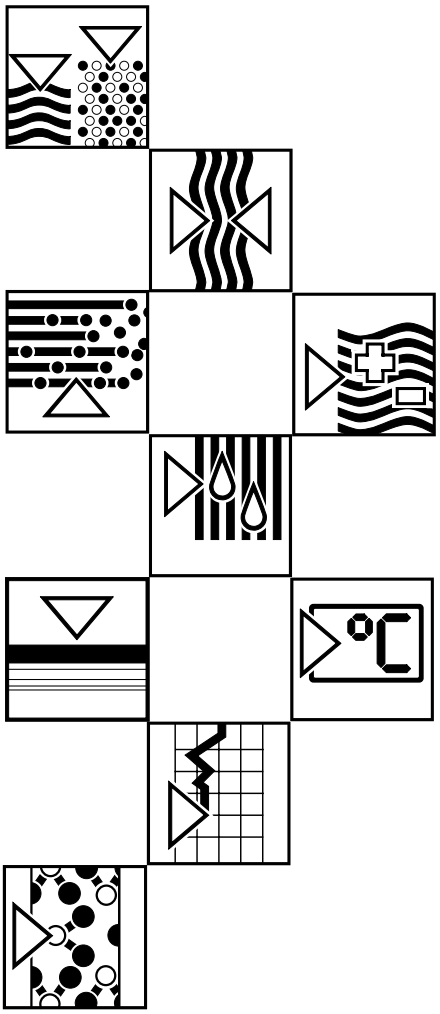
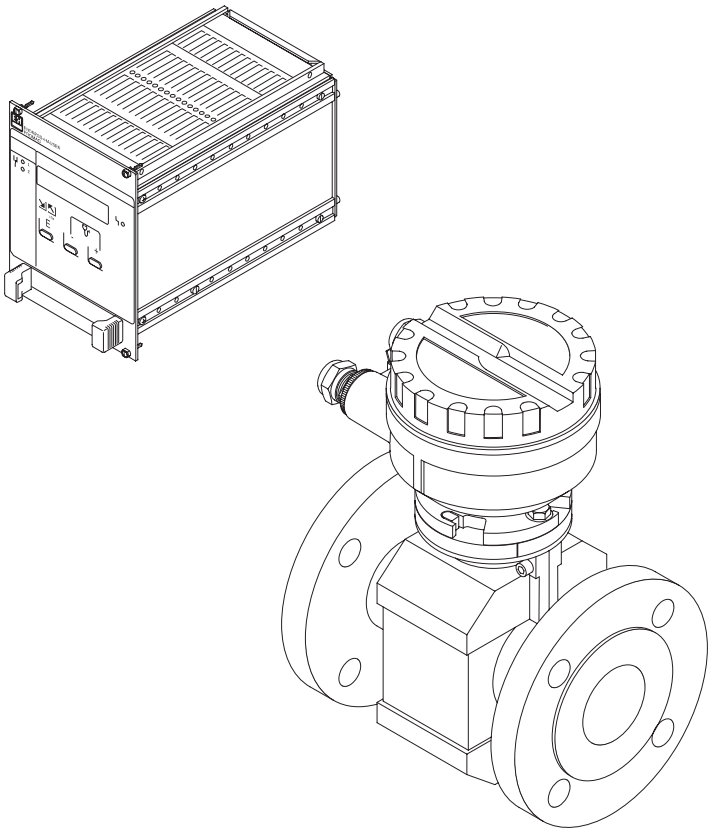
BA 024D/06/e/06.96
No. 50077300

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

promag 39
Electromagnetic Flow Measuring System

Operating Manual





Endress+Hauser

Nothing beats know-how

Safety Instructions

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

Documentation for Ex instruments

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 centre.

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Contents

1 Safety Instructions

1.1 Correct Usage

- The Promag 39 is only to be used for measuring the flow of conductive fluids.
- The manufacturer assumes no liability for damage caused by incorrect use of the instrument.

1.2 Dangers and Notes

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

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

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

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

1.3 Personnel for Installation, Start-up and Operation

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

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

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

1.4 Repairs, Dangerous Chemicals

The following procedures must be carried out before a Promag 39 flowmeter is sent to Endress+Hauser for repair:

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

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

1.5 Technical Improvements

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

2 System Description

2.1 Fields of application

The Promag 39 measuring system enables flow to be measured precisely and at low cost using the magnetic-inductive principle. Any fluids with a minimum conductivity of 5 µS/cm may be measured.

- Acids, alkalis, pastes, pulps
- Drinking water, waste water, sewage sludge
- Milk, beer, wine, mineral water, yoghurt, molasses

2.2 Principle of measurement

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

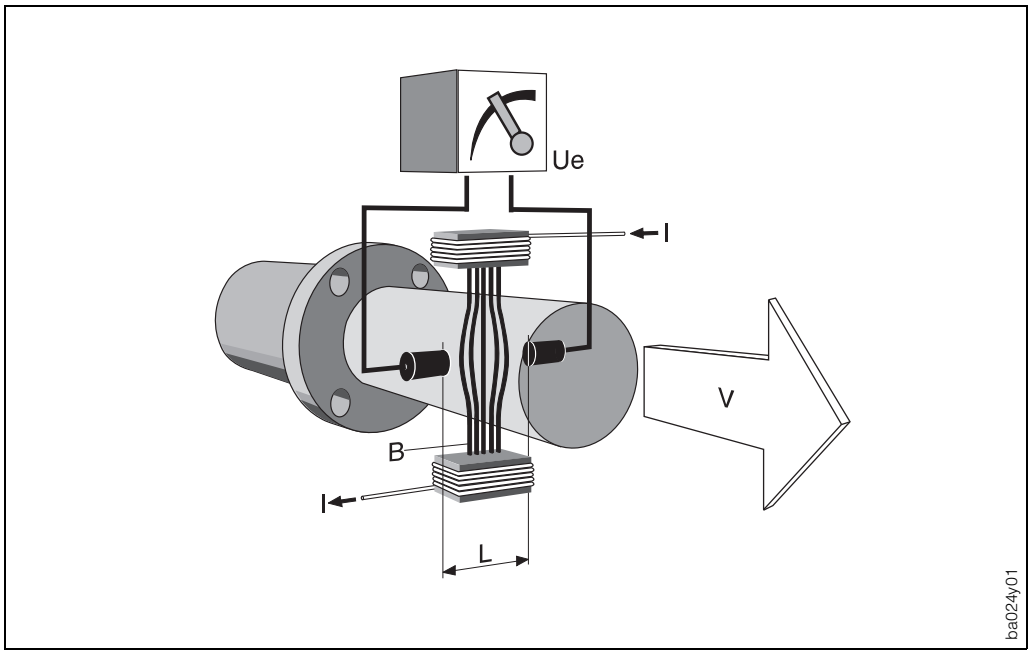


Fig. 1

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

2.3 The Promag 39 measuring system

The Promag measuring system is fully modular, both electrically and mechanically. The measuring system can be updated at any time by exchanging electronic boards. The measuring point can always be optimally equipped and supplemented.

The following illustration is a synopsis of the Promag 39 measuring system.

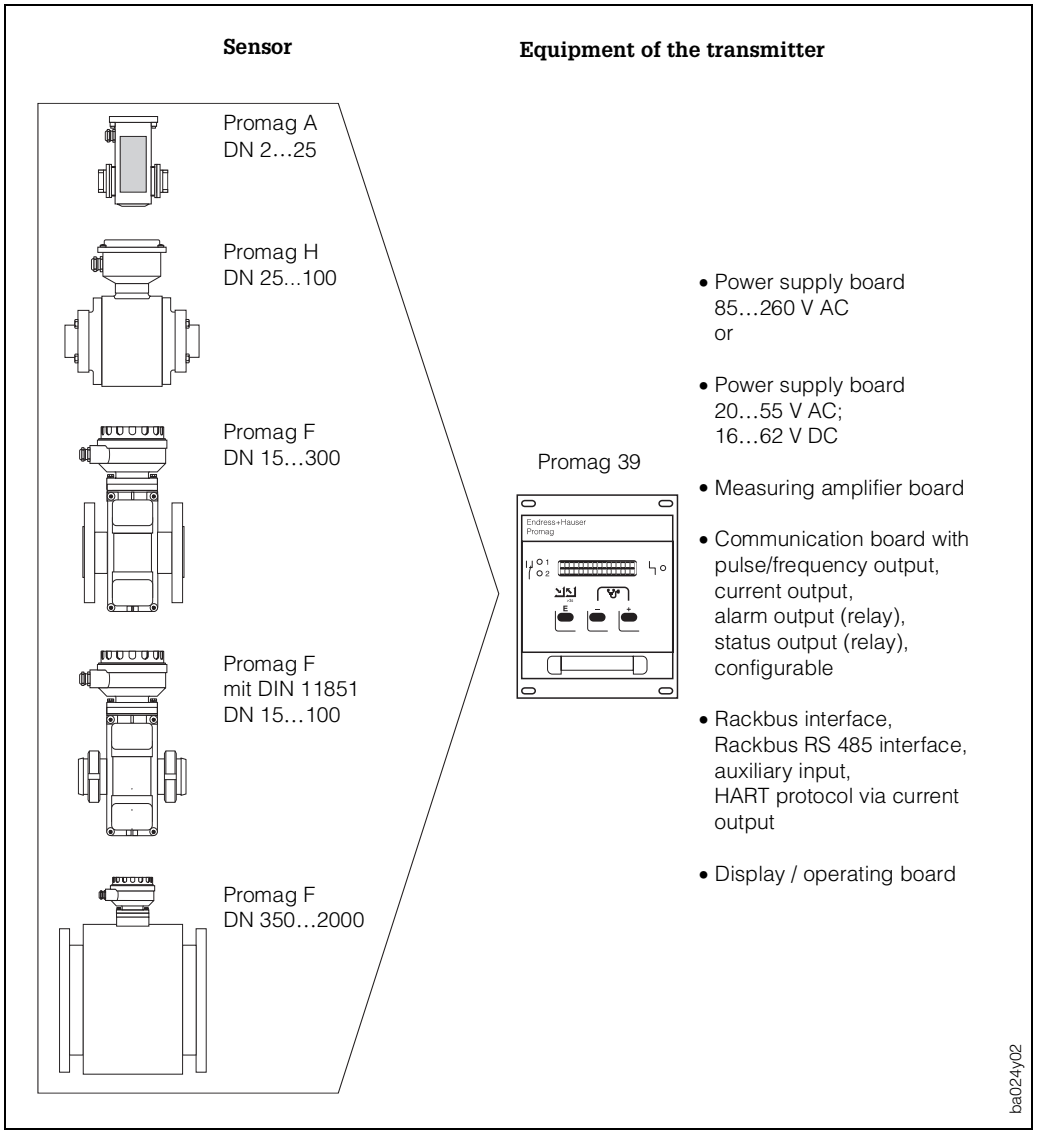


Fig. 2

Caution!
The Promag 39 measuring system is available with various hazardous-area approvals. Your E+H representative will be pleased to supply further information on the available approvals. Approval relevant information can be found in the supplement to this Operating Manual and can also be ordered from the E+H representative.

Caution

The measuring system consists of:
- a Promag 39 transmitter and
- a Promag A, H or F sensor

The transmitter is installed independently from the sensor:
- maximum cable length = 200 m
- minimum fluid conductivity = 5 µS/cm
- The electrical connection between transmitter and sensor is routed through the connection housings (exception: Promag A).

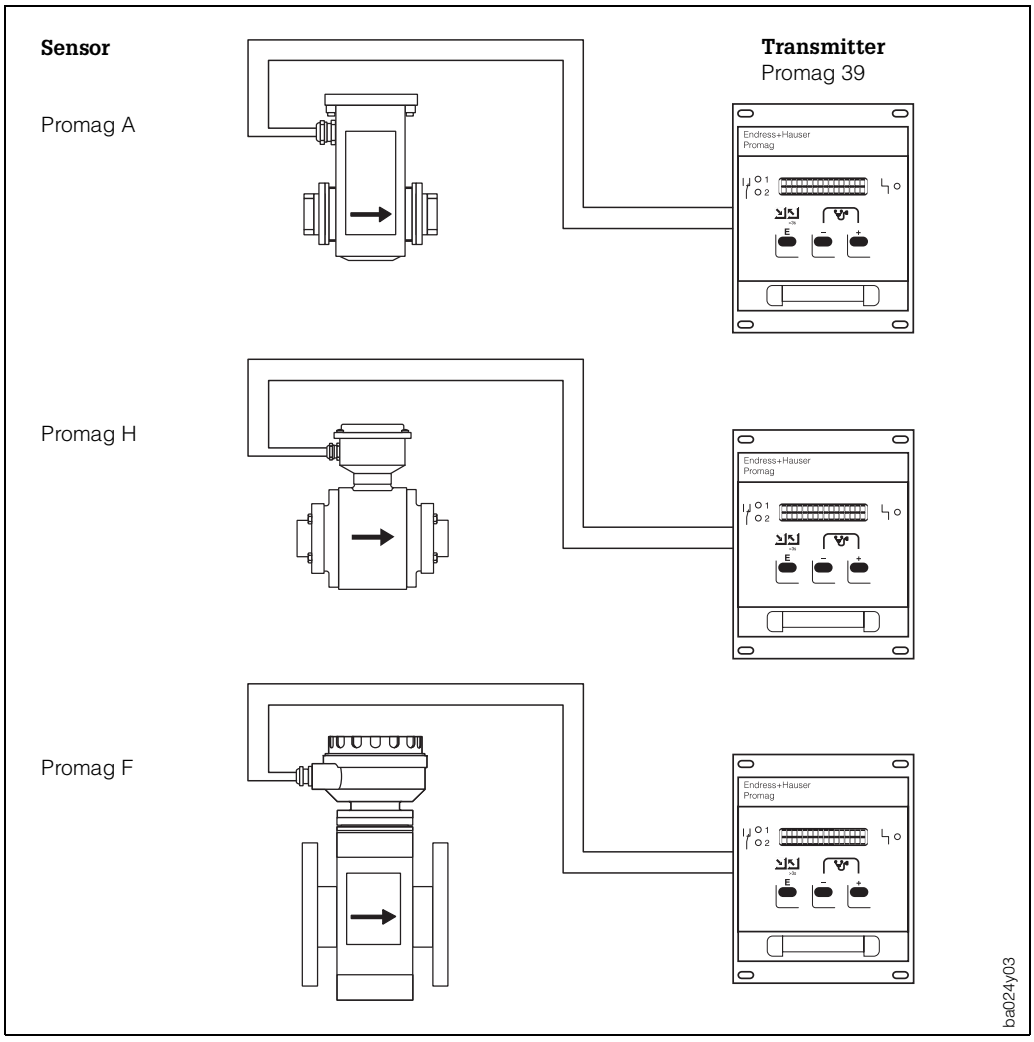
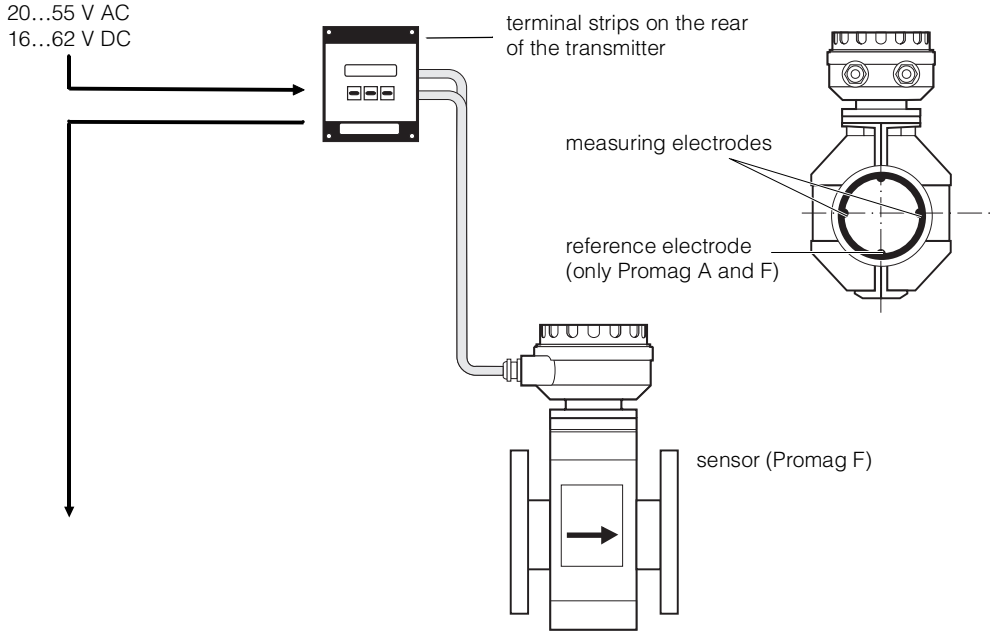


Fig. 3

2.4 Description and design of the measuring system



Outputs*

Current output	active, galvanically isolated, 0/4…20 mA, R_L <700 Ω full-scale value, current range, time constant, etc., can be selected
Pulse/ frequency output	active or passive (open collector) can be selected galvanically isolated, 0…10 kHz pulse value, pulse width, full-scale frequency, full-scale value, etc., can be selected
Alarm output	relay output 1 either NC and NO contact available, galvanically isolated configurable for: signalling of faults (system errors), limit value 1, exceeding measuring range (v >12.5 m/s), dual range mode, pre-batch contact or direction of flow
Status output	relay output 2 either NC and NO contact available galvanically isolated configurable for: limit value 2, exceeding measuring range (v >12.5 m/s), dual range mode, batching contact or direction of flow

***** Technical data → see Section 9

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Fig. 4

Operation

The Promag 39 is equipped with a two-line LCD. Configuration is very simple to carry out using the E+H matrix-driven operation. All parameters can be selected and varied with only three control elements, e.g.

- engineering units
- functions of the current output
- functions of the totaliser
- functions of the pulse/frequency output
- relay functions
- limit values
- batching function with integral preselection counter
- display parameters
- creep suppression

Twelve languages may be selected for the display text.

Dynamic response
The Promag 39 measuring amplifier shows a very high dynamic response of more than 1000:1. It measures at medium velocities from 0.01 m/s to more than 10 m/s at the specified accuracy. If the flow is pulsating, the amplifier is not overloaded even above the preset end value if velocities are less than 12.5 m/s. Thus, there is no falsification of the measured value, provided that outputs are not overloaded.

Safety
- The Promag 39 measuring system fulfils the safety requirements of the European standard EN 61010 “Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures”.
- The Promag 39 measuring system fulfils all general requirements for electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as the NAMUR recommendations.
- A comprehensive self-monitoring facility of the measuring system assures high safety. Any system alarm (coil current error, amplifier error, DAT error, EEPROM error, ROM error, RAM error) or power supply failures are immediately signalled via a separate alarm output.
- Corresponding error messages also appear on the transmitter display. Any errors present can be systematically scanned and their cause determined by means of the diagnostic function.
- In the event of a power supply failure, all data in the measuring system are safely stored in the EEPROM (no batteries required).

Data memory (DAT)
The DAT is an exchangeable memory module. It stores all characteristic data of the sensor, such as calibration factors, nominal diameter, sampling rate, serial number. Once the transmitter has been replaced, the previous DAT is inserted into the new transmitter. When the measuring system is started, the measuring point continues to operate with the data stored in the DAT memory. Thus, the DAT assures maximum safety and optimum ease of operation if any components of the equipment are exchanged.

3 Mounting and Installation

Warning!
- All 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 General information

Protection IP 67 (EN 60529) for the sensor
The sensors 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 protection IP 67.

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

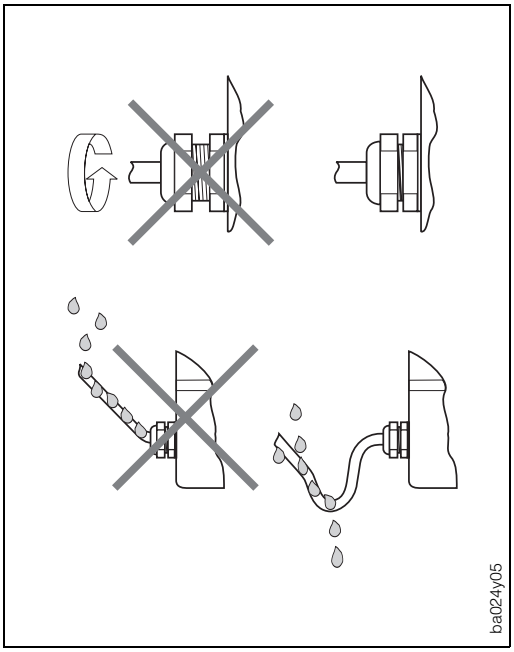


Fig. 5

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

Caution

Note!
The sensors Promag A and F can optionally be supplied with the type of protection IP 68 (permanently under water to a depth of 3 m). The transmitter fulfils the requirements of IP 20.

Note

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

3.2 Transport instructions for sensor from >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.

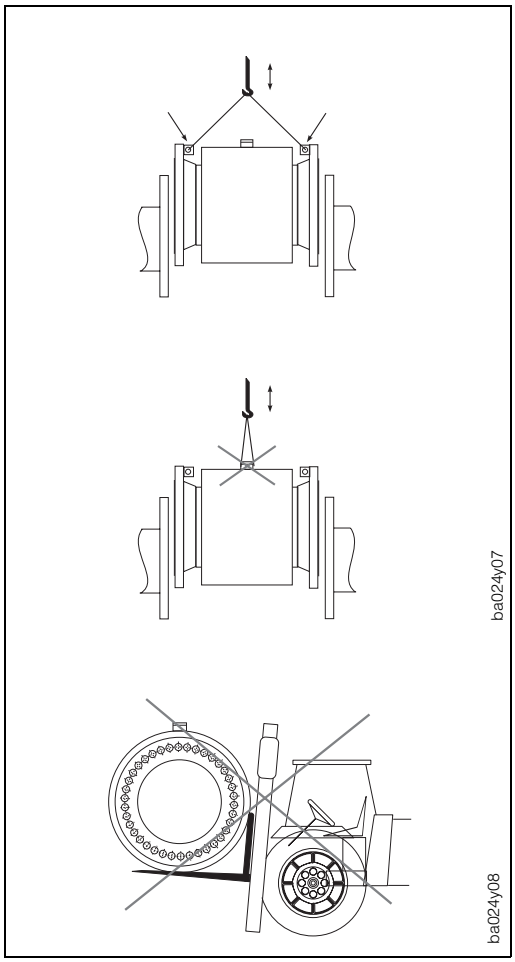


Fig. 6

Transporting to the measuring point

- The grips on the flange must be used when lifting the sensor and when installing the sensor in the pipeline (from DN 350/14").
- The sensor must not be lifted by the wiring housing.
- The sensor must not be lifted by the metal casing using a fork lift truck. The casing may be dented and so damage the magnetic coils inside the sensor.

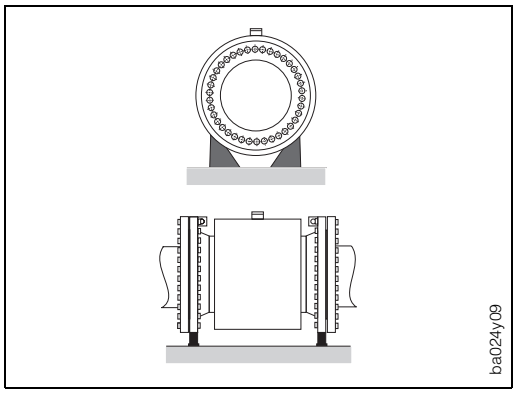


Fig. 7

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

Note

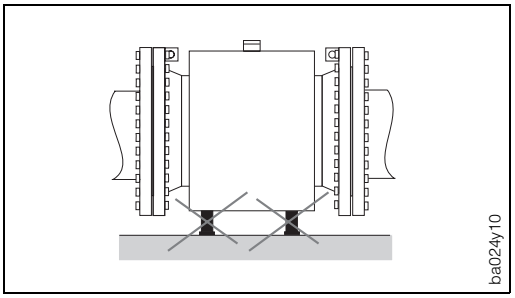


Fig. 8

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

3.3 Mounting instructions

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

Mounting position (as preferred)

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

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

Note!
The plane in which the electrode axis lies is identical for the sensors Promag A, H and F.

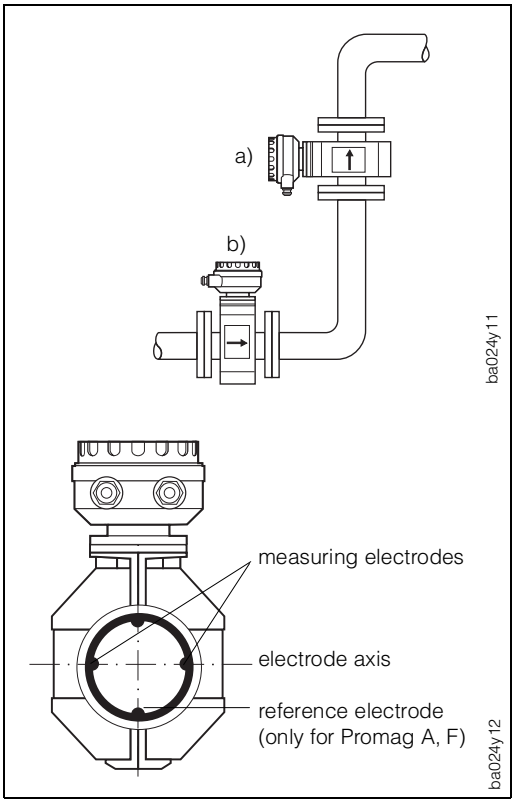


Fig. 9

Vibration

- Secure the piping upstream and downstream of the sensor.
- Mechanical supports are recommended for free runs of piping over 10 m long.

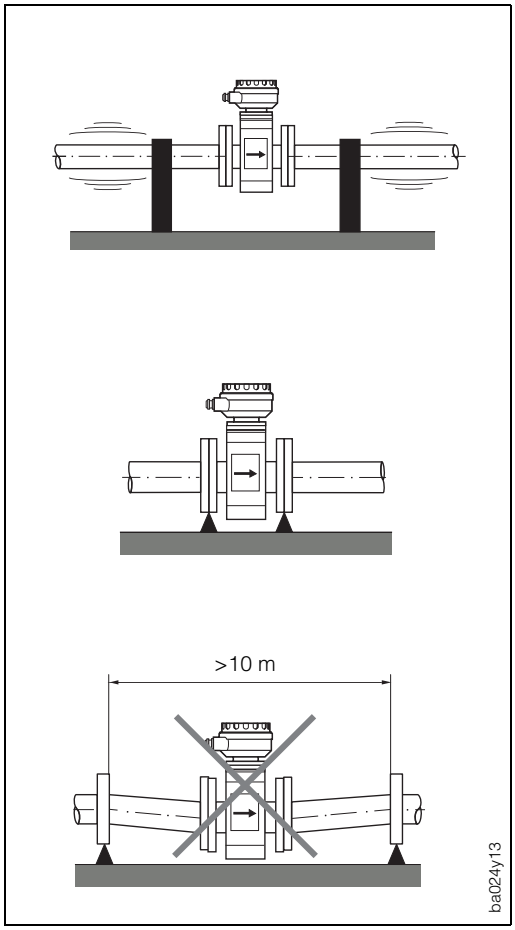


Fig. 10

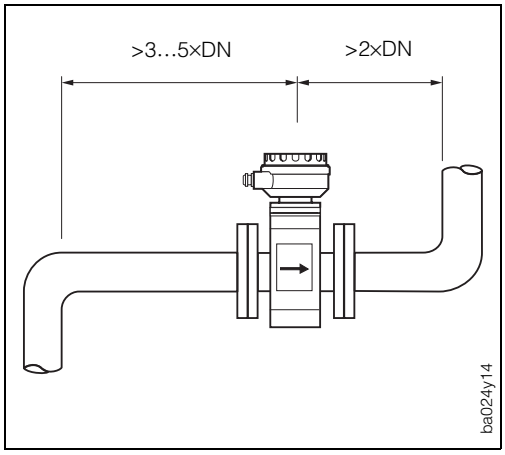


Fig. 11

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

Inlet run: >3…5×DN
Outlet run: >2×DN

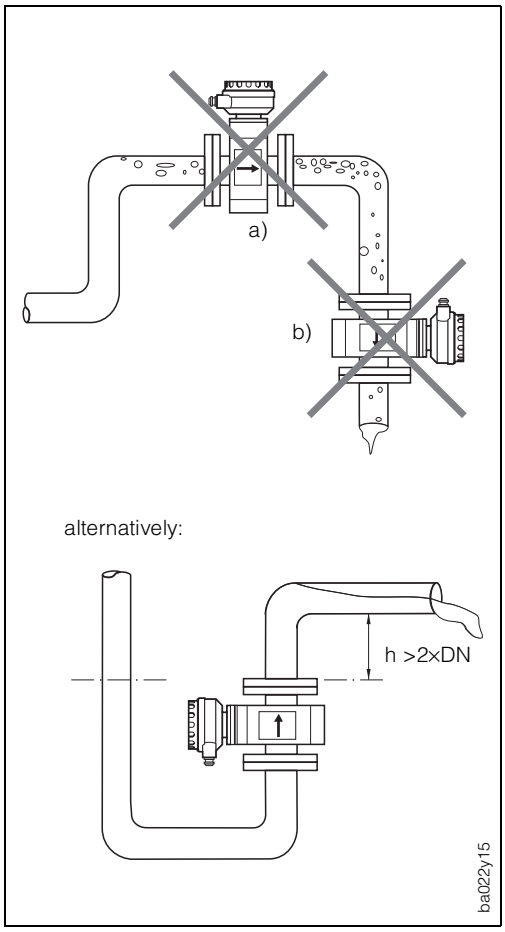


Fig. 12

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

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

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

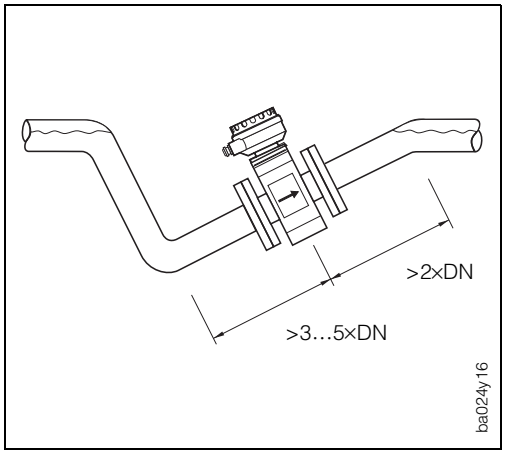


Fig. 13

Note

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

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

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

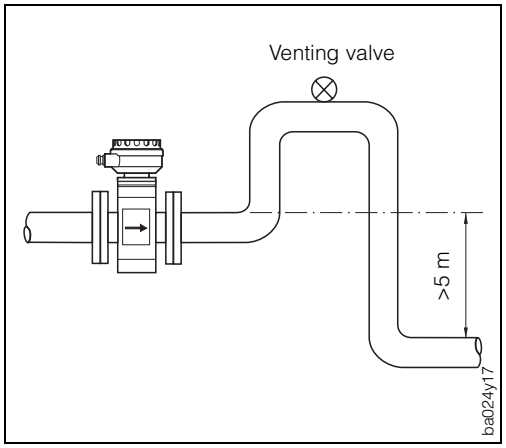


Fig. 14

Installation of pumps
Do not mount the sensor on the suction side of pumps. There is a risk of vacuum! Information on the resistance to vacuum of the measuring pipe lining can be found on page 98.

