple	M	Unsigned 8	1	S
MODE_BLK		71	X		Record	M	DS-37	3	
ALARM_SUM	V7H0/1	72	X		Record	M	DS-42	8	D
FLOWRATE	V0H0	73	X		Simple	M	float	4	D
NOMINAL_SIZE	V4H1	74	X	X	Simple	M	float	4	S
FILTER_TYPE	V9H4	75	X	X	Simple	O	Unsigned 8	1	S
DEVICE_MODE	V9H0	76	X	X	Simple	O	Unsigned 8	1	S
FLOWRATE_UNITS	V0H1	77	X	X	Simple	M	Unsigned 16	2	S
SELF_CHECKING	V9H1	78	X	X	Simple	O	Unsigned 8	1	S
CALIBRATION_FACTOR	V4H0	79	X	X	Simple	M	float	4	S
ZERO_POINT	V9H3	80	X	X	Simple	O	float	4	N
FLOW_DIRECTION	V5H3	81	X	X	Simple	O	Unsigned 8	1	S
UPPER_SENSOR_LIMIT (not used)		82							
LOWER_SENSOR_LIMIT (not used)		83							
SAMPLE_RATE (not used)		84							
EPD _THRESHOLD (not used)		85							
LOW_FLOW_CUTOFF (not used)		86							
MASS_FLOWRATE (not used)		87							
MASS_FLOWRATE_UNITS (not used)		88							
ZERO_POINT_ADJUST (not used)		89							
OSCILLATION_FREQ. (not used)		90							
VORTEX_FREQ. (not used)		91							
VOLUME_FLOW		92	X		Simple	O	float	4	D
VOLUME FLOW UNITS		93	X	X	Simple	O	Unsigned 16	2	S
TEMPERATURE (not used)		94							
TEMPERATURE UNITS		95							
DENSITY (not used)		96							
DENSITY_UNITS (not used)		97							
not used		98							
not used		99							
TB_SYSTEM_CONFIG		100	X		Simple	O	Unsigned 8	1	D
TB_TOTALIZER_OVERFLOWS		101	X		Simple	O	Unsigned 16	2	N
TB_GAL_BAR		102	X	X	Simple	O	Unsigned 8	1	S
TB_UNIT_DIAMETER		103	X	X	Simple	O	Unsigned 16	2	S
TB_UNIT_VOLUME		104	X	X	Simple	O	Unsigned 16	2	S
TB_PZR		105	X	X	Simple	O	Unsigned 8	1	N
TB_EPD_RESPONCE_TIME		106	X	X	Simple	O	Unsigned 8	1	N
TB_FUNCTION_ECC		107	X	X	Simple	O	Unsigned 8	1	N
TB_EPD_ELECTRODE		108	X		Simple	O	Unsigned 8	1	Cst
TB_RECOVERY_TIME_ECC		109	X	X	Simple	O	Unsigned 16	2	N

* Parameter: O = Optional
M = Mandatory

Name	E+H Matrix	Index	Read	Write	Object typ	* Parameter	Data type	Size bytes	Storage class
Transducer Block (continued)									
TB_POLARITY_ECC		110	X	X	Simple	O	Unsigned 8	1	N
TB_AMP_MODE		111	X	X	Simple	O	Unsigned 8	1	N
TB_DELAY		112	X	X	Simple	O	Unsigned 16	2	N
TB_CALIB_FACT_NEG		113	X	X	Simple	O	Float	4	S
TB_MAX_SAMPLE_RATE		114	X	X	Simple	O	Float	4	N
TB_SENS_SW_VER		115	X		Simple	O	Visible String	16	Cst
TB_ASSIGN_DISP_LINE1		116	X	X	Simple	O	Unsigned 8	1	N
TB_ASSIGN_DISP_LINE2		117	X	X	Simple	O	Unsigned 8	1	N
TB_ASSIGN_LANGUAGE		118	X	X	Simple	O	Unsigned 8	1	N
TB_DISPLAY_CONTRAST		119	X	X	Simple	O	Unsigned 8	1	N
TB_DISPLAY_DAMPING		120	X	X	Simple	O	Unsigned 16	2	N
TB_DISPLAY_FORM_FLOW		121	X	X	Simple	O	Unsigned 8	1	N
not used		122							
TB_IOUT_URV		123	X	X	Simple	O	float	4	S
TB_IOUT_TAU		124	X	X	Simple	O	float	4	S
TB_IOUT_FAILSAVE		125	X	X	Simple	O	Unsigned 8	1	S
TB_IOUT_SIM_CURRENT		126	X	X	Simple	O	Unsigned 8	1	N
TB_IOUT_ACT_VALUE		127	X		Simple	O	float	4	D
TB_LOCAL_REMOTE		128	X	X	Simple	O	Unsigned 8	1	S
TB_CODE_PAGE		129	X	X	Simple	O	Signed 16	2	S
TB_TOT_1		130	X		Simple	O	Float	4	D
TB_CUR_RANGE		131	X	X	Simple	O	Unsigned 8	1	N
TB_MSUE_PAGE		132	X	X	Simple	O	Unsigned 8	1	N
TB_TOT_RESET		133	X	X	Simple	O	Unsigned 8	1	N
TB_SYSTEM_OPTIONS		134	X		Simple	O	Unsigned 8	1	Cst
TB_SENS_SOFT_INT		135	X		Simple	O	Unsigned 16	2	Cst
TB_COIL_SLOPE_PAGE		136	X	X	Simple	O	Unsigned 16	2	N
not used		137							
not used		138							
not used		139							
not used		140							
not used		141							
not used		142							
not used		143							
not used		144							
not used		145							
not used		146							
not used		147							
not used		148							
not used		149							
not used		150							
not used		151							
not used		152							
not used		153							
not used		154							
not used		155							
not used		156							
not used		157							
not used		158							
not used		159							

* Parameter: O = Optional
M = Mandatory

Name	E+H Matrix	Index	Read	Write	Object typ	* Para-meter	Data type	Size bytes	Storage class
AI - Volumeflow Block									
BLOCK OBJECT		160	X		Record	M	DS-32	20	C
ST_REV	V8H1	161	X		Simple	M	Unsigned 16	2	N
TAG_DESC	V8H0	162	X	X	Simple	M	Octet String	32	S
STRATEGY		163	X	X	Simple	M	Unsigned 16	2	S
ALERT_KEY		164	X	X	Simple	M	Unsigned 8	1	S
TARGET_MODE	V6H0	165	X	X	Simple	M	Unsigned 8	1	S
MODE_BLK	V6	166	X		Record	M	DS-37	3	
ALARM_SUM	V7	167	X		Record	M	DS-42	8	D
not used		168							
not used		169							
OUT	V0	170	X		Record	M	DS-33	5	D
PV_SCALE	V0H5/6	171	X	X	Record	M	DS-36	11	S
OUT_SCALE	V0H2/3	172	X	X	Record	M	DS-36	11	S
not used		173							
CHANNEL		174	X	X	Simple	M	Unsigned 16	2	S
not used		175							
PV_FTIME	V0H8	176	X	X	Simple	M	float	4	N
not used		177							
not used		178							
ALARM_HYS	V1H0	179	X	X	Simple	M	float	4	S
not used		180							
HI_HI_LIM	V2H0	181	X	X	Simple	M	float	4	S
not used		182							
HI_LIM	V3H0	183	X	X	Simple	M	float	4	S
not used		184							
LO_LIM	V4H0	185	X	X	Simple	M	float	4	S
not used		186							
LO_LO_LIM	V5H0	187	X	X	Simple	M	float	4	S
not used		188							
not used		189							
HI_HI_ALM	V2	190	X		Record	M	DS-39	16	D
HI_ALM	V3	191	X		Record	M	DS-39	16	D
LO_ALM	V4	192	X		Record	M	DS-39	16	D
LO_LO_ALM	V5	193	X		Record	M	DS-39	16	D
SIMULATE	V9	194	X	X	Record	M	DS-50	6	N
not used		195							
not used		196							
not used		197							
not used		198							
not used		199							
AI1_TYPE		200	X		Simple	O	Unsigned 16	2	Cst
VIEW_PHYSICAL BLOCK		201	X		Record	M	Unsigned16, DS-37,DS-42, Octet String [4]	17	D
VIEW_TRANSDUCER BLOCK		202	X		Record	M	Unsigned16, DS-37,DS-42, float	17	D
VIEW_AI		203	X		Record	M	Unsigned16, DS-37,DS-42, DS-33	18	D

* Parameter: O = Optional
M = Mandatory

All parameters in **Slot 2**, the index are derived from the following tables:

Name	E+H Matrix	Index	Read	Write	Object typ	* Parameter	Data type	Size bytes	Storage class
Totalizer 1 Block									
BLOCK OBJECT		0	X		Record	M	DS-32	20	C
ST_REV		1	X		Simple	M	Unsigned 16	2	N
TAG_DESC		2	X	X	Simple	M	Octet String	32	S
STRATEGY		3	X	X	Simple	M	Unsigned 16	2	S
ALERT_KEY		4	X	X	Simple	M	Unsigned 8	1	S
TARGET_MODE		5	X	X	Simple	M	Unsigned 8	1	S
MODE_BLK		6	X		Record	M	DS-37	3	
ALARM_SUM		7	X		Record	M	DS-42	8	D
not used		8							
not used		9							
OUT_TOTAL		10	X		Record	M	DS-33	5	D
not used		11							
TOT_UNITS		12	X	X	Index	M	Unsigned 16	2	S
not used		13							
CHANNEL		14	X	X	Simple	M	Unsigned 16	2	S
RESET_TOT		15	X	X	Simple	M	Unsigned 8	1	N
MODE_TOT		16	X	X	Simple	M	Unsigned 8	1	S
not used		17							
FAIL_TOT		18	X	X	Simple	M	Unsigned 8	1	S
not used		19							
POLAR_TOT		20	X	X	Simple	M	Unsigned 8	1	S
not used		21							
ALARM_HYS		22	X	X	Simple	M	float	4	S
HI_HI_LIM		23	X	X	Simple	M	float	4	S
HI_LIM		24	X	X	Simple	M	float	4	S
HI_HI_ALM		25	X		Record	M	DS-39	16	D
HI_ALM		26	X		Record	M	DS-39	16	D
not used		27							
not used		28							
not used		29							
not used		30							
not used		31							
TOT1_TYPE		32	X		Simple	O	Unsigned 16	2	Cst
VIEW_TOT		33	X		Record	M	Unsigned 16	18	D

* Parameter: O = Optional
M = Mandatory

5.10 Commuwin II operating matrix

Transmitter Device-Block, PROFIBUS-DP

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURED VALUE	FLOWRATE	TOTALIZED VOL.	FLOW RATE UNITS	VOLUME UNIT		PIPE SIZE UNIT				
V1										
V2										
V3										
V4										
V5 DISPLAY		RESET TOTALIZER	DISPLAY LINE 1	DISPLAY LINE 2	DISPLAY DAMPING	SIGNIFICANT DIDIT	LCD CONTRAST	LANGUAGE		
V6 COMMUNI-CATION		BUS ADDRESS	LOC OPERATION							
V7 SYSTEM PARAMETER	POS. ZERO RETURN		ACCESS CODE	SELFCHECK	DIAGNOSTIC CODE		SW VERSION	SW VERSION COM	HW VERSION DP	
V8 PROCESS PARAMETER	LOW FLOW CUTOFF	NOISE SUPPRESSION	EMPTY PIPE DET.		DEVICE MODE	FLOW DIRECTION			GAIN RANGE	DELAY
V9 SENSOR DATEN	K-FACTOR POS.	K-FACTOR NEG.	ZERO POINT	NOMINAL DIAMETER	MAX. SAMPLE RATE	SAMPLE RATE	SERIAL NUMBER	EPD ELECTRODE		
VA SETUP	TAG NUMBER									

Commuwin II - operating matrix
Transmitter Device-Block, PROFIBUS-PA

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 MEASURED VALUE	FLOWRATE	TOTALIZED VOL.	FLOW RATE UNITS	VOLUME UNIT		PIPE SIZE UNIT				
V1 CURRENT OUTPUT	FULL SCALE 1				TIME CONSTANT	CURRENT RANGE	FAILSAFE MODE	SIMULATION CURR.	ACTAUL CURRENT	
V2										
V3										
V4										
V5 DISPLAY		RESET TOTALIZER	DISPLAY LINE 1	DISPLAY LINE 2	DISPLAY DAMPING	SIGNIFICANT DIDIT	LCD CONTRAST	LANGUAGE		
V6 COMMUNI-CATION		BUS ADDRESS	LOC OPERATION							
V7 SYSTEM PARAMETER	POS. ZERO RETURN		ACCESS CODE	SELFCHECK	DIAGNOSTIC CODE		SW VERSION	SW VERSION COM	HW VERSION PA	
V8 PROCESS PARAMETER	LOW FLOW CUTOFF	NOISE SUPPRESSION	EMPTY PIPE DET.		DEVICE MODE	FLOW DIRECTION			GAIN RANGE	DELAY
V9 SENSOR DATEN	K-FACTOR POS.	K-FACTOR NEG.	ZERO POINT	NOMINAL DIAMETER	MAX. SAMPLE RATE	SAMPLE RATE	SERIAL NUMBER	EPD ELECTRODE		
VA SETUP	TAG NUMBER									