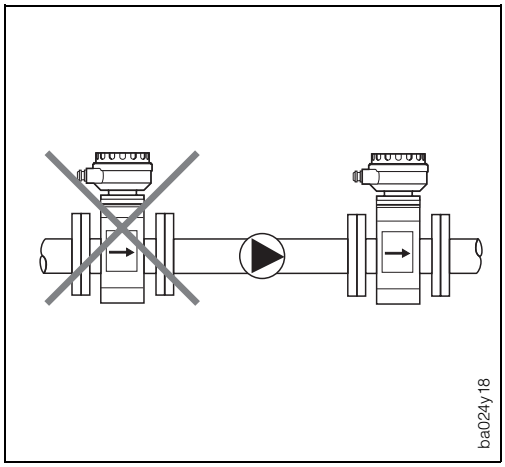


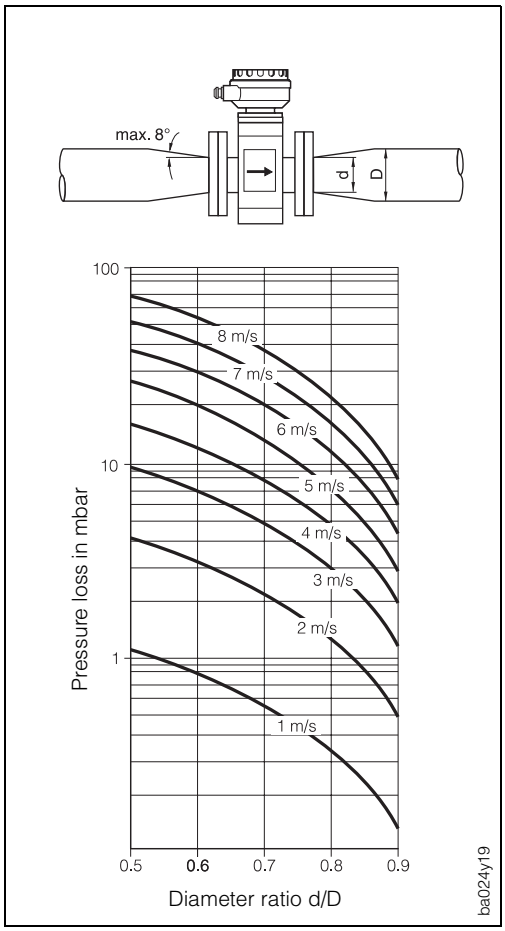
Fig. 15

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

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

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

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



Note

Fig. 16

3.4 Mounting the sensor

Mounting Promag 39 A

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

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

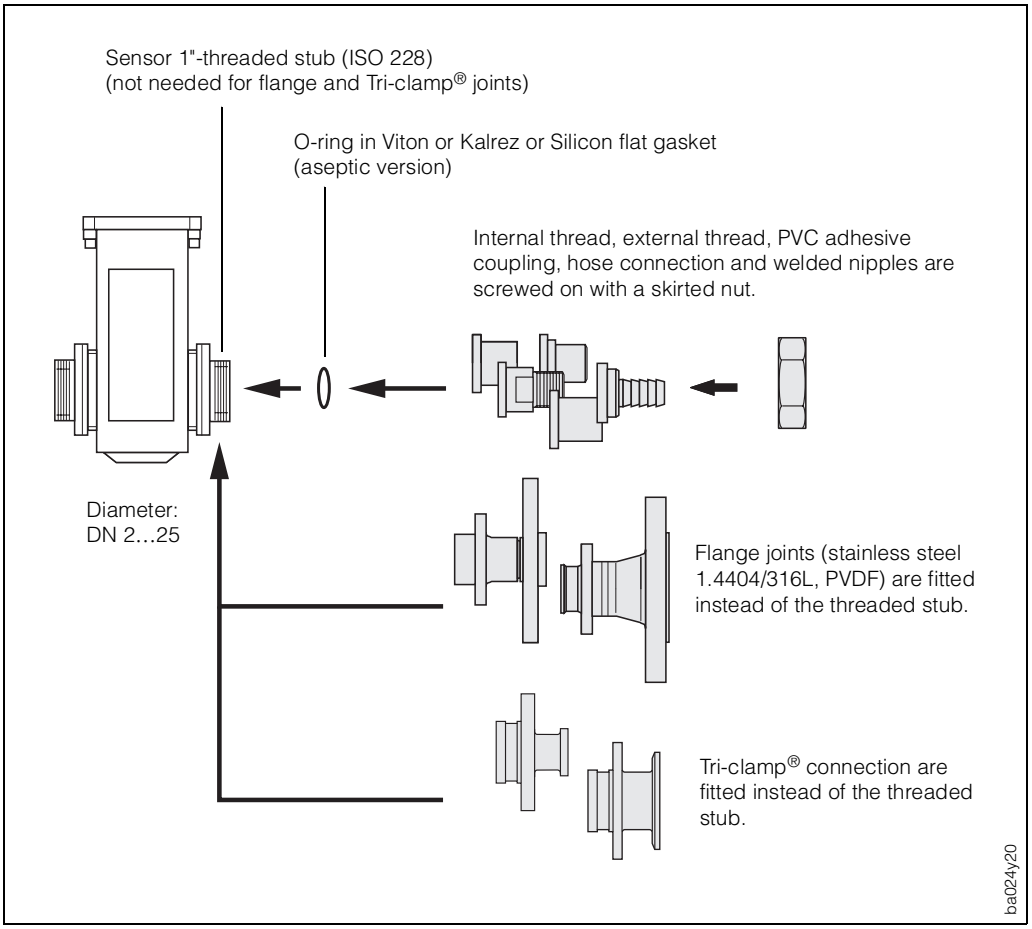


Fig. 17

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

Mounting Promag 39 H

Lengths and dimensions
See Section 9.1 «Dimensions and weights».

Mounting
The various process connectors are fastened to the sensor with 4 or 6 screws. As a rule, the Promag H sensor is supplied with works-mounted process connectors.

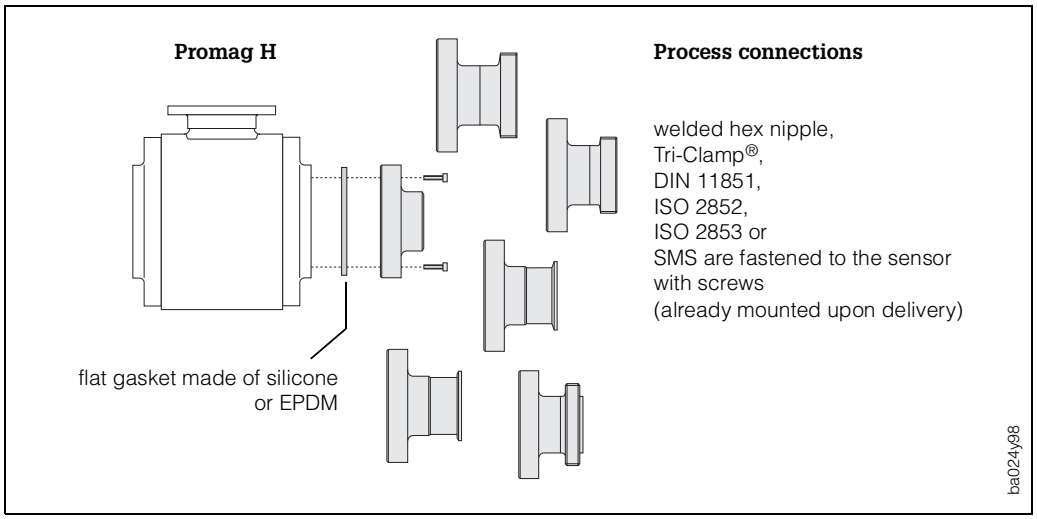


Fig. 18

When mounting the process connectors, please make sure that the gasket is free of dirt and correctly centred. The screws have to be tightened. The process connector forms a metal connection with the sensor, so the gasket is not compressed.

DN		PN	Max. tightening torque
DIN [mm]	ANSI [inch]	DIN [bar]	[Nm]
25	1"		10
40	1½"		10
50	2"	16	25
65	2½"		25
80	3"		88
100	4"		88

Welding the sensor into the pipework
If the sensor is directly welded into the pipework, we recommend that you:
1. fasten the Promag H sensor with some welding points into the pipe;
2. loosen the screws at the process-connector flange and remove the sensor from the pipe; make sure that the gasket is also removed from the process connector;
3. weld the process connector into the pipe;
4. once again install the sensor into the pipe; make sure everything is clean and that the gasket is correctly positioned.

Note!
- If the welding process is correctly executed, the gasket will not be damaged by the heat, even when mounted. Nevertheless, we recommend you remove the sensor and gasket first.
- For the mounting, the pipe has to be opened by about 4 mm.

Note

Caution!
Please note that the grounding of the welding set does not occur by way of the Promag 39 H (sensor or transmitter). If you fail to observe this, the electronics might be destroyed.

Caution

Mounting Promag 39 F

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

Mounting
The sensor is mounted between the flanges of the pipe (see Fig. 19). Since the lining of the measuring pipe also covers the sensor flange, it also functions as a seal.

Caution

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

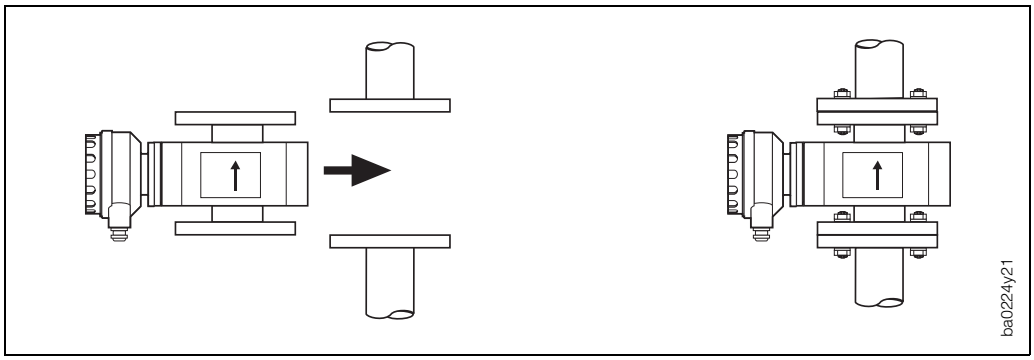


Fig. 19

DN		PN				Screws	Max. tightening torque [Nm]		
[mm]	[inch]	DIN [bar]	ANSI [lbs]	AWWA	JIS		hard rubber	soft rubber (EPDM)	Teflon (PTFE)
15	½"				20K	4×M 12	–	–	15
25	1"		Class		20K	4×M 12	25	5	33
32	–	40	150	–	20K	4×M 16	40	8	53
40	1½"				20K	4×M 16	50	11	67
50	2"				10K	4×M 16	64	15	84
65	–				10K	4×M 16	87	22	114
80	3"				10K	8×M 16	53	14	70
100	4"	16	Class	–	10K	8×M 16	65	22	85
125	–		150		10K	8×M 16	80	30	103
150	6"				10K	8×M 20	110	48	140
200	8"				10K	8×M 20	108	53	137
250	10"	10	Class	–	10K	12×M 20	104	29	139
300	12"		150		10K	12×M 20	119	39	159
350	14"					16×M 20	141/193	39/79	188/258
400	16"					16×M 24	191/245	59/111	255/326
–	18"	10/16	Class	–	–	20×M 24	170/251	58/111	227/335
500	20"		150			20×M 24	197/347	70/152	262/463
600	24"					20×M 27	261/529	107/236	348/706
700	28"					24×M 27	312/355	122/235	–
800	30"	10/16	–	Class	–	24×M 30	417/471	173/330	–
900	32"			D		28×M 30	399/451	183/349	–
1000	36"					28×M 33	513/470	245/470	–
1200	48"					32×M 36	720	328	–
–	54"					36×M 39	840	432	–
1400	–					36×M 39	840	432	–
–	60"	6	–	Class	–	40×M 45	1217	592	–
1600	–			D		40×M 45	1217	592	–
–	66"					44×M 45	1238	667	–
1800	72"					44×M 45	1238	667	–
–	78"					48×M 45	1347	749	–
2000	–					48×M 45	1347	749	–

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

Gaskets
- with soft rubber/Teflon (PTFE) lining flange gasket can be dispensed with
- with soft rubber lining the mating flange should have a thin film of nonconductive sealing grease applied
- use a gasket according to DIN 2690

Caution!
Do not use sealing material that conducts electrically (e.g. graphite).This could result in an electrically conductive layer forming on the inside of the measuring pipe and result in a short-circuit of the measuring signal.

Caution

3.5 Exchangeable measuring electrodes

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

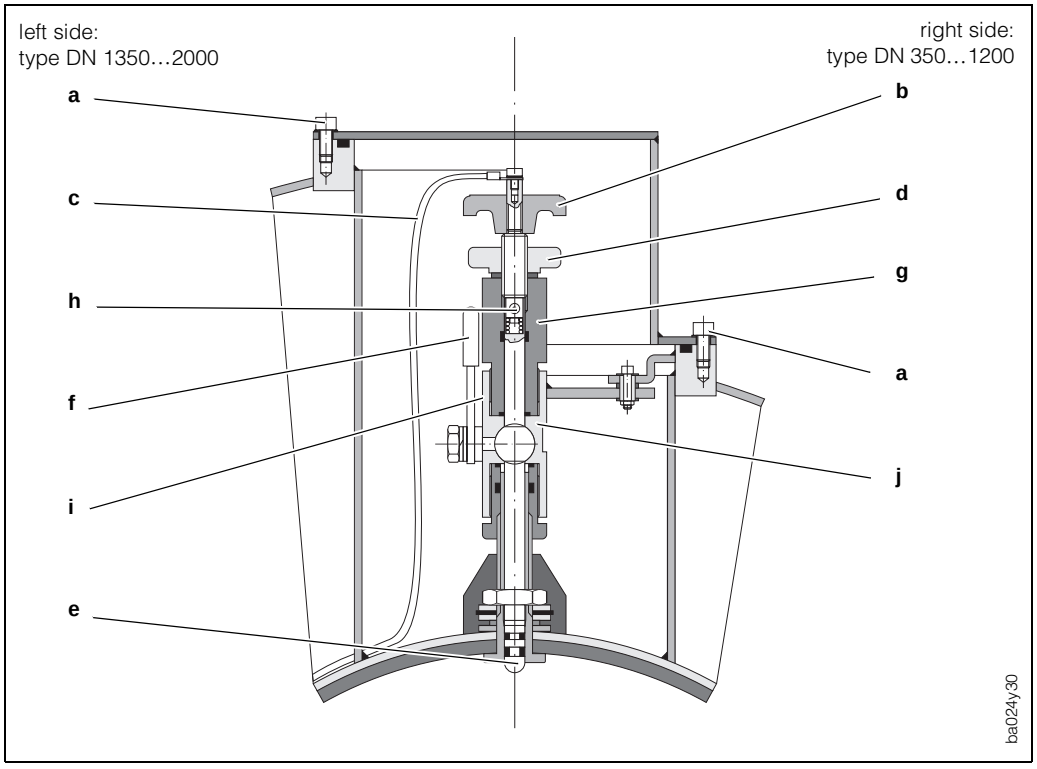


Fig. 20

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

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

Warning

(Continued on next page!)

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

Warning

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

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

Assembling the electrode

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

Note

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

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

Caution

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

3.6 Mounting the transmitter

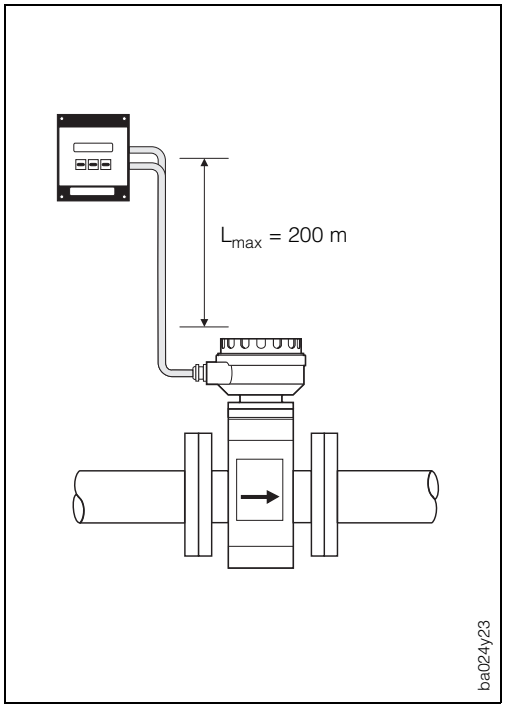


Fig. 21

Caution

The separate installation of transmitter and sensor is advantageous because:

- it assures improved accessibility,
- requires less space,
- copes better with extreme fluid and ambient temperatures (for temperature ranges: see page 96, 98)
- or strong vibrations (>2 g /2 h day; 10…100 Hz).

Caution!

- The maximum admissible cable length L_{max} between sensor and transmitter for non-Ex applications is 200 m and independent from fluid conductivity, provided minimum conductivity is 5 µS/cm.
- Do not lay cable in the vicinity of electrical machines or switching elements.
- Ensure potential equalisation between the transmitter and the sensor.

3.7 Potential equalisation

The sensor and the medium must have roughly the same electrical potential to ensure that the measurement is accurate and no electrical erosion takes place at the electrodes. Normally the reference electrode in the sensor or the metal pipe ensures that the potentials are equalised. With an existing reference electrode and for media carried in grounded metal piping it is therefore sufficient to connect the earth terminal of the connection housing on the sensor to the potential equalising line.
Fig. 22 shows the reference electrode in the Promag F sensor.

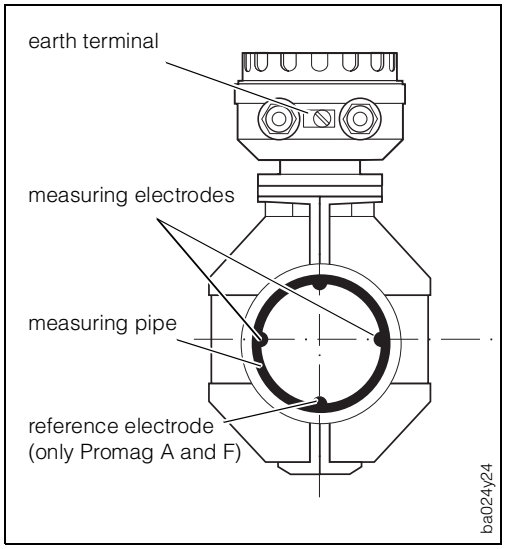


Fig. 22

Potential equalisation in certain special cases will now be described:

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

Observe all national regulations for potential-free installations.

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

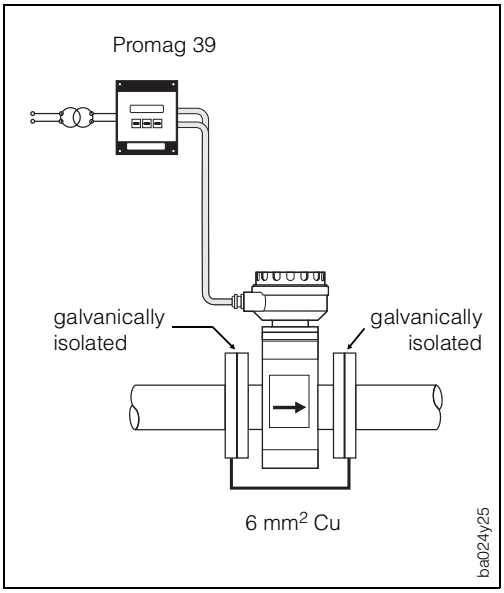
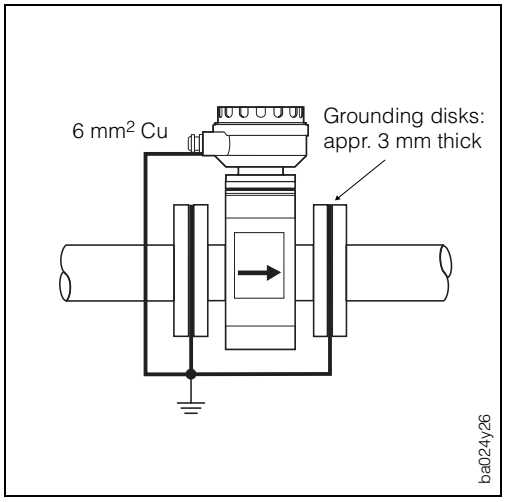


Fig. 23

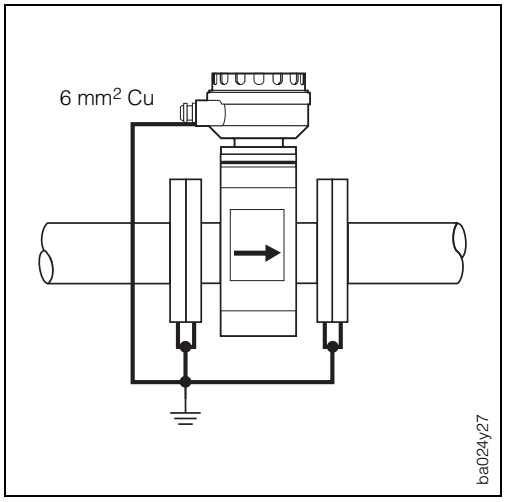


Caution

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

Caution!
Ensure the grounding disks are corrosion-resistant!

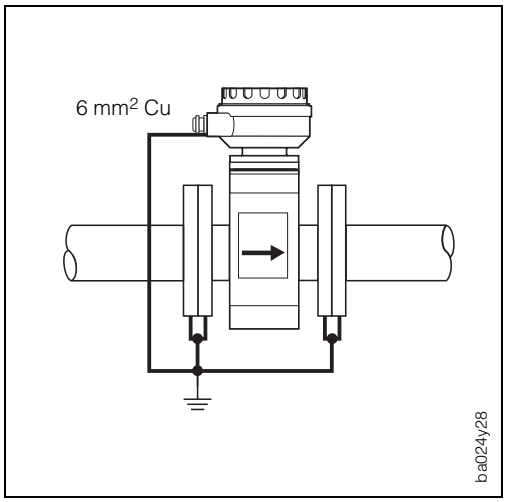
Fig. 24



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

Fig. 25

3.8 Grounding in an area with severe electrical interference



In order to make the most of the electromagnetic compatibility (EMC) of the Promag 39, it is advisable to provide two flange-to-flange links and to connect them jointly with the connection housing to earth potential.

Fig. 26

4 Electrical Connection

4.1 General information

Warning!
- Note the information given in Section 3.1 on maintaining the type of protection IP 67.
- When connecting an explosion-protected version, refer to the corresponding information and connection diagrams in the Ex supplement to this Operation Manual. Your E+H representative will be pleased to provide you with more information.

4.2 Connecting the sensor

Warning!
- Risk of electric shock! Do not install or wire the unit when it is connected to the power supply. Failure to comply can also result in damage to electronic components.
- Connect the protective conductor to the earth contact on the z32 plug (power supply board) of the transmitter before the power is switched on. By way of this connection, the 19" housing is also connected to the protective-conductor potential.
- Check that local power supply and frequency agree with the information on the type plate. All relevant national regulations for mounting must also be observed.

1. Remove the lid of the sensor connection housing:
   Promag A and Promag H: to do so, remove the four recessed-head screws.
   Promag F: remove the safety claw of the screw cap with a 3 mm Allan key.

2. Slide signal and coil cable through the respective cable gland.

3. Connect cable acc. to the electric connection diagrams (page 26f.)
   - fine-wire line: max. 4 mm², sheat with a cable-end sleeve;
   - single-wire line: max. 6 mm².