Commuwin II - operating matrix
Transmitter Physical-Block, PROFIBUS-DP/-PA

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0										
V1										
V2										
V3										
V4										
V5										
V6										
V7 ALARM STATUS	CURRENT	DISABLE								
V8 BLOCK PARAMETER	TAG NUMBER	ST REVISION								
V9 DIAGNOSIS	DIAGNOSIS	DIAGNOSIS 2	DIAGNOSIS 3	MASK	MASK 2	MASK 3	SOFTWARE VERSION	HARDWARE VERSION	DIAGNOSIS EXT	DIAG MASK EXT
VA DEVICE DATA	DESCRIPTOR	MANU-FACTERER ID	DEVICE ID	SERIAL NUMBER	INSTALLATION DATE	MESSAGE	DEVICE CERTIFICAT	SECURITY LOCKING	SOFTWARE RESET	

Commuwin II - operating matrix
Transmitter Flow-Block, PROFIBUS-DP/-PA

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 FLOWRATE	FLOWRATE	FLOW UNIT								
V1										
V2 VORTEX		SAMPLE RATE								
V3										
V4 SENSOR DATA	CALIBR. FACTOR	NOMINAL DIAMETER								
V5 PROCESSING PARAMETER		LOW FLOW CUTOFF		FLOW DIRECTION						
V6										
V7 ALARM STATUS	CURRENT	DISABLE								
V8 BLOCK PARAMETER	TAG NUMBER	ST REVISION								
V9 SYSTEM PARAMETER	DEVICE MODE	SELF CHECK		ZERO POINT						
VA										

Commuwin II - operating matrix
Transmitter Analog Input-Block, PROFIBUS-DP/-PA

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 OUT	OUT VALUE	OUT STATUS	OUT MIN	OUT MAX	OUT UNIT	PV MIN	PV MAX	PV SCALE UNIT	PV TIME	
V1 ALARM-LIMITS	ALARM HYSTERESE									
V2 HI_HI_ALARM	HI_HI_LIM	VALUE	ALARM STATUS	SWITCH ON POINT	SWITCH OFF POINT					
V3 HI_ALARM	HI_LIM	VALUE	ALARM STATUS	SWITCH ON POINT	SWITCH OFF POINT					
V4 LO_ALARM	LO_LIM	VALUE	ALARM STATUS	SWITCH ON POINT	SWITCH OFF POINT					
V5 LO_LO_ALARM	LO_LO_LIM	VALUE	ALARM STATUS	SWITCH ON POINT	SWITCH OFF POINT					
V6 BLOCK MODE	TARGET MODE	ACTUAL	PERMITTED	NORMAL						
V7 ALARM-SUMMARY	CURRENT	DISABLE								
V8 BLOCK-PARAMETER	TAG DESCRIPTION	ST REVISION								
V9 SIMULATION	VALUE	STATUS	ON OFF							
VA										

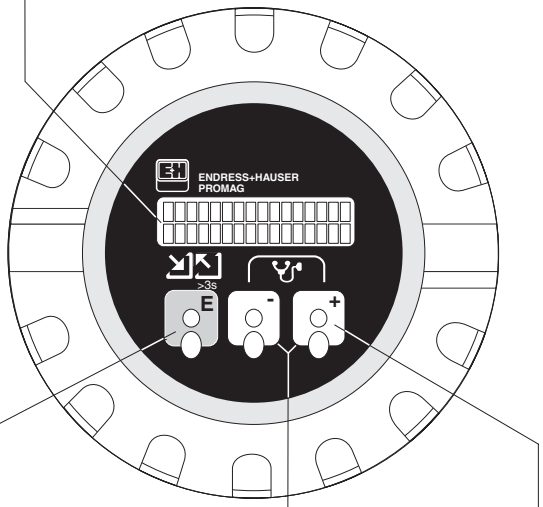
6 Display and Operation

6.1 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

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

E Access function
Save entered figures and settings

ba029y34

Fig. 35
Display and operating elements

6.2 Operation (operating matrix)

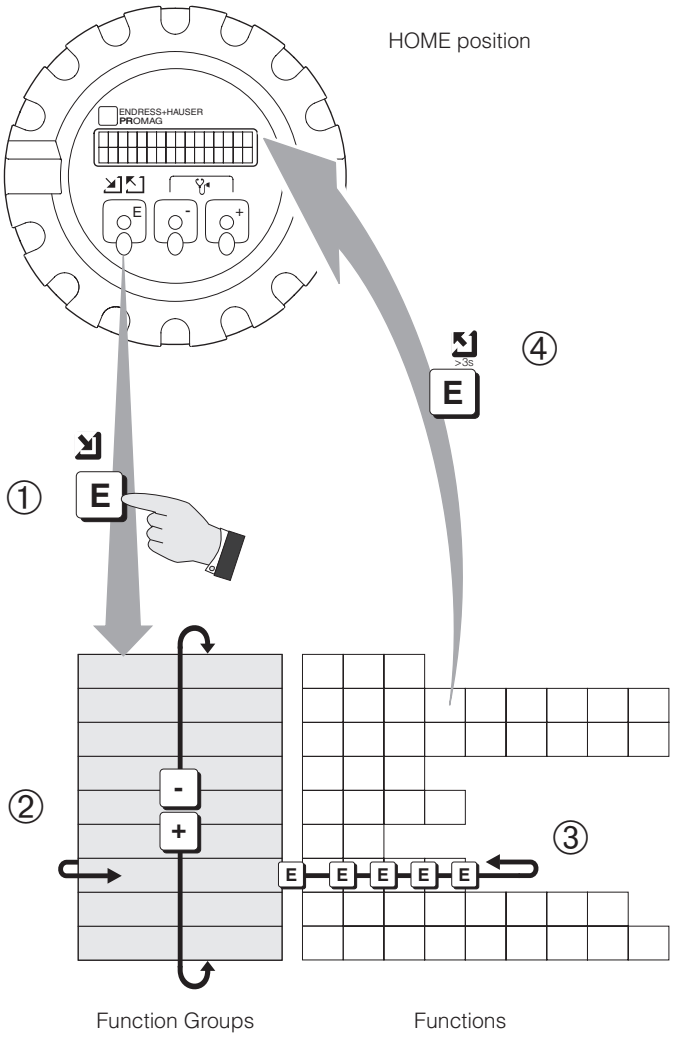
① Access to the operating matrix (from the HOME position)

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 109
Operating example → see page 60
Function description → see page 61 ff.

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



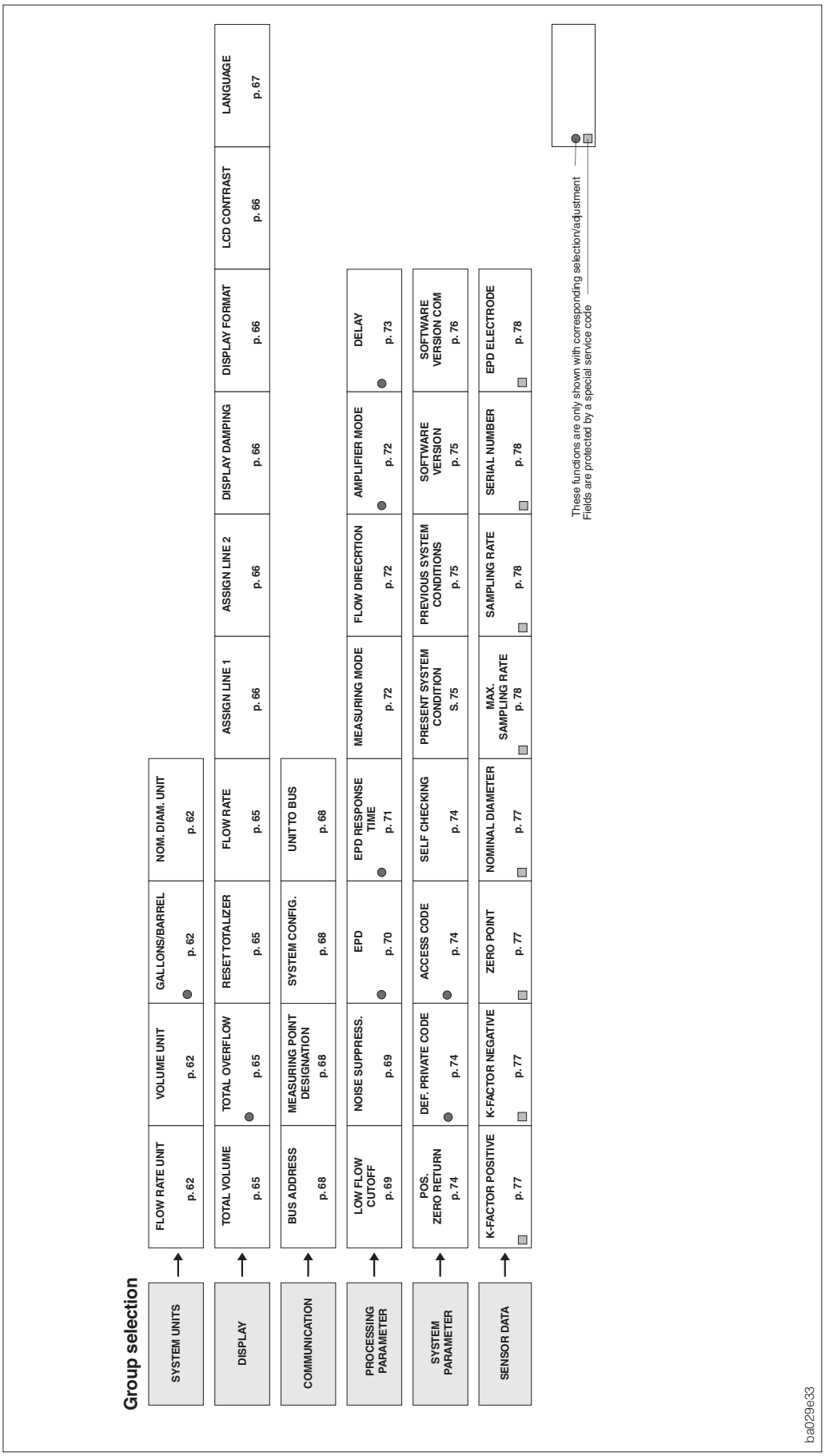
Note!

- 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.

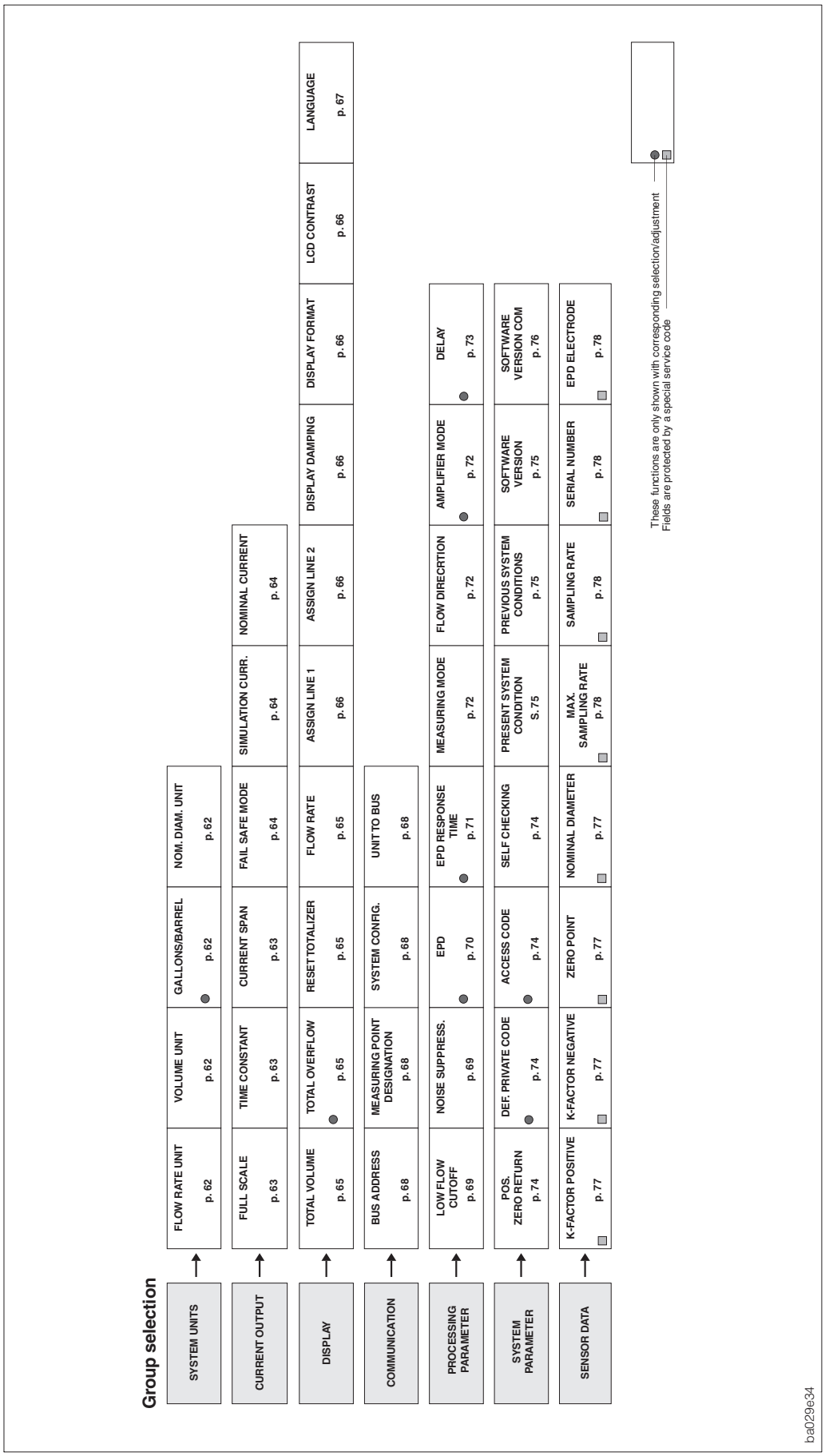
ba009y33

Fig. 36
Selecting functions in the E+H operating matrix

Operating matrix Promag 33 PROFIBUS-DP



Operating matrix Promag 33 PROFIBUS-PA



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 Fig. on page 57 resp. 58). Selection of these functions within the E+H matrix is carried out as described on page 56. 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.