4. Screw lid tightly back on the connection housing (Promag F: tighten safety claw).

5. Cable sensor and transmitter according to the connection diagrams (see page 26f.).

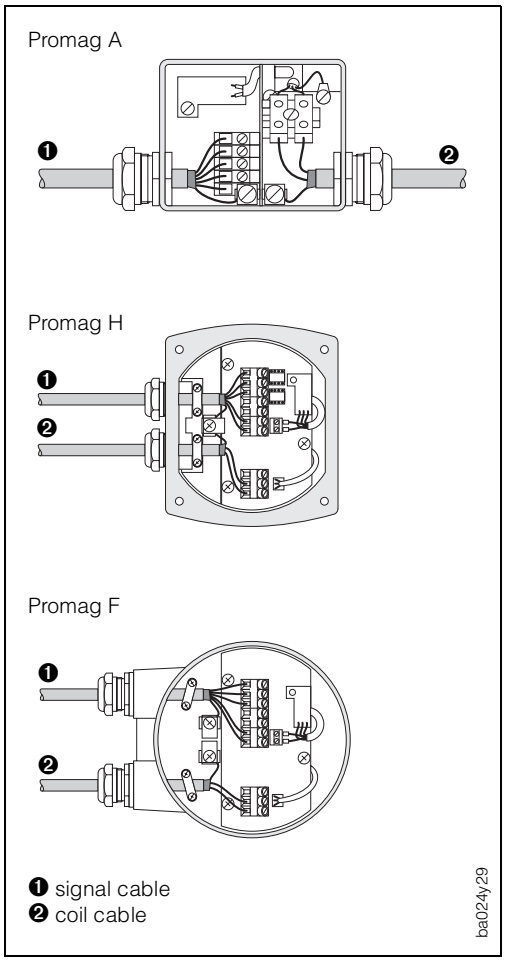


Fig. 27

4.3 Wiring diagrams

Promag 39 A

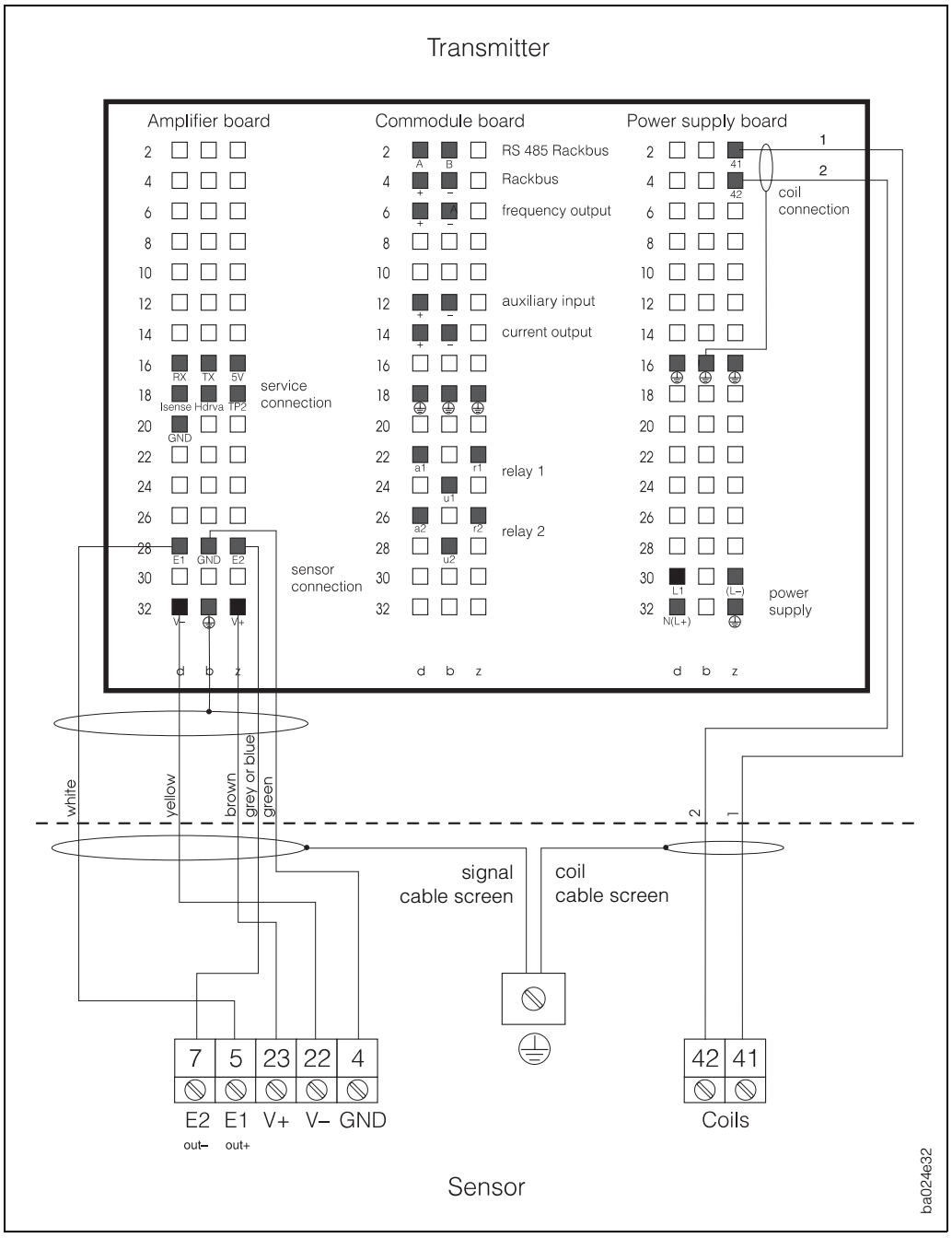


Fig. 28

Promag 39 H and Promag 39 F

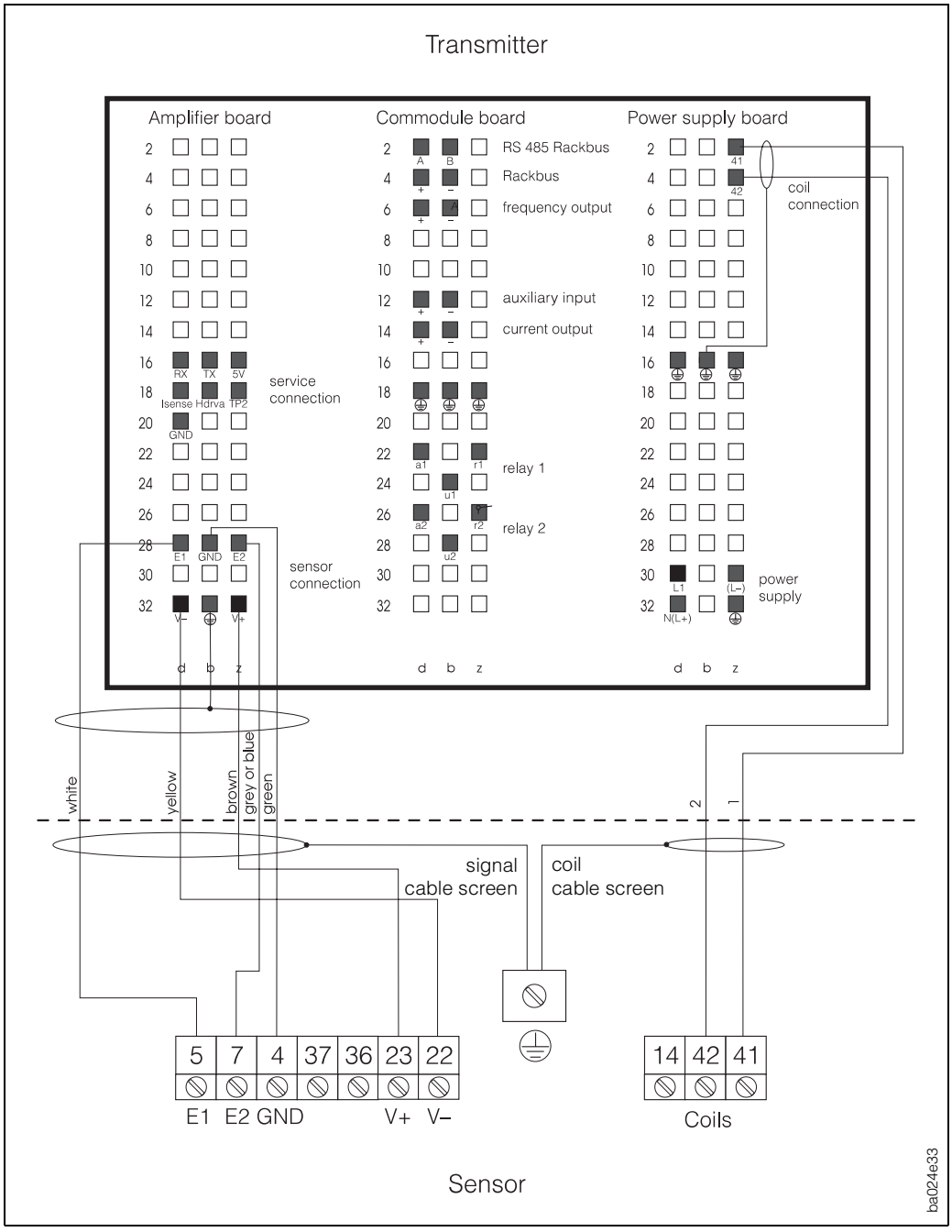
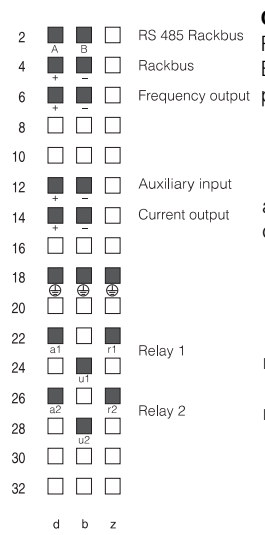


Fig. 29

Wiring synopsis Promag 39 A, Promag 39 H and Promag 39 F



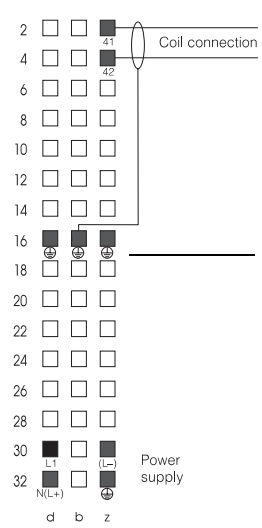
Commodule board
RS 485 hardware standard; Rackbus protocol
E+H hardware standard; Rackbus protocol
pulse/frequency output (active/passive)
active: 24 V DC, 25 mA (250 mA for 20 ms), R_L >100 Ω
passive: open collector, 30 V DC; 25 mA (250 mA for 20 ms)

auxiliary input +/– or –/+ (3…30 V DC)
current output active 0/4…20 mA ($R_{L\,min}$ for HART = 250 Ω)

relay 1 alarm output: available as NC and NO contact, maximum 250 V AC/30 V DC, max. 1 A
relay 2 status output: available as NC and NO contact, maximum 250 V AC/30 V DC, max. 1 A

ba024e34

Fig. 30
Commodule board



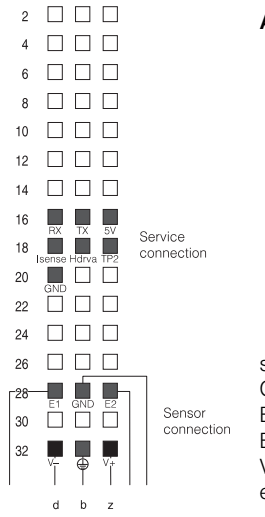
Power supply board
coil terminal

earth terminal (coil cable screen)

power supply:
L1/N for AC
L+/L– for DC
earth terminal (protective earth)

ba024e35

Fig. 31
Power supply board



Amplifier board

sensor connection:
GND: measuring ground
E1: electrode 1
E2: electrode 2
V–, V+ (auxiliary power for preamplifier)
earth terminal (signal cable screen)

ba024e36

Fig. 32
Amplifier board

4.4 Cable specifications

Coil cable: 2×0.75 mm² PVC cable with common screen
conductor resistance: ≤37 Ω/km
capacitance: core/core, screen grounded ≤120 pF/m
permanent operation temperature: –20...+70 °C

Signal cable: 5×0.5 mm² PVC cable with common screen
and separately screened cores
conductor resistance: ≤37 Ω/km
capacitance: core/screen ≤120 pF/m
permanent operation temperature: –20...+70 °C

Cable specifications for use in areas with severe electrical interference
The Promag 39 measuring system fulfils all general requirements for electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 if installed in accordance with the NAMUR recommendations.


Note

Note!
- The signal and the coil cables between the sensor and transmitter must always be screened and grounded at both ends. This is done at the earth terminals inside the connection housing of the sensor. The grounding on the transmitter is done with the respective connectors on the terminal strips (see page 26, 27).
- If the Promag H sensor is used at a fluid temperature of +150 °C, the cables have to be heat resistant up to an ambient temperature of +80 °C.

4.5 Commissioning

Before the measuring system is switched on for the first time, the following checks should be carried out again:
- check the electrical connections and terminal assignments
- compare the data on the type plate with the local mains voltage and frequency
- does the direction of the arrow on the type plate of the sensor correspond with the actual direction of flow in the pipe?

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

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

P	R	O	M	A	G		3	9					
V	2	.	0	4	.	0	0			R	A	C	K

The communication board software will appear on the display.

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

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

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

Note!
If it is not possible to start up successfully, a message is displayed, depending on the causes of the fault. A list of the possible fault messages can be found in Section 8.3.


Note

5 Operation

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

Note

5.1 Operating and display elements

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

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

During normal operation, two freely selectable measured values are shown on the display simultaneously (HOME position), e.g. flowrate, totalised value, batch quantity, batch cycles, etc:

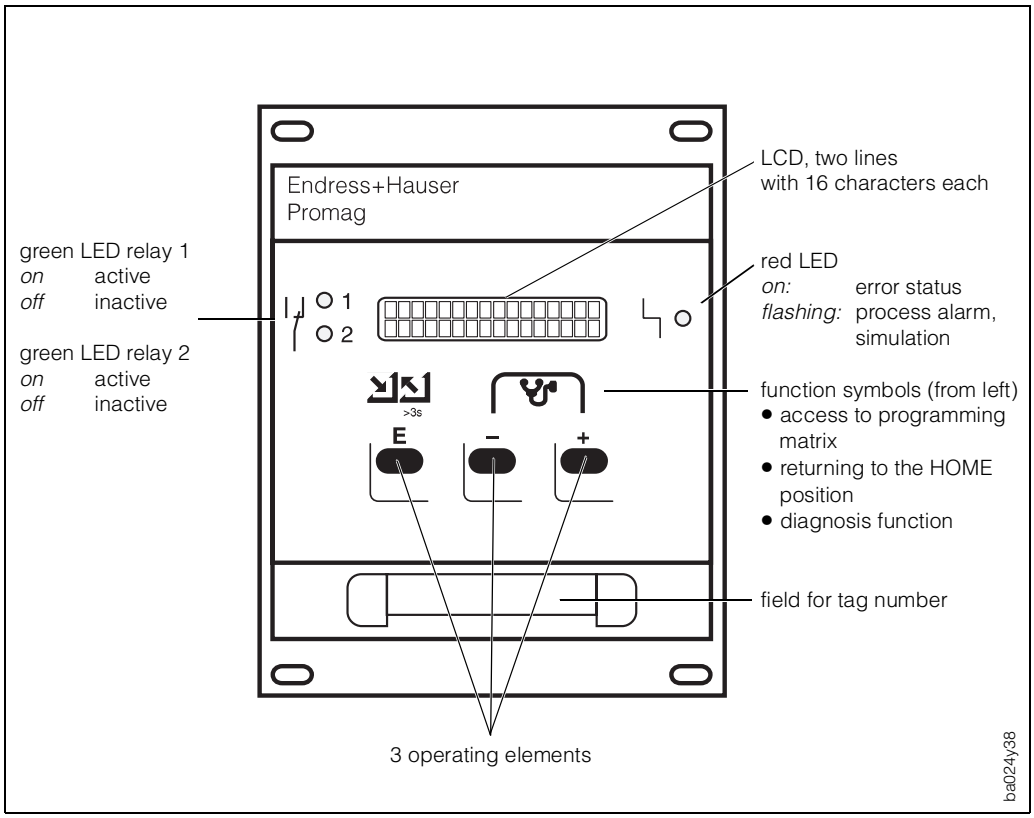


Fig. 33

5.2 Operating concept Promag 39 (E+H matrix)

There is a choice of over 60 functions and parameters for the Promag 39 measuring system, which the user can set individually and adapt to his process.

The individual functions are allocated to various function groups (see Fig. 34). Selection of these functions within the E+H matrix is carried out as described on page 104 “Programming at a Glance”. Numerical values or factory settings which may be altered are indicated on the LCD by flashing signals.


Note

Note!
- The folding pages at the end of this Operating Manual show all important information required for programming at a glance (display and operating elements, operating matrix, possible settings and factory settings).
- All functions are described in detail in Chapter 6 of this Operating Manual.

Enabling programming (access code)
Normally, the programming function is locked. It is, therefore, impossible for system functions, numbers, or factory settings to be accidentally changed. Parameters may only be entered or altered if the code (factory setting = 39) has been entered first. The use of a freely chosen personal code prevents unauthorised persons from gaining access to data (see page 63).
A few parameters, e.g. all sensor data, are protected by a special service code known only to the E+H Service Organisation and cannot be changed by entering the personal code. Any change in the data of these parameters directly influences the accuracy of the system. If problems arise, then please contact your E+H Service Organisation.


Caution

Caution!
- If the programming function is blocked and the ⊞ operating elements are activated for any given function, a call to enter the code is automatically displayed.
- With customer code **0** (zero) the programming is **always** enabled!

Locking the programming
Following a return to the HOME position, programming is locked again after 1 minute if no operating element is activated. In addition, programming can be deliberately locked by entering a value not corresponding to the code in the function “ACCESS CODE” (see page 64).


Note

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

Programming matrix Promag 39

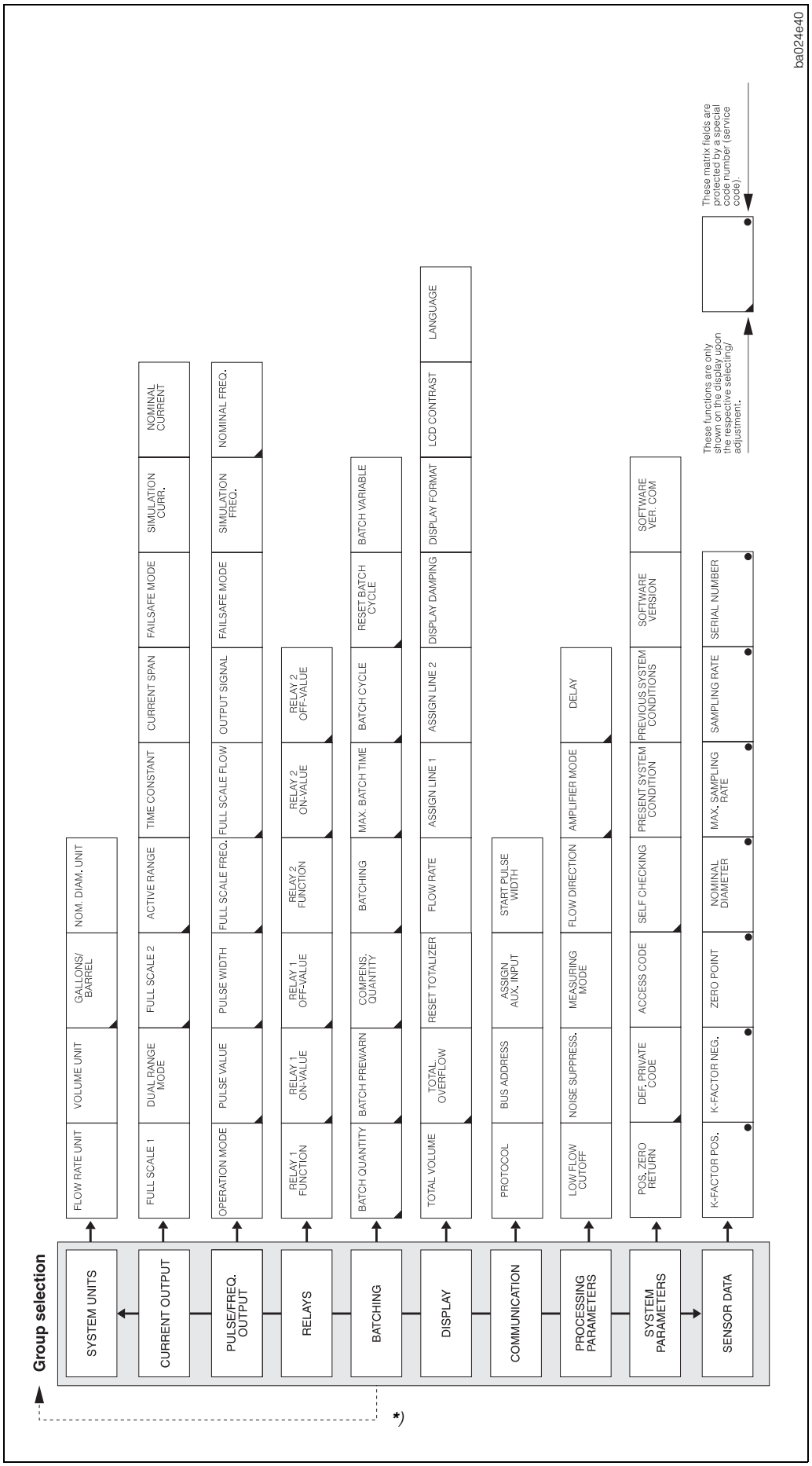
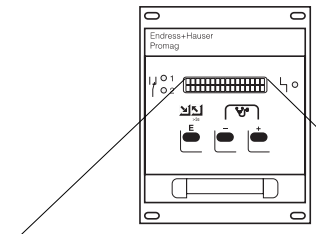


Fig. 34
Programming matrix Promag 39

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

5.3 Programming example

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



E — Entering the programming matrix.

SYSTEM UNITS
> GROUP SELECT <

+ / – — Select the desired function group “CURRENT OUTPUT”.

CURRENT OUTPUT
> GROUP SELECT <

E — Select the function “CURRENT SPAN”.

4 – 20 mA
CURRENT SPAN

+ / – — On pressing **+** or **–**, the entry of the code is automatically demanded.

0
ACCESS CODE

+ / – — Enter the code number (factory setting: 39).

39
ACCESS CODE

E — Programming is now enabled.

EDITING ENABLED

The programmable value starts flashing.

4 – 20 mA
CURRENT SPAN

+ / – — Select the desired current span. (0…20 mA or 4…20 mA). The display stops flashing.

0 – 20 mA
CURRENT SPAN

E — Save the input.

INPUT STORED

The display flashes and the value can now be altered again.

0 – 20 mA
CURRENT SPAN

E (> 3 s) — Return to the HOME position (press E for more than 3 seconds). In the HOME position, the programming level is blocked again after 1 minute, without activating any of the three operating elements.

or

E — Select other functions: following the last function, an automatic return to the respective function group will take place.

BACK TO GROUP
SELECTION

6 Functions

This section is an in-depth description of the individual functions and specifications of Promag 39. Factory settings are indicated in ***bold italics.***
On request, Promag 39 measuring instruments are also available with customized parameterization. In such cases, values/settings may differ from the factory settings shown here.

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

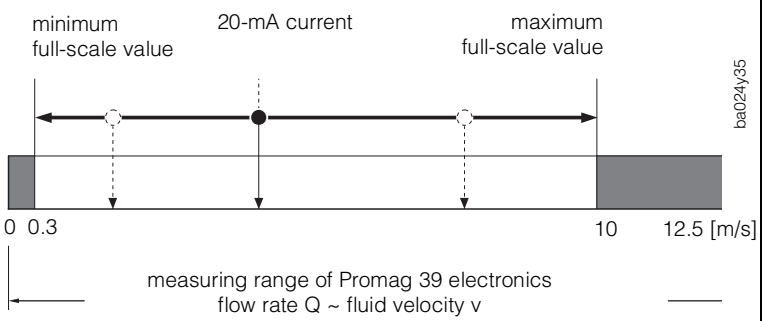
Function Group SYSTEM UNITS	
VOLUME UNIT	Selection of the required and indicated volume unit. The unit selected here is the same as that for: • batching rate • pulse value • totalizer value (and totalizer overflow) **Selection** dm³, ***m³***, l, hl, gal, bbl, 10³ gal, ft³ Diagnosis The actual totalizer value is displayed on the screen.
GALLONS/ BARREL Note	In the USA and the UK, the relationship between the units “barrel” (bbl) and “gallon” (gal) is defined differently from one medium and branch to the other. The required relationship can be selected here. Selection is also necessary on whether to use US or imperial gallons. Note! This function is only available if barrel or gallon are selected as “FLOW RATE UNIT” or “VOLUME UNIT”. **Selection** US: 31.0 gal/bbl ⇒ beer ***US: 31.5 gal/bbl*** ⇒ normal fluids US: 42.0 gal/bbl ⇒ petrochemicals US: 55.0 gal/bbl ⇒ filling tanks Imp: 36.0 gal/bbl ⇒ beer Imp: 42.0 gal/bbl ⇒ petrochemicals
NOM. DIAM. UNIT Note	This function is used to programme the required unit for nominal diameter. Note! The unit selected here is shown under “NOMINAL DIAMETER” (see page 68). **Selection** ***mm*** inch Diagnosis The nominal diameter set is shown for the unit selected.

Function Group
CURRENT OUTPUT

With this group of functions, the user is able to adjust the output current to suit his requirements (full-scale value, time constant, current span, etc.). We thus offer two basic versions of the current output: If programming “0/4...20 mA (25 mA)”, the current output can overrun to 125% of the calibrated full-scale value (25 mA), if programming “0/4...20 mA”, the current output functions according to NAMUR recommendations. This allows a maximum full-scale overrun of up to 102.5% (20.5 mA).

FULL SCALE 1

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



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

Note

Input

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

Diagnosis

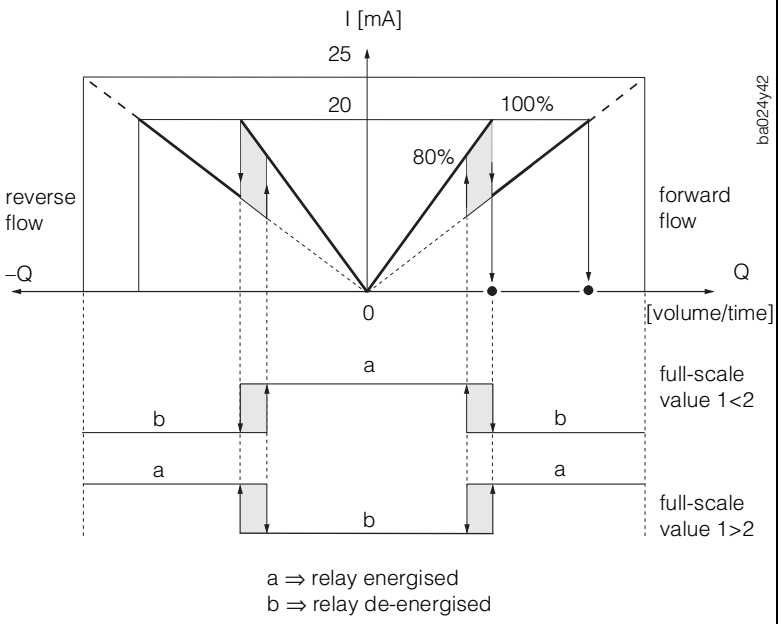
The unit can be selected in the “FLOW RATE UNIT” function
(see page 35).

Function Group
CURRENT OUTPUT

DUAL RANGE MODE

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

By activating the dual range mode, the system automatically changes between full-scale value 1 and 2. This changeover takes place at 100% or 80% of the lower full-scale value (hysteresis = 20%). Full-scale values 1 and 2 can be selected freely. (The changeover of the full-scale values can also be carried out via the auxiliary input.)



a ⇒ relay energised
b ⇒ relay de-energised

Note

Note!
Full-scale value 1 active ⇒ relay 1 or 2 energized (live)
Full-scale value 2 active ⇒ relay 1 or 2 de-energized (dead)

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

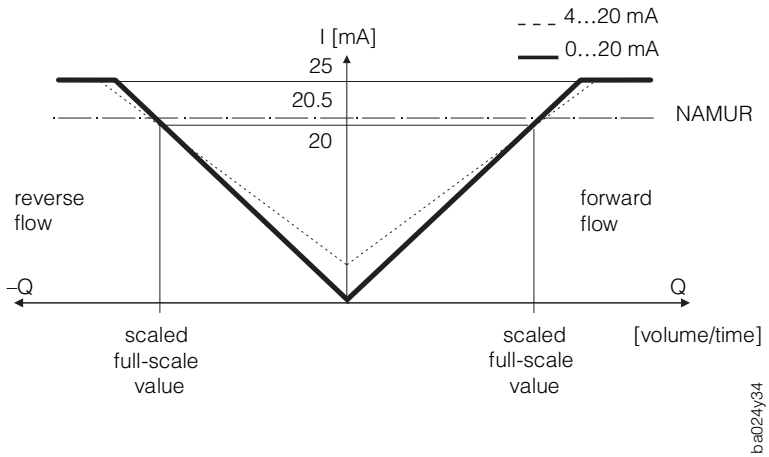
Selection

+ / – ***OFF***
ON

Function Group **CURRENT OUTPUT**	
FULL SCALE 2	By scaling the full-scale value, a flow rate is assigned to the 20 mA current. Scaling always applies to both flow directions (bidirectional), but with the unidirectional mode, no signal is shown for a negative flow. The direction of flow with appropriate configuration is emitted at the status output (relay 1 or 2). (This is always positive with unidirectional mode.) Note! This function is only available if the dual range mode is activated. **Input** 5-digit number with floating decimal point (e.g. 9,500.0 dm^3/min) Diagnosis The unit can be selected in the “FLOW RATE UNIT” function (see page 35).
ACTIVE RANGE	Display of the current full-scale value if the dual range mode is active. **Display** ***FULL-SCALE VALUE 1*** or FULL-SCALE VALUE 2
TIME CONSTANT	Selecting the time constant determines whether the current-output signal responds rapidly to a varying flow (short time constant) or is delayed (long time constant). Note! The time constant does not affect the behaviour of the flow indicator. **Input** max. 3-digit number with fixed decimal point: 0.01...100 s Factory setting: ***1 s***

Note

Note

Function Group **CURRENT OUTPUT**	
CURRENT SPAN	Select the 0/4…20 mA current range. This allows a choice between the current output with NAMUR recommendations (max. 20.5 mA) or a current output with a 25 mA maximum. Note! The current output can only be programmed to 0…20 mA if the HART communication is first switched off.  **Selection** 0…20 mA — current output according to NAMUR ***4…20 mA*** — current output according to NAMUR 0…20 mA (25 mA) — maximum 25 mA 4…20 mA (25 mA) — maximum 25 mA
FAILSAFE MODE	In the event of a fault and for safety reasons it is useful for the current output to assume a previously defined status. Note! The setting only affects the current output. **Selection** ***MIN. CURRENT*** If a fault occurs, the current signal is set to 0 mA (0…20 mA) or 2 mA (4…20 mA) MAX. CURRENT Current signal set to 25 mA for 0/4…20 mA (25 mA) or 22 mA for 0/4…20 mA [NAMUR] HOLD VALUE Last valid measured value is maintained ACTUAL VALUE Normal measured output despite fault

Function Group **CURRENT OUTPUT**	
SIMULATION CURR.	With this function an output current can be simulated. The simulation values that can be selected correspond to 0%, 50% or 100% of the scaled full-scale value. The two errors 2 mA (at 4…20 mA) and 25 mA (maximum possible value) or 22 mA for NAMUR can also be simulated. Specimen application 1: for checking downstream units. Specimen application 2: for checking the internal adjustment of the current signal. Note! • The specified current span of 0/4…20 mA determines the simulation values which can be selected here. • The flowmeter is fully operational for measuring during simulation, i.e. the totalizer and the flow indicator continue to operate correctly. • The "POSITIVE ZERO RETURN" function deactivates any simulation in progress and sets the output current to 0/4 mA. • The 25 mA simulation value is not available for programming according to NAMUR. • The active current simulation is indicated by the red flashing LED on the front of the transmitter and by a status message on the display. **Selection** *OFF* 0 mA 0% 10 mA 50% 20 mA 100% 22 mA 110% 25 mA 125% (overflow) } 0…20 mA 2 mA error 4 mA 0% 12 mA 50% 20 mA 100% 22 mA 110% 25 mA 125% (overflow) } 4…20 mA
NOMINAL CURRENT	Display of the current calculated from the measured flow. The effective current may vary slightly due to external factors such as temperature. **Display** The actual set point is shown on the display (0.00…25.00 mA). Diagnosis The actual flow rate is shown on the display.

Note

Function Group **PULSE/FREQUENCY OUTPUT**	
With this group of functions, the pulse/frequency output can be configured.	
OPERATION MODE Note	Select operation as pulse **or** frequency output. Note! Depending on the selection (pulse or frequency), different functions are available in this group. **Selection** + / - ***PULSE*** FREQUENCY
PULSE VALUE Note	The pulse value indicates what volume flow an output pulse will be supplied for. By means of an external counter the sum of these pulses can be recorded so that the total volume flow since the start of measurements is known. Note! This function is only available if the “PULSE” mode is selected. **Input** + / - 5-digit number with floating decimal point (e.g. 75.000 dm^3/p) Diagnosis + / - The unit can be selected in the “VOLUME UNIT” function.