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 74).
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.


Caution!

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”.

6.3 Operating example

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

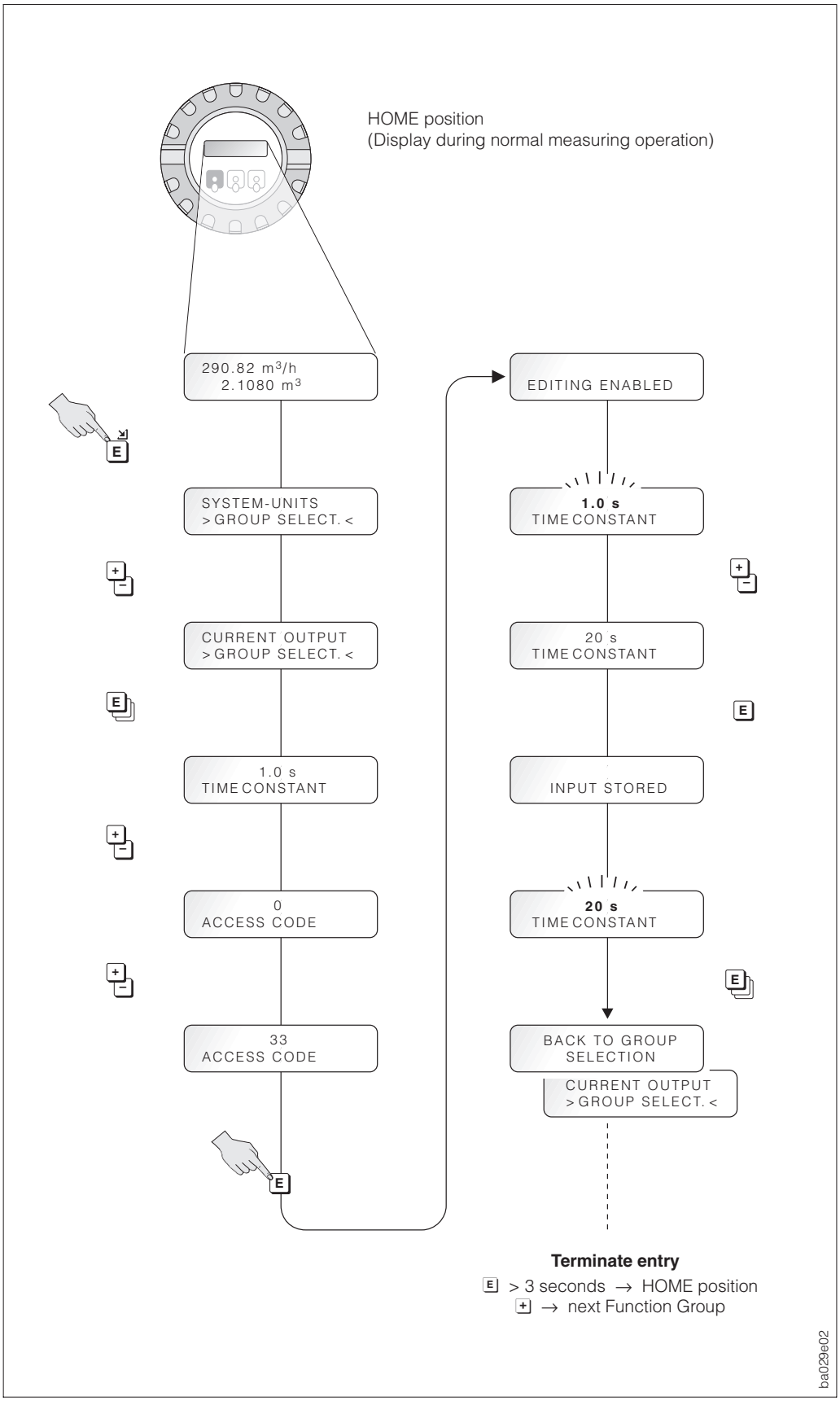


Fig. 37
Operating example
(E+H operating matrix)

7 Functions

This section is an in-depth description of the individual functions and specifications of Promag 33. Factory settings are indicated in ***bold italics***.
With Promag 33 instruments with customer-specific configuration, values/settings may differ from the factory settings shown here.

Function group **SYSTEM UNITS**	
FLOW RATE UNIT	Selection of the required units for the flow rate (volume/time). The units selected here also define those for: • Creepage • Full scale values for current output (only with PROFIBUS-PA available) 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 are also the same as those for the totaliser value (and totaliser overflow) dm³ – ***m³*** – l – hl – gal – bbl – 10³ gal – ft³
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 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 77). ***mm*** – inch Display of the actual set nominal diameter (in the units selected).

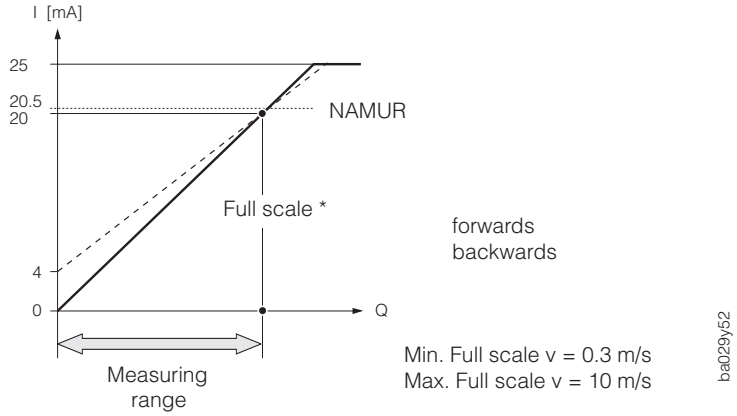
Note!

Function group
CURRENT OUTPUT (only with PROFIBUS-PA available)

FULL SCALE

Enter the desired full scale value for the flow rate at 20 mA. The max. possible overload of the scaled full scale value depends on the setting in the function "CURRENT SPAN" (see page 63).

Note!
Scaling always applies to both directions of flow (bidirectional), but with the unidirectional mode, only the positive flow signal is shown (forwards).



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

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.

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)

Function group

CURRENT OUTPUT (only with PROFIBUS-PA available)

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.

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.

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!

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 (NAMUR)

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 (NAMUR)

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.

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. 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. Display of the actual totalizer value (HOME position).
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. ***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. Max. 5-digit number: –99999...+99999. Unit according to the selection in the function “FLOW RATE UNIT”. UNIT ==> FLOW RATE UNIT Unit selection → see “FLOW RATE UNIT” function

Note!

Note!

Note!

Function group **DISPLAY**	
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
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
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.

Note!

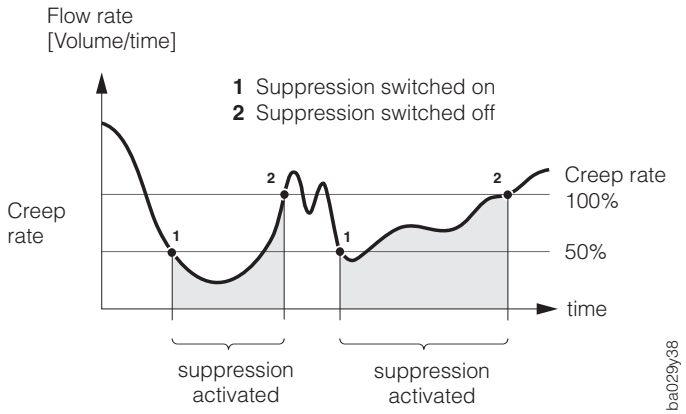
Note!

Caution!

Function group **DISPLAY**	
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)


Note!

Function group **COMMUNICATION**	
BUS ADDRESS	In this function, the bus address can be set. Local configuration can de deactivated using a miniature switch (DIP switch) on the communication board. When this is done, “DIP switch” is displayed (see also page 33)  3-digit number: 0...126 factory setting: ***126***
MEASURING POINT DESIGNATION	In this function, the actual measuring point designation (name) is displayed. It is set by PROFIBUS master, e.g. Commuwin II. The measuring point designation corresponds to the TAG-DESC of the Physical Block, as defined in the PROFIBUS-PA profile.  The complete measuring point designantion is displayed (up to 32 characters).
SYSTEM CONFIG.	Using this function, it is possible to switch between local operation with E+H matrix and remote operation via PROFIBUS-DP/-PA. The device can only be operated either via local operation in **>local<** mode or via PLC (Class I master / Class II master) in **>remote<** mode at one time. The system configuration and parameters are independent from the operation mode and valid even in the event of a change of the operating mode.  ***LOCAL*** – REMOTE
UNIT TO BUS	In this function the system units set on the instrument are transmitted to the bus or to Class I master. This function is only required if the system unit have been changed via the local operation and this change shall be propagated to the AI blocks. Changes to the system units via local operation are not automatically transmitted to the bus or master. Only after the function “UNIT TO BUS” is activated, the system units will be transmitted to the bus or master and updated there.  ***CANCEL*** – UNIT TO BUS

Function group **PROCESSING PARAMETERS**	
LOW FLOW CUTOFF	Set the required switch point for the creepage (low flow cutoff). The creep suppression prevents the flow rate 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. 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 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

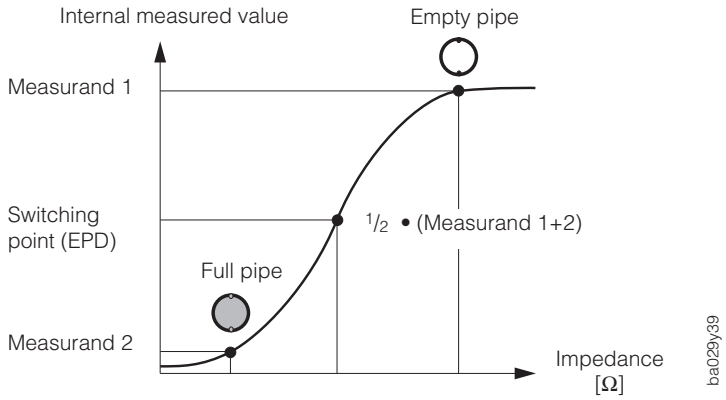
EMPTY PIPE DET.

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.

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 81.

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!

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!

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!

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 ** – CANCEL * Positive flow according to the arrow on the nameplate. ** Positive flow in the opposite direction to the arrow on the nameplate.
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 flow rate 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

Note!

Caution!

Function group **PROCESSING PARAMETERS**	
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 the positive zero return (PZR) the output signals can be deliberately set to zero. Measured value suppresion is equivalent to zero flow: • PROFIBUS-PA interface: flow = 0 • Current output signal (only PROFIBUS-PA): 0/4 mA • Display of HOME position: flow = 0 • Totalizer remains at the laste applicable value. Note! This function has top priority above all other functions of the instrument. Simulations are suppressed for example. ***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***
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 74) 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. 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 83 ff.

Note!

⊞ 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 83 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.

Note!

⊞ 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.

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. XX

- XX: Number of changes if the new software contains additional functions.
- 01.: Number changes if minor alterations are made to the new software. This also applies to special versions of software.
- 3.: Number changes if basic alternations have to be made to the software, e.g. due to technical modifications to the flowmeter.

Function group
SYSTEM PARAMETERS

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. 06. XX. PBUS

- PBUS: Communication interface
- XX.: Number of changes if the new software contains additional functions.
- 06.: Number changes if minor alterations are made to the new software. This also applies to special versions of software.
- 2.: Number changes if basic alternations have to be made to the software, e.g. due to technical modifications to the flowmeter.


Note!

Note!
If display does not show "PBUS", no PROFIBUS-DP/-PA communications board is installed, but another type!

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.

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


Caution!

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.

Value between 2...2000 mm or $^{1}/_{12}$"... 78"
Factory setting: ***dependent*** on the sensor diameter

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!

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


Caution!

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. max. 3-digit number with fixed decimal point: 1.0...60.0 /s (per second) Factory setting: ***dependent*** on the sensor 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.
SAMPLING RATE	Display of the sampling rate (= SAPS). The sampling rate is set in the factory. It is dependent on the sensor type and the pipe diameter. Example: – Promag A, F (DN 25) → 16.7 / s – Promag H (DN 25...100) → 25.0 / s max. 3-digit number with fixed decimal point: – upper limit = depending on nominal diameter (max. 60.0 / s) – lower limit = 1.0 / s Notes! • 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.
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

8 Trouble-shooting, Maintenance and Repairs

8.1 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 83). The error response of the current output (only with PROFIBUS-PA available) is described in the following table:

Positive zero return *not* activated	
	Current output (only with PROFIBUS-PA)
No System / process error present	Measurement OK
System- or process error present	Failsafe mode selectable (see page 64): 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.

Positive zero return *activated*	
	Current output (only with PROFIBUS-PA)
No System / process error present	For 0–20 mA → 0 mA For 4–20 mA → 4 mA
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).

Simulation:

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

8.2 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 83 – Alarm messages **A: ....** → see page 85 – Status messages **S: ....** → see page 85 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 resp. 25, 90. 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 88
The display is blank, with outputs still functioning.	**1** Check the ribbon cable connector of the display module → see page 88 (No. 3b) **2** Replace display module → see page 88 **3** Replace electronics → see page 88
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 88 (No. 8) **2** Replace electronics → see page 88
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 27) and if necessary change round Terminals 41 and 42. **2** Change the setting in the function “FLOW DIRECTION” accordingly → see page 72
Is the display unsettled despite continuous flow?	**1** Check ground and potential equalisation → see page 29 **2** Check to see if air bubbles are in the fluid. **3** Increase the time constant for the current output → see page 63 **4** Increase the display damping for flow → see page 66 *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 66 **2** Function TIME CONSTANT > 5 seconds page 63 **3** Function LOW FLOW CUTOFF = 0 page 69 **4** Function NOISE SUPPRESSION = OFF page 69 **5** Function MEASURING MODE = BIDIRECTIONAL page 72 **6** Function AMPLIFIER MODE = MODE 2 page 72 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?	Negative flows are ignored, i.e. the display of the Promag or the PROFIBUS master show different values → set function “MEASURING MODE” to “UNIDIRECTIONAL” (see page 72).
Is a low flow indicated despite standstill of the fluid and filled measuring tube?	**1** Check ground and potential equalisation → see page 29 **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 69
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 70 ff. **2** Check the following terminal connections: • Electronics: EPD cable → see page 88 (No. 5c) • Remote version: EPD cable → see page 27 (Terminals 36 and 37) **3** Fill the measuring tube.
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 90 (“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** _ _ _ _ – _ _ _ _ _ _ _ _ _ _ _ _ *Order code* **33 X MOD –** □ □ □ □ *Electronic plug-in board* The last four places correspond to the order code on the nameplate of the transmitter → see page 7.

8.3 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 82, 88)
	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 27). 3. Switch off power supply and check the coil current cable (see page 88, No. 7). 4. Replace electronics (see page 82, 88)
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 88, 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 75). 3. Replace electronics (see page 82, 88) 4. Order a DAT, giving the serial number and order code (see page 7, 8) and replace (see page 88).
	7	**: EEPROM FAILURE** Error when accessing EEPROM data (adjusted values of the amplifier).	Replace electronics (see page 82, 88)
	8	**: ROM / RAM FAILURE** Error when accessing program memory (ROM) or main memory (RAM) of the processor.	Replace electronics (see page 82, 88)
	9	**: GAIN ERROR AMPLIFIER** Gain error of the amplifier.	1. Check ground and potential equalisation (see page 29). 2. Switch the power supply off and on again. 3. Replace electronics (see page 82, 88)

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 82, 88)
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 82, 88)
F: SYSTEM ERROR COM-MODULE	**11**	**: MODULE NOT COMPATIBLE** Communication module and amplifier are not compatible.	Replace electronics (see page 82, 88)
	12	**: EEPROM FAILURE** Error when accessing EEPROM data (process and adjustment data of the communication module).	Replace electronics (see page 82, 88)
	13	**: RAM ERROR** Error when accessing the main memory (RAM).	Replace electronics (see page 82, 88)
	14	**: ROM ERROR** Error when accessing the program memory (ROM).	Replace electronics (see page 82, 88)
	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 82, 88)
	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 82, 88)

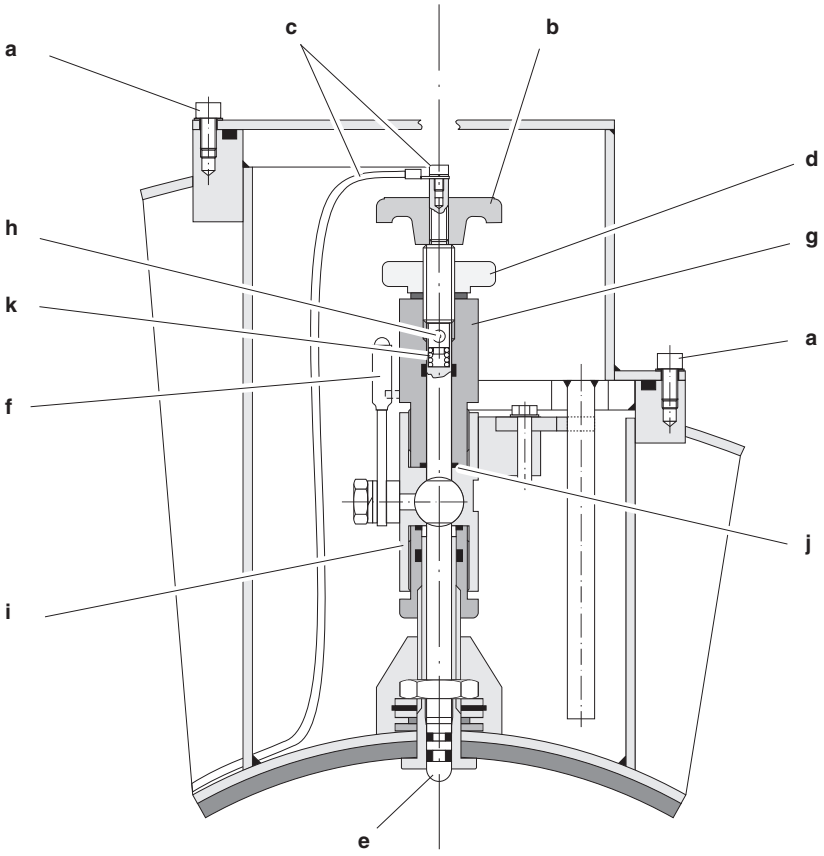
Alarm message	Code	Cause	Remedy
A: EPD ADJUSTMENT VALUES MISSING	**18**	EPD is switched on, but no adjustment has taken place.	Carry out an EPD adjustment as per page 70 ff.
A: EPD ADJUSTMENT NOT POSSIBLE	**19**	EPD is switched on, but an adjustment is not possible because the conductivity of the fluid 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 70 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 70 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 value (see page 63) or 2. Reduce flow rate.
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: EPD ADJUSTMENT RUNNING	**27**	EPD adjustment in progress (full / empty pipe adjustment).	–

8.4 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)		

ba029y21

Fig. 38
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).

8.5 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 105).

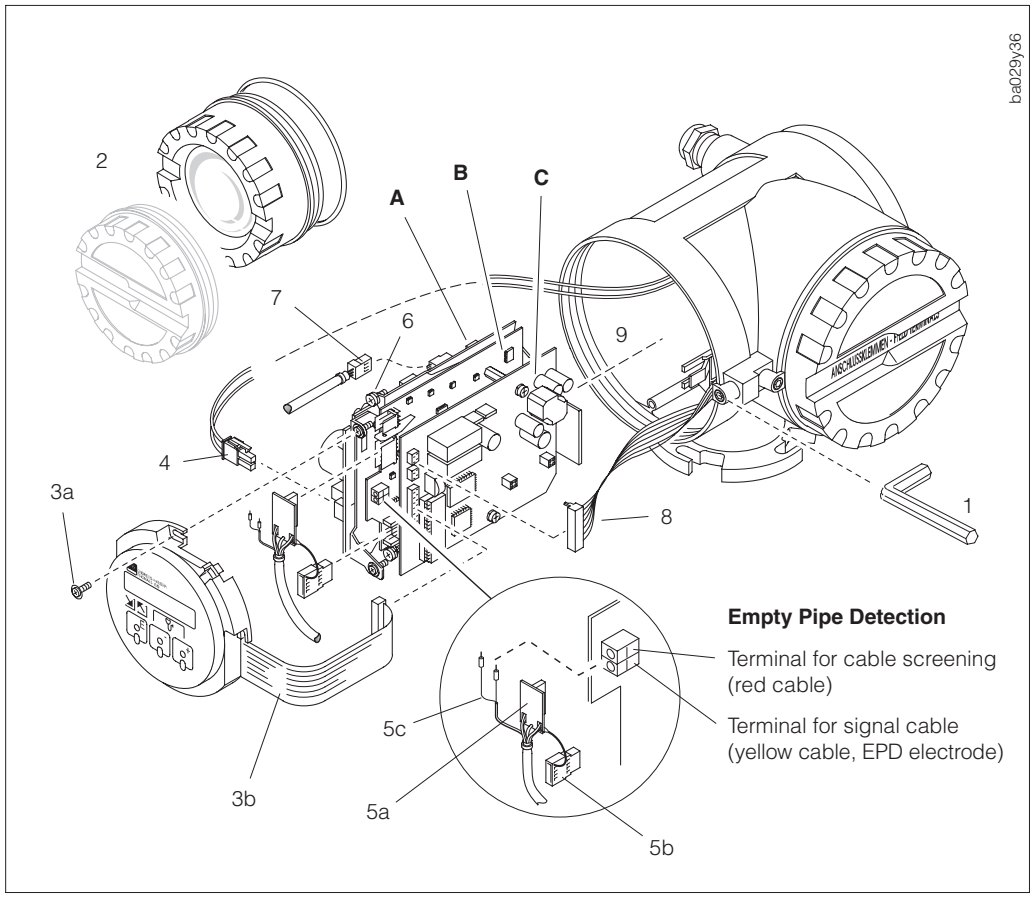


Fig. 39
Replacing the transmitter electronics:

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

8.6 Replacing the COM-Modul

Warning!
- Danger of electrical shock! Switch of the power supply before opening the elctronics housing.
- The local power supply voltage and frequency must agree with the technical data of the power supply boards used.
- When using Ex instruments, the regulations given in the separate Ex documentation have to be observed.

Warning!

❶ a) Loosen the screw of the safety claw (3 mm Allen key).
b) Unscrew the cover of the transmitter electronics compartment.

❷ Remove the local display (if present):
a) Loosen the mounting screws of the display module.
b) Unplug the ribbon cable of the display module from the communications board.

❸ Unplug the two-pole plug of the power supply cable by pressing down the vatch from the power supply board.

❹ Remove cable board of the screened signal cable (incl. the DAT module connected) from the amplifier board..

❺ Loosen the two Phillips screws of the board support plate. Carefully remove the board plate approx. 4…5 cm out of the transmitter housing

❻ Remove the excitation current cable plug from the power supply board.

❼ Remove the ribbon cable plug (connection cable to the terminal area) from the communications board.

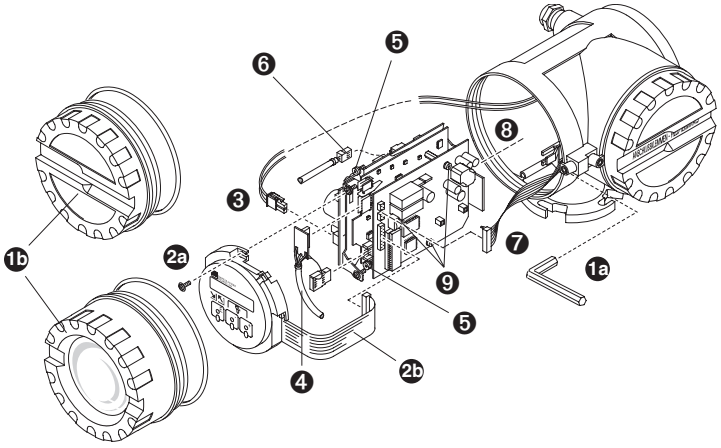
❽ The entire transmitter electronics, together with the board support plate, can now be completely removed from the housing.

Caution!
The Promass M and F electronics are not identical with those of Promass A or I.

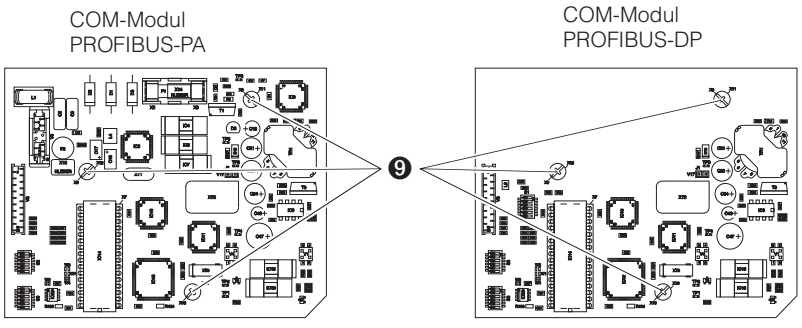
Caution!