Function Group
PULSE/FREQUENCY OUTPUT

PULSE WIDTH

Pulse width can be set between 0.05...2.00 s.

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

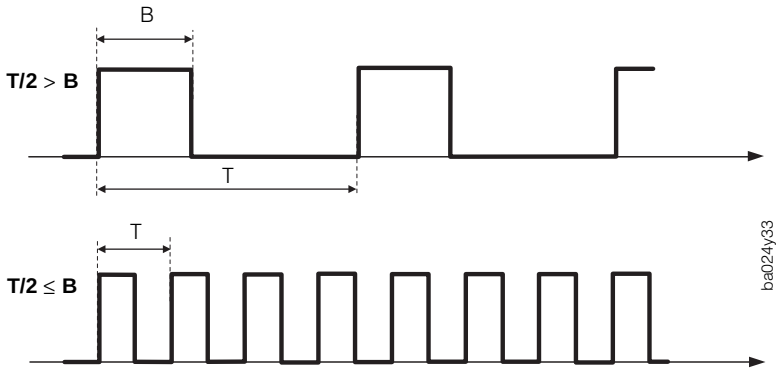
Note

Input

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

Diagnosis

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



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

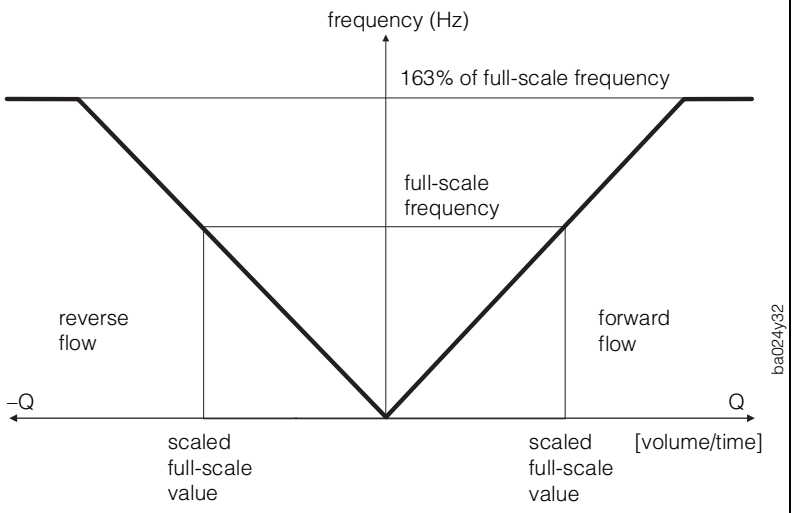
Function Group
PULSE/FREQUENCY OUTPUT

FULL SCALE FREQ.

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

Note

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

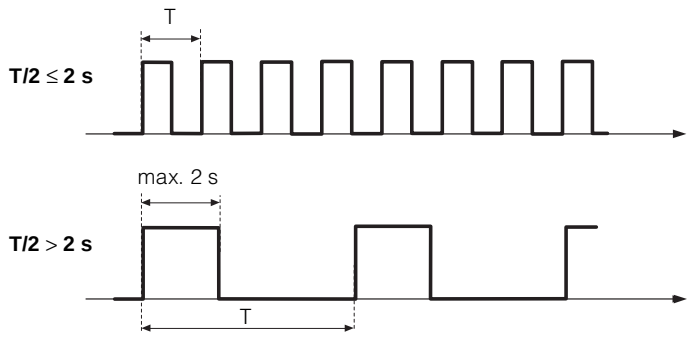


Input

Max. 5-digit number: 2…***10000 Hz***

Diagnosis

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



The above diagram applies to positive pulses.

Function Group

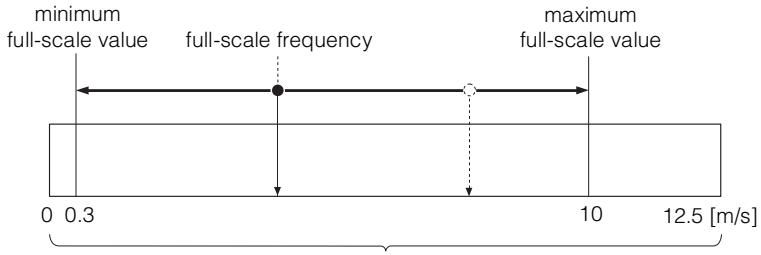
PULSE/FREQUENCY OUTPUT

FULL SCALE FLOW

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

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

Note



measuring range of Promag 39 electronics
flow rate Q ~ fluid velocity v

ba024y40

Input

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

Diagnosis

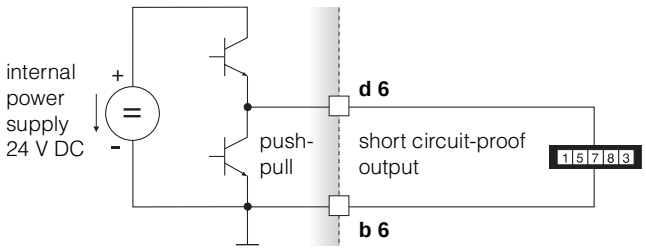
The unit can be selected in the “FLOW RATE UNIT” function.

Function Group
PULSE/FREQUENCY OUTPUT

OUTPUT SIGNAL

Various configurations are possible for the pulse/frequency output:
- ACTIVE: internal power supply available (+24 V)
- PASSIVE: external power supply required
- POSITIVE: fallback value at 0 V
- NEGATIVE: fallback value at 24 V or external power supply

ACTIVE **Commodule board**



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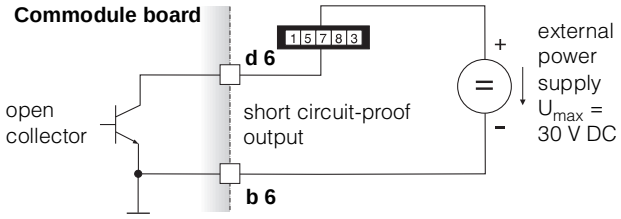
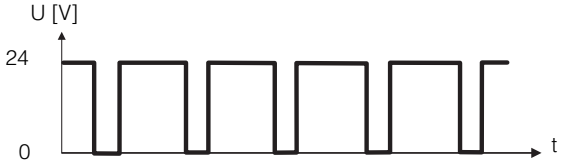
For high output frequencies and continuous currents up to 25 mA (I_{max} = 250 mA for 20 ms)

PASSIVE **Commodule board**

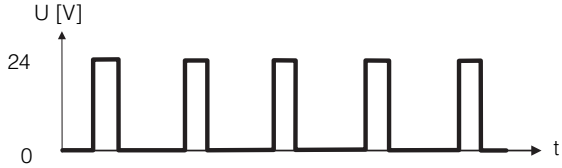


Only for low output frequencies or high continuous currents up to 25 mA (I_{max} = 250 mA for 20 ms)

Negative pulses



Positive pulses



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Selection (with prompt)

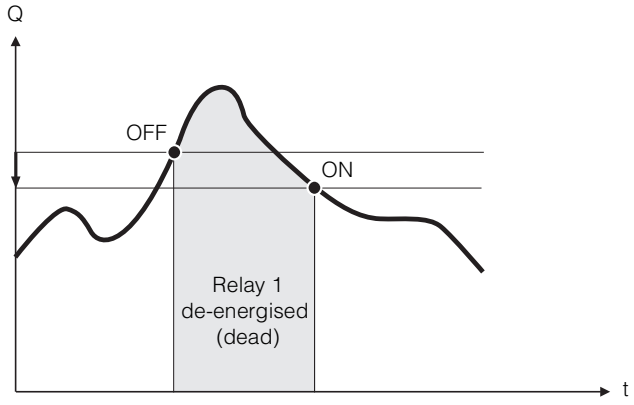
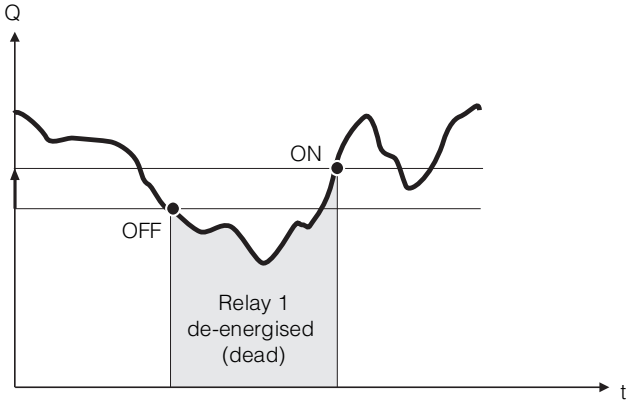
PASSIVE/POSITIVE
PASSIVE/NEGATIVE
ACTIVE/POSITIVE
ACTIVE/NEGATIVE

Diagnosis

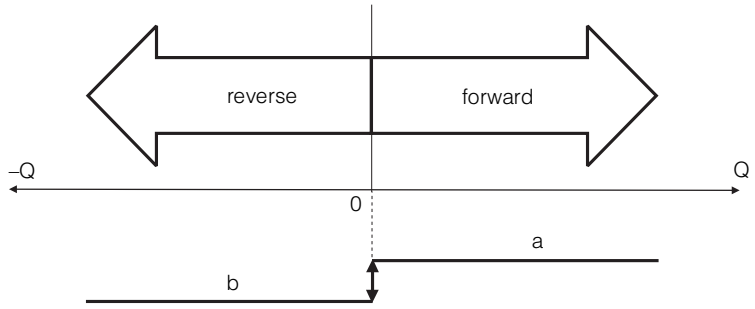
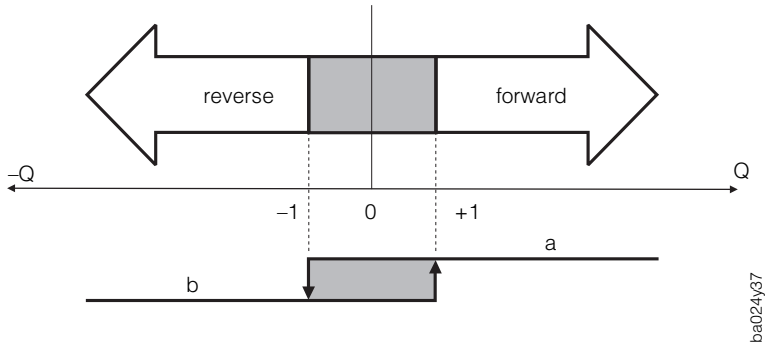
PASSIVE = OPEN COLL or ACTIVE = PUSH-PULL
(see above diagrams for details)

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

Function Group RELAYS	
RELAY 1 FUNCTION	With the Promag 39 transmitter, relay 1 can be assigned to various functions. The error function can only be assigned to this relay. Note! • Depending on what relay function is selected different functions are available. • As standard, the normally closed contact of relay 2 is brought out. This configuration, however, can be altered by connecting a jumper on the communication board. **Selection** ***FAILURE*** signalling system errors, failure DUAL RANGE MODE full-scale value 1 ⇒ 2 * BATCH PRECONTACT filling * FLOW DIRECTION forward/reverse LIMIT FLOWRATE 1 MAX/MIN safety or exceeding measuring range * Only appears on the display when the appropriate function has already been activated. Caution! Refer to the figures on page 52 for the response of relay 1.

Function Group RELAYS	
RELAY 1 ON-VALUE	Specifying the switch-on point for relay 1. Note! This function is only available when relay 1 is configured for “LIMIT FLOWRATE 1” or “FLOW DIRECTION”. **Relay 1 → “LIMIT FLOWRATE 1”** Relay 1 switches over as soon as the actual flow is above or below a defined switch point. • **MAX** safety: Exceeding the limit causes the relay to switch over. If you intend to use the limit function to detect when the measuring range has been exceeded, then proceed as follows: Set the switch-on and switch-off point to the maximum possible value. Press the key (+) until the message “LIMIT REACHED” appears on the display. Relay 1 is dead as soon as the maximal permissible measuring range (≥12.5 m/s) is exceeded. • **MIN** safety: Dropping below the limit enables the relay to switch over. **MAX safety** (switch-on point ≤ switch-off point)  **MIN safety** (switch-on point > switch-off point)  ba022y36 (Continued next page)

Note

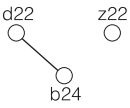
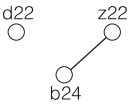
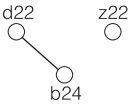
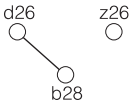
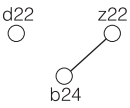
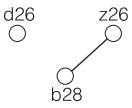
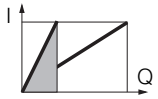
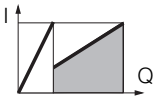
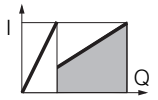
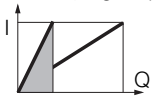
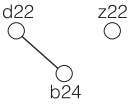
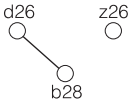
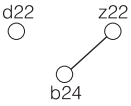
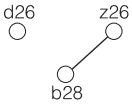
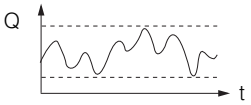
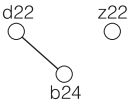
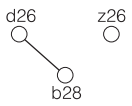
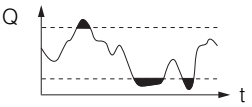
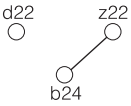
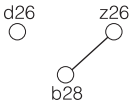
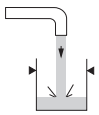
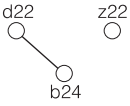
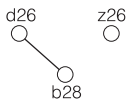
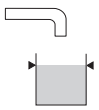
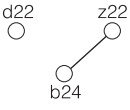
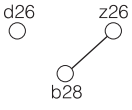
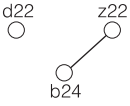
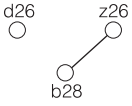
Function Group RELAYS	
RELAY 1 ON-VALUE (continued)	**Relay 1 → "FLOW DIRECTION"** Detection of flow direction operates with a hysteresis determined by the switch point. For instance, if the switch point is at 1 dm^3/min, the relay does not de-energize until –1.0 dm^3/min and picks up again at +1.0 dm^3/min.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

Function Group **RELAYS**	
RELAY 1 OFF-VALUE (Limit alarm 1)	Set the switch-off point required for relay 1. The switch-off point is given in flow units. • **MAX** safety if switch-on point ≤ switch-off point: relay 1 de-energizes on exceeding the switch-off point. • **MIN** safety if switch-on point > switch-off point: relay 1 de-energizes on falling below the switch-off point. Note! This function is only available when relay 1 is configured to "LIMIT FLOWRATE 1". **Input** 5-digit number with floating decimal point (e.g. 10.000 dm^3/min) Diagnosis The unit can be selected in the function "FLOW RATE UNIT".
RELAY 2 FUNCTION	With the Promag 39 transmitter, relay 2 can be assigned to various functions. Note! Depending on what function is selected, different functions are available. As standard, the normally closed contact of relay 2 is brought out. This configuration, however, can be altered by connecting a jumper on the communication board. Selection DUAL RANGE MODE — full-scale value 1 → 2 * BATCH CONTACT — filling * FLOW DIRECTION — forward/reverse ***LIMIT FLOWRATE 2*** — MIN/MAX safety or measuring range exceeded * Only appears on the display when the appropriate function has already been activated Caution! Refer to the figures on page 52 for the response of relay 2.
RELAY 2 ON-VALUE	For description of the function see function "RELAY 1 ON-VALUE " or "RELAY 1 OFF-VALUE".
RELAY 2 OFF-VALUE	

Note

Note

Caution

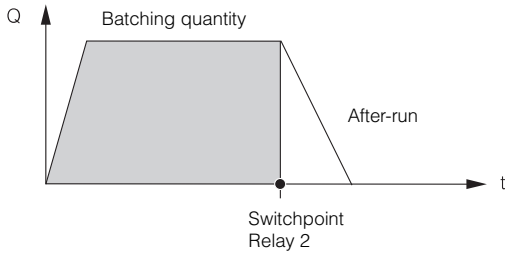
Functions Relay 1 Relay 2	**State**	**Relay Coil**	**Relay Contact on the Commodule Board**	
			Relay 1	Relay 2
FAILURE (This function is only available on relay 1)	no error present 	energised (live)		
	error present 	de-energised (dead)		
FLOW DIRECTION	forward 	energised (live)		
	reverse 	de-energised (dead)		
DUAL RANGE MODE	full-scale value 1<2  full-scale value 1 active full-scale value 1>2  full-scale value 1 active (larger span) full-scale value 2 active (larger span)  full-scale value 2 active 	energised (live)		
		de-energised (dead)		
LIMIT FLOW RATE	measurand *not* above or below limit 	energised (live)		
	measurand *either* above or below limit 	de-energised (dead)		
BATCH PRECONTACT (Relay 1) **BATCH CONTACT** (Relay 2)	batching cycle running: batch quantity or pre-batch quantity *not* reached 	energised (live)		
	batch quantity or pre-batch quantity reached (batching cycle not running) 	de-energised (dead)	 Batch precontact	 Batch contact
	power failure	de-energised (dead)		

Function Group
BATCHING

Introduction

The batching function together with the preset totalizer (batching quantity) enables simple batching cycles to be controlled. The Promag 39 transmitter has two relays which can be used for controlling the batching cycle. This enables either single (one relay) or two-stage (two relays) batching cycles to be carried out:

Single-stage batching (with one switchpoint)



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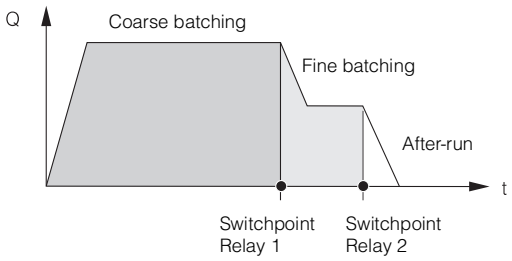
Two-stage batching cycle (with series contact)



If the Function “BATCHING” is activated, then Relay 2 can be assigned as *batching contact*, and Relay 1 as *pre-batch contact* for two-stage batching cycles.
An error in batching amounts due to plant operation (e.g. due to after-running of a pump, closing time of a valve, etc.) can be compensated for by entering a compensation quantity. Positive or negative compensation quantities are possible.

Note!
- For short-cycle batching (filling time <20 s) → see Function “SELF CHECKING”, page 64.
- If a system error (failure) occurs during a batching cycle, the filling procedure is immediately stopped.

Note

Starting/Stopping a Batching Cycle

The batching cycle can be started and stopped in four different ways:
- via the HART interface or Rackbus 485
- via the auxiliary input (with the “RS 485” communications module only)
- via the Function “BATCHING”
- from the HOME position (starting the batching cycle from the HOME position is always possible if a batching variable is selected in the function “BATCH VARIABLE”, see page 55):

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

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

Note

Function Group BATCHING	
BATCH QUANTITY	This function is used to set the filling quantity. Note! • Relay 2 can be assigned as a batching contact (see "FUNCTION RELAY 2", page 51) **Input** 5-digit number with floating decimal point (e.g. 240.00 l) Factory setting: ***0.0000*** (unit according to the selection in the function "VOLUME UNIT", page 36) Diagnosis Display showing which function Relay 2 is assigned.
BATCH PREWARN	In this function a pre-batch quantity can be defined which is used for two-stage batching cycles. Note! Relay 1 can be assigned as a pre-batch contact (see "FUNCTION RELAY 1", page 48). **Input** 5-digit number with floating decimal point (e.g. 200.00 l) Factory setting: ***0.0000*** (unit according to the selection in the function "VOLUME UNIT", page 36) Diagnosis Display showing which function Relay 1 is assigned.
COMPENS. QUANTITY	In this function a positive or negative compensation quantity is defined. This quantity compensates for a consistent error in batching amounts due to plant operation. This can be caused, e.g. due to after running of a pump or the closing time of a valve. The compensation quantity is determined by the operator of the plant. The compensation quantity only affects the batching quantity. • Overfilling → a negative correction factor is to be set • Underfilling → a positive correction factor is to be set Note! If no sufficiently large negative correction factor can be set then the initial switch-off quantity may have to be lowered. **Input** 5-digit number with floating decimal point and arithmetical sign (e.g. –10.000 l; 250.00 l); Factory setting: ***0.0000*** *Example* Batching quantity = 100 l; pre-batch quantity = 90 l → maximum positive correction factor = 100 l → maximum negative correction factor = –10 l Diagnosis The unit can be selected in the "VOLUME UNIT" function, page 36

Function Group **BATCHING**	
BATCHING	This function is used to manually start a batching cycle or to stop a batching cycle already running. A running batching cycle can be stopped at any time. Starting or stopping a batching cycle has a direct influence on relay 1 and 2, if configured for “BATCH PRECONTACT” and/or “BATCH CONTACT“. **Selection** + / – START – STOP – ***CANCEL*** (E activates START or STOP)
MAX. BATCH TIME	With this function a maximum filling interval can be set after Relay 2 (batching contact) has been de-energised, for example, due to safety reasons with a plant fault. Note! If the batching time is set to zero seconds, then batching time monitoring is inactivated. **Input** + / – max. 5-digit number (0...30000 s) Factory setting: ***0 s***
BATCH CYCLE	With this function the number of batching cycles completed is shown. **Display** Max. 7-digit number (0...9999999) Factory setting: ***0***
RESET BATCH CYC.	With this function the batching totalizer can be reset. **Selection (with prompt)** + / – ***NO*** – YES Diagnosis + / – Display showing how many batching cycles have been successfully completed.
BATCH VARIABLE	In this function, the batching mode can be activated or switched off. **Selection** + / – ***OFF*** – VOLUME


Note

Function Group DISPLAY	
TOTAL VOLUME	Here, the summed up flow quantity is shown as a floating-point number of maximally 7 digits. **Display** max. a 7-digit number (–9999999...+9999999) Factory setting: ***0.000000*** Diagnosis The units can be selected in the function “VOLUME UNIT”, see page 36
TOTAL OVERFLOW	The totaliser overflow value is displayed by a max. 7-digit number with variable decimal point. Larger numbers (>9,999,999) are shown as overflow in this function. The effective quantity is thus the sum of the overflow and the value shown in the HOME position resp. in the “TOTAL VOLUME” function. *Example:* Supposing the overflow is **2e7 dm³** ⇒ overflow = 2×10^7 dm³ = 20,000,000 dm³. The actual totalizer value is 196,845.7 dm³. The total amount, added since measurement started, is therefore 20,196,845.7 dm³. Note! • This value is only displayed if there is an overflow. In addition, in the HOME position an overflow is made visible by optically inverting the “>” sign. • The totalizer value may have a positive or negative sign as a result of the bidirectional measurement. **Display** Integer to a decimal power e.g. 10e7dm³ Diagnosis The actual totalizer value is displayed.
RESET TOTALIZER	The totalizer can be reset to zero (reset function). Note! Not only the “overflow” but also the value displayed in the HOME position is reset to zero. **Selection (with prompt)** ***NO*** – YES Diagnosis The actual totalizer value is displayed.

Function Group DISPLAY	
FLOW RATE	Here, the current flow value is shown. This is particularly advantageous if the HOME position is assigned to other measuring devices (e.g. to BATCHING). **Display** max. 5-digit number (–99999...+99999) Unit according to the selection in the function “FLOW RATE UNIT”, page 35
ASSIGN LINE 1	With this function the variable is defined which should be displayed on the *upper* display line during normal operation (“HOME” position). **Selection** + / – ***FLOW RATE*** – TOTAL VOLUME – BATCH QUANTITY [1] – BATCH UPWARDS [1] – BATCH DOWNWARDS – BATCH CYCLE [1] [1] These parameters only appear if the function “BATCH VARIABLE” is set to “VOLUME” (see page 55).
ASSIGN LINE 2	With this function the variable is defined which should be displayed on the *lower* display line during normal operation (“HOME” position). **Selection** + / – OFF – FLOW RATE – ***TOTAL VOLUME*** – TOTAL. OVERFLOW – BATCH QUANTITY [1] – BATCH UPWARDS [1] – BATCH DOWNWARDS – BATCH CYCLE [1] [1] These parameters only appear if the function “BATCH VARIABLE” is set to “VOLUME” (see page 55).
DISPLAY DAMPING	Selecting a time constant determines whether the display reacts quickly (small time constant) or slowly (large time constant) to widely changing flow variables. Note! Damping is inactivated when set to “zero”. **Input** + / – max. 2-digit number: 0...99 seconds Factory setting: ***1 s***


Note

Function Group DISPLAY	
DISPLAY FORMAT	Here, it is determined with how many significant digits the *actual flowrate* is shown on the display. Along with the "DISPLAY DAMPING" function, this serves to stabilize strongly fluctuating flows. Note! • Insignificant digits in front of the decimal point are shown as zeroes. • Insignificant digits after the decimal points are not shown, while the last digit displayed is rounded. **Selection** ***X.XXXX*** (5 significant digits) X.XXX (4 significant digits) X.XX (3 significant digits)
LCD CONTRAST	The contrast can be optimally adjusted to match the operating conditions on site. Caution! At minus temperatures, the visibility of the display is no longer assured even at maximum contrast. If no display is visible, refer to Section 8.2. **Adjustment** **IIIIIIIII**..... A change in contrast is immediately seen on the bar graph.
LANGUAGE	Selection of the operating language required. Note! By simultaneously pressing the ± keys when starting the Promag 39 (power supply on), the system starts with 'ENGLISH'. **Selection** ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS DANSK NORSK SVENSKA SUOMI BAHASA/INDONESIA JAPANESE Factory setting: ***according*** to the respective country

Function Group **COMMUNICATION**	
With this group of functions, the user can programme the interfaces or assign a function to the auxiliary input. More information on both interfaces can be found in Chapter 7.	
PROTOCOL	With this parameter, the respective communication protocol can be selected. **Selection** +/- ***OFF*** HART RACKBUS RS485 With a jumper on the communications board you can additionally choose between 'Rackbus' or 'Rackbus RS 485' (see page 87).
BUS ADDRESS	The bus address for your Promag 39 can be set in this funciton using data exchange via the HART protocol or the RS 485. Note! • In case of changing from Rackbus RS 485 to HART communication the HART address will be set to "0" if the Rackbus RS 485 address was >15, else the bus address is taken over. • In case of changing from HART to Rackbus RS 485 the bus address is taken over. **Input** +/- 2-digit number HART: ***0***...15 Rackbus RS 485: ***0***...63
ASSIGN AUX. INPUT	Here, various functions can be assigned to the auxiliary input (see Table on page 60). The functions of the auxiliary input are started or activated by applying an external voltage. Two types of activating are to be distinguished: • *Level trigger* • *Pulse trigger:* It is necessary to programme an appropriate minimum width for the start pulse in the function "START PULSE WIDTH" (see page 60). **Selection** +/- *Pulse trigger:* RESET TOTALIZER BATCHING *Level trigger:* DUAL RANGE MODE ***POS. ZERO RETURN***


Note

Function Group COMMUNICATION	
START PULSE WIDTH	If the auxiliary input is assigned to the pulsed function, e.g. “BATCHING” or “RESET TOTALIZER”, the minimum required pulse width can be set in this function. The input pulse must reach at least the set pulse width so that the function is activated. This ensures that the function is not activated by transient voltage peaks (interference pulses). Note! If the auxiliary input has no function with a pulse control assigned to it, this function is blanked out. **Selection** max. 3-digit number: ***20***...100 ms

Note

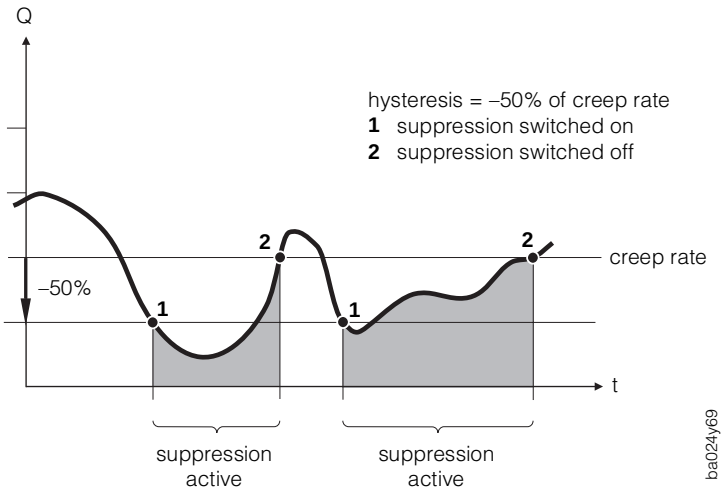
Functions of the auxiliary input

Pulsed mode

Assignment	Pulse at auxiliary input	Function	Remarks
RESET TOTALISER	• No pulse at auxiliary input	no function	
	• Pulse between 3 and 30 V at auxiliary input, at least for the time of the set start pulse width	totaliser is reset	
BATCHING	• No pulse at auxiliary input	no function	
	• Pulse between 3 and 30 V at auxiliary input, at least for the time of the set start pulse width	batching is started	The option “BATCHING” is only available, if the function “BATCH VARIABLE” (see page 55) is set to “VOLUME”. By deactivating the batching function (→“OFF”) the auxiliary input is automatically set to “POS. ZERO RETURN”.
	Another pulse at auxiliary input during the filling procedure, at least for the time of the set start pulse width	batching is stopped	

Level mode

Assignment	Voltage at auxiliary input	Function	Remarks
DUAL RANGE MODE	• No voltage at auxiliary input	current output operates at full-scale value 1	This parameter is only available if the dual-range mode of the current output is activated. If the dual-range mode is deactivated, the auxiliary input is automatically set to the function positive zero return
	• Voltage of 3…30 V at the auxiliary input	current output operates at full-scale value 2	
POS. ZERO RETURN	• No voltage at auxiliary input	instrument operates normally	
	• Voltage of 3…30 V at the auxiliary input	all output signals set to 0 (no flow)	