❾ Loosen the three screws and remove the communication board.

❿ Replace the old transmitter electronics and reassemble in reverse sequence.



ba029y92



ba029y93

Fig. 40
Replacing the COM-Modul Promag 33

8.7 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 resp. 25.

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 → 1.0 A slow-blow / 250 V; 5.2 × 20 mm

8.8 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.

8.9 Spare parts

The electronics plug-in module of the Promag 33 can be ordered separately as a spare part:
- Replacement → see page 88
- Order code → see page 82

8.10 Maintenance

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

9 Dimensions

9.1 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.

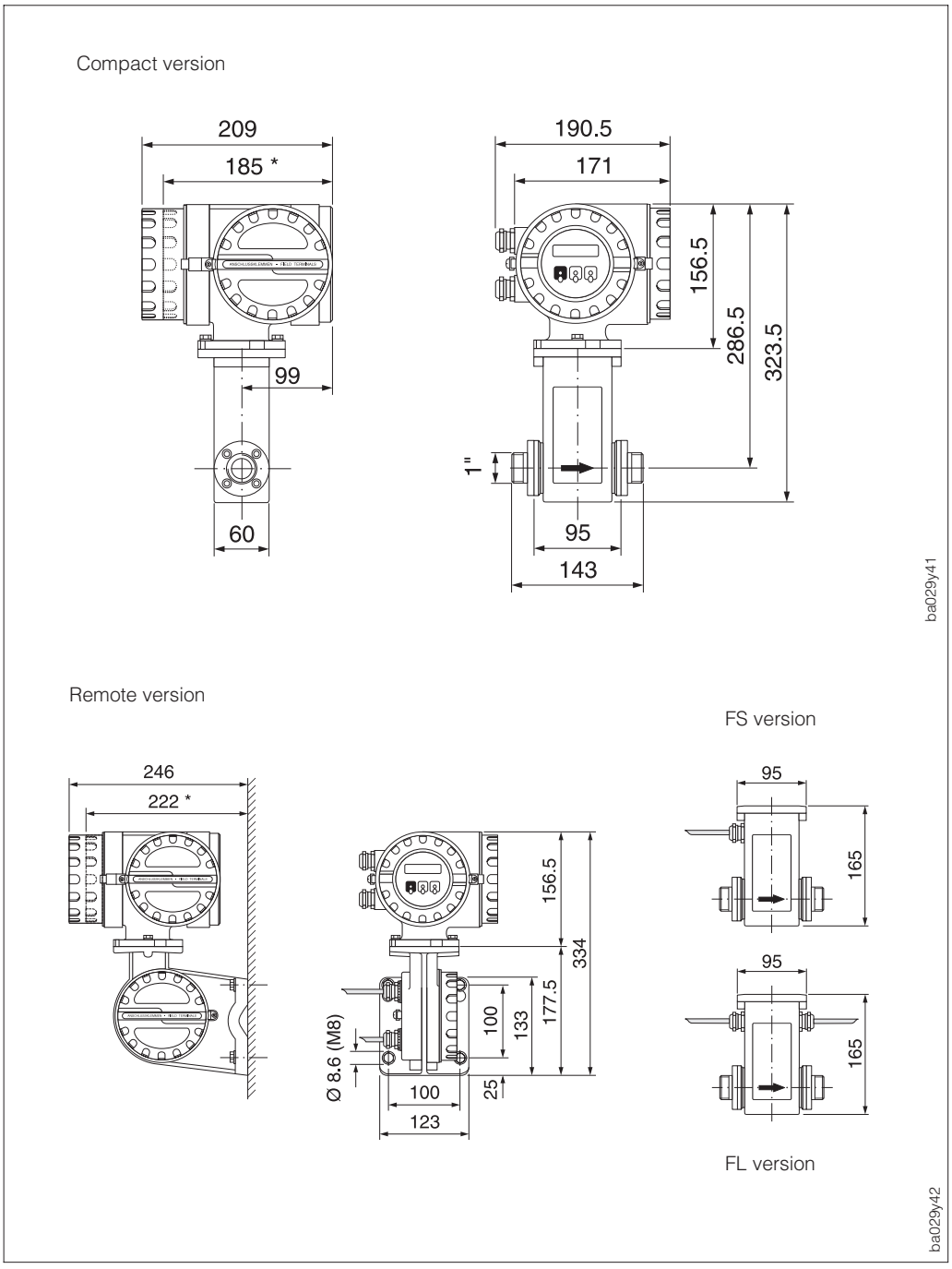


Fig. 41
Dimensions Promag 33 A

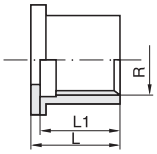
** with blind version*

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

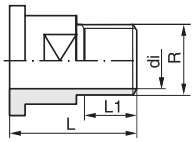
Internal thread
standard thread:
ISO 228/DIN 2999



y43-01..08

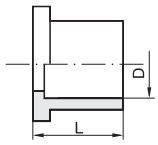
DN	L	L1	Thread
2...15	20	18	1/2"
2...15	20	18	1/2" NPT
25	45	22	1"
25	45	22	1" NPT

External thread
standard thread:
ISO 228/DIN 2999



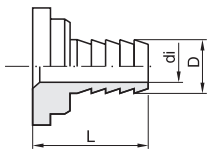
DN	L	L1	di	Thread
2...15	35	13.2	16.1	1/2"
2...15	42	20.0	16.1	1/2" NPT
25	50	16.8	22.0	1"
25	60	25.0	22.0	1" NPT

PVC adhesive coupling



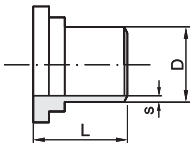
DN	L	D	Pipe connection
2...15	19	20.0	20 · 2
2...15	20	21.5	1/2"
25	66	25.0	25 · 2
25	69	32.0	32 · 2.5
25	69	33.5	1"

Hose connection



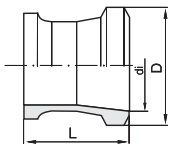
DN	L	D	di	LW
2...15	30	14.5	8.9	13
2...15	30	17.5	12.6	16
2...15	30	21.0	16.1	19

Welded nipple
DN 2...15



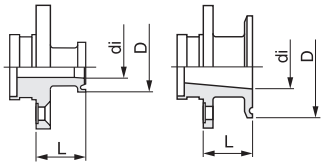
DN	L	D	s	Pipe connection
2...15	20	21.3	2.6	1/2"
2...15	20	21.3	2.6	18 · 1

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



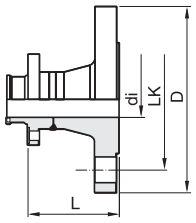
DN	L	D	di	Pipe connection
2...8	24	25.0	9.5	1/2"
15	24	25.0	16.0	3/4"
2...8	24	50.4	22.1	1"
15	24	50.4	22.1	1"
25	24	50.4	22.1	1"

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

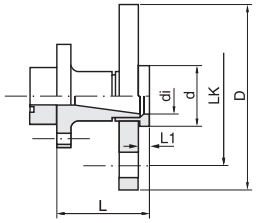
DN	L	D	di	LK
2...8	62.5	95	15	70
15	62.5	95	16	70
25	62.5	115	25	90

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)

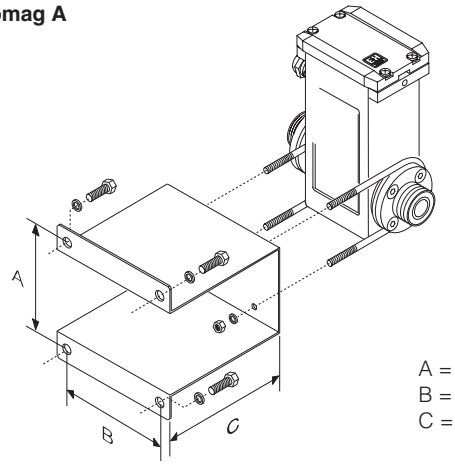


Flange as per DIN 2501/ANSI B16.5/JIS B2210
PN 16/Class 150/10K

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

ba029y59

Fig. 42
Dimensions
Wall mounting kit for Promag A

9.2 Dimensions Promag 33 H

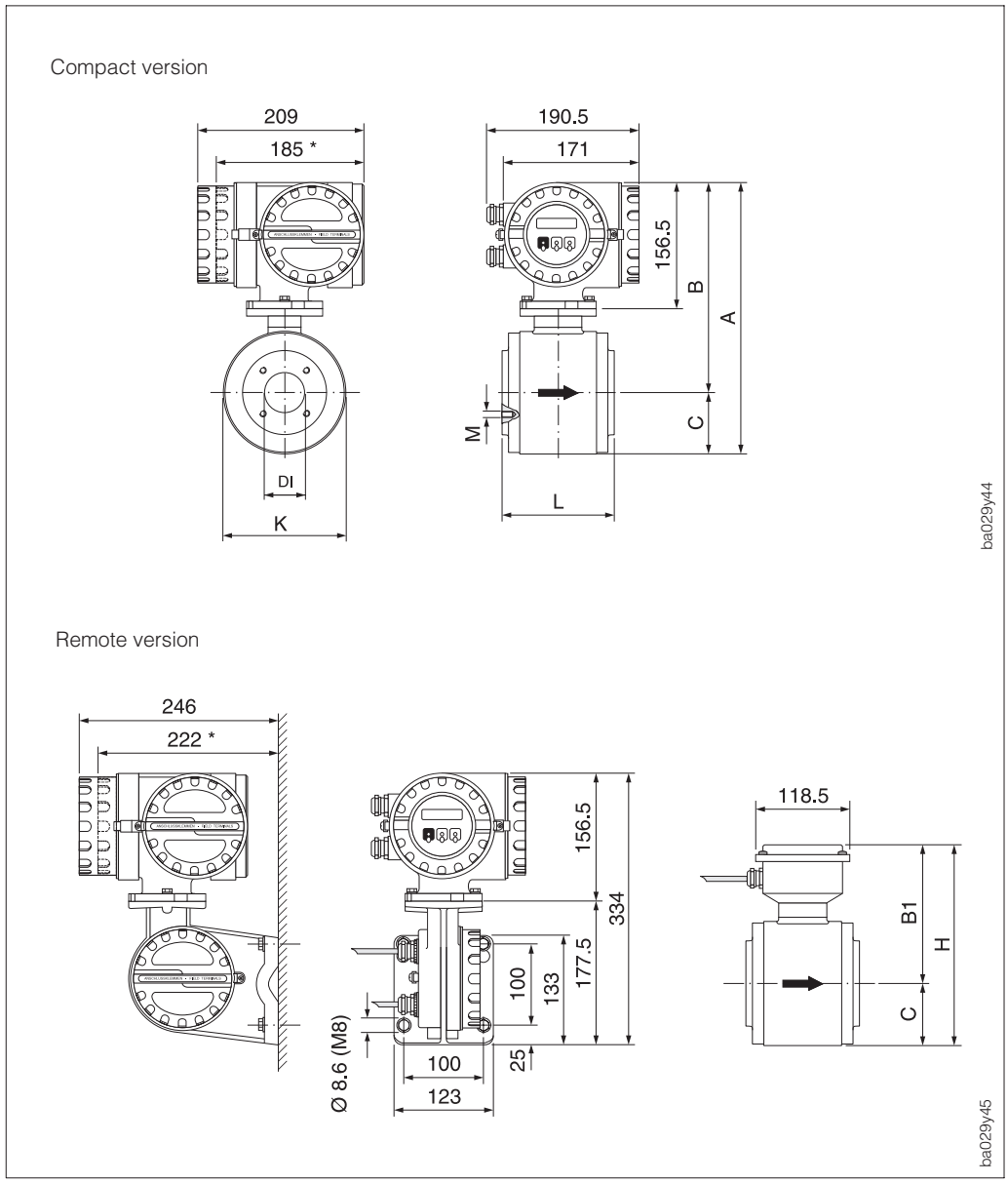


Fig. 43
Dimensions Promag 33 H

** with blind version*

DN [mm]	DN [inch]	DI [1] [mm]	PN DIN [bar]	L [mm]	A [mm]	B [mm]	B1 [mm]	C [mm]	K [mm]	H [mm]	M [mm]	Weight [2] [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

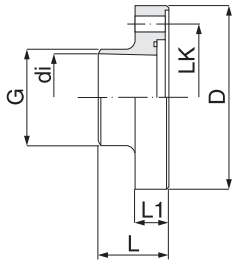
[1] Internal diameter of tube [2] Weight of compact version

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)

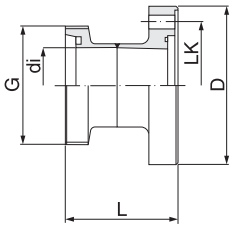
Welded nipple



y46-01..06

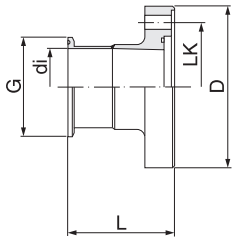
DN	D	G	di [1]	L	L1	LK
25	75	27	22.6	42	19	56.0
25 DIN	79	31	26.0	42	19	60.0
40	92	40	35.3	42	19	71.0
40 DIN	92	43	38.0	42	19	71.0
50	105	55	48.1	42	19	83.5
50 DIN	105	55	50.0	42	19	83.5
65	121	66	59.9	42	21	100.0
65 DIN	121	72	66.0	42	21	100.0
80	147	79	72.6	42	24	121.0
80 DIN	147	87	81.0	42	24	121.0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