Function Group **PROCESSING PARAMETERS**	
LOW FLOW CUTOFF	Set the required switch point for the creep rate (volume/time). Creep suppression prevents a flow rate being determined in the lower part of the range (e.g. fluctuating head at standstill). The creep function always operates with negative hysteresis:  Note! • If creep suppression is active, the flow sign is displayed optically inverted. • The max. creep rate depends on the nominal diameter of the sensor currently being used and corresponds to a flow rate of v = 1 m/s. • The unit shown can be selected in the “FLOW RATE UNIT” function. **Input** 5-digit number with floating decimal point (e.g. 15.000 dm^3/min) Diagnosis Creep suppression operates with a negative hysteresis of 50%
NOISE SUPPRESS.	A software filter (= interference blanking) can be used to reduce the sensitivity of the output signals with response to transient flows and interference peaks, e.g. with fluids containing solids. **Selection** OFF LOW ***MEDIUM*** HIGH

Note

Function Group **PROCESSING PARAMETERS**	
MEASURING MODE	The measuring system is able to measure both flow directions (bidirectional). The signal outputs (current output, pulse/frequency output and the internal totalizer) can all be switched to an unidirectional mode. In this case, a signal is only shown or totalized internally for a positive flow. The flow display in the HOME position still operates in both flow directions. **Selection** UNIDIRECTIONAL ***BIDIRECTIONAL***
FLOW DIRECTION	There is an arrow on the type plate of the flowmeter to indicate a positive (forward) flow direction. Under certain circumstances it may be necessary to operate the flowmeter in the reverse direction. This can be done by inverting the sign of the flowrate measured (reverse). **Selection** ***FORWARD*** [1] REVERSE [2] [1] Positive flow according to the arrow on the type plate. [2] Positive flow in the opposite direction to the arrow on the type plate.
AMPLIFIER MODE	The Promag measuring amplifier has an automatic amplifier level control. This ensures the amplifier always works at optimum amplification depending on the fluid velocity. In this manner, a high precision result is achieved for the entire dynamic range of 1000:1. For applications with fast and strongly fluctuating flows, the measurement may, however, be impaired and the desired precision not reached. For such applications, it may be better to program the amplifier to a fixed amplifier level. **Selection** ***NORMAL*** automatic amplifier level control MODE 1 for flowrates 0...>12 m/s MODE 2 for flowrates 0...12 m/s MODE 3 for flowrates 0... 4 m/s MODE 4 for flowrates 0... 1 m/s
DELAY	Within the measuring amplifier, the delay of the automatic amplification switch-over 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 programmed number thus corresponds to the number of measuring events (samples) to be ignored before a switch-over of the amplifier booster is necessary. **Input** max. 4-digit number: ***10***...1000

Function Group **SYSTEM PARAMETERS**	
POS. ZERO RETURN	With the positive zero return (PZR), output signals can be deliberately set to zero. Positive zero return is equivalent to zero flow: • current output signal ⇒ 0/4 mA • pulse/frequency output signal ⇒ at fallback value • display of HOME position: flow = 0; totalizer remains at actual value. Caution! • This value has top priority over all other instrument functions. • Both relays are live, i.e. energized. Any faults that occur during positive zero return can only be scanned directly using the diagnostic function or with the "PRESENT SYSTEM CONDITION" function. • The active positive zero return is indicated by the red flashing LED on the front of the transmitter and by a status message on-screen. Note! Any simulation in progress is interrupted by the PZR. **Selection** + / − ***OFF*** ON
DEF. PRIVATE CODE	Selection of a personal number with which programming can be enabled. For the Promag 39 measuring system the factory setting is 39. Caution! Programming is always enabled if the customers code number '0' is selected. Note! • If programming is blocked, this function is not available and access to the personal code by third parties is excluded. • The code number can only be altered if programming has been enabled first. **Input** + / − max. 4-digit number (0...9999) Factory setting: ***39***

Caution

Note

Caution

Note

Function Group **SYSTEM PARAMETERS**	
ACCESS CODE	All data of the Promag 39 measuring system are protected against unauthorized access. By entering a code number, programming is enabled and the settings of the instrument can be altered: → entering code set in the factory ("39") or → entering personal code Note! • If, in any function, the ± keys are pressed if programming is locked, a call to enter the code number is automatically issued. Once this number has been entered, programming is enabled. • Following a return to the HOME position, programming is again locked after 1 minute if no key is pressed during this time. • Programming can also be locked by entering another code number in the "ACCESS CODE" function (not the same number as the personal code). • A number of functions can only be altered once a special code (service code) has been entered as changing these parameters would lead to inaccuracies in measurement. This code is known by your E+H Service Organization. For further information, please contact your E+H Service Organization. Caution! If you can no longer find your personal code, the Endress+Hauser Service Organization will be able to help you. **Input** ± max. 4-digit number: ***0***...9999
SELF CHECKING	Switching the periodical self check of the amplifier *on* or *off*. The amplifier is fitted with an automatic temperature compensation. Any temperature drift occurring in the region of the amplifier path can be compensated for by a periodical measurement against an internal reference voltage. Note! This function is not available if the function "BATCH VARIABLE" (see page 55) is set to "OFF". In this case no periodical self check is carried out. **Selection** ± OFF ***ON***

Function Group
SYSTEM PARAMETERS

PRESENT SYSTEM CONDITION

System and process errors as well as status messages which occur while measurement is in progress are displayed in the HOME position, alternately to the measuring values. A jump to the diagnostic function is made automatically by pressing the diagnostic key. The user can scan the error and status messages currently available in their order of importance.

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

Note

Procedure (example):

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

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

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

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

Ask for further error or status messages.

PREVIOUS SYSTEM CONDITIONS

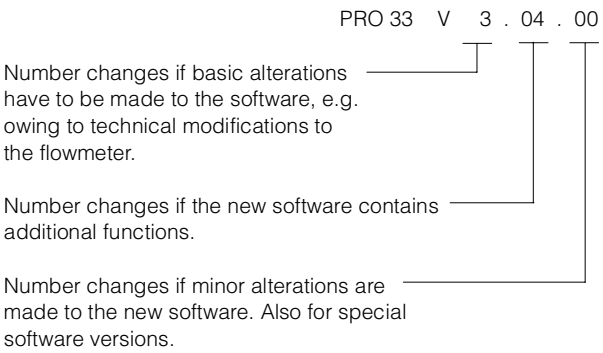
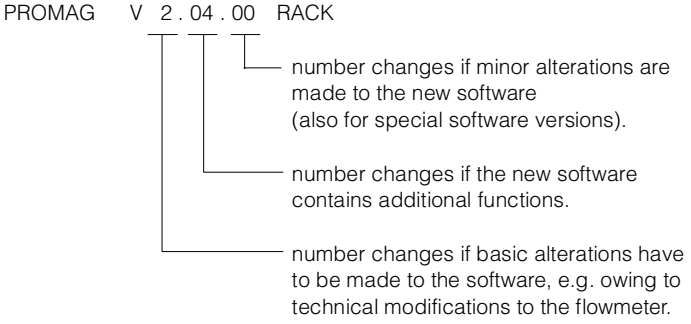
This function lists all error and status messages which have occurred in chronological order (max. 10 messages).

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

Note

Selection

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

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

Function Group
SENSOR DATA

Sensor data, such as nominal diameter, calibration factor, etc., are set at the factory. All characteristic values of the sensor are stored in the DAT memory (see page 11). The functions of this group can only be changed after entering a special service code and cannot be altered using the personal code. Please contact your E+H Service Organization for additional information.

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

K-FACTOR POS.

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

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

Selection

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

K-FACTOR NEG.

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

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

Selection

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

ZERO POINT

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

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

Selection

+/- Max. 4-digit number (–1000…+1000)
Factory setting: ***dependent on*** the sensor (nominal diameter) and its calibration

Function Group **SENSOR DATA**	
NOMINAL DIAMETER	The nominal diameter is determined by the size of the sensor. It is set at the factory. Caution! The nominal diameter given may, as a rule, not be altered. Numerous functions directly depend on the nominal diameter (technical units, full-scale values, switch points, creep rate, etc.). If the nominal diameter is changed, all dependent parameters are set to a **new** and plausible value. **Selection** Value from 2…2000 mm or $^{1}/_{12}$…78" Factory setting: ***dependent on*** the sensor Diagnosis The unit can be selected in the function "NOM. DIAM. UNIT" (see page 36)
MAX. SAMPLE RATE	The maximum permissible sampling rate (SAPS) depends on the particular sensor being used. It is set at the factory. Caution! Under normal circumstances, the max. sampling rate should not be altered. **Input** max. 3-digit number with fixed decimal point (1.0…60.0 per second) Factory setting: ***dependent on*** the sensor
SAMPLING RATE	The sampling rate (SAPS) is set at the factory. The standard value for the Promag A and F flowmeters is 16.7 per second. Note! • The sampling rate is usually set to the MAX. SAMPLING RATE. It should only be altered in special cases. • The Promag 39 measuring system is synchronized with the main power supply. Therefore, the sampling rate entered is set to the nearest possible value or rounded off to it. **Input** max. 3-digit number with fixed decimal point Factory setting: upper limit → ***depending on*** nominal diameter, maximum 60.0/s; lower limit: 1.0/s)
SERIAL NUMBER	Display of the serial number of the sensor. Note! The serial number is normally entered at the factory. **Input** max. 6-digit number Factory setting: ***dependent on*** the sensor

7 Communication Interfaces

Promag 39 can be configured to the following digital communications protocols:
- the Rackbus communication
- the RS 485 Rackbus communication
- the HART communication.

The selection between HART, Rackbus/RS 485 Rackbus is possible using the "PROTOCOL" function in the programming matrix. The subselection for Rackbus or RS 485 Rackbus is made by setting the jumper V20 on the communication board (see Fig. 38).
Usually your Promag 39 is delivered with the digital communication turned off.
The subselection Rackbus/RS 485 Rackbus is set to Rackbus.

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

7.1 The E+H Rackbus and RS 485 Rackbus

This section describes the connection of Promag 39 to an existing RS 485 network. If installing a RS 485 Rackbus network for the first time, the operating manuals of both the instruments and other network components used should be considered (see especially BA 134/01/Rackbus RS 485, topology, components, software).

Rackbus communication (see Fig. 40)
Promag 39 integrated in a 19" rack usually use Rackbus signals for communication. This allows direct link to the E+H Gateways Modbus, Profibus, and FIP control systems. Several 19" racks with a maximum of 64 instruments per rack can be integrated into the system.

RS 485 Rackbus communication (see Fig. 39)
The RS 485 Rackbus is an extension of the Rackbus using true RS 485 hardware signals. Field-mounted Promag 39 or stand-alone Promag 39 usually use the RS 485 Rackbus.
This allows a direct connection of Promag 39 to a personal computer via a RS 485 serial interface card or a RS 232C/RS 485 converter. The Promag 39 can then be configured and the measuring values displayed on a personal computer using "Fieldmanager 485", "Commugraph 485" and "Commuwin II" software.

Note!
- The installation of a Promag 39 with RS 485 Rackbus communication in a 19" Commutec Rack is not permitted and causes communication malfunctions.
- The indirect connection via FXA 675 is possible.
- The Promag 39 with RS 485 Rackbus communication may be wired to the A and B terminals from the RS 485 channels of the FXA 675.

Wiring for Rackbus (Commutec Rack)

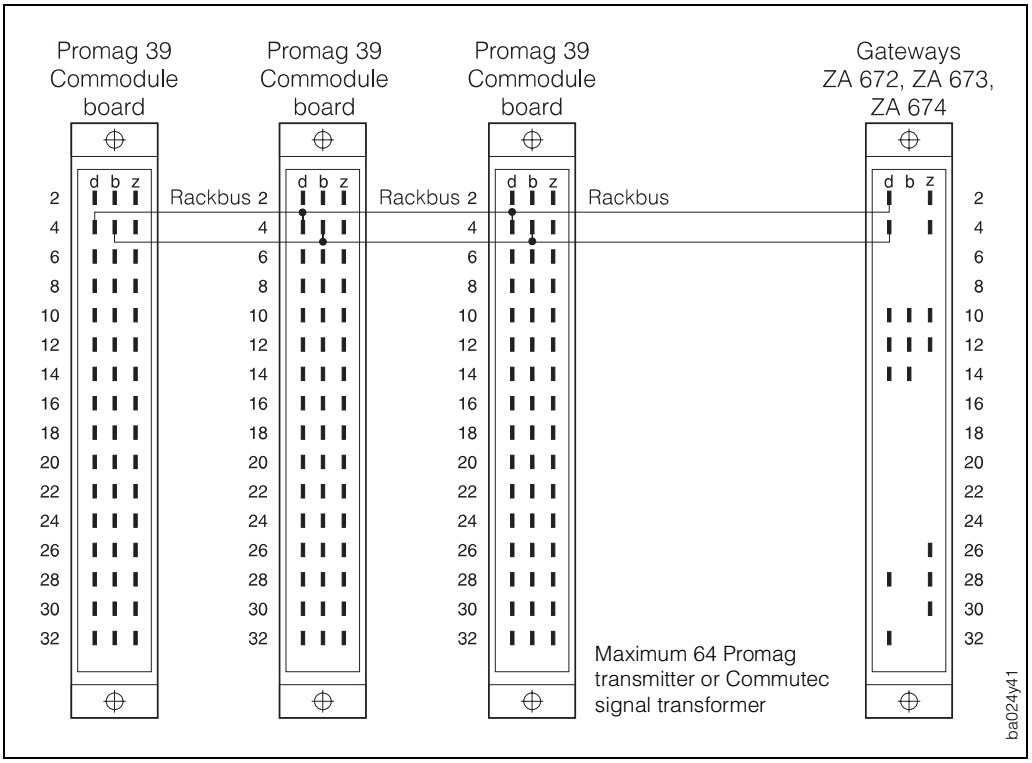


Fig. 35

Wiring the RS 485 Rackbus (not for Commutec Rack)

1. Terminal d2 = data A
   terminal b2 = data B
2. Ground the bus screening to terminal d18

Cable specifications

- connection cable: twisted pairs, screened
- cable diameter: ≥0.20 mm^2 (24 AVG)
- cable length: max. 1,200 m (3,900 ft)

RS 485 bus termination

The miniature switches for the RS 485 bus termination can usually remain in the default position (all switches ⇒ OFF). The switches are located on the commodule board.

- If a Promag 39 terminates the bus, turn on the terminating resistor with switch SW1: OFF – ON – ON – OFF.
- If a bias voltage is to be provided, position switch SW1 to “ON – ON – ON– ON”.

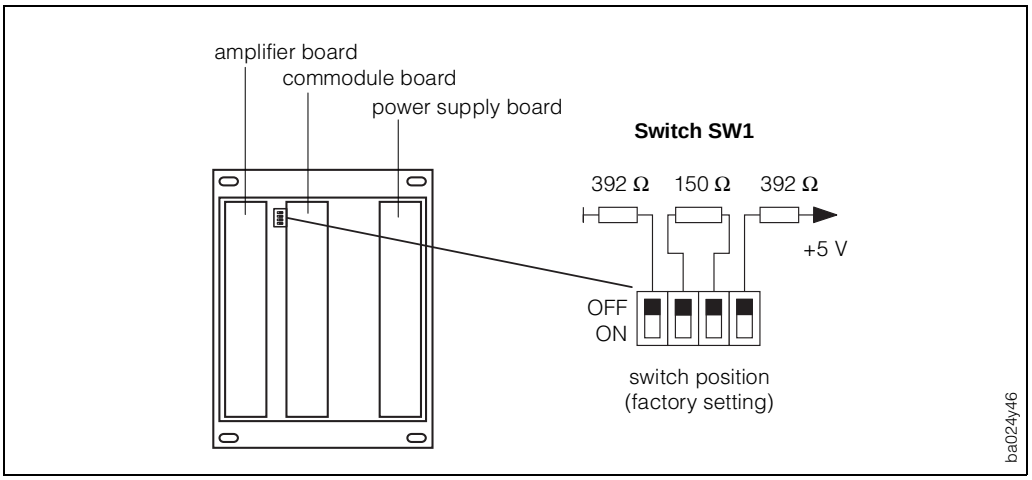


Fig. 36

Promag 39 communication terminals for Rackbus, RS 485 Rackbus and HART

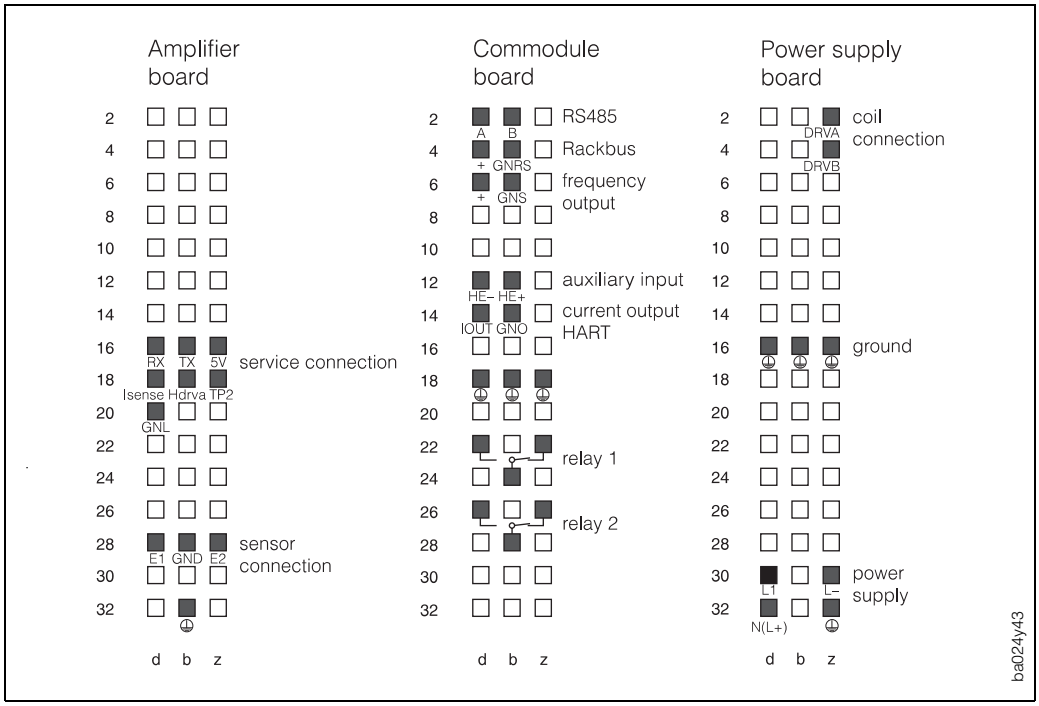


Fig. 37

The Promag 39 communication board

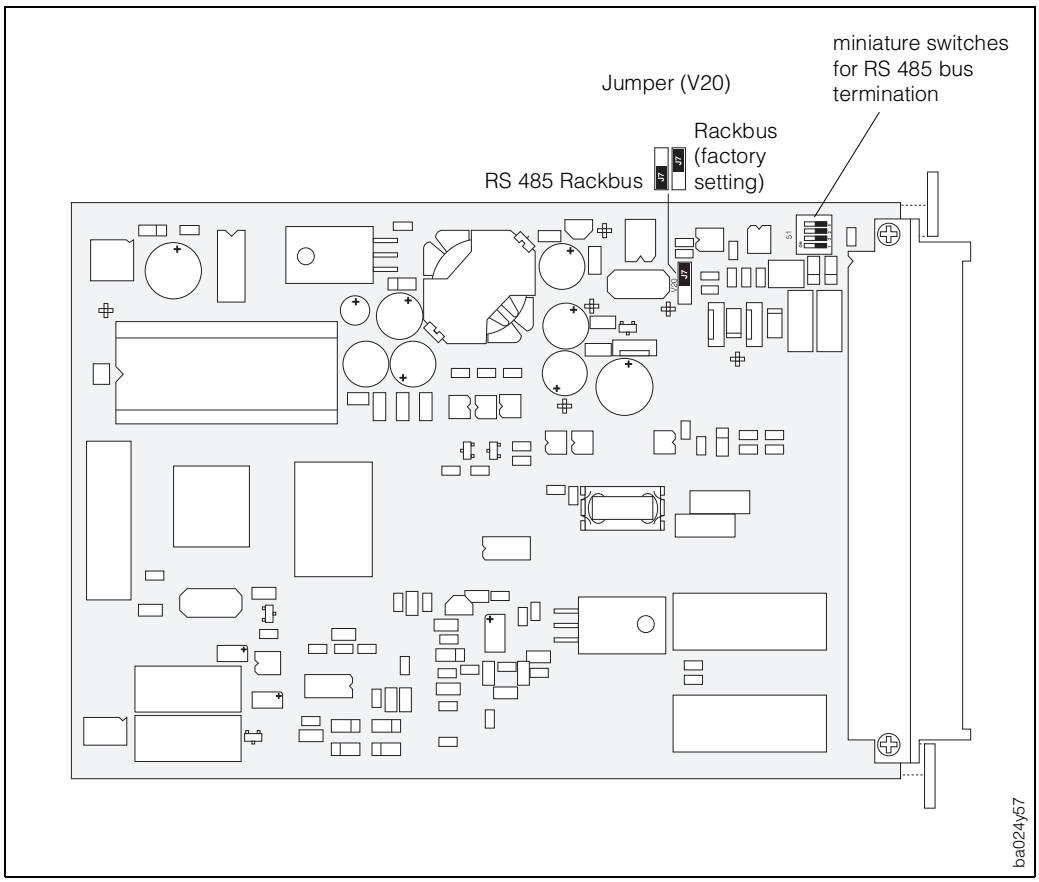


Fig. 38

Direct connection to a PC

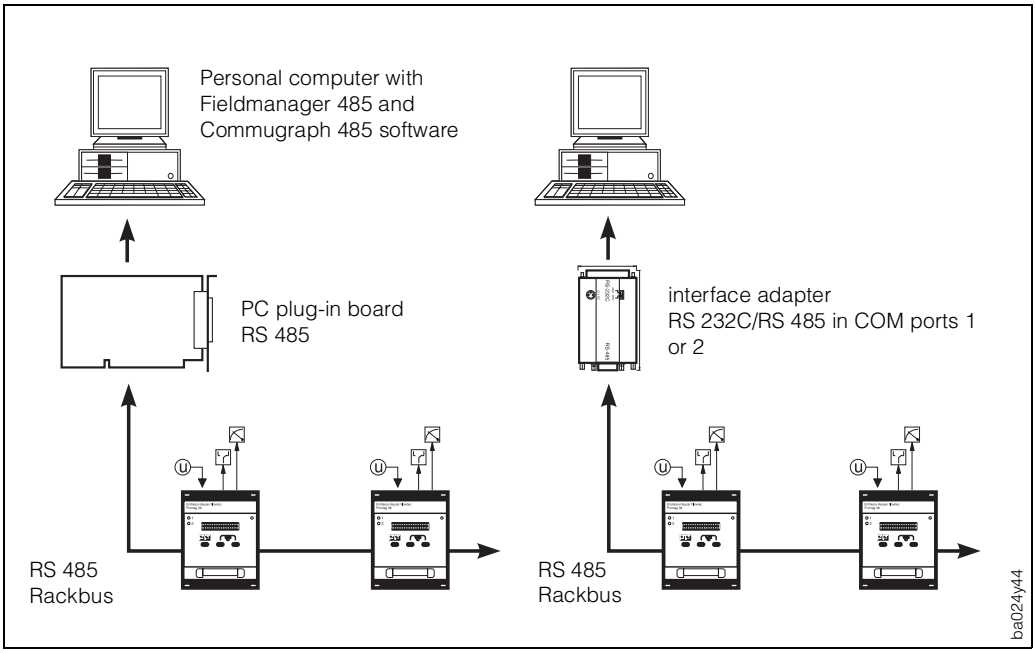


Fig. 39

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

Connection to a PC through the RS 232 port of ZA 672 gateway (Commutec Rack)

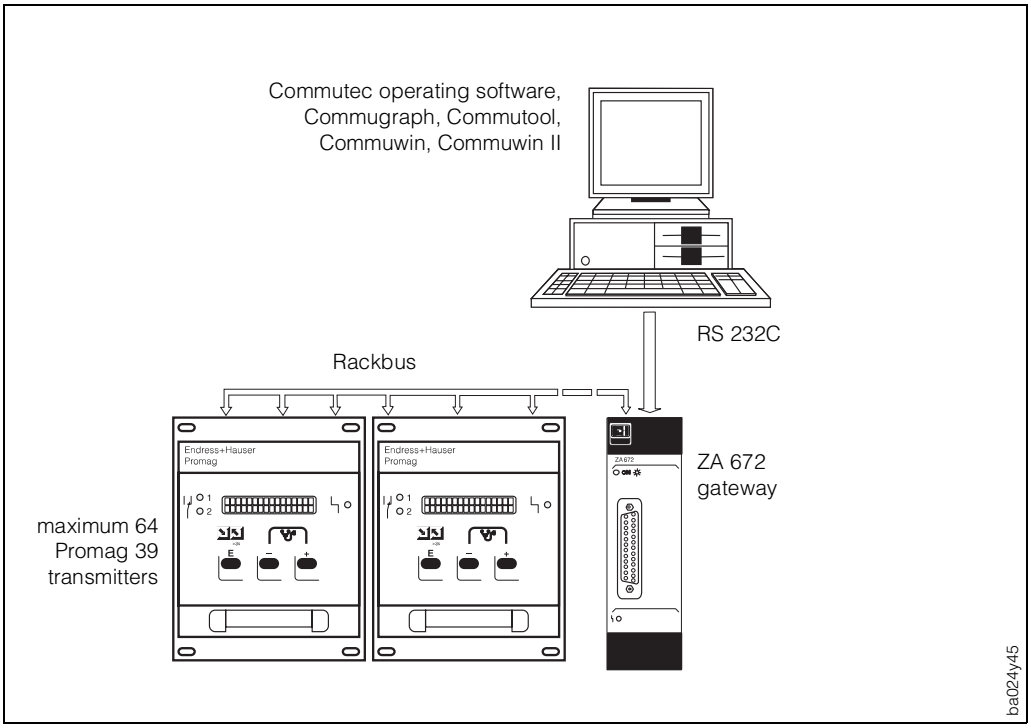


Fig. 40

Programming matrix for Rackbus RS 485

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

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

7.2 HART® Protocol

Besides local operation, the Promag 39 flowmeter can also be calibrated and measured values called up using the HART Protocol.
Two procedures can be used:

- Operation using the “HART Communicator DXR 275” universal handheld terminal.
- Operation using a personal computer with specific software, e.g. “Commuwin II”, and the “Commubox FXA 191” HART modem.

Operation using the HART Communicator DXR 275

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

Connection

The following connection versions are available to the user:

- Direct connection to the Promag transmitter via Terminals b14/d14
- Connection via the analogue 4...20 mA cable of current output (see Fig. 41).

Note

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

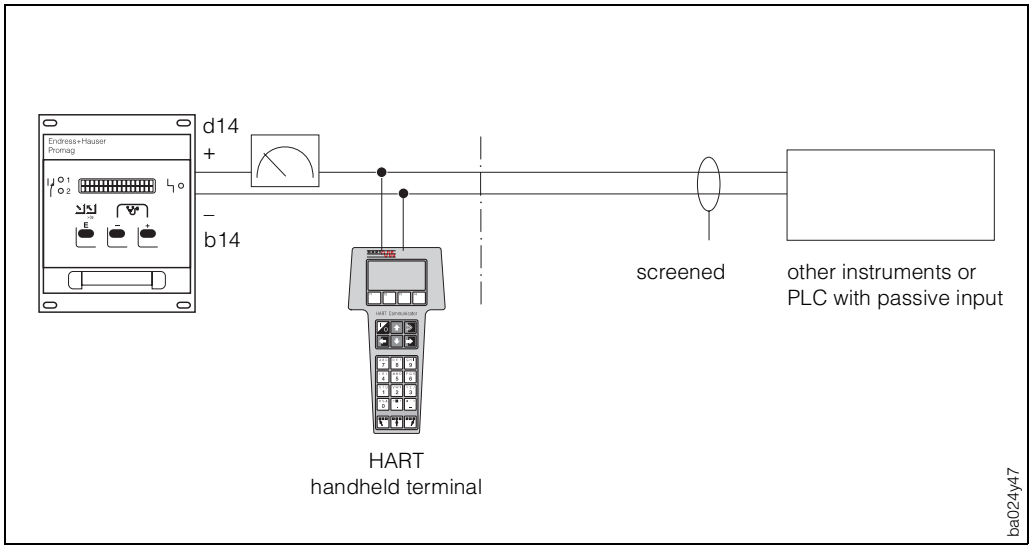


Fig. 41

Operating the Promag 39 with the HART Communicator

Operating the Promag 39 measuring system using a handheld terminal differs from local operation.

Promag 39 functions are selected with the HART Communicator over a number of menu levels (see Fig. 42, 43). Only the universal HART set of commands is available for this unit at present. This means that operating with the HART Communicator is limited to those functions which the universal commands offer. The measuring variables associated to the current output can therefore be called up and altered.

Caution!

The HART protocol requires a 4…20 mA setting of current output. The 0…20 mA setting is only selectable if the setting "HART" is *not* selected in the function "PROTOCOL" (see page 59).