DIN 11851



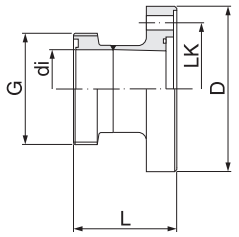
DN	di [1]	G	D	L	LK
25	26	52 x 1/6"	79	68	60.0
40	38	65 x 1/6"	92	72	71.0
50	50	78 x 1/6"	105	74	83.5
65	66	95 x 1/6"	121	78	100.0
80	81	110 x 1/4"	147	83	121.0
100	100	130 x 1/4"	168	92	141.5

Tri-Clamp



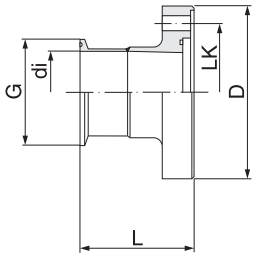
DN	ANSI	di [1]	G	D	L	LK
25	1"	22.1	50.4	75	68.6	56.0
40	1 1/2"	34.8	50.4	92	68.6	71.0
50	2"	47.5	63.9	105	68.6	83.5
65	–	60.2	77.4	121	68.6	100.0
80	3"	72.9	90.9	147	68.6	121.0
100	4"	97.4	118.9	168	68.6	141.5

SMS 1145



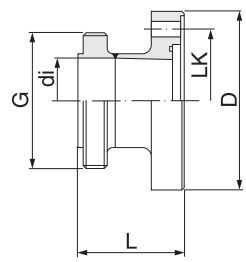
DN	di [1]	G	D	L	LK
25	22.5	40 x 1/6"	75	60	56.0
40	35.5	60 x 1/6"	92	63	71.0
50	48.5	70 x 1/6"	105	65	83.5
65	60.5	85 x 1/6"	121	70	100.0
80	72.0	98 x 1/6"	147	75	121.0
100	97.6	132 x 1/6"	168	70	141.5

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!

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

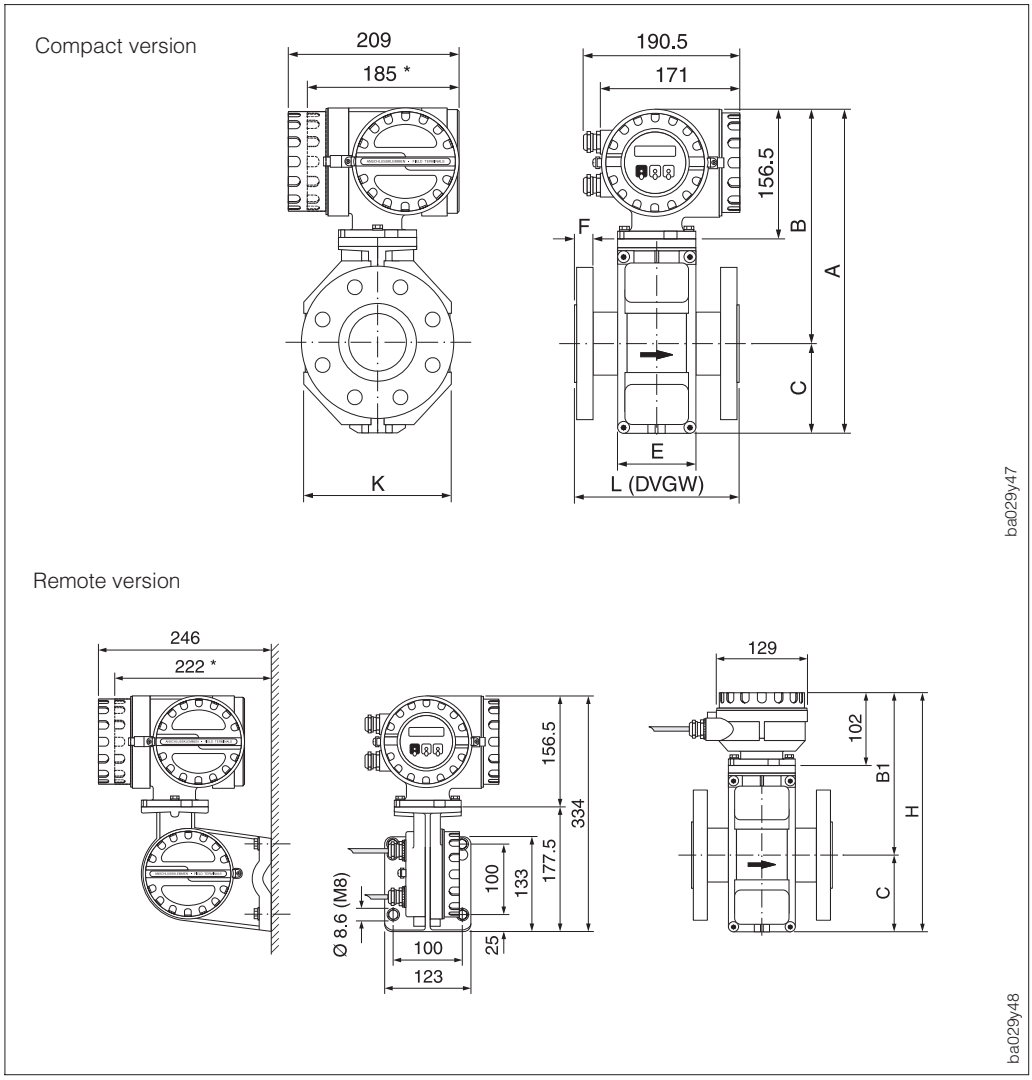


Fig. 44
Dimensions
Promag 33 F (DN 15...300)

** 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

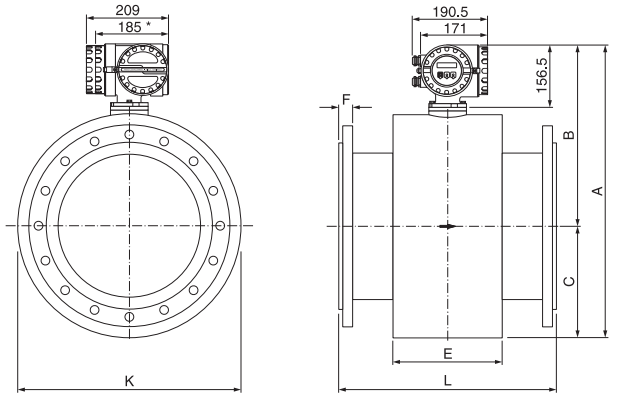
[1)] The length is always identical independent of the chosen pressure rating.
[2)] Weights for compact version only.

Weight:

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

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

Compact version



Remote version

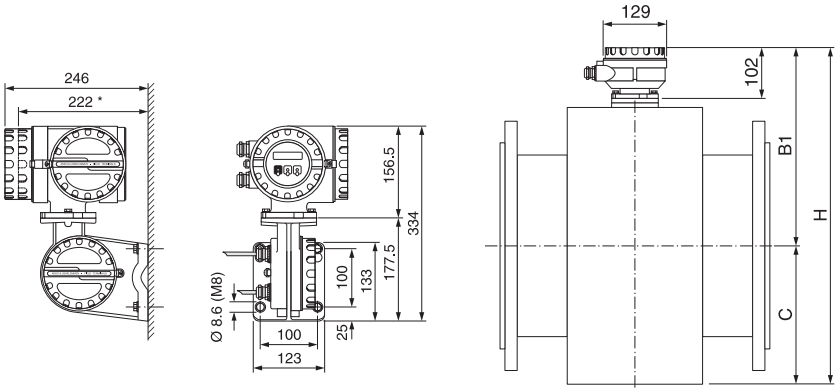


Fig. 45
Dimensions
Promag 33 F (DN 350...2000)

** with blind version*

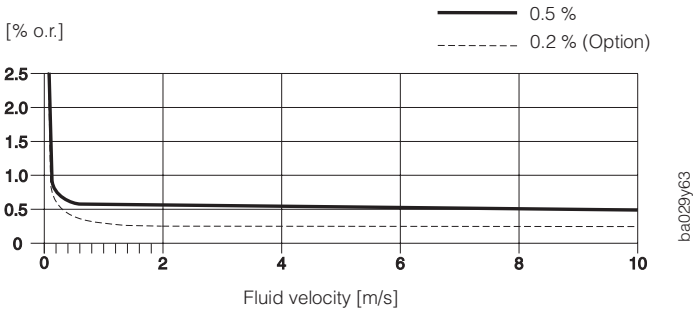
DN		PN			L [1]	A	B	C	K	E	F			H	B1	Weight [2]
[mm]	[inch]	DIN [bar]	ANSI [Class]	AWWA [Class]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	DIN [mm]	ANSI [mm]	AWWA [mm]	[mm]	[mm]	[kg]
350	14"	10	150	–	550	738	456.0	282.0	564	276	26	34.9	–	683.5	401.5	110
400	16"	10	150	–	600	790	482.0	308.0	616	276	26	36.5	–	735.5	427.5	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

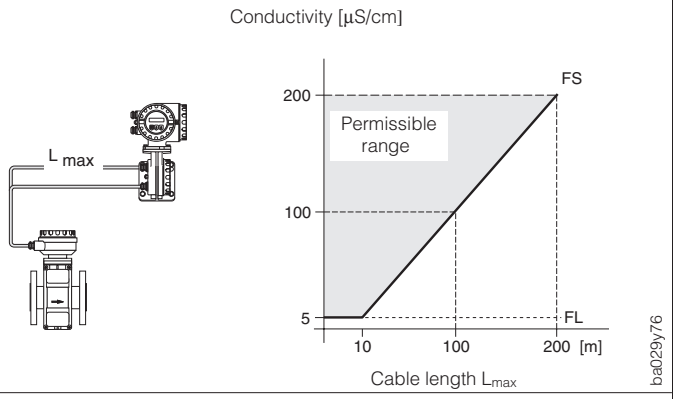
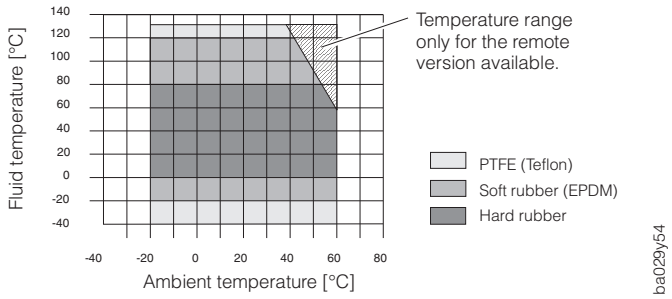
[1] Thickness of the flange face includes sealing strip. The length is always identical independent of the chosen pressure rating.
[2] Weights of compact DIN PN 10 version. Weights for transmitter: see previous page

10 Technical Data

Application	
Instrument name	Flow measuring system “Promag 33” (PROFIBUS-DP/-PA)
Instrument function	Flow measurement of liquids in closed piping. Applications in measurement, control and regulation processes, 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 (PROFIBUS-DP/-PA) consisting of: • Transmitter: Promag 33 • 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.

Output variables PROFIBUS-DP	
Output signal	*PROFIBUS-DP interface:* PROFIBUS-DP according EN 50170 volume 2, RS 485
Signal on alarm	*PROFIBUS-DP interface:* Status- and alarm messages according PROFIBUS profile version 2
Speed of transmission	*Baud rates used:* 9,6 kBaud; 19,2 kBaud; 93,75 kBaud; 187,5 kBaud; 500 kBaud; 1,5 MBaud; 3 MBaud; 6 MBaud; 12 MBaud
Signal encoding	NRZ code
Output variables PROFIBUS-PA	
Output signal	*PROFIBUS-PA interface:* PROFIBUS-PA according EN 50170 volume 2, IEC 1158-2, profile version 2.0 galvanically isolated *Current output:* 0/4...20 mA, galvanically isolated, R_L = max. 350 Ω, time constant selectable, full scale value scaleable, temperature coefficient typ.: 0.005% v.M./°C
Signal on alarm	*PROFIBUS-PA interface:* Status- and alarm messages according PROFIBUS profile version 2 *Current output:* In case of an alarm the current output delivers the previous defined signal.
Current consumption	Current consumption = 12 mA
Permissible power voltages	Non intrinsically safe = 9 V... 32 V
FDE (Fault Disconnection Electronic)	0 mA
Speed of transmission	*Baud rate used:* 31.25 kBit/s
Signal encoding	Manchester II
Output variables general	
Creep suppression	• Switching points selectable (see page 69) • 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.
Measured error	• PROFIBUS-PA interface: ± 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. ± 0.05% 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

Operating conditions (continued)	
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 
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)
Degree of protection (EN 60529)	IP 67 (NEMA 4X) Option: IP 68 (NEMA 6P) for sensor A and F
CIP cleanable	Promag A, H, F → Yes (observe maximum temperature)
SIP cleanable	Promag A → No Promag H → Yes (observe maximum temperature) Promag F → No
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

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"*)

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 102 *"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 107

Mechanical construction	
Design / Dimensions	Dimensions → see pages 91–97 Internal diameter of measuring tube → see page 106
Weight	See pages 91–97
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 *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 28 • 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, –, +) • E+H operating matrix for all instrument functions • Operation via PROFIBUS-DP/-PA
Display	• LC display: illuminated, double-spaced with 16 characters each • Damping of flow display can be adjusted: 0...99 s
Communication	• 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 90
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 50170	Volume 2, PROFIBUS
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 95		
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

11 Functions at a Glance

SYSTEM UNITS	
FLOW RATE UNIT (p. 62)	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. 62)	dm^3 – ***m^3*** – l – hl – gal – bbl – 10^3 gal – ft^3 Your setting: .....
GALLONS / BARREL (p. 62)	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. 62)	***mm*** – inch Your setting: .....