Caution

Procedure

1. Turn on the handheld terminal:
   a. The flow meter is *not yet* connected → the HART main menu is displayed. This menu level is shown with every HART programming procedure, i.e. independent of flowmeter type. For further information see the operating menu for the "DXR 275 Communicator". Continue with "Online".
   b. The flow meter is *already* connected → the "Online" menu level is directly shown. At the "Online" menu level are continually shown the actual measurement data such as flow, totaliser value, etc., as well as the zero and full scale value of the set measuring range.
2. Other menu levels can be selected for the function required with "Device setup", e.g. "URV" (upper range value). All settings or values of this particular function can be seen immediately.
3. Enter values or change setting.
4. The "SEND" field is shown by pressing the F2 function key. By pressing this key, all values and settings entered with the handheld terminal are transferred to the Promag 39 measuring system.
5. Press the F3 HOME function key to return to the "Online" menu level. The actual values measured by the Promag 39 flow meter with the new settings can now be read.

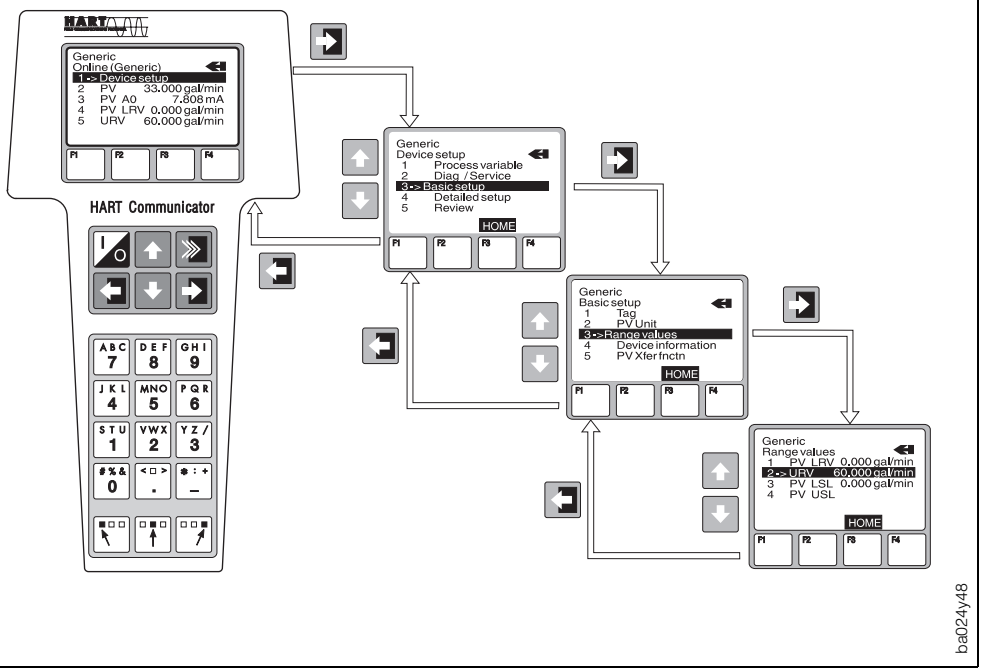


Fig. 42

HART Operating Matrix (Promag 39)

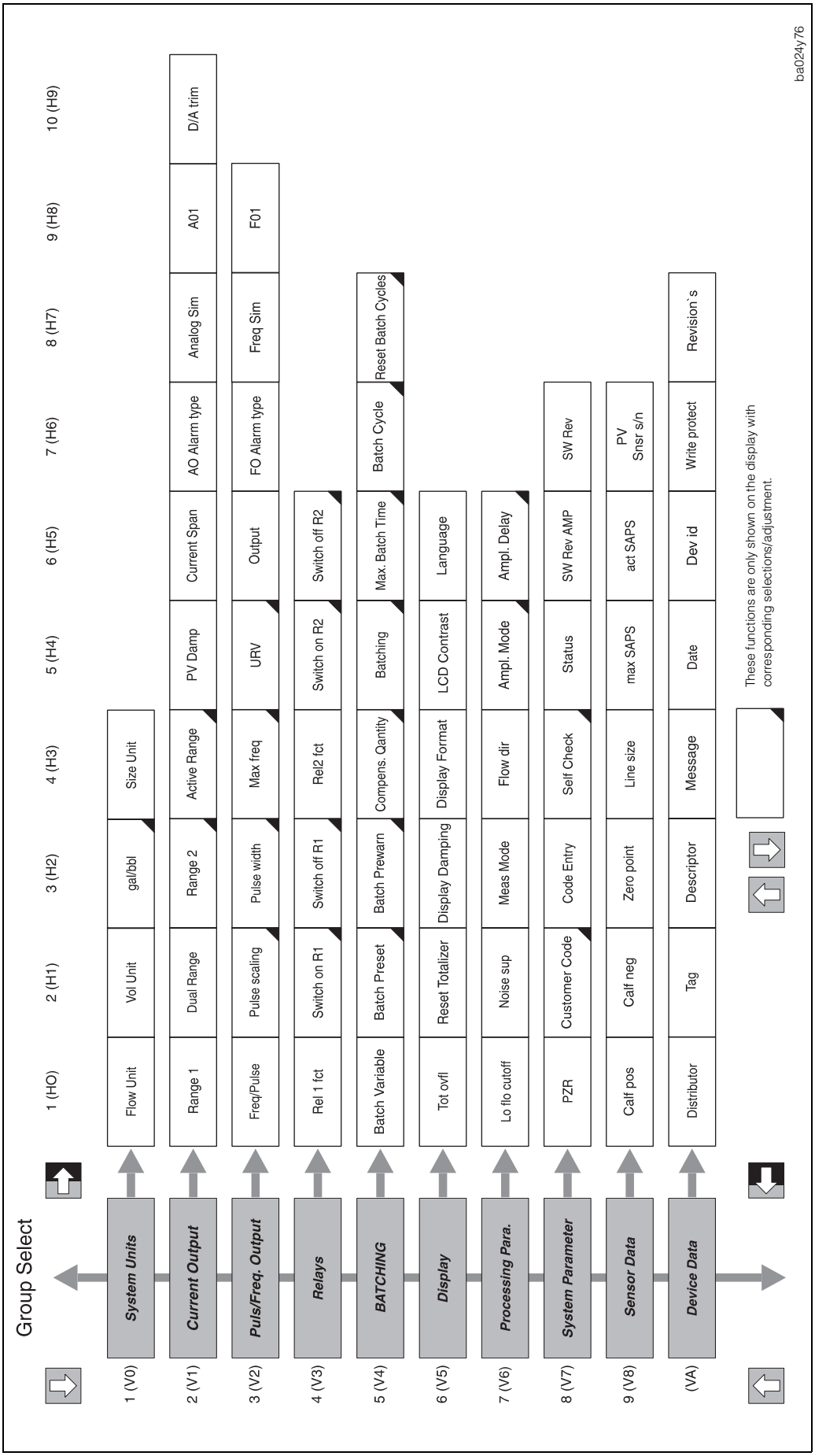


Fig. 43

Operation using “Commuwin II” software

The Promag 39 transmitter can be connected to the RS 232 C serial interface of a personal computer via the Commubox FXA 191. It can be remotely operated using the E+H “Commuwin II” program.

Connection

The following connection versions are available to the user:
- Direct connection to the Promag transmitter via Terminals b14/d14.
- Connection via the analogue 4...20 mA cable of current output (see Fig. 44).

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

Note

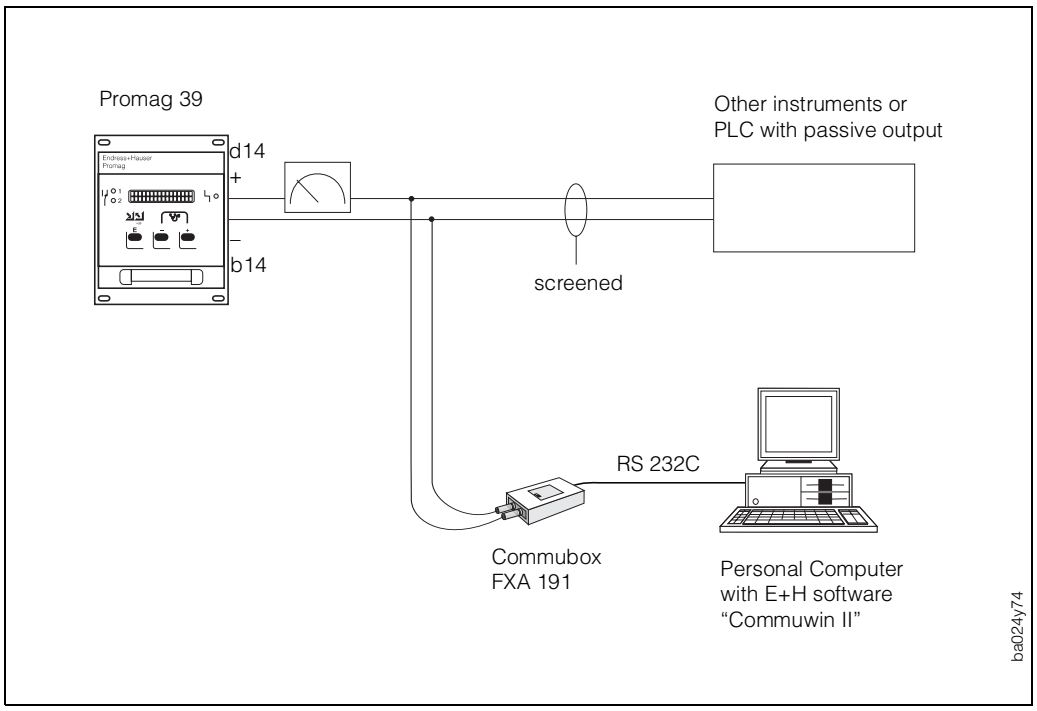


Fig. 44

8 Troubleshooting and Remedies

8.1 Response of the measuring system to faults or alarms

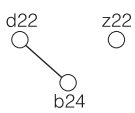
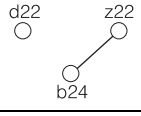
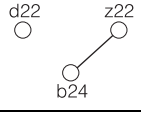
Error messages which occur while measuring is in progress are displayed in the HOME position, alternately to the measured values. The Promag 39 measuring system distinguishes two kinds of error:

Type of error	Response of the measuring instrument
Fault (system error) Fault due to failure of the instrument	⇒ corresponding message on the display ⇒ alarm output (see table below) relay 1 dead ⇒ the signal outputs respond according to set failure mode (see page 40, 47) ⇒ red LED is on
Alarm (process error) Fault due to factors influencing the process	⇒ corresponding message displayed ⇒ response of relay 1 or 2 (see page 52) ⇒ red LED is flashing

Caution!
Note the following points if positive zero return or simulation is active:

Positive zero return
- This function has top priority. The appropriate status message “S: POSITIVE ZERO RETURN ACTIVE” is also displayed with priority in the HOME position. Any error messages which occur during this time can only be accessed and displayed with the aid of the diagnostic function.
- Positive zero return resets all signal outputs to zero (corresponding to zero flow).
- Both relays are live, i.e. energised.
- The red LED is flashing on the front of Promag 39 transmitter.

Simulation
- This function is accorded the second highest priority, as is the corresponding status message. Any error messages which occur during this time can only be accessed and displayed with the aid of the diagnostic function.
- The simulation mode is indicated by the red flashing LED on the front of Promag 39 transmitter.
- Normal output of system errors via the error output (relay 1).
- Normal functioning of relay 1 or 2 (as per configuration, see page 52).

Function Relay 1	**State of Measuring System**	**Relay Coil**	**Relay Contact on the Commodule Board** Relay 1
Reporting sytsems errors (fault)	measuring system working normally	energised	
	system error occurde (see Section 8.3)	de-energised	
	power supply failure	de-energised	

8.2 Instructions for troubleshooting

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

To help you locate faults, some possible causes are shown here.

Is supply voltage present at terminals on the power supply board?
d32, z30 ⇒ 20… 55 V AC, 16…64 V DC
d30, d32 ⇒ 85…260 V AC

No →
- Check the wiring against the wiring diagrams.
- Check the distribution fuse.

Yes ↓

Is the fuse on power supply board sound?

No → Replace blown fuse.

Yes ↓

Is the display visible?

Caution!
Visibility of the LCD is no longer assured at temperatures <0 °C.

No →
1. Switch off the supply voltage.
2. Reapply the supply voltage at the same time actuating the ± operating elements. The measuring system starts at a maximum possible contrast.

Yes ↓

Does one of the following status messages appear on the display?
S: POS.ZERO-RETURN ACTIVE
S: CURRENT OUTP. SIMUL. ACTIVE
S: FREQ. OUTPUT SIMUL. ACTIVE

Yes → Switch off the function concerned.

No ↓

Does an error message appear on the display?

No →
No system or process error has occurred:
- check the wiring of the output signal cable.
- check parameters.

Yes ↓

Is a system error concerned? (fault, failure, red LED is on)
F: . . . . . .

Yes →
- Ask for more details of the fault with the diagnostic function (±).
- Take measures to clear the fault (see Section 8.3).

No ↓

Is a process fault involved (alarm, red LED is flashing)?
A: . . . . . .

Yes → Take measures to clear the fault (see Section 8.3).

No ↓

Does a status message appear on the display?
S: . . . . . .

Yes → Note status messages (see Section 8.3). No action necessary.

Diagnostic function for fault location

1. In the HOME position, an error message is displayed alternately to the measured value (provided neither positive zero return no simulation is active).

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

(Example)

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

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

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

(Example)

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

4. Return to HOME position.

8.3 Error and status messages

Note

Note!
Each *error message* is accompanied by a continuously illuminated red LED on the front of the transmitter.
Each *status and alarm (process) message* is accompanied by a red flashing LED on the front of the transmitter.

Fault messages F:... (system fault, failure)	**Cause** (call up using ⊞)	**Remedy**
F: SYSTEM ERROR POWER SUPPLY	↯: LOW VOLTAGE DETECTED	by an Endress+ Hauser Service Organisation
	The voltage from the power supply board is too low.	
	↯: COIL CURRENT CONTROL	by an Endress+ Hauser Service Organisation
	Coil current beyond tolerance limits.	
F: SYSTEM ERROR AMPLIFIER	↯: EEPROM FAILURE	by an Endress+ Hauser Service Organisation
	Error when accessing EEPROM data (adjusted values of the amplifier).	
	↯: DAT FAILURE	notify the Endress+Hauser Service Organisation
	Error when accessing DAT data (adjusted value of sensor).	
	↯: ROM / RAM FAILURE	by an Endress+ Hauser Service Organisation
	Error when accessing programme memory (ROM) or main memory (RAM) of the processor.	
	↯: GAIN ERROR AMPLIFIER	by an Endress+ Hauser Service Organisation
	Gain error of the amplifier.	
	↯: NO AMPLIFIER RESPONSE	by an Endress+ Hauser Service Organisation
	Faulty data transmission between communication module and amplifier.	

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

Alarm messages A:... (process errors)	**Cause**	**Remedy**
A: FLOW TOO HIGH	Medium flow rate in measuring pipe >12.5 m/s. Measuring range of transmitter electronics exceeded.	reduce flow rate
A: CURRENT OUTP. TOO HIGH	The actual flow rate is too high for the scaled full-scale value (I_{max} = 25 mA).	scale a higher full-scale value (see p. 37, 39) or reduce flow rate
A: FREQ. OUTPUT OVERFLOW	The actual flow rate is too high for the scaled full-scale value (f_{max} = approx. 163% of f_{End}).	scale a higher full-scale value (see p. 45) or reduce flow rate
S: POS. ZERO RET. ACTIVE	Positive zero return active. This message has top priority for Promag 39.	unnecessary
S: CURRENT OUTP. SIMUL. ACTIVE	Current simulation active.	unnecessary
S: FREQ. OUTPUT SIMUL. ACTIVE	Frequency simulation active.	unnecessary
S: BATCHING IS RUNNING	Batching in progress until the selected quantity has been discharged.	unnecessary
S: BATCH TIME EXCEEDED	The maximum time for a batching cycle has been exceeded.	Identify the cause for exceeding the time provided. Possible plant error (defective or blocked valve). It is possible that you have to increase the max. batching time (see page 55) or that you have to switch off batching time monitoring (batching time → 0 seconds).

8.4 Replacing of electronic boards

Warning!
- Danger of electric shock. Switch off the supply voltage.
- Observe the appropriate regulations when using instruments in Ex Zone 1. Refer also to the Ex-specific supplement to this documentation.

Caution!
- Exchanging electronic boards, make sure that their markings (39) agree.
- The local supply voltage and frequency must agree with the technical data of the power supply board concerned.

Procedure

1. Switch off the supply voltage (isolate the measuring system).
2. Release the 4 screws **a** on the fixing frame on the back of the Promag 19" rack frame.
3. Pull out of the rack the electronics module (commodule and amplifier board). For the removal of the power supply board the fixing screws on the side must be released **b**.
4. Release the corresponding two screws **c** on the fixation frame before you replace the electronics board.
5. If necessary, pull out the DAT module from the pin base concerned (Fig. 47: V10) on the amplifier board:
   - this is necessary if exchanging the amplifier board (plugging an old DAT onto a new board).
   - this is also necessary if replacing a defective DAT (plugging a new DAT onto old amplifier board).
6. Replace the old board with the new one.
7. Assemble in reverse order.

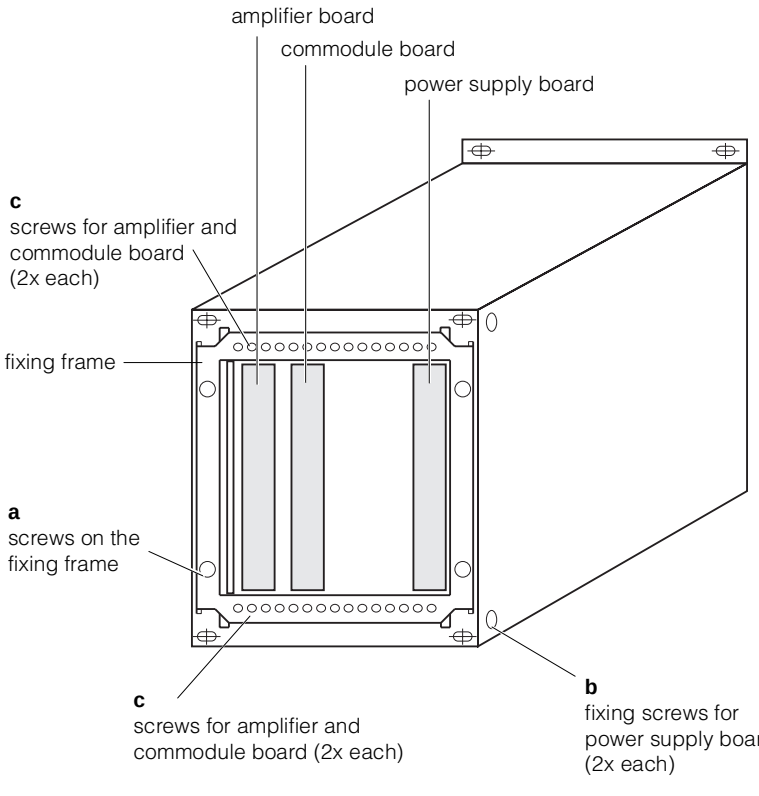


Fig. 45

The Promag 39 power supply board

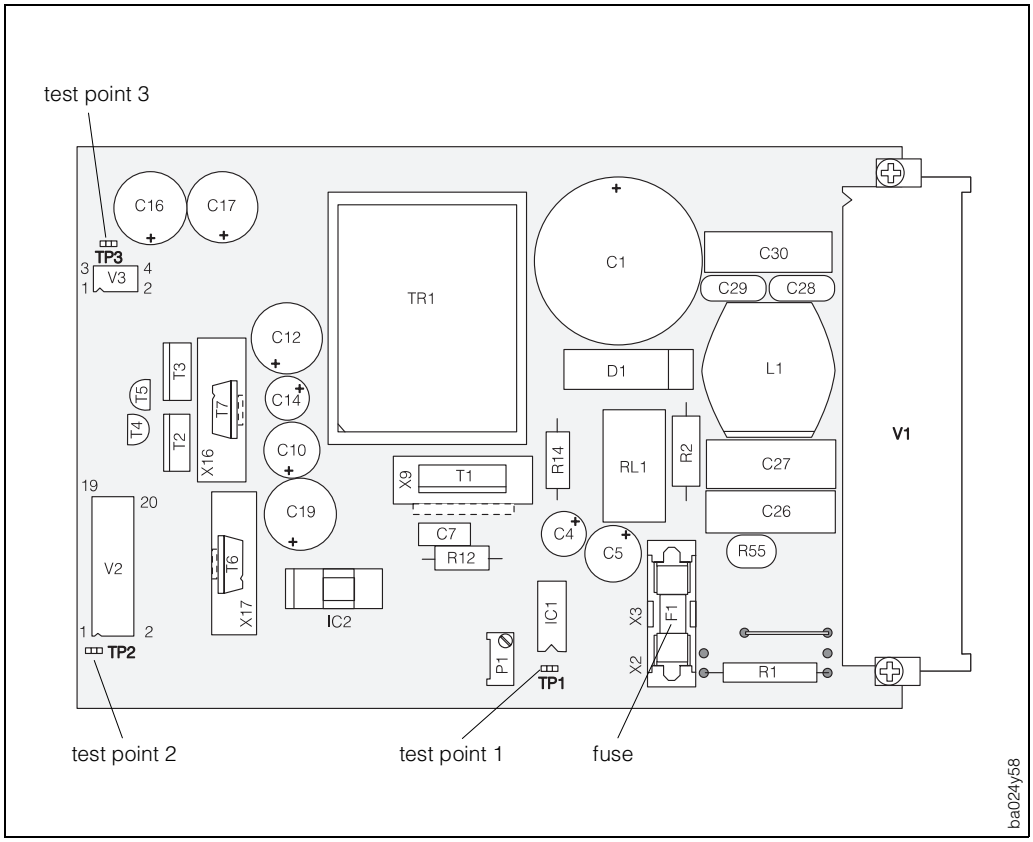


Fig. 46

The Promag 39 amplifier board

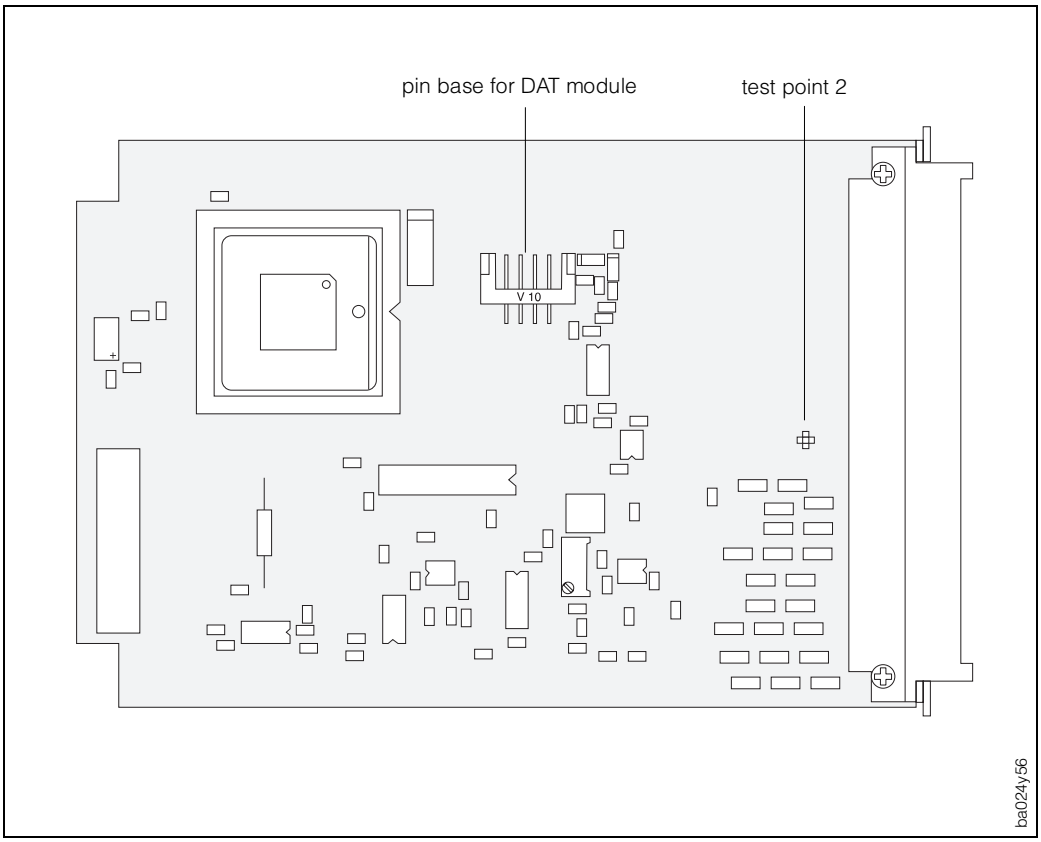


Fig. 47

The Promag 39 commodule (communication) board

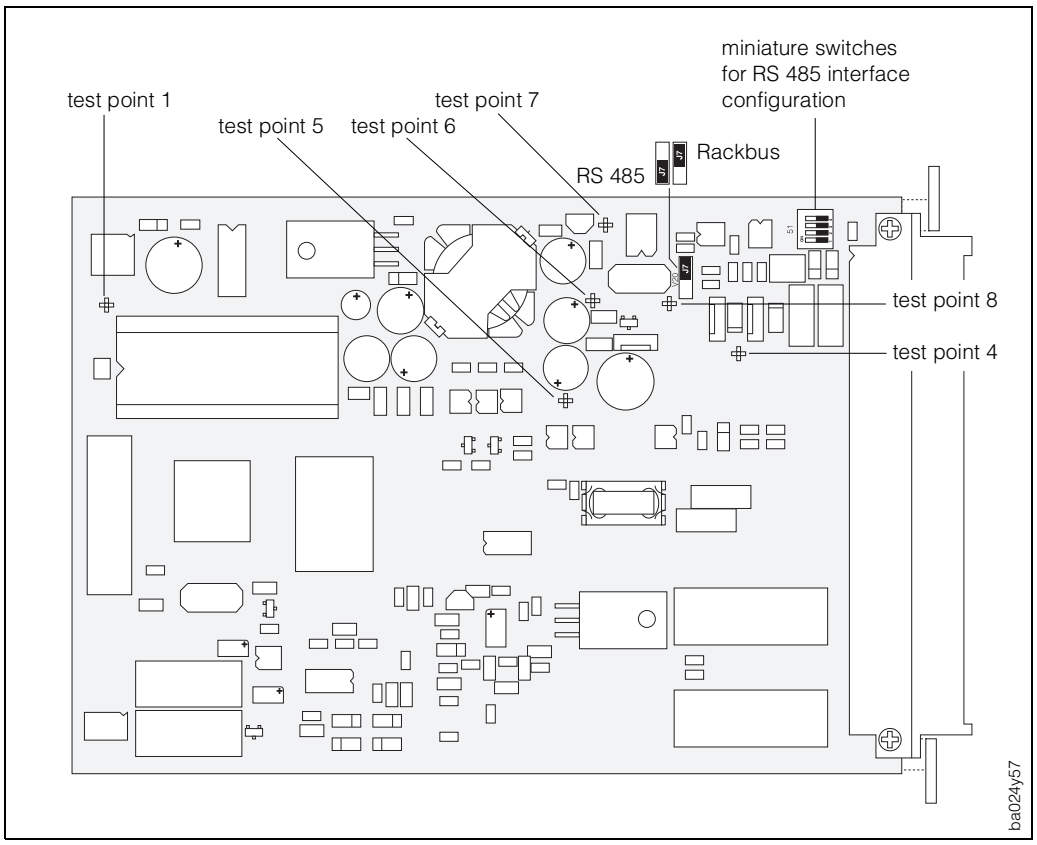


Fig. 48

8.5 Repairs

If a Promag 39 flow meter is to be sent to Endress+Hauser for repair, it must always be accompanied by a note listing the following information:
- description of the application
- description of the fault
- description of the chemical and physical properties of the product being measured.

Caution!
The following procedures must be carried out before a Promag 39 flow meter is sent for repair.

- Remove all residue which may be present.
- This is especially important if the medium is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- No instrument should be returned to us without first completely removing all dangerous material (e.g. penetrated into scratches or diffused through plastic parts).