CURRENT OUTPUT (only with PROFIBUS-PA available)	
FULL SCALE 1 (p. 63)	5-digit floating point (e.g. 250.00 m^3/h) Factory setting: ***dependent*** on diameter Your setting: .....
TIME CONSTANT (p. 63)	Floating point: 0.01...100 s Factory setting: ***1.0 s*** Your setting: .....
CURRENT SPAN (p. 63)	0–20 mA ***4–20 mA*** 0–20 mA (25 mA) 4–20 mA (25 mA) Your setting: .....
FAILSAFE MODE (p. 64)	***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 0/4–20 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. 64)	*With "0–20 mA":* ***OFF*** – 0 mA – 10 mA – 20 mA – 22 mA (NAMUR) *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 (NAMUR) *With "4–20 mA (25 mA)":* ***OFF*** – 2 mA – 4 mA – 12 mA – 20 mA – 25 mA Your setting: .....
NOMINAL CURRENT (p. 64)	Display of the actual flow rate. Displayed value: 0.00...25.00 mA

DISPLAY	
TOTAL VOLUME (p. 65)	Display: max. 7-digit floating point 0.0000...9999999 [unit]
TOTAL OVERFLOW (p. 65)	Display: e.g. 74 e7 dm^3 = 74,000,000 dm^3
RESET TOTALIZER (p. 65)	***NO*** – YES
FLOW RATE (p. 65)	Display: max. 5-digit number –99999...+99999 [unit]
ASSIGN LINE 1 (p. 66)	***FLOW RATE*** – TOTAL VOLUME Your setting: .....
ASSIGN LINE 2 (p. 66)	OFF FLOW RATE ***TOTAL VOLUME*** TOTAL OVERFLOW Your setting: .....
DISPLAY DAMPING (p. 66)	max. 2-digit number: 0...99 s Factory setting: ***1 s*** Your setting: .....
DISPLAY FORMAT (p. 66)	***X.XXXX*** 5 significant digits X.XXX 4 significant digits X.XX 3 significant digits Your setting: .....
LCD CONTRAST (p. 66)	**IIIIIIIIIII** ..... A change in contrast is immediately seen on the bar graph
LANGUAGE (p. 67)	ENGLISH – DEUTSCH – FRANCAIS – ESPANOL – ITALIANO – NEDERLANDS – DANSK – NORSK – SVENSKA – SUOMI – BAHASA INDONESIA – JAPANESE (in original alphabet) Your setting: .....

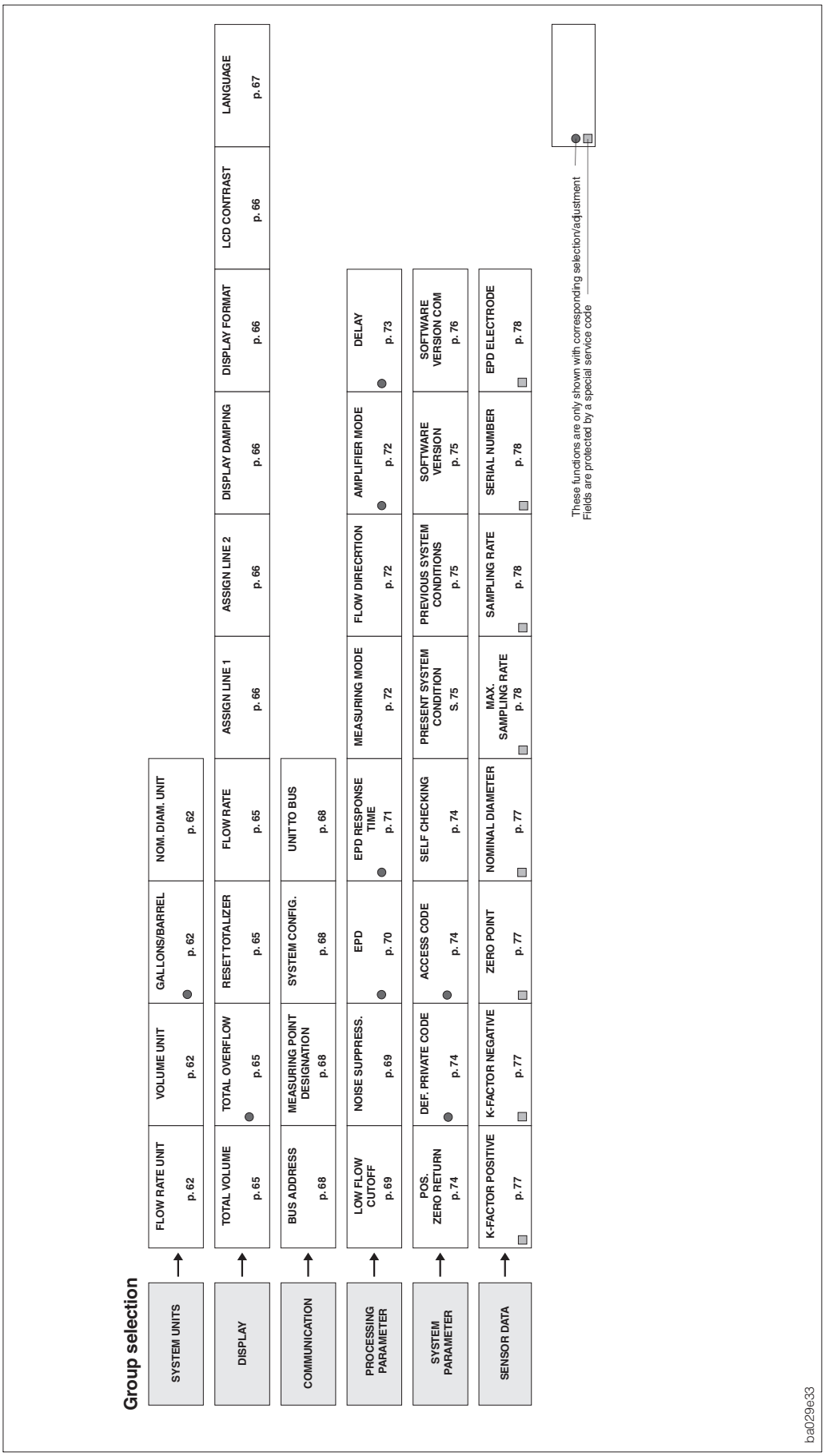
COMMUNICATION	
BUS ADDRESS (p. 68)	max. 3-digit number: 0...126 Factory setting: ***126*** Your setting: .....
TAG NUMBER (S. 69)	Displays the actual measuring-point designation (name)
SYSTEM CONFIG. (p. 68)	Possibility to change between local operation with E+H matrix and remote operation via PROFIBUS-DP /-PA (REMOTE). ***LOCAL*** – REMOTE Your setting: .....
UNIT TO BUS (p. 68)	The system units localy set on the instrument are transmitted to the bus or to Class I master after activation of this function. ***CANCEL*** – UNIT TO BUS

PROCESSING PARAMETERS	
LOW FLOW CUTOFF (p. 69)	5-digit floating point: e.g. 15.000 dm^3/min Factory setting: ***dependent*** on diameter Your setting: .....
NOISE SUPPRESS. (p. 69)	***0.00***...2.00 seconds (in 10 ms steps) Factory setting: ***0.00 s*** 0.00 seconds = OFF 2.00 seconds = high damping Your setting: .....
EMPTY PIPE DET. (p. 70)	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. 71)	***1 s*** – 2 s – 5 s – 10 s – 30 s – 60 s Your setting: .....
MEASURING MODE (p. 72)	UNIDIRECTIONAL – ***BIDIRECTIONAL*** Your setting: .....
FLOW DIRECTION (p. 72)	***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: .....
AMPLIFIER MODE (p. 72)	***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. 73)	max. 4-digit number: 10...1000 Factory setting: ***10*** Your setting: .....

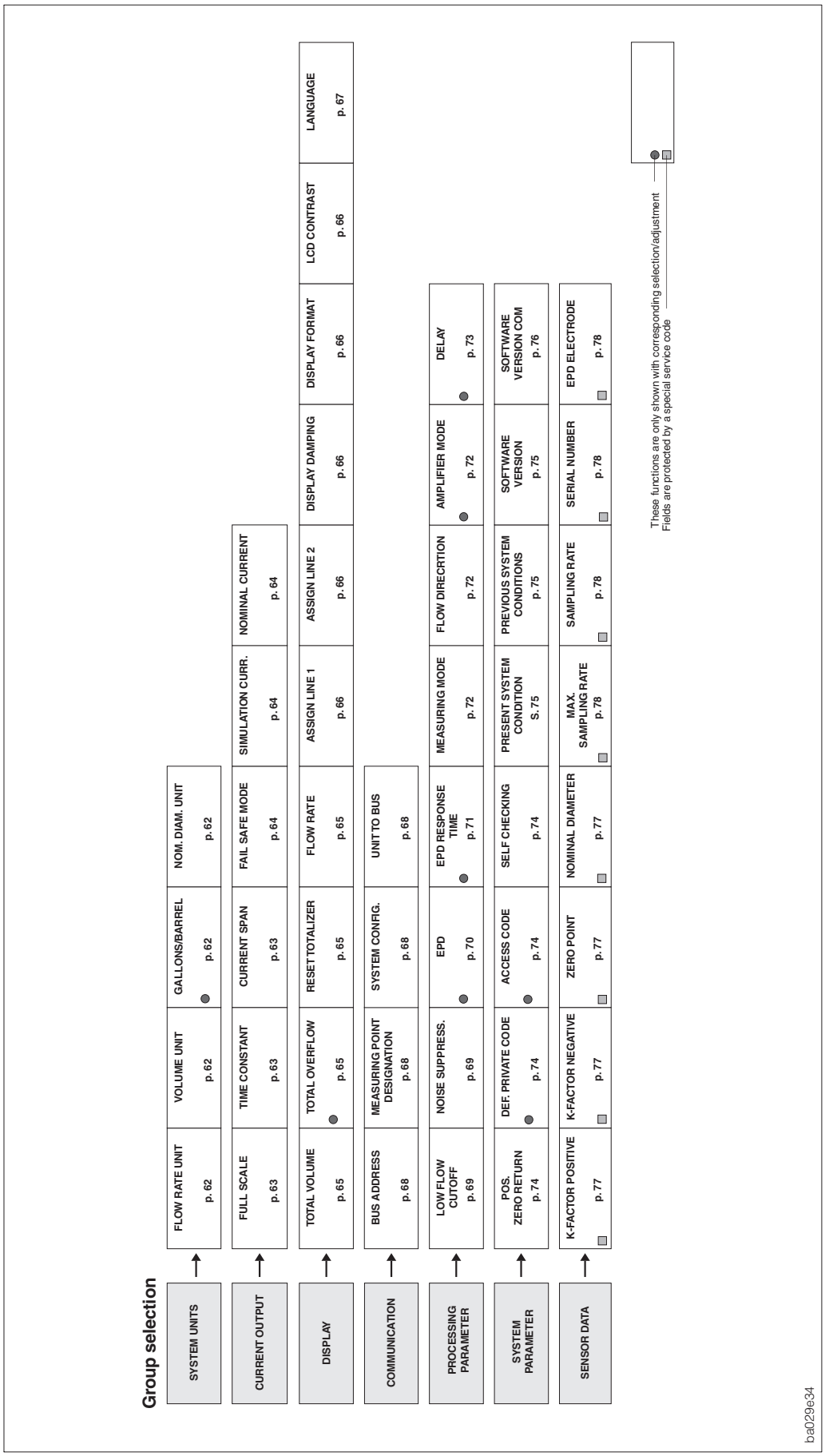
SYSTEM PARAMETERS	
POS. ZERO RETURN (p. 74)	***OFF*** – ON
DEF. PRIVATE CODE (p. 74)	max. 4-digit number: 0...9999 Factory setting: ***33*** Your setting: .....
ACCESS CODE (p. 74)	max. 4-digit number: 0...9999 Factory setting: ***0*** Your setting: .....
SELF CHECKING (p. 74)	OFF – ***ON*** Your setting: .....
PRESENT SYSTEM CONDITION (p. 75)	Display (entries chronological): F: ... = Error message (system error) A: ... = Alarm message (process error) S: ... = Status message ***S: SYSTEM WORKS NORMALLY***
PREVIOUS SYSTEM CONDITIONS (p. 75)	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. 75)	Display: e.g. PRO 33 V3.01.XX
SOFTWARE VER. COM (p. 76)	Display: e.g. V 2.06.XX PBUS

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. 77)	max. 5-digit fixed point: 0.5000...2.0000 Factory setting: ***dependent*** on the sensor (DN) and its calibration Your setting: .....
K-FACTOR NEG. (p. 77)	max. 5-digit fixed point: 0.5000...2.0000 Factory setting: ***dependent*** on the sensor (DN) and its calibration Your setting: .....
ZERO POINT (p. 77)	max. 4-digit number: –1000...+1000 Factory setting: ***dependent*** on the sensor (DN) and its calibration Your setting: .....
NOMINAL DIAMETER (p. 77)	Selected from fixed table: 2...2000 mm or $^{1}/_{12}$"...78" Factory setting: ***dependent*** on the sensor (DN) Your setting: .....
MAX. SAMPLING RATE (p. 78)	max. 3-digit fixed point: 1.0...60.0 / s (per second) Factory setting: ***dependent*** on the sensor (DN) Your setting: .....
SAMPLING RATE (p. 78)	max. 3-digit fixed point: 1.0...60.0 /s (upper limit as for MAX. SAMPLING RATE) Factory setting: ***dependent*** on the sensor (DN) Your setting: .....
SERIAL NUMBER (p. 78)	max. 6-digit number: 1...999999 Your setting: .....
EPD ELECTRODE (p. 78)	***YES**** – NO * with EPD electrode as standard Your setting: .....

Operating matrix Promag 33 PROFIBUS-DP



Operating matrix Promag 33 PROFIBUS-PA



Index

Europe

Austria
❏ Endress+Hauser GmbH
Wien
Tel. (01) 88 05 60, Fax (01) 88 05 635

Belarus
Belorgsintez
Minsk
Tel. (0172) 26 31 66, Fax (0172) 26 31 11

Belgium / Luxembourg
❏ Endress+Hauser S.A./N.V.
Bruxelles
Tel. (02) 2 48 06 00, Fax (02) 2 48 05 53

Bulgaria
INTERTECH-Automation
Sofia
Tel. (02) 62 48 34, Fax (02) 68 81 86

Croatia
❏ Endress+Hauser GmbH+Co.
Zagreb
Tel. (01) 6 60 14 18, Fax (01) 6 60 14 18

Cyprus
I+G Electrical Services Co. Ltd.
Nicosia
Tel. (02) 48 47 88, Fax (02) 48 46 90

Czech Republic
❏ Endress+Hauser Czech s.r.o.
Praha
Tel. (02) 66 78 42 00, Fax (02) 66 78 41 79

Denmark
❏ Endress+Hauser A/S
Søborg
Tel. 70 13 11 32, Fax 70 13 21 33

Estonia
Elvi-Aqua
Tartu
Tel. (7) 42 27 26, Fax (7) 42 27 27

Finland
❏ Endress+Hauser Oy
Espoo
Tel. (9) 8 59 61 55, Fax (9) 8 59 60 55

France
❏ Endress+Hauser S.A.
Huningue
Tel. (0389) 69 67 68, Fax (0389) 69 48 02

Germany
❏ Endress+Hauser Messtechnik GmbH+Co.
Weil am Rhein
Tel. (07621) 9 75 01, Fax (07621) 9 75 55 5

Greece
I & G Building Services Automation S.A.
Athens
Tel. (01) 9 24 15 00, Fax (01) 9 22 17 14

Hungary
MILE Ipari-Elektro
Budapest
Tel. (01) 2 61 55 35, Fax (01) 2 61 55 35

Iceland
BIL ehf.
Reykjavik
Tel. (05) 61 96 16, Fax (05) 61 96 17

Ireland
Flomeaco Company Ltd.
Kildare
Tel. (045) 86 86 15, Fax (045) 86 81 82

Italy
❏ Endress+Hauser S.p.A.
Cernusco s/N Milano
Tel. (02) 92 10 64 21, Fax (02) 92 10 71 53

Kazakhstan
AO "Elmo"
Kazakhstan
Tel. (3272) 42 53 63, Fax (3272) 42 80 44

Latvia
Rino
Riga
Tel. (07) 31 28 97, Fax (07) 31 28 94

Lithuania
Agava Ltd.
Kaunas
Tel. (07) 20 24 10, Fax (07) 20 74 14

Netherlands
❏ Endress+Hauser B.V.
Naarden
Tel. (035) 6 95 86 11, Fax (035) 6 95 88 25

Norway
❏ Endress+Hauser A/S
Lierskogen
Tel. (032) 85 98 50, Fax (032) 85 98 51

Poland
❏ Endress+Hauser Polska Sp. z o.o.
Warsaw
Tel. (022) 7 20 10 90, Fax (022) 7 20 10 85

Portugal
Tecnisis - Tecnica de Sistemas Industriais
Linda a Velha
Tel. (01) 4 17 26 37, Fax (01) 4 18 52 78

Romania
Romconseng S.R.L.
Bucharest
Tel. (01) 4 10 16 34, Fax (01) 4 10 16 34

Russia
❏ Endress+Hauser GmbH+Co
Moscow
Tel. + Fax see E+H Instruments International

Slovak Republic
Transcom Technik s.r.o.
Bratislava
Tel. (07) 44 88 86 84, Fax (07) 44 88 71 12

Slovenia
❏ Endress+Hauser D.O.O.
Ljubljana
Tel. (061) 1 59 22 17, Fax (061) 1 59 22 98

Spain
❏ Endress+Hauser S.A.
Sant Just Desvern
Tel. (93) 4 80 33 66, Fax (93) 4 73 38 39

Sweden
❏ Endress+Hauser AB
Sollentuna
Tel. (08) 6 26 16 00, Fax (08) 6 26 94 77

Switzerland
❏ Endress+Hauser AG
Reinach/BL 1
Tel. (061) 7 15 75 75, Fax (061) 7 11 16 50

Turkey
Intek Endüstriyel Ölcü Ve Kontrol Sistemleri
Levent/Istanbul
Tel. (0212) 2 75 13 55, Fax (02 12) 2 66 27 75

Ukraine
Photonika GmbH
Kiev
Tel. (44) 2 68 81 02, Fax (44) 2 69 08 05

United Kingdom
❏ Endress+Hauser Ltd.
Manchester
Tel. (0161) 2 86 50 00, Fax (0161) 9 98 18 41

Yugoslavia Republic
Meris d.o.o.
Beograd
Tel. (11) 4 44 29 66, Fax (11) 43 00 43

Africa

Egypt
Anasia
Cairo
Tel. (02) 4 17 90 07, Fax (02) 4 17 90 08

Morocco
Oussama S.A.
Casablanca
Tel. (02) 24 13 38, Fax (02) 40 26 57

Nigeria
J F Technical Invest. Nig. Ltd.
Lagos
Tel. (1) 62 23 45 46, Fax (1) 62 23 45 48

Rep. South Africa
❏ Endress+Hauser (Pty.) Ltd.
Sandton
Tel. (011) 4 44 13 86, Fax (011) 4 44 19 77

Tunisia
Controle, Maintenance et Regulation
Tunis
Tel. (01) 79 30 77, Fax (01) 78 85 95

America

Argentina
❏ Endress+Hauser Argentina S.A.
Buenos Aires
Tel. (01) 5 22 79 70, Fax (01) 5 22 79 09

Bolivia
Tritec
Cochabamba
Tel. (042) 5 69 93, Fax (042) 5 09 81

Brazil
❏ Samson Endress+Hauser Ltda.
Sao Paulo
Tel. (011) 5 36 34 55, Fax (011) 5 36 30 67

Canada
❏ Endress+Hauser (Canada) Ltd.
Burlington / Ontario
Tel. (905) 6 81 92 92, Fax (905) 6 81 94 44

Chile
DIN Instrumentos Ltda.
Santiago
Tel. (02) 2 05 01 00, Fax (02) 2 25 81 39

Colombia
Colsein Ltd.
Bogota D.C.
Tel. (01) 2 36 76 59, Fax (01) 6 10 78 68

Costa Rica
EURO-TEC S.A.
San Jose
Tel. 2 96 15 42, Fax 2 96 15 42

Ecuador
INSETEC Cia. Ltda.
Quito
Tel. (02) 25 12 42, Fax (02) 46 18 33

Guatemala
ACISA Automatizacion y Control
Industrial S.A.
Guatemala
Tel. (03) 34 59 85, Fax (03) 32 74 31

Mexico
❏ Endress+Hauser GmbH+Co.,
Instruments International, Mexico City Office,
Mexico City
Tel. (5) 5 68 96 58, Fax (5) 5 68 41 83

Paraguay
Incoel S.R.L.
Asuncion
Tel. (021) 21 39 89, Fax (021) 2 12 65 83

Peru
Esim S.A.
Lima
Tel. (1) 4 71 46 61, Fax (1) 4 71 09 93

Uruguay
Circular S.A.
Montevideo
Tel. (02) 92 57 85, Fax (02) 92 91 51

USA
❏ Endress+Hauser Inc.
Greenwood, Indiana
Tel. (317) 5 35 71 38, Fax (317) 5 35 84 98

Venezuela
Controval C.A.
Caracas
Tel. (02) 9 44 09 66, Fax (02) 9 44 45 54

Asia

Brunei
American International Industries (B)
Sdn Bhd
Lorong Tengah
Tel. (3) 22 37 37, Fax (3) 22 54 58

China
❏ Endress+Hauser Shanghai
Shanghai
Tel. (021) 64 64 67 00, Fax (021) 64 74 78 60

Hong Kong
❏ Endress+Hauser (H.K.) Ltd.
Hong Kong
Tel. 25 28 31 20, Fax 28 65 41 71

India
❏ Endress+Hauser India Branch Office
Mumbai
Tel. (022) 8 52 14 58, Fax (022) 8 52 19 27

Indonesia
PT Grama Bazita
Jakarta
Tel. (21) 7 97 50 83, Fax (21) 7 97 50 89

Japan
❏ Sakura Endress Co. Ltd.
Tokyo
Tel. (0422) 54 06 11, Fax (0422) 55 02 75

Malaysia
❏ Endress+Hauser (M) Sdn. Bhd.
Petaling Jaya, Selangor Darul Ehsan
Tel. (03) 7 33 48 48, Fax (03) 7 33 88 00

Myanmar
Sein Pyinsayupa Gen. Tranding & Agency
Co-op. Soc. Ltd.
Myanmar
Tel. (1) 24 23 25, Fax (1) 25 05 94

Pakistan
Speedy Automation
Karachi
Tel. (021) 7 72 29 53, Fax (021) 7 73 68 84

Papua-Neuguinea
SBS Electrical Pty Ltd.
PNG Port Moresby
Tel. 3 25 11 88, Fax 3 25 95 56

Philippines
❏ Endress+Hauser Philippines Inc.
Manila
Tel. (2) 6 38 80 41, Fax (2) 6 38 80 42

Singapore
❏ Endress+Hauser (S.E.A.) Pte. Ltd.
Singapore
Tel. 5 66 82 22, Fax 5 66 68 48

Korea
❏ Endress+Hauser (Korea) Co. Ltd.
Seoul
Tel. (02) 6 58 72 00, Fax (02) 6 59 28 38

Taiwan
Kingjarl Corporation
Taipei
Tel. (02) 27 18 39 38, Fax (02) 27 13 41 90

Thailand
❏ Endress+Hauser (Thailand) Ltd.
Bangkok
Tel. (2) 9 96 78 11-20, Fax (2) 9 96 78 10

Vietnam
Tan Viet Bao Co. Ltd.
Ho Chi Minh City
Tel. (08) 8 33 52 25, Fax (08) 8 33 52 27

Iran
Telephone Technical Services Co. Ltd. (TTS)
Tehran
Tel. (021) 8 74 67 50, Fax (021) 8 73 72 95

Israel
Instrumetrics Industrial Control Ltd.
Tel Aviv
Tel. (03) 6 48 02 05, Fax (03) 6 47 19 92

Jordan
A.P. Parpas Engineering S.A.
Amman
Tel. (06) 5 53 92 83, Fax (06) 5 53 92 05

Kuwait
Kuwait Maritime & Mercantile Co. K.S.C.
Safat
Tel. 2 43 47 52, Fax 2 44 14 86

Lebanon
Network Engineering Co.
Jbeil
Tel. 3 25 40 51, Fax 9 94 40 80

Sultanate of Oman
Mustafa & Jawad Sience & Industry Co. LLC
Ruwi
Tel. 60 20 09, Fax 60 70 66

United Arab Emirates
Descon Trading Est.
Dubai
Tel. (04) 65 36 51, Fax (04) 65 32 64

Yemen
Yemen Company for Ghee and Soap Industry
Taiz
Tel. (04) 23 06 64, Fax (04) 21 23 38

Australia + New Zealand

Australia
ALSTOM Australia Ltd.
Villawood N.S.W.
Tel. (02) 97 22 47 77, Fax (02) 97 22 48 83

New Zealand
EMC Industrial Group Limited
Auckland
Tel. (09) 4 15 51 10, Fax (09) 4 15 51 15

All other countries

❏ Endress+Hauser GmbH+Co.
Instruments International
Weil am Rhein, Germany
Tel. (07621) 9 75 02, Fax (07621) 97 53 45

http://www.endress.com

Endress+Hauser