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

9 Technical Data

9.1 Dimensions and weights

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

Promag 39 A (DN 2…25)

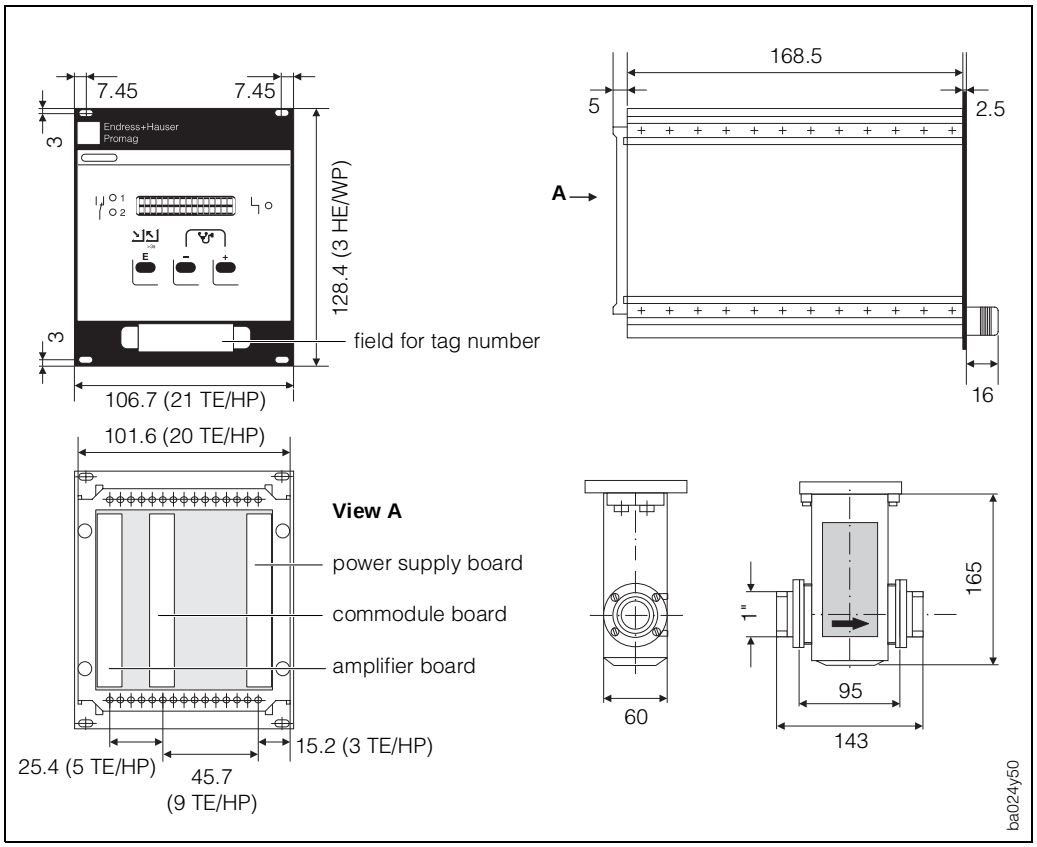
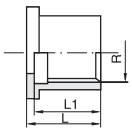


Fig. 49

Weights
Promag 39 transmitter: 1 kg
Promag A sensor: 2 kg

Dimensions of the inserted parts of sensor Promag A

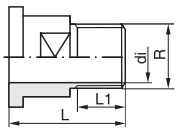
Internal thread



DN	L	L1	R
2...15	20	18	½"
25	45	22	1"

(standard thread ISO 228/DIN 2999)

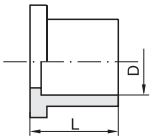
External thread



DN	L	L1	di	R
2...15	35	13.2	16.1	½"
25	50	16.8	22.0	1"

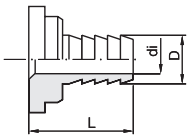
(standard thread ISO 228/DIN 2999)

PVC adhesive coupling



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

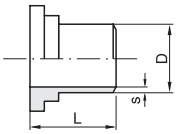
Hose connection



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

(LW = interior tube diameter)

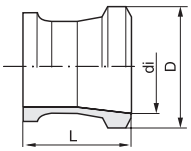
Welded nipple DN 2...15



DN	L	D	s
2...15	20	21.3	2.6

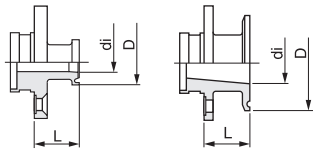
(Dimensions for aseptic version are identical)

Welded nipple DN 25



DN	L	D	di
25	30	33.7	26

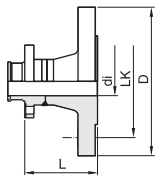
Tri-clamp®
stainless steel
1.4404/316L



DN		L	D	di
2...8	½"	24	25	9.5
15	¾"	24	25	16
2...8	1"	24	50.4	22.1
15	1"	24	50.4	22.1
25	1"	24	50.4	22.1

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

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

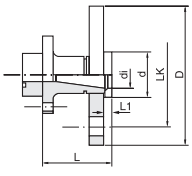


Flange as per DIN 2501, PN 40				
DN	L	D	di	LK
2...15	52.5	95	17.3	65
25	52.5	115	28.5	85

Flange as per JIS B 2210				
DN	L	D	di	LK
2...15	62.5	95	16	70
25	62.5	115	25	90

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

Flange connection
PVDF with joint dimensions to
DIN 2501/ ANSI B 16.5
DN 2...15:
with DN 15 or ½" flanges
DN 25:
with DN 25 or 1" flanges



Flange to ANSI B 16.5								
DN	Class 150				Class 300			
	L	D	LK	di	L	D	LK	
2...15	62.5	88.9	60.5	15.7	67.0	95.2	66.5	
25	68.3	108.0	79.2	26.7	74.7	123.9	88.9	

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

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

Length
2xL+143 mm
2xL+95 mm (for flange and
Tri-Clamp version)

ba024y77

Fig. 50
(all dimensions in mm)

Promag 39 H (DN 25…100)

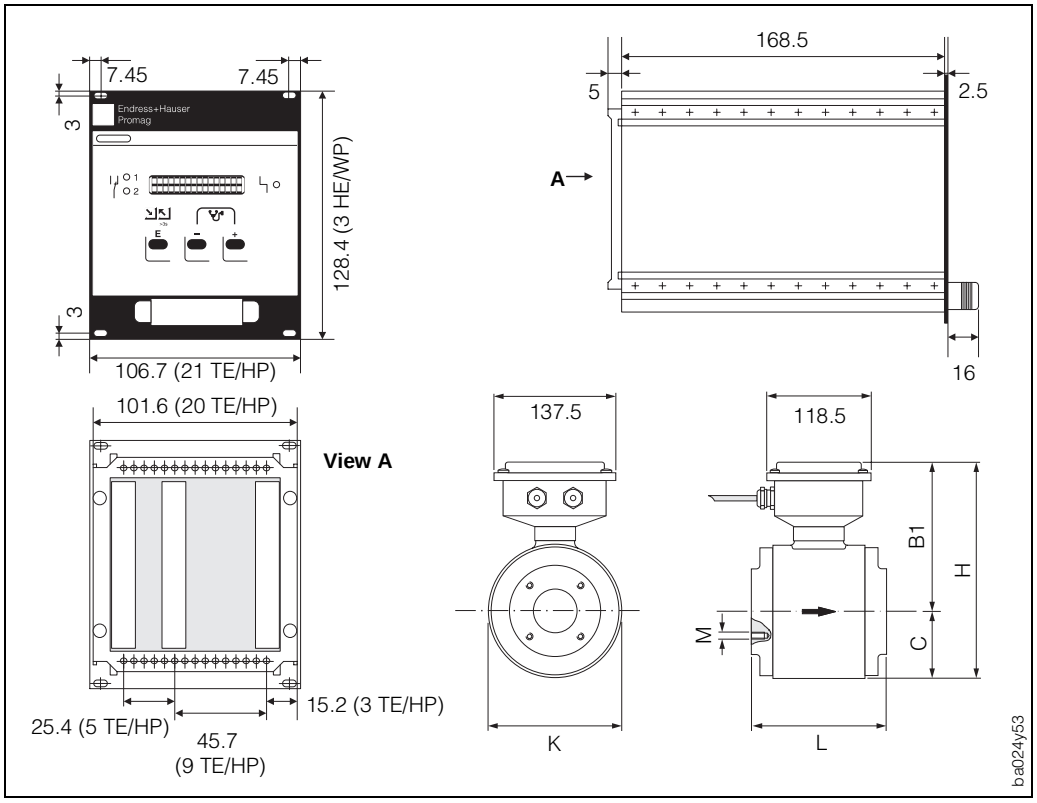


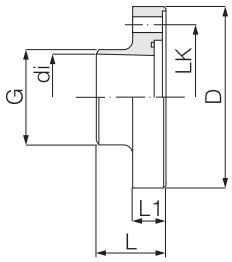
Fig. 51

DN		PN			L	C	K	H	B1	M	Weight
[mm]	[inch]	DIN [bar]	ANSI [lbs]	JIS	[mm]	[mm]	[mm]	[mm]	[mm]	[thread]	[kg]
25	1"	16	150	20K	140	64	128	222.5	158.5	M6	6.0
40	1½"	16	150	20K	140	64	128	222.5	158.5	M6	6.5
50	2"	16	150	10K	140	76.5	153	247.5	171	M8	9
65	—	16	—	10K	140	76.5	153	247.5	171	M8	9
80	3"	16	150	10K	200	101.5	203	297.5	196	M12	19
100	4"	16	150	10K	200	101.5	203	297.5	196	M12	18.5

Weights
Promag 39 transmitter: 1 kg
Promag H sensor: see table above

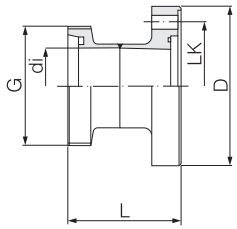
Process connections Promag H

Weld nipple



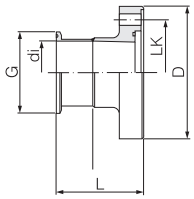
DN	D	G	di	L	L1	LK
25	75	27	22.6	42	19	56
25 DIN	79	31	26	42	19	60
40	92	40	35.3	42	19	71
40 DIN	92	43	38	42	19	71
50	105	55	48.1	42	19	83.5
50 DIN	105	55	50	42	19	83.5
65	121	66	59.9	42	21	100
65 DIN	121	72	66	42	21	100
80	147	79	72.6	42	24	121
80 DIN	147	87	81	42	24	121
100	168	104	97.5	42	24	141.5
100 DIN	168	106	100	42	24	141.5

DIN 11851



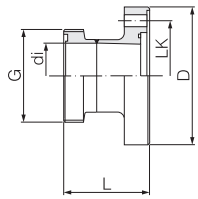
DN	di	G	D	L	LK
25	26.0	52×1/6"	79.0	68	56
40	38.0	65×1/6"	92.0	72	71
50	50.0	78×1/6"	105.0	74	83.5
65	66.0	95×1/6"	121.0	78	100
80	81.0	110×1/4"	147.0	83	121
100	100.0	130×1/4"	168.0	92	141.5

Tri-Clamp®



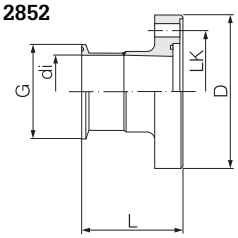
DN	di	G	D	L	LK
25	22.1	50.4	75.0	68.6	56
40	34.8	50.4	92.0	68.6	71
50	47.5	63.9	105.0	68.6	83.5
65	60.2	77.4	121.0	68.6	100
80	72.9	90.9	147.0	68.6	121
100	97.4	118.9	168.0	68.6	141.5

SMS 1145



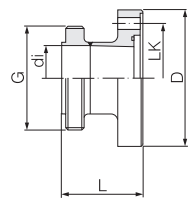
DN	di	G	D	L	LK
25	22.5	40×1/6"	75.0	60	56
40	35.5	60×1/6"	92.0	63	71
50	48.5	70×1/6"	105.0	65	83.5
65	60.5	85×1/6"	121.0	70	100
80	72.0	98×1/6"	147.0	75	121
100	97.6	132×1/6"	168.0	70	141.5

ISO 2852



DN	di	G	D	L	LK
25	22.6	50.5	75.0	68.50	56
40	35.6	50.5	92.0	68.50	71
50	48.6	64.0	105.0	68.50	83.5
65	60.3	77.5	121.0	68.50	100
80	72.9	91.0	147.0	68.50	122
100	97.6	119.0	168.0	68.50	141.5

ISO 2853



DN	di	G	D	L	LK
25	22.6	52×1/6"	75.0	61.50	56
40	35.6	65×1/6"	92.0	61.50	71
50	48.6	78×1/6"	105.0	61.50	83.5
65	60.3	95×1/6"	121.0	61.50	100
80	72.9	110×1/4"	147.0	61.50	122
100	97.6	130×1/4"	168.0	61.50	141.5

Length
DN 25…65 ⇒ 2×L+136 mm
DN 80…100 ⇒ 2×L+196 mm

ba024y71

Promag 39 F (DN 15…300)

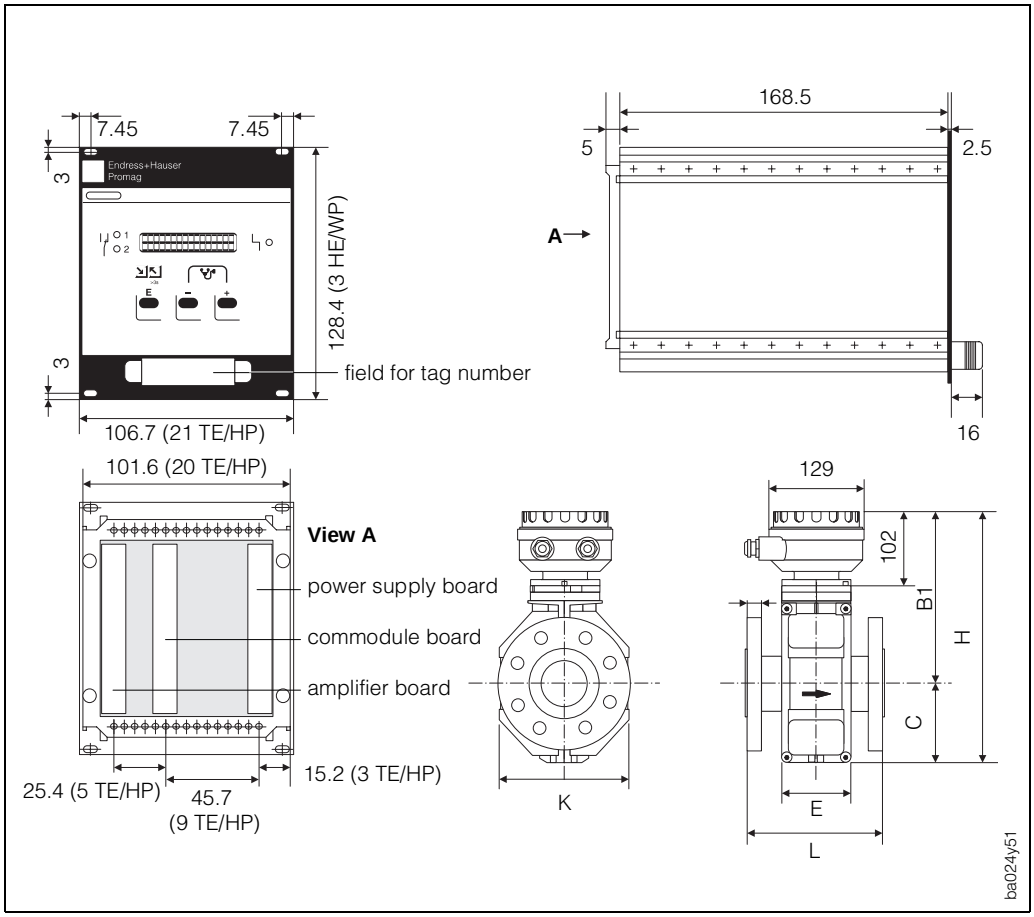


Fig. 52

DN		PN			L[1]	C	K	E	F		H	B1	Weight
		DIN	ANSI	JIS					DIN	ANSI			
[mm]	[inch]	[bar]	[lbs]		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
15	½"	40	150	20K	200	84	120	94	14	11.2	286	202	4.3
25	1"	40	150	20K	200	84	120	94	16	14.2	286	202	5.3
32	—	40	—	20K	200	84	120	94	18	—	286	202	6.0
40	1½"	40	150	20K	200	84	120	94	18	17.5	286	202	7.4
50	2"	40	150	10K	200	84	120	94	20	19.1	286	202	8.6
65	—	16	—	10K	200	109	180	94	18	—	336	227	10.0
80	3"	16	150	10K	200	109	180	94	20	23.9	336	227	12.0
100	4"	16	150	10K	250	109	180	94	22	23.9	336	227	14.0
125	—	16	—	10K	250	150	260	140	24	—	417	267	19.5
150	6"	16	150	10K	300	150	260	140	24	25.4	417	267	23.5
200	8"	10	150	10K	350	180	324	156	26	28.4	472	292	33.3
250	10"	10	150	10K	450	205	400	166	28	30.2	522	317	46.5
300	12"	10	150	10K	500	230	460	166	28	31.8	572	342	55.5

[1] The length is always identical independently of the chosen pressure rating.

Weights
Promag 39 transmitter: 1 kg
Promag F sensor: see table above

Promag 39 F (DN 350…2000)

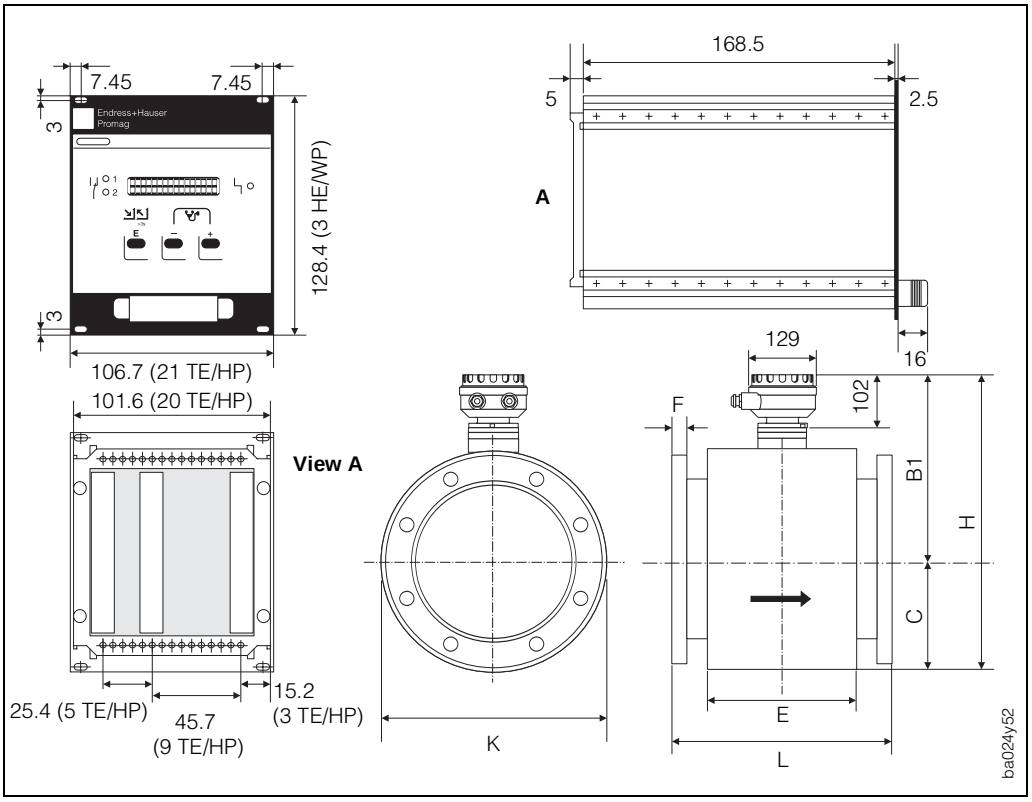


Fig. 53

DN [mm]	[inch]	PN DIN [bar]	PN ANSI [Class]	PN AWWA [Class]	L[1] [mm]	C [mm]	K [mm]	E [mm]	F DIN [mm]	F ANSI [mm]	F AWWA [mm]	H [mm]	B1 [mm]	Weight PN10/ANSI [kg]
350	14"	10	150	—	550	282	564	276	26	34.9	—	683.5	401.5	110
400	16"	10	150	—	600	308	616	276	26	36.5	—	735.5	427.5	130
450	18"	—	150	—	650	333	666	292	—	39.7	—	785.5	452.5	240
500	20"	10	150	—	650	358.5	717	292	28	42.9	—	836.5	478.0	170
600	24"	10	150	—	780	410.5	821	402	28	47.6	—	940.5	530.0	230
700	28"	10	—	D	910	512	1024	589	30	—	33.3	1143.5	631.5	350
750	30"	—	—	D	975	512	1024	626	—	—	34.9	1143.5	631.5	450
800	32"	10	—	D	1040	533.5	1067	647	32	—	38.1	1186.5	653.0	450
900	36"	10	—	D	1170	610	1220	785	34	—	41.3	1339.5	729.5	600
1000	40"	10	—	D	1300	686	1372	862	34	—	41.3	1491.5	805.5	720
1050	42"	—	—	D	1365	712	1424	912	—	—	44.5	1543.5	831.5	1050
1200	48"	6	—	D	1560	811	1622	992	28	—	44.5	1741.5	930.5	1200
1350	54"	—	—	D	1755	912	1824	1252	—	—	54.0	1943.5	1031.5	2150
1400	56"	6	—	D	1820	987	1974	1252	32	—	—	2093.5	1106.5	1800
1500	60"	—	—	D	1950	1011	2022	1392	—	—	57.2	2141.5	1130.5	2600
1600	64"	6	—	D	2080	1056	2112	1482	34	—	—	2231.5	1175.5	2500
1650	66"	—	—	D	2145	1093	2186	1482	—	—	63.5	2305.5	1212.5	3700
1800	72"	6	—	D	2340	1188	2376	1632	36	—	66.7	2495.5	1307.5	3300
2000	78"	6	—	D	2600	1238	2476	1732	38	—	69.9	2595.5	1357.5	4100

[1] Thickness of the flange face includes sealing strip.
The length is always identical independently of the chosen pressure rating.

Weights

Promag 39 transmitter: 1 kg
Promag F sensor: see table above

Promag 39 F (with screwd connection acc. to DIN 11851)

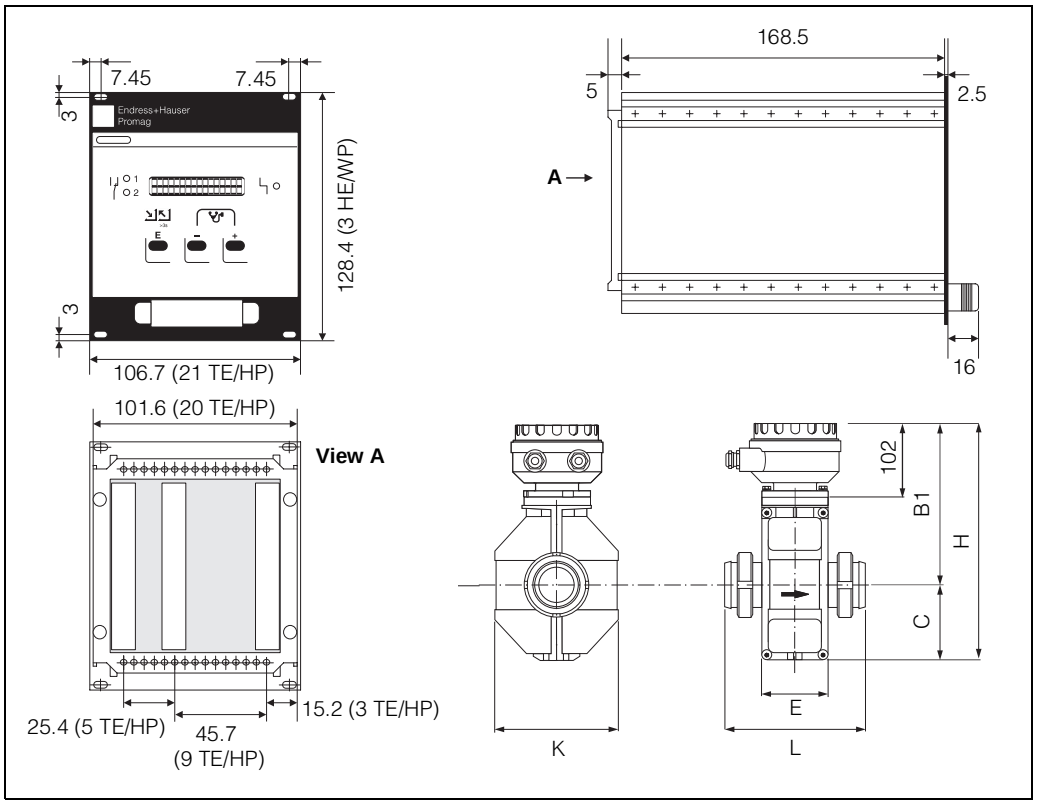


Abb. 54

DN [mm]	PN DIN [bar]	L [mm]	C [mm]	K [mm]	E [mm]	H [mm]	B1 [mm]	Weight PN10/ANSI [kg]
15	16	200	84	120	94	286	202	4.1
25	16	200	84	120	94	286	202	4.7
32	16	200	84	120	94	286	202	4.7
40	16	200	84	120	94	286	202	7.0
50	16	200	84	120	94	286	202	8.2
65	16	200	109	180	94	336	227	9.5
80	16	200	109	180	94	336	227	11.5
100	16	250	109	180	94	336	227	13.5

Weights
Promag 39 transmitter: 1 kg
Promag F (DIN 11851) sensor: see table above

9.2 Technical data: sensor

	Promag A	Promag H	Promag F
Nominal diameter	DN 2, 4, 8, 15, 25	DN 25…100	DN 15…2000
Nominal pressure	PN 40	PN 16	DIN: PN 6 (DN 1200…2000) PN 10 (DN 200…1000) PN 16 (DN 65…150) PN 40 (DN 15…50) PN 16/25 (DN 200…300), opt. PN 40 (DN 65…100), option ANSI: Class 150 (½…24") Class 300 (½…6"), option AWWA: Class D (28"…48") JIS: 10K (DN 50…300) 20K (DN 25…300) 20K (DN 50…300), option
Process connection	internal and external thread, PVC adhesive coupling, hose connection, welded nipples for pipelines according to DIN 11850, Tri-clamp®, flange connection (DIN, ANSI, JIS)	welded hex nipple for OD-tube, SMS JIS, ISO and DIN 11850 pipes, DIN 11851 screwed connection, SMS screwed connection, ISO 2853 screwed connection, Tri-Clamp® connection, ISO 2852 connection	flange connection (DIN, ANSI; JIS) milk coupling to DIN 11851 (DN 15…100)
Flange material	DIN: stainless steel 1.4404 PVDF ANSI: 316L; PVDF JIS: SUS 316L; PVDF Threaded stubs: 1.4435; PVC	1.4435 / 316L	DIN: St. 37.2, stainless steel St. 1.4571 ANSI: A 105, 316L AWWA: A 105, A 36 JIS: S20C, SUS 316L
Fluid temperature range	–20…+130 °C PFA	–20…+150 °C PFA (with EPDM gaskets: –20…+130 °C)	–40…+130 °C PTFE (DN 15…600) –20…+120 °C soft rubber (DN 65…2000) 0…+ 80 °C hard rubber (DN 65…2000)
Ambient temperature range	–20…+60 °C	–20...+60 °C	–20…+60 °C
Electrode material	1.4435, Platinum/Rhodium 80/20, Titanium, Hastelloy C-22, Tantalum	1,4435	1.4435, Platinum/Rhodium 80/20, Titanium, Hastelloy C-22, Tantalum
Electrodes fitted	measuring and reference electrodes	measuring and EDP electrodes	DN 15…2000: measuring, reference and EPD electrodes (1.4435 and Hastelloy C-22 as standard)
Minimum conductivity	5 µS/cm	5 µS/cm	5 µS/cm
Gasket material	Viton Kalrez (option) Silicon (aseptic version)	EPDM, Silicon	—
Housing material	1.4435 incl. threaded stub (see also dimensions of inserted parts)	1.4301	DN 15…300: powder-coated die-cast aluminum DN 350…2000: varnished steel
Type of protection	IP 67; IP 68 optional (EN 60529) NEMA 4X (NEMA 6P for option)	IP 67 (EN 60529) NEMA 4X	IP 67; IP 68 option (EN 60529) NEMA 4X (NEMA 6P for option)
CIP-suitable	yes (observe max. temperature)	yes (observe max. temperature)	yes (observe max. temperature)
SIP-suitable	—	yes (observe max. temperature)	—
Power supply	the sensor is supplied by the transmitter	the sensor is supplied by the transmitter	the sensor is supplied by the transmitter
Explosion-protected version	Ex-zone 2 according to VDE 0165 CENELEC sensor for Ex-zone 1, transmitter Ex-zone 2	Ex-zone 2, according to VDE 0165	Ex-zone 2 according to VDE 0165 CENELEC sensor for Ex-zone 1, transmitter Ex-zone 2
Approvals	—	3A approval EHEDG approved	—
Cable entries	PG 11 (5…12 mm)	PG 13.5 (5...15 mm)	PG 13.5 (5…15 mm)

Inside diameter of measuring pipe

Sensor	DN		PN			AWWA	Lining		
	[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"		Class			4.6	—	—
	8	5/16"	40/16	150/300	10K/20K	—	8.6	—	—
	15	1/2"					16.1	—	—
	25	1"					22.0	—	—
Promag H	25 DIN			—	—	—	26	—	—
	25	1"		—	—	—	22.6	—	—
	40	1 1/2"		—	—	—	35.3	—	—
	50	2"	16	—	—	—	48.1	—	—
	65	2 1/2"		—	—	—	59.9	—	—
	80	3"		—	—	—	72.6	—	—
	100	4"		—	—	—	97.5	—	—
Promag F	15	1/2"	40	Class 150	20K	—	—	15	—
	25	1"	40	Class 150	20K	—	—	26	—
	32	—	40	—	20K	—	—	35	—
	40	1 1/2"	40	Class 150	20K	—	—	41	—
	50	2"	40	Class 150	10K	—	—	52	—
	65	—	16	—	10K	—	—	68	65
	80	3"	16	Class 150	10K	—	—	80	78
	100	4"	16	Class 150	10K	—	—	105	100
	125	—	16	—	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
	—	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 pipe lining	Limits for vacuum [mbar absolute] at different 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	0	0
Promag H	25…100	1…4"	PFA	0	0	0	0	0	0
Promag F	65…1200 15…1200	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						

** Values not available*

Temperature ranges of the sensor

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

- **Promag A**
  Ambient temperature: –20…+ 60 °C
  Medium temperature: –20…+130 °C (PFA)

- **Promag H**
  Ambient temperature: –20…+ 60 °C
  Medium temperature: –20…+150 °C

- **Promag F**
  Ambient temperature: –20…+ 60 °C
  Medium temperature: –40…+130 °C PTFE (Teflon)
  –20…+120 °C soft rubber (EPDM)
  0…+ 80 °C hard rubber

Temperature ranges of the transmitter

- **Promag 39**
  Ambient temperature: –20…+50 °C
  Display function: 0…+50 °C

Pressure/temperature load diagrams: sensor promag F (flange-mounted unit)

Pressure limitation due to fluid temperature (DIN 2413 and 2505)

Flange material: steel 37.2

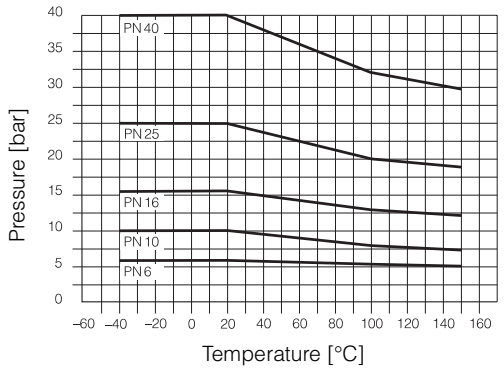


Fig. 55

Pressure limitation due to fluid temperature (DIN 2413 and 2505)

Flange material: stainless steel 1.4571

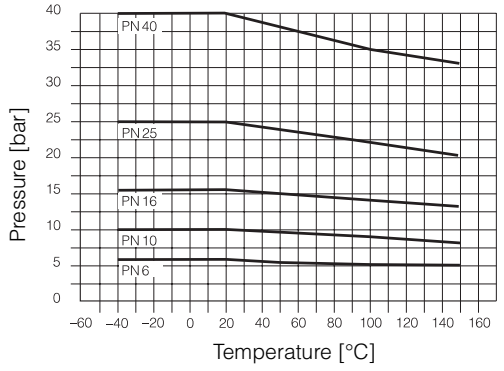


Fig. 56

Pressure limitation due to fluid temperature (ANSI B16.5)

Flange material: steel A 105

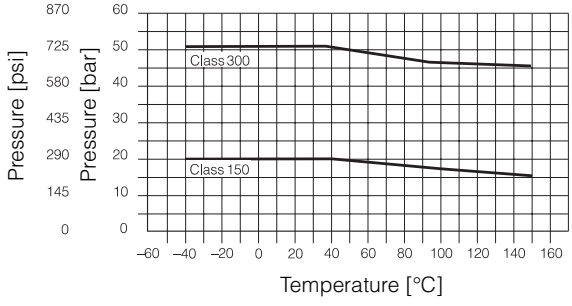


Fig. 57

Pressure limitation due to fluid temperature (ANSI B 16.5)

Flange material: steel 316L

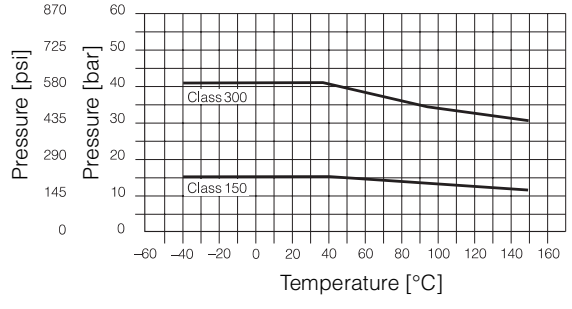


Fig. 58

Pressure limitation due to fluid temperature (AWWA C207, Class D)

Flange material: steel A 105

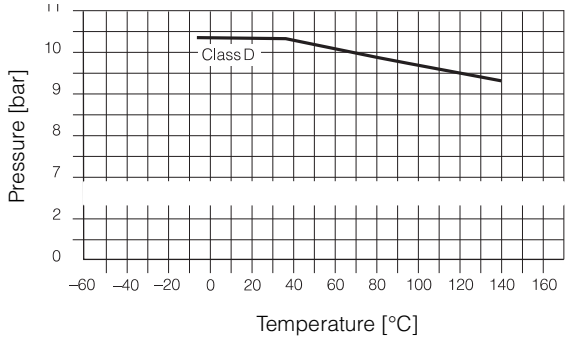


Fig. 59

Sensor Promag A

Pressure limitation due to fluid temperature

Flange material: steel 1.4404/1.4435, PVDF, PVC

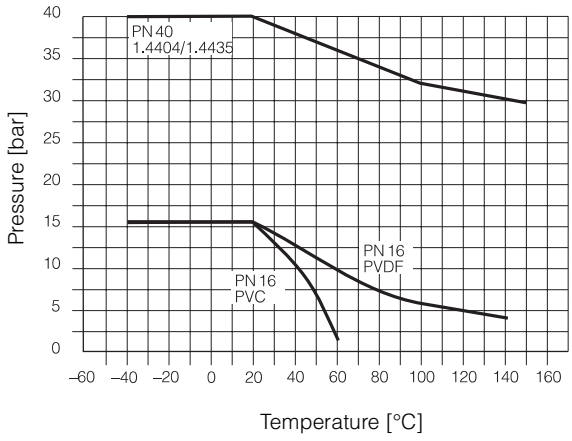


Fig. 60

Sensor Promag H

Pressure limitation due to fluid temperature (DIN 2413 and 2505)

Flange material: steel 1.4435

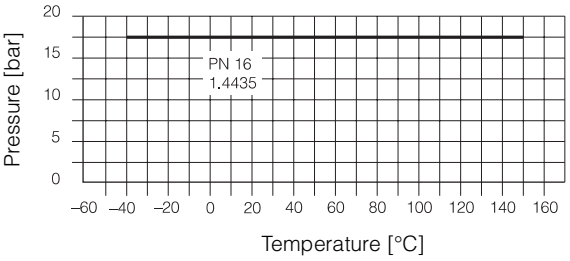


Fig. 61

9.3 Technical data: transmitter and measuring system

Promag 39-Meßumformer/Meßsystem

Housing	19" rack cassette 21 TE (128×106×196) front cover: plastic cleanable with 90% alcohol
Type of protection	IP 20 (EN 60529)
Ambient temperature	for operation: –20…+50 °C for display: 0…+50 °C
Resistance to shock and vibration	acceleration up to 2 g / 2 h per day; 10…100 Hz (complete measuring system)
Cable entries	spring contact DIN 41612 F 48
Power supply	85…260 V AC, 45…65 Hz 20…55 V AC, 16…62 V DC power supply failure: bridging at least 1 main cycle (≤22 ms)
Power consumption	AC: <15 VA (incl. sensor) DC: <15 W (incl. sensor)
Galvanical isolation	input and outputs calvanically isolated from the supply, from the sensor and one another
Full-scale value scaling	0.3…10 m/s
Current output	0/4…20 mA adjustable, calvanically isolated, R_L <700 Ω (with HART at least 250 Ω) time constant can be chosen, scaleable full-scale value, temperature coefficient typically: 0.005% o.r./°C
Pulse/frequency output	choice of active/passive, calvanically isolated, active: 24 V DC, 25 mA (250 mA for 20 ms), R_L >100 Ω passive: open collector, 30 V DC, 25 mA (250 mA for 20 ms) frequency output: f_{End} = selectable to 10 kHz, pulse/pause ratio 1:1, pulse width max. 2 s pulse output: choice of value per pulse, pulse polarity selectable, pulse width adjustable (50 ms…2 s); above a frequency of 1/(2× pulse width) the pulse/pause ratio is 1:1.
Error output	relay 1, NC and NO contact available, max. 250 V AC/30 V DC, max. 1 A, calvanically isolated, programmable for error, limit value 1, exceeding measure range (v≥12.5 m/s), dual range mode, batching or direction of flow
Status output	relay 2, NC and NO contact available, max. 250 V AC/30 V DC, max. 1 A, calvanically isolated, programmable for limit value 2, exceeding measuring range (v ≥12.5 m/s), dual range mode, batching or direction of flow
Communication	RS 485 interface (Rackbus protocol) or Rackbus (Rackbus protocol) and SMART (HART protocol via current output)
Data backup	EEPROM saves data of measuring system in the event of a power failure (without battery required)
Display	LCD, two lines (16 characters each)
Compatibility with interference (EMC)	according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as to NAMUR recommendations (complete measuring system)
Explosion-protected version	Ex-zone 2: VDE 0165 Ex-zone 1: Ex CENELEC sensor zone 1 transmitter zone 2

9.4 Nominal diameter and flow rate

The diameter of the pipe usually governs the nominal diameter of the sensor. The optimum flow rate range is v = 2…3 m/s (see table below). Furthermore, the flow rate (v) has to be matched to the physical properties of the medium:

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

If it should be necessary to increase the flow rate, this can be done by reducing the nominal diameter of the sensor (see page 17 "Adapters").
The table below shows the scaleable minimum and maximum full-scale values incl. factory settings.

DN		**Minimum full-scale value** (scaling at v ~0.3 m/s)	**Full-scale value set in factory** (scaling at v ~2.5 m/s)	**Maximum full-scale value** (scaling at v ~10 m/s)
[mm]	[inch]			
2	1/12"	0.0034 m³/h	0.0283 m³/h	0.1131 m³/h
4	5/32"	0.0136 m³/h	0.1131 m³/h	0.4524 m³/h
8	5/16"	0.0543 m³/h	0.4524 m³/h	1.8096 m³/h
15	1/2"	0.1909 m³/h	1.5904 m³/h	6.3617 m³/h
25	1"	0.5310 m³/h	4.4179 m³/h	17.671 m³/h
32	1 1/4"	0.8686 m³/h	7.2382 m³/h	28.953 m³/h
40	1 1/2"	1.3572 m³/h	11.310 m³/h	45.239 m³/h
50	2"	2.1206 m³/h	17.671 m³/h	70.686 m³/h
65	2 1/2"	3.5838 m³/h	29.865 m³/h	119.46 m³/h
80	3"	5.4287 m³/h	45.239 m³/h	180.96 m³/h
100	4"	8.4823 m³/h	70.686 m³/h	282.74 m³/h
125	5"	13.254 m³/h	110.45 m³/h	441.79 m³/h
150	6"	19.085 m³/h	159.04 m³/h	636.17 m³/h
200	8"	33.929 m³/h	282.74 m³/h	1131.0 m³/h
250	10"	53.014 m³/h	441.79 m³/h	1767.1 m³/h
300	12"	76.341 m³/h	636.17 m³/h	2544.7 m³/h
350	14"	103.91 m³/h	865.90 m³/h	3463.6 m³/h
400	16"	135.72 m³/h	1131.0 m³/h	4523.9 m³/h
450	18"	171.77 m³/h	1431.4 m³/h	5725.6 m³/h
500	20"	212.06 m³/h	1767.1 m³/h	7068.6 m³/h
600	24"	305.36 m³/h	2544.7 m³/h	10179 m³/h
700	28"	415.63 m³/h	3463.6 m³/h	13854 m³/h
750	30"	477.13 m³/h	3976.1 m³/h	15904 m³/h
800	32"	542.87 m³/h	4523.9 m³/h	18096 m³/h
900	36"	687.07 m³/h	5725.6 m³/h	22902 m³/h
1000	40"	848.23 m³/h	7068.6 m³/h	28274 m³/h
1050	42"	935.17 m³/h	7793.1 m³/h	31172 m³/h
1200	48"	1221.5 m³/h	10179 m³/h	40715 m³/h
1350	54"	1545.9 m³/h	12882 m³/h	51530 m³/h
1400	56"	1662.5 m³/h	13854 m³/h	55418 m³/h
1500	60"	1908.5 m³/h	15904 m³/h	63617 m³/h
1600	64"	2171.5 m³/h	18096 m³/h	72382 m³/h
1700	66"	2451.4 m³/h	20428 m³/h	81713 m³/h
1800	72"	2748.3 m³/h	22902 m³/h	91609 m³/h
2000	78"	3392.9 m³/h	28274 m³/h	113097 m³/h

1 m³= 1000 litres

9.5 Error limits

Measuring uncertainty under reference conditions

Pulse output	±0.5% o.r. ±0.01% o.f.s. (f.s. = 10 m/s)
Current output	plus ±5 µA
Repeatability	±0.1% o.r. ±0.005% o.f.s.
Power supply voltage	within the specified range, supply fluctuation have no influence.

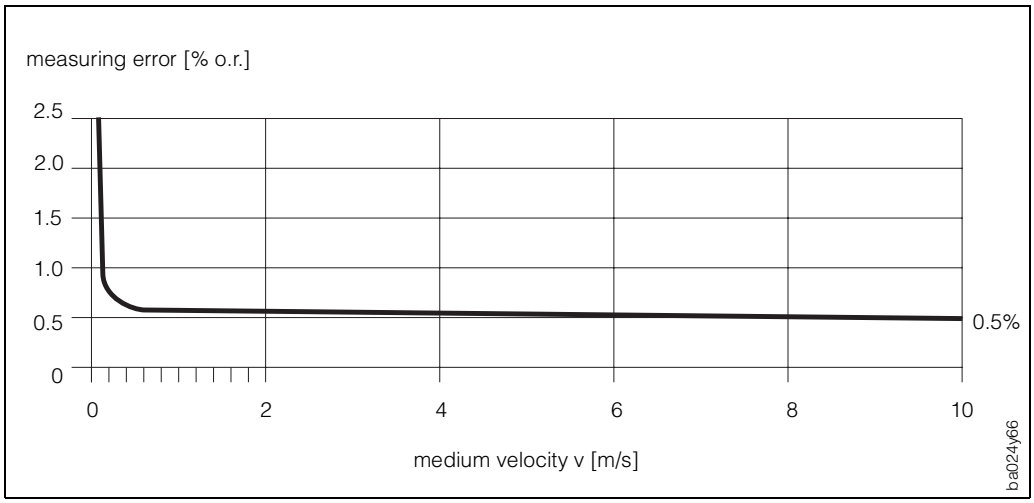


Fig. 62

Reference condition (DIN 19200 and VDI/VDE 2641)

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

10 Programming at a Glance

Operating procedure

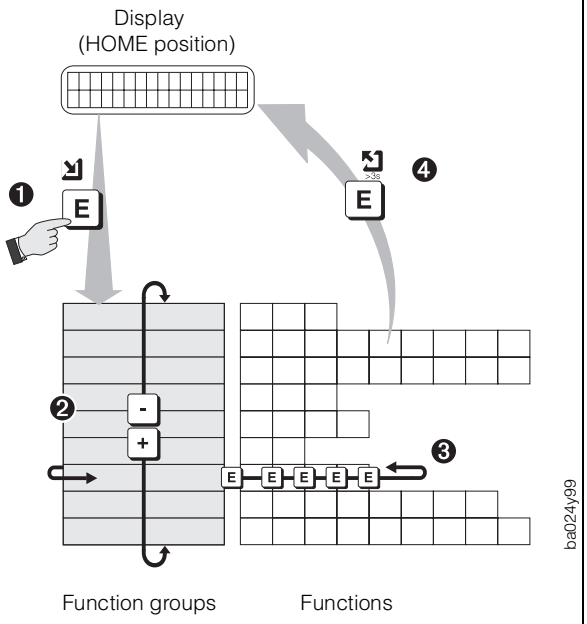
❶ Access to programming matrix

❷ Select function group (>GROUP SELECT.<)

❸ Select function

❹ Return to HOME position from any matrix position (after programming)

Programming example → see page 34
Function description → see page 35



Functions of the operating elements

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

E (≥3s) — *Return to the HOME position* by pressing E for more than 3 seconds.

E — *Selecting individual functions* within the function group saving the data or settings entered.

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

+ / − simultaneously: *Diagnostic function* or *help function* (display of important additional information)

Note

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

Enabling/Locking the programming

- Enabling: enter the code number (factory setting = 39)
- Locking: 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”.

FUNCTION GROUPS Functions	Possible settings *Factory settings*
SYSTEM-UNITS	
FLOW RATE UNIT p. 35	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 sec.), cc/min
VOLUME UNIT p. 36	dm^3, ***m^3***, l, hl, gal, bbl, 10^3 gal, ft^3
GALLONS/BARREL p. 36	US: 31.0 gal/bbl ***US: 31.5 gal/bbl*** US: 42.0 gal/bbl US: 55.0 gal/bbl Imp: 36.0 gal/bbl Imp: 42.0 gal/bbl
NOM. DIAM. UNIT p. 36	***mm***, inch

FUNCTION GROUPS Functions	Possible settings *Factory settings*
CURRENT OUTPUT	
FULL SCALE 1 p. 37	5-digit number with floating decimal point (e.g. 520.00 dm^3/h)
DUAL RANGE MODE p. 38	***OFF*** (only full-scale value 1 active) ON
FULL SCALE 2 p. 39	5-digit number with floating decimal point (e.g. 9500.0 dm^3/h)
ACTIVE RANGE p. 39	Only displayed value: ***FULL SCALE 1*** or FULL SCALE 2
TIME CONSTANT p. 39	max. 3-digit number with fixed dec. point: 0.01...100 s ***1 s***
CURRENT SPAN p. 40	0...20 mA ***4***...***20 mA*** 0...20 mA (25 mA) 4...20 mA (25 mA)
FAILSAFE MODE p. 40	***MIN. CURRENT*** (0 mA at 0–20 mA; or 2 mA at 4–20 mA) MAX. CURRENT (22/25 mA) HOLD VALUE (last valid measured value is held) ACTUAL VALUE (normal measured value output despite fault)
SIMULATION CURR. p. 41	***OFF*** 0 mA (0% at 0...20 mA) 2 mA (error at 4...20 mA) 4 mA (0% at 4...20 mA) 10 mA (50% at 0...20 mA) 12 mA (50% at 4...20 mA) 20 mA (100%) 22 mA (max. value with NAMUR) 25 mA (max. value)
NOMINAL CURRENT p. 41	Only displayed value: 0.0...25.0 mA

FUNCTION GROUPS Functions	Possible settings *Factory settings*
PULSE / FREQ. OUTPUT	
OPERATION MODE p. 42	***PULSE*** FREQUENCY
PULSE VALUE p. 42	5-digit number with floating decimal point (e.g. 75.000 dm^3/p)
PULSE WIDTH p. 43	3-digit number with fixed decimal point: 0.05...***2.00 s***
FULL SCALE FREQ. p. 44	max. 5-digit number: 2...***10000 Hz***
FULL SCALE FLOW p. 45	5-digit number with floating decimal point (e.g. 7.2500 m^3/h)
OUTPUT SIGNAL p. 46	***PASSIVE / POSITIVE*** (open-collector/ active-high) PASSIVE / NEGATIVE (open-collector/ active-low) ACTIVE / POSITIVE (push-pull/active-high) ACTIVE / NEGATIVE (push-pull/active-low)
FAILSAFE MODE p. 47	***FALLBACK VALUE*** (corresponding to zero flow) LAST VALUE (last valid measured value is held) ACTUAL VALUE (normal measured value output despite fault)
SIMULATION FREQ. p. 47	***OFF*** 0 Hz (zero flow) 2 Hz 10 Hz 1 kHz 10 kHz
NOMINAL FREQ. p. 47	Only displayed value: 0.0...16,383 Hz

FUNCTION GROUPS Functions	Possible settings *Factory settings*
RELAYS	
RELAY 1 FUNCTION p. 48	***FAILURE*** DUAL RANGE MODE BATCH PRECONTACT FLOW DIRECTION LIMIT FLOWRATE 1
RELAY 1 ON-VALUE p. 49	5-digit number with floating decimal point (***any value*** which agrees with a nominal diameter set between 0...12.5 m/s fluid velocity)
RELAY 1 OFF-VALUE p. 51	5-digit number with floating decimal point (***any value*** which agrees with a nominal diameter set between 0...12.5 m/s fluid velocity)
RELAY 2 FUNCTION p. 51	DUAL RANGE MODE BATCH CONTACT FLOW DIRECTION ***LIMIT FLOWRATE 2***
RELAY 2 ON-VALUE p. 51	5-digit number with floating decimal point (***any value*** which agrees with a nominal diameter set between 0...12.5 m/s fluid velocity)
RELAY 2 OFF-VALUE p. 51	5-digit number with floating decimal point (***any value*** which agrees with a nominal diameter set between 0...12.5 m/s fluid velocity)

FUNCTION GROUPS Functions	Possible settings *Factory settings*
BATCHING	
BATCH QUANTITY p. 54	5-digit number with floating decimal point (e.g. 240 l) ***0.0000*** [unit]
BATCH PREWARN p. 54	5-digit number with floating decimal point (e.g. 200 l) ***0.0000*** [unit]
COMPENS. QUANTITY p. 54	5-digit number with floating decimal point (e.g. +10.000 l) ***0.0000*** [unit]
BATCHING p. 55	START STOP ***CANCEL***
MAX. BATCH TIME p. 55	max. 5-digit number: ***0***...30000 s
BATCH CYCLE p. 55	max. 7-digit number: ***0***...9999999
RESET BATCH CYC. p. 55	***NO*** YES
BATCH VARIABLE p. 55	***OFF*** VOLUME

FUNCTION GROUPS Functions	Possible settings *Factory settings*
DISPLAY	
TOTAL VOLUME p. 56	Only displayed value: max. 7-digit number ***0.000000***...9999999 with appropriate unit
TOTAL. OVERFLOW p. 56	Only displayed value (e.g. 74e7 dm^3 = 740,000,000 dm^3)
RESET TOTALIZER p. 56	***NO*** YES
FLOW RATE p. 57	max. 5-digit number with floating dec. point: –99999...+99999 ***0.0000*** [unit]
ASSIGN LINE 1 p. 57	***FLOW RATE*** TOTAL VOLUME BATCH QUANTITY BATCH UPWARDS BATCH DOWNWARDS BATCH CYCLE
ASSIGN LINE 2 p. 57	OFF FLOW RATE ***TOTAL VOLUME*** TOTAL. OVERFLOW BATCH QUANTITY BATCH UPWARDS BATCH DOWNWARDS BATCH CYCLE
DISPLAY DAMPING p. 57	max. 2-digit number: 0...99 s, ***1 s***
DISPLAY FORMAT p. 57	***X.XXXX*** (5 sign. digits) X.XXX (4 sign. digits) X.XX (3 sign. digits)
LCD CONTRAST p. 58	IIIIIIIII..... Min. to max. contrast illustrated by bar graph
LANGUAGE p. 58	ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS DANSK NORSK SVENSKA SUOMI BAHASA INDONESIA JAPANESE Factory setting: ***according to*** the respective country

FUNCTION GROUPS Functions	Possible settings *Factory settings*
COMMUNICATION	
PROTOCOL p. 59	***OFF*** HART RACKBUS RS485
BUS ADDRESS p. 59	2-digit number: ***0***…63 (RS 485) ***0***…15 (HART)
ASSIGN AUX. INPUT p. 59	*Pulsed mode:* RESET TOTALIZER BATCHING *Level mode:* DUAL RANGE MODE ***POS. ZERO RETURN***
START PULSE WIDTH p. 60	max. 3-digit number: ***20***…100 ms

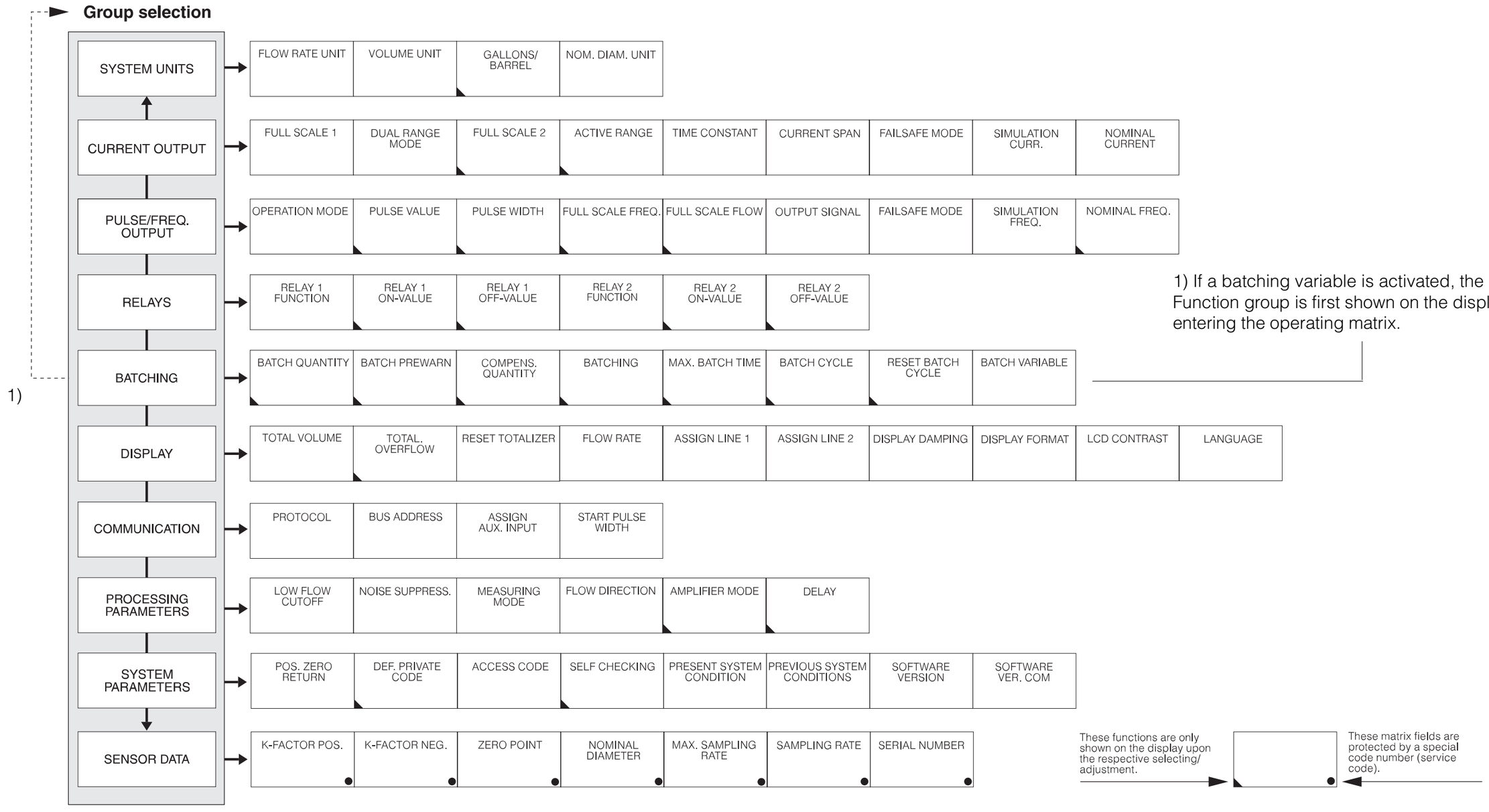
FUNCTION GROUPS Functions	Possible settings *Factory settings*
PROCESSING PARAMETERS	
LOW FLOW CUTOFF p. 61	5-digit number with floating decimal point (e.g. 15.000 dm^3/h)
NOISE SUPPRESS. p. 61	OFF LOW ***MEDIUM*** HIGH
MEASURING MODE p. 62	UNIDIRECTIONAL ***BIDIRECTIONAL***
FLOW DIRECTION p. 62	***FORWARD*** REVERSE
AMPLIFIER MODE p. 62	***NORMAL*** (aut. control) MODE 1 (v = 0...>12 m/s) MODE 2 (v = 0...12 m/s) MODE 3 (v = 0... 4 m/s) MODE 4 (v = 0... 1 m/s)
DELAY p. 62	max. 4-digit number: ***10***...1000

FUNCTION GROUPS Functions	Possible settings *Factory settings*
SYSTEM PARAMETER	
POS. ZERO RETURN p. 63	***OFF*** ON
DEF. PRIVATE CODE p. 63	max. 4-digit number: 0…9999, ***39***
ACCESS CODE p. 64	max. 4-digit number: ***0***…9999
SELF CHECKING p. 64	OFF ***ON***
PRESENT SYSTEM CONDITION p. 65	Display only (entries in order of priority): F ⇒ Error message (system error) A ⇒ Alarm message (process error) S ⇒ Status message
PREVIOUS SYSTEM CONDITIONS p. 65	Display only (entries chronological): F ⇒ Error message (system error) A ⇒ Alarm message (process error) S ⇒ Status message
SOFTWARE VERSION p. 66	Display only
SOFTWARE VER. COM p. 66	Display only

FUNCTION GROUPS Functions	Possible settings *Factory settings*
SENSOR DATA	
K-FACTOR POS. p. 67	5-digit number with fixed decimal point: 0.5000…2.0000 Factory setting: ***dependent on*** the sensor and its calibration
K- FACTOR NEG. p. 67	5-digit number with fixed decimal point: 0.5000…2.0000 Factory setting: ***dependent on*** the sensor and its calibration
ZERO POINT p. 67	max. 4-digit number: –1000…+1000 Factory setting: ***dependent on*** the sensor and its calibration
NOMINAL DIAMETER p. 68	Select from fixed table: 2…2000 mm or $^1/_{12}$…78 inch Factory setting: ***dependent on*** the sensor
MAX. SAMPLE RATE p. 68	max. 3-digit number with fixed decimal point: 1.0…60.0/s Factory setting: ***dependent on*** the sensor
SAMPLING RATE p. 68	Number with fixed decimal point and 1 decimal place (upper limit as for “MAX. SAMPLE RATE”)
SERIAL NUMBER p. 68	max. 6-digit serial number: 1...999999

Programming Matrix/Client Settings

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



